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Operational-Scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3)

Version 1.2: USER'S GUIDE

S.J. Kull, G.J. Rampley, S. Morken, J. Metsaranta, E.T. Neilson, and W.A. Kurz
Northern Forestry Centre

Canada

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Canadian Forest Service
Northern Forestry Centre
2024

Erratum for this guide

The following corrections have been made to the originally released version of this guide:

- Natural Resources Canada and Canada identifiers have been added to the title page.
- All mentions of "Remsoft Spatial Planning System" have been updated to "Woodstock Optimization Studio."
- A correction was made to the definition of UsingID in Table 3-3.
- All Remsoft citations were updated.
- Some figure numbers and text appearing in the footnotes in Appendixes 3-5 were corrected.
- All figures in Appendix 10 were updated to reflect software changes.
- Some instructions in Appendix 10 were modified to reflect changes in the Woodstock Optimization Studio software.
- All figures in Appendix 11 were replaced with higher resolution versions.

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Kull, S.J.; Rampley, G.J.; Morken, S.; Metsaranta, J.; Neilson, E.T.; Kurz, W.A. 2024. *Operational-scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) version 1.2: user's guide*. Nat. Resour. Can., Can. For. Serv., North. For. Cent., Edmonton, AB.

ABSTRACT

The Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3), version 1.2, described in this user's guide, was developed to meet the operational-scale forest carbon accounting needs of forest managers and analysts across Canada. The CBM-CFS3 is a stand- and landscape-level modeling framework that can be used to simulate the dynamics of all forest carbon stocks required under the United Nations Framework Convention on Climate Change. It is compliant with the carbon estimation methods outlined in the guidelines of the Intergovernmental Panel on Climate Change. The model uses much of the same information that is required for forest management planning activities (e.g., forest inventory, growth and yield curves, natural and human-induced disturbance information, forest management schedule, and land-use change information), supplemented with information from national ecological parameter databases. With this sophisticated but user-friendly software tool, users can apply their own stand- and landscape-level forest management information to calculate carbon stocks and stock changes for the past (monitoring) or into the future (projection). Users can also create, simulate, and compare various forest management scenarios to assess impacts on carbon. Tools supplied with the model assist users with importing required data from common timber supply models or from user-developed data files. The model contains tools to help prepare data, define scenarios, perform analyses, and examine results. Results of analyses can be used for various types of forest ecosystem carbon reporting requirements. Although the model currently contains a set of default ecological parameters appropriate for Canada, these parameters can be modified by the user, which allows for the application of the model in other countries.

RÉSUMÉ

Le Modèle du bilan du carbone du secteur forestier canadien (MBC-SFC3), version 1.2 présenté dans ce guide d'utilisation a été développé afin de répondre aux besoins de comptabilité du carbone forestier à l'échelle opérationnelle qu'ont les aménagistes et analystes forestiers à travers le Canada. Le MBC-SFC3 est un cadre de modélisation à l'échelle du peuplement et du paysage qui peut servir à la simulation des dynamiques des stocks de carbone forestier comme requis par la Convention-Cadre des Nations Unies sur les Changements Climatiques. Il se conforme aux méthodes d'estimations citées par le document Recommandations en matière de bonnes pratiques pour le secteur de l'utilisation des terres, changements d'affectation des terres et foresterie issu du Groupe d'experts intergouvernemental sur l'évolution du climat. Ce modèle emploie plusieurs informations qui sont déjà requises pour la planification des activités d'aménagement forestier (par ex. inventaire forestier, courbes de croissance et de rendement, données sur les perturbations naturelles et anthropiques, calendrier d'exécution de l'aménagement forestier et données sur les changements d'affectation des terres), complétées par des informations provenant de bases de données écologiques nationales. Au moyen de cet outil informatique sophistiqué mais convivial, les utilisateurs peuvent intégrer leurs propres informations relatives à l'aménagement forestier à l'échelle du peuplement et du paysage pour calculer les stocks de carbone et les changements de ces stocks dans le passé (surveillance) ou dans l'avenir (projection). Les utilisateurs peuvent aussi créer, simuler et comparer divers scénarios d'aménagement forestier afin d'en évaluer les impacts sur le carbone. Les outils fournis avec le modèle sont conçus pour aider les utilisateurs à importer les

données requises à partir de modèles courants d'approvisionnement en bois ou encore depuis des fichiers de données faits sur mesure par les utilisateurs eux-mêmes. Le modèle contient des outils pour aider à préparer les données, à définir des scénarios, à effectuer les analyses et à examiner les résultats. Les résultats des analyses peuvent servir à divers types de comptes-rendus sur le carbone des écosystèmes forestiers. Bien que le modèle contienne des paramètres écologiques par défaut qui s'appliquent au Canada, ces paramètres peuvent être modifiés par l'utilisateur, ce qui permet d'appliquer le modèle dans d'autres pays.

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PREFACE

The Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) is the result of research about forest and global carbon cycles, which was initiated in 1989 by Senior Research Scientists Mike Apps (retired) and Werner Kurz of the Canadian Forest Service. Originally developed as a research tool, the model was used to simulate and track, over a given period of time, stand- and landscape-level carbon dynamics at multiple scales (nationally, provincially, at the forest management unit level, and at the stand level; Kurz et al. 1992). The second version of the model, CBM-CFS2, was used to analyze past and future changes in forest biomass and dead organic matter carbon stocks. It also helped researchers to explore how natural disturbances, forest management, and rates of growth and decomposition might affect forest carbon stocks (Kurz and Apps 1999; Kurz et al. 2002). The CBM-CFS2 was developed with partial funding from the Panel on Energy Research and Development, administered by Natural Resources Canada.

The operational-scale CBM-CFS3 was developed by the carbon accounting team (CFS-CAT) of the Canadian Forest Service (Natural Resources Canada). The CFS-CAT comprises team members from both the Pacific Forestry Centre, in Victoria, British Columbia, and the Northern Forestry Centre, in Edmonton, Alberta. The team consists of Max Fellows, Katie Fisher, Mark Hafer, Sasha Hararuk, Ben Hudson, Stephen Kull, Werner Kurz (emeritus), Vinicius Manvailer Goncalves, Juha Metsaranta, Michael Magnan, Scott Morken, Eric Neilson, Andrea Nesdoly, Derek Sattler, Carolyn Smyth, Piotr Tompalski, Mihai Voicu, Sheng Xie, and Gary Zhang. Many others, too numerous to mention, were involved in the design, review, and implementation of the CBM-CFS3. Development of the Carbon Budget Model began in 1989, and development of the CBM-CFS3 in 2001.

The CBM-CFS3 was developed in partnership with and with funding assistance from the Canadian Model Forest Network, to ensure free availability and use of the software. Funding was also provided by the Climate Change Action Fund, Action Plan 2000, and the Canadian Forest Service.

CHAPTER 1

INTRODUCING THE OPERATIONAL-SCALE CARBON BUDGET MODEL OF THE CANADIAN FOREST SECTOR

This chapter provides an overview of how the operational-scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) can be used to account for carbon stocks and changes in carbon stocks on a managed forest landscape. Major concepts underlying the CBM-CFS3 and the major steps required to use the CBM-CFS3 for analysis and reporting purposes are introduced.

1.1 About the CBM-CFS3

The CBM-CFS3 is a landscape-level model of forest ecosystem carbon dynamics that forest managers and analysts can use to assess the carbon stocks and changes in carbon stocks in their operational forest areas. Although developed primarily to assess carbon dynamics at the operational scale, the model can also be used to explore carbon dynamics for smaller areas, down to the stand level. The model can be used to assess past changes in carbon stocks using information on management actions and natural disturbances that have already occurred or to evaluate future changes that would result from scenarios of management actions and natural disturbances. The CBM-CFS3 accounts for carbon stocks and stock changes in tree biomass and dead organic matter (DOM) pools (Fig. 1-1). Programming languages of the CBM-CFS3 include C++ (Stroustrup, 1995), C# (Microsoft 2000a), and Visual Basic .NET (Microsoft 2002).

This user's guide introduces many of the main concepts of forest carbon modeling but does not provide detailed explanations of the methods or algorithms used by the model. This document describes how to use the model and provides suggestions for its efficient application in forest management planning. Earlier versions of the CBM-CFS have been described in various publications (Kurz et al. 1992, 1996; Kurz and Apps 1999; Li et al. 2003).

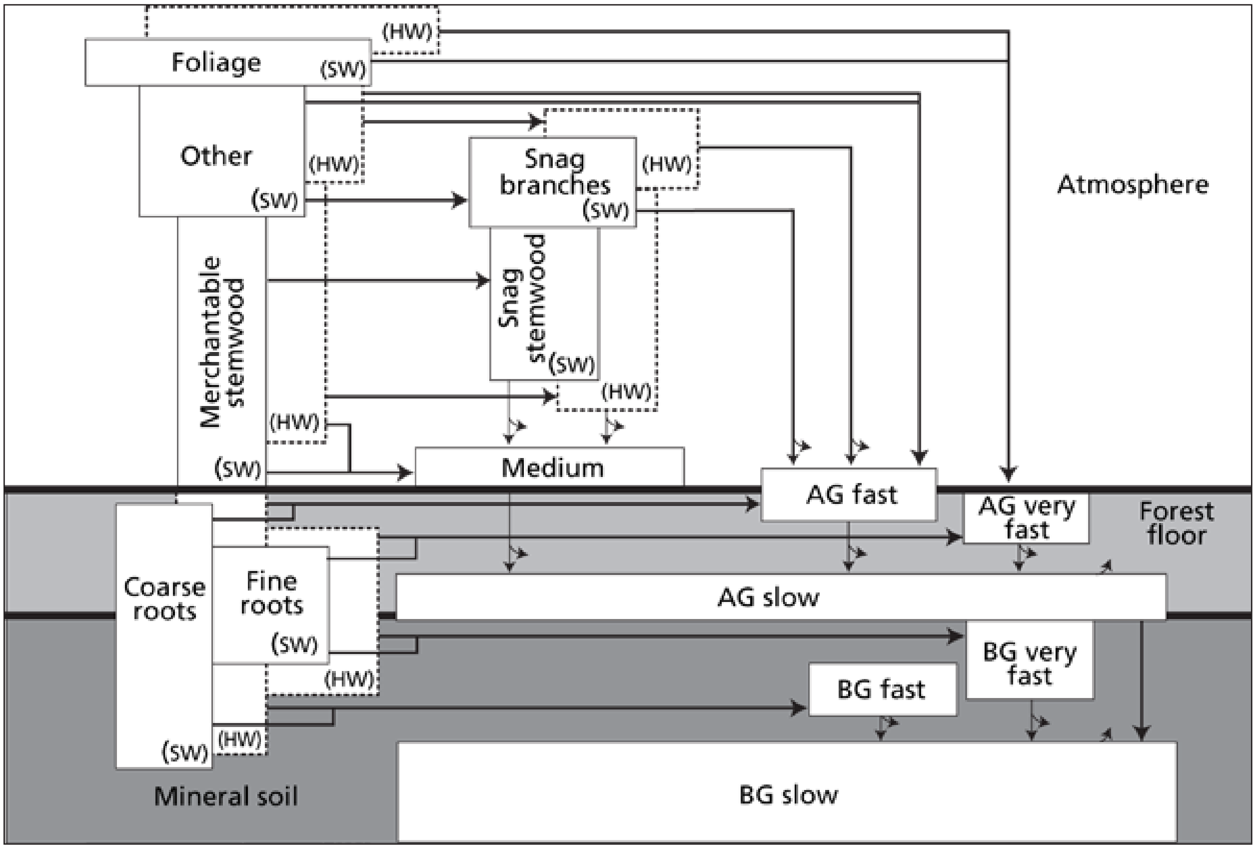


Figure 1-1. The carbon pool structure of the CBM-CFS3. "Very fast," "fast," "medium," and "slow" refer to the relative decay rates for the pools. Curved arrows represent transfers of carbon to the atmosphere, and straight arrows represent transfers from one pool to another. SW = softwood, HW = hardwood, AG = aboveground, BG = belowground.

1.2 Forest Management Planning

Consultations with forest managers and analysts during the design phase for the operational-scale version of the CBM-CFS highlighted the fact that, when used as an indicator, forest carbon would have to be viewed in the context of other forest planning indicators. Moreover, the model would have to be designed for ease of use by forest planners and analysts and would have to take into account existing forest inventory and growth and yield information. In response to these requests, the CBM-CFS3 builds, to the greatest extent possible, on forest inventory and growth and yield information that is commonly used in forest management planning (Kurz et al. 2002). The CBM-CFS3 can help forest managers to meet carbon-related criteria and indicator-reporting requirements of provincial and territorial governments, sustainable forest certification organizations, and international greenhouse gas reporting requirements.

The CBM-CFS3 allows users to explore a range of situations, including the effects of different levels of natural disturbances and management actions, and changes to growth and yield on forest ecosystem carbon stocks. The model can be used as a landscape-planning tool to evaluate the likely consequences for carbon of alternative management scenarios and thus to assist in the development of management plans for forest management areas. The primary intention, however, is that the model be used in combination with existing planning tools. It can also be used to assess the impacts of past management activities on carbon stocks within a forest management area.

1.3 Relation to International Reporting Requirements

The Canadian Forest Service (CFS), in cooperation with other federal departments, provincial and territorial agencies, universities, and the forest industry, has developed Canada's National Forest Carbon Monitoring, Accounting and Reporting System (NFCMARS) (Kurz and Apps 2006; Stinson et al. 2011). This system is used to prepare the annual estimates of carbon stock changes and greenhouse gas (GHG) emissions other than carbon dioxide (CO_2) on Canada's managed forest. These estimates are submitted annually to meet national reporting requirements of the United Nations Framework Convention on Climate Change (UNFCCC). The NFCMARS uses the CBM-CFS3 as its core model. The operational-scale version of the CBM-CFS3 aids forest managers in assessing and understanding the contributions of their forest estates to the provincial and national totals.

1.4 Representation of Space

The CBM-CFS3 is an aspatial model. Each record represents a stand or a group of stands with similar attributes. The members of a group of stands need not be contiguous. The minimum forest stand area that can be processed by the model is 0.002 hectares. To avoid errors, users should not split stands through the use of disturbance events into stands smaller than this area.

The total area included in an analysis is divided into one or more spatial units (SPU). Within each SPU, the locations of the stands represented by the records are not known, but the total forest area and its attributes are described by the information in the records.

The model does not recognize adjacencies or other spatial relationships of stands within an SPU. It performs both stand-level and landscape-level simulations. At the stand level, the model simulates ecosystem carbon dynamics such as growth, litterfall, decomposition, and the impacts of management and disturbances. At the landscape level, the model selects and schedules stands for management actions and natural disturbances. The model loads the records for all stands that are members of an SPU into memory and conducts all operations on those records.

The user has the option of defining multiple SPUs as members of a disturbance group to which specific rule sets are applied (explained in more detail in section 6.2). If this is done, then all records of all SPUs in the disturbance group are loaded for a simulation.

A large analysis area with a very large number of records can be broken into SPUs and disturbance groups. Each SPU can be simulated independent of all others that are not members of its disturbance group. A CBM-CFS3 project can be run in a spatially explicit mode by entering additional information into project import files, and this will be discussed in Chapter 3, section 3.1.2.

1.5 Capabilities and Limitations

As stated earlier, the CBM-CFS3 is an aspatial model. The size of the area represented in the model is constrained only by the number of records that are loaded when the model simulates an area. This includes all records for the SPUs contained in a disturbance group.

The model can be used to simulate a single stand. The upper limit of the number of stands that can be simulated depends on the user's computer configuration, specifically the amount of memory available to the model. Simulation runs with several thousand records have been executed. In one of the most computationally intensive applications to date, the model simulated about 1.4 million records distributed across some 100 disturbance groups (in that case, administrative management units), each of which comprised several ecological SPUs (for a total of nearly 800 SPUs).

The model works in annual time steps. It is not possible to simulate time steps of less than 1 year. Research applications of the model have simulated periods extending over several centuries, but for most applications shorter simulation periods are more appropriate.

The CBM-CFS3 incorporates the best available science, and efforts will be made to continually review the performance of the model against new scientific findings.

At this time, the model does not address the following situations:

Age-class structure of stands: The CBM-CFS3 cannot accommodate stands containing different age classes (i.e., uneven-aged stands). The current workaround to reflect multiple age classes in a single-species stand type is to enter a yield curve that reflects the volumes associated with multiple ages over time. With multispecies stand types, separate yield curves can be entered for each species component, with each curve reflecting the assumed volume associated with that species, given its position in the stand structure.

Peatland carbon dynamics: Despite originally including (disabled) placeholders for carbon in peat, the model's original design and platform limitations will not address peatland carbon dynamics. However, the Canadian Model for Peatlands (CaMP) was recently developed and programmed as a module in NRCan's spatially explicit Generic Carbon Budget Model (GCBM).

Impacts of climate change on forest growth: The CBM-CFS3 can simulate the effects of temperature changes on decomposition rates (Kurz and Apps 1999), but it does not address the impacts of changes in precipitation on decomposition. It also does not address the impacts of climate change on forest growth. Most applications of the CBM-CFS3 focus on the recent past or the next few decades. Refining the representation of climate change impacts is the subject of ongoing research.

Impacts of climate change on disturbance regimes: The impacts of climate change on disturbance regimes are not directly predicted through process simulation, but users can implement them by providing scenarios that incorporate changes in disturbance regimes without explicit attribution to possible causes, such as fire suppression or climate change.

The CBM-CFS3 accounts for forest ecosystem carbon dynamics: Although transfers of carbon are made to a "Forest Products" pool and users can track how much carbon has been harvested from their land base, only the inputs to this pool are tracked (i.e., the carbon dynamics of the forest products sector are not explicitly modeled).

For further information on the short-term limitations of the model, consult the most recent "Known Issues" document available in the model.

1.6 Uncertainty and the CBM-CFS3

Estimates from the CBM-CFS3 are subject to uncertainties related to input data, ecological modelling parameters, and model algorithms. Sources of uncertainty related to user data that have been imported or entered into the model may pertain to forest inventories, merchantable volume yield curves, as well as data describing forest management and disturbance activities. Sources of uncertainty related to ecological parameters include the default parameters used to simulate soil and DOM C dynamics, the disturbance matrices used to simulate disturbance impacts on carbon dynamics, and the allometric equations used to convert aboveground stand-level merchantable volume to aboveground (Boudewyn et al. 2007) and belowground (Li et al. 2003) biomass. Sources of uncertainty related to model algorithms include those created by the computational algorithms of the CBM-CFS3, specifically those occurring in the initialization procedure to populate soil and DOM carbon pools, and in the methods used to select stands for disturbance. **It is the user's responsibility to determine and reduce uncertainties related to input data, as well as any default parameters modified by the user.**

There are also additional uncertainties related to process representation. All models are simplifications of the real world, and therefore will not simulate all possible ecosystem processes that could influence carbon dynamics. In addition, there may be reasonable scientific debate about how certain processes should be mathematically represented, and each model will typically use only one of these representations. Sources of uncertainty related to process representation exclude weather events causing interannual variation in productivity, enhancement of net primary productivity (NPP) because of global change factors (e.g., CO2 fertilization, deposition of nitrogen [N], and climate change), and soil and DOM dynamics as they relate to water stress and peatlands. For scientific analysis, the typical approach used to quantify uncertainty owing to process representation is model inter-comparison, where several models are compared under controlled conditions to understand where they do and do not agree in their predictions (e.g., Wang et al. 2011, 2013). **It is the user's responsibility to determine if the representation of ecological processes in the CBM-CFS3 is suitable for their needs.**

To be consistent with the national GHG inventory guidelines of the Intergovernmental Panel on Climate Change (IPCC), GHG inventories should be " … accurate in the sense that they are neither systematically over- nor under-estimating the true emissions or removals, so far as can be judged, and they should be precise so far as practicable." (IPCC 2019). To meet this requirement, standardized sets of assumptions regarding uncertainties in model inputs, parameters, and algorithms have been developed and are used annually to develop uncertainty estimates for reported values in Canada's GHG inventory using the CBM-CFS3. Monte Carlo simulation-based approaches are used to perform these calculations, as detailed in Metsaranta et al. (2017). Users of the CBM-CFS3 may also wish to apply these methods to their own stand (e.g., Metsaranta et al. 2021) or landscape level (e.g., Drever et al. 2021; Dugan et al. 2021) projects. Users wishing to quantify uncertainties using these approaches will require support from the Canadian Forest Service Carbon Accounting Team.

1.7 Structure of the CBM-CFS3

The basic structure of the CBM-CFS3 has either three or four stages, depending on the purpose for which the model is being used (Fig. 1-2).

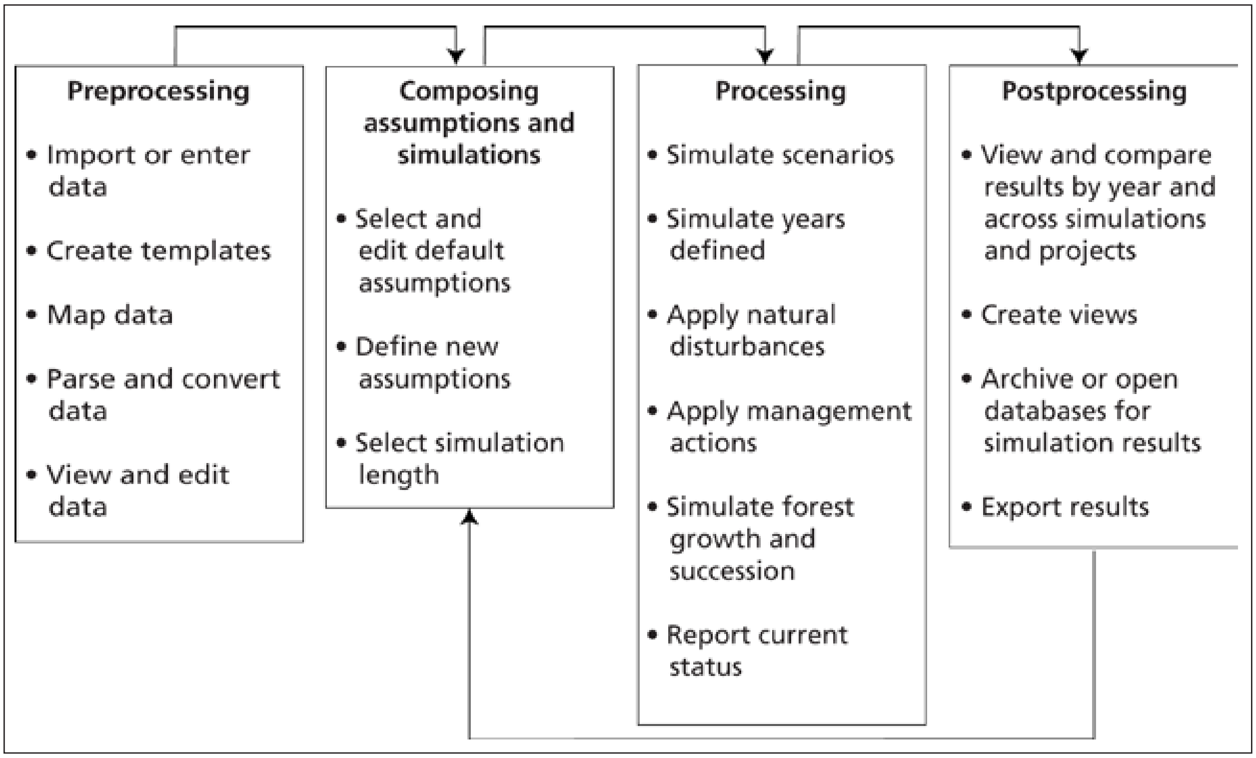


Figure 1-2. The main stages of the analysis using the operational-scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3).

In the first and most complex step, the user must create templates that tell the CBM-CFS3 how to map and import the user's land base information into the software's input database. Once loaded, the data and information can be used for model simulations. The optional second step is to set up new model assumptions and scenarios by defining the assumptions that will be used in each simulation run of the model. In the third step, the user instructs the model to run one or more simulations. In the fourth step, the user can review and compare, for multiple output variables, the simulation results for one or more scenarios.

1.7.1 Preprocessing

The preprocessing tools used by the CBM-CFS3 allow the user to import, parse and convert, and prepare input data (Fig. 1-3).

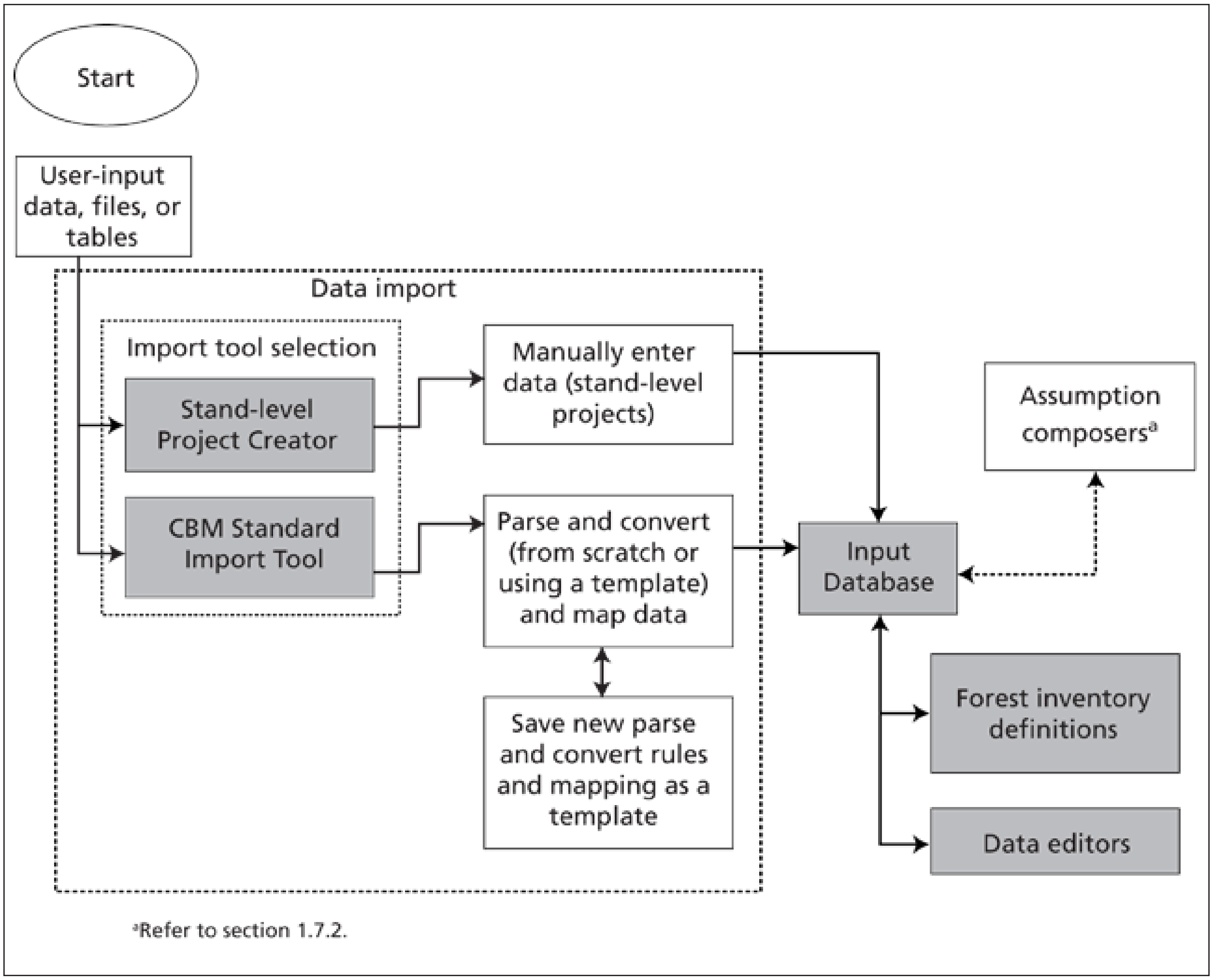


Figure. 1-3. Preprocessing tools (gray boxes) of the CBM-CFS3.

Import Tools

Import tools within the model permit the user to import data for one stand or for entire forest management units. The Stand-Level Project Creator can be used to manually enter information for one stand or a small number of stands. With the CBM Standard Import Tool, the user can load forest management data and specify the rules for parsing and converting these data into the appropriate format for the CBM-CFS3. The user saves the parsing steps as a template. The user has the option of performing partial data imports with this tool. Templates created during the initial import process for a project can be reused for parsing any future data imports (of a similar format) for the project.

To facilitate use of the CBM Standard Import Tool by users of the Woodstock Optimization Studio timber supply model (Remsoft Inc. 2025), the tool includes a conversion feature for converting project data exported from the Woodstock Optimization Studio model to CBM Standard Import Tool format.

The CBM Standard Import Tool can also be used by those who are not using the Woodstock Optimization Studio; this requires the creation of import files specifically formatted for the CBM-CFS3.

Each of these tools is described in detail in Chapter 3.

Input Database

The Input Database stores the imported (and modified) information and data (e.g., inventory, growth-and-yield curves, disturbance history, disturbance forecasts) to be used by the CBM-CFS3.

Forest Inventory Definitions

The forest inventory definitions allow users to view and, if necessary, modify the data that they have imported into the model. Each of these definitions is described in more detail in Chapter 4.

Data Editors

The data editors allow the user to view, edit, or add data and information to previously imported data. The seven editors — the Climate Data Editor, the Disturbance Events Editor, the Transition Rules Editor, the Disturbance Matrix Editor, the Growth Curve Editor, the Inventory Editor, and the Default Input Data Editor — are described in detail in Chapter 6.

1.7.2 Composing Assumptions and Simulations

The CBM-CFS3 includes tools that allow the user to view and define the assumptions and simulations that will be run through the model. These tools are the assumption composers (Fig. 1-4).

When the user imports data into the CBM-CFS3 Input Database (Fig. 1-4), the import tools create a set of default assumptions based on the assumptions in the data. Where assumptions are missing, the CBM-CFS3 creates default assumptions using information provided by the user during the import process, such as the project's geographic and ecological location in Canada, disturbance types, and tree species. With these default assumptions (and the data to which they are linked in the data editors) in place, the user can proceed to the Simulation Scheduler to start the simulation process and then examine the results in the Results Explorer. A user who would like to create alternative assumptions in the model for the purposes of sensitivity analysis can do so by manipulating data in the data editors, linking these data to new assumptions in the assumption composer tools, and running new simulations in the Simulation Scheduler (section 1.7.3).

Assumption Composer Tools

The assumption composer tools (Fig. 1-4) can be used to define the assumption, data, and parameter components for a model simulation. Assumptions can be created for simulations, stand initialization, model runs, growth and yield, disturbance matrices, biomass turnover, DOM turnover, volume-to-biomass conversion, climate, and disturbance and management activities.

Assumptions for a project in the CBM-CFS3 are hierarchical, with the simulation assumptions at the top (Fig. 1-4). Simulation assumptions can be selected and run in the Simulation Scheduler (section 1.7.3). Each simulation assumption is composed of a CBM Run Assumption and a Stand Initialization Assumption. These assumptions are in turn composed of underlying assumptions from the same assumption composer tools, the exceptions being that CBM Run Assumptions are linked to Disturbance and Management Assumptions and Stand Initialization Assumptions are linked to Nonforest Initialization Assumptions, Historic Growth Types Assumptions, and Historic Disturbance Types Assumptions. Each of the assumption composer tools is described in detail in Chapter 7.

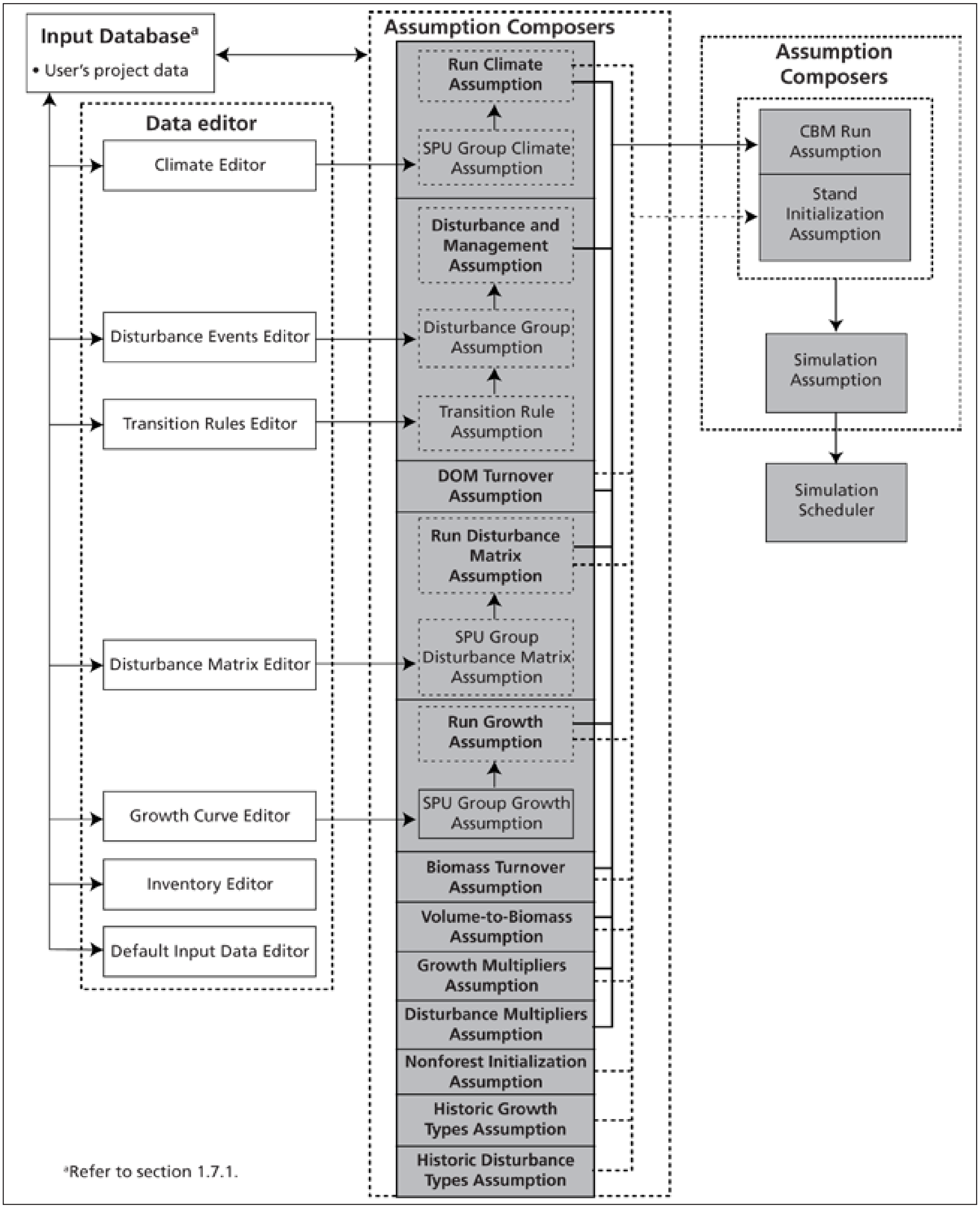


Figure 1-4. Diagram of the CBM-CFS3 assumption composer tools and Simulation Scheduler (gray boxes). DOM = dead organic matter; SPU = spatial unit.

1.7.3 Processing

The Simulation Scheduler is used to simulate projects in the CBM-CFS3. The simulation process includes application of the MAKELIST preprocessing program, modeling and calculation of carbon stocks and stock changes, and creation of a simulation results database that is linked to the Archive Index Database.

Simulation Scheduler

The Simulation Scheduler is used to instruct the model as to which simulation assumptions are to be run and allows the user to view the simulation, stand initialization, and CBM-CFS3 run details for each simulation. Each simulation performed by the CBM-CFS3 is uniquely identified by a run number stored in both the Input Database (see Fig. 1-3 and section 1.7.1) and the Archive Index Database. The Simulation Scheduler is described in more detail in Chapter 7.

MAKELIST

MAKELIST is a preprocessing program that is used to format the inventory information for input into the CBM-CFS3 and to initialize the DOM carbon pools. These pools include carbon from aboveground and belowground dead tree biomass (e.g., coarse woody debris; litter, fibric, and humic layers; and mineral soil). The CBM-CFS3 uses a larger number of DOM carbon pools than did the CBM-CFS2 (Kurz and Apps 1999).

Behind the scenes: Initialization of dead organic matter carbon pools

Forest inventory information typically does not include information about the amount of carbon stored in dead organic matter (DOM) pools. The CBM-CFS3 uses a well-established simulation approach to initialize the DOM pools of each record in the inventory (Kurz and Apps 1999; Kurz et al. 2009). To minimize changes in DOM pools at the beginning of a simulation that are artifacts from the initialization of these pools, the CBM-CFS3 uses a simulation approach that assigns values to the DOM carbon pools that reflect the disturbance history and dynamics of the stand (Kurz and Apps 1999). After all the inventory information has been loaded, but before CBM-CFS3 simulation runs have started, MAKELIST is used to generate initial values for the DOM pools. MAKELIST uses the same algorithms and parameters as the CBM-CFS3 and simulates each stand record through a number of natural disturbance cycles (grow, burn, grow, burn, etc.) until the slow DOM carbon pool at the end of two successive rotations meets a default tolerance of 0.1%. By default, MAKELIST assumes that the historical natural disturbance regime is stand-replacing fire, and it therefore grows stands for *X* years between fires, where *X* is the mean fire-return interval for the region, determined from the literature and provided in the input databases. However, the historical disturbance type and the stand-replacing disturbance interval can be changed by the user. MAKELIST allows specification of whether the last stand-replacing disturbance was fire or some other disturbance (i.e., whether the stand is first or second growth at the start of the CBM-CFS3 runs).

The model then simulates one more rotation to the current age of the stand record. The DOM pool values at that time are then assigned to that record in the database. When the CBM-CFS3 starts the actual simulations, the simulated DOM dynamics are a continuation of the dynamics that led to the pools at the initial age. For example, a stand that is at age 55 in the inventory will, in the next time step, reach age 56, and the DOM dynamics will be a continuation of those that occurred in the previous time step, from age 54 to 55. No "jumps" or discontinuities occur in the first time step of the CBM-CFS3 simulation. MAKELIST and the CBM-CFS3 are always run together. The model will allow a user to conduct a single MAKELIST simulation and to simulate multiple scenarios from this common starting point.

As of July 2022, the model permits users to include more than one "last pass" disturbance event and define the stand-replacing disturbance interval for each; however, this must be implemented manually in the

Behind the scenes (continued): Initialization of dead organic matter carbon pools

database for a project, rather than in the import files or through the graphical user interface. Instructions to implement more than one "last pass" disturbance can be found in Chapter 3, section 3.1.1.

Archive Index Database

The Archive Index Database tracks the relations between model input and the results databases (i.e., projects and their results) that the user has created. Most users will have only one Archive Index Database on their respective computer systems. The Archive Index Database also tracks the status of the user's simulations (i.e., whether or not the simulation has been executed).

1.7.4 Postprocessing

After performing a simulation run with the CBM-CFS3, the user may view and obtain results for the run with the postprocessing tools, the Results Explorer and the View Editor (Fig. 1-5).

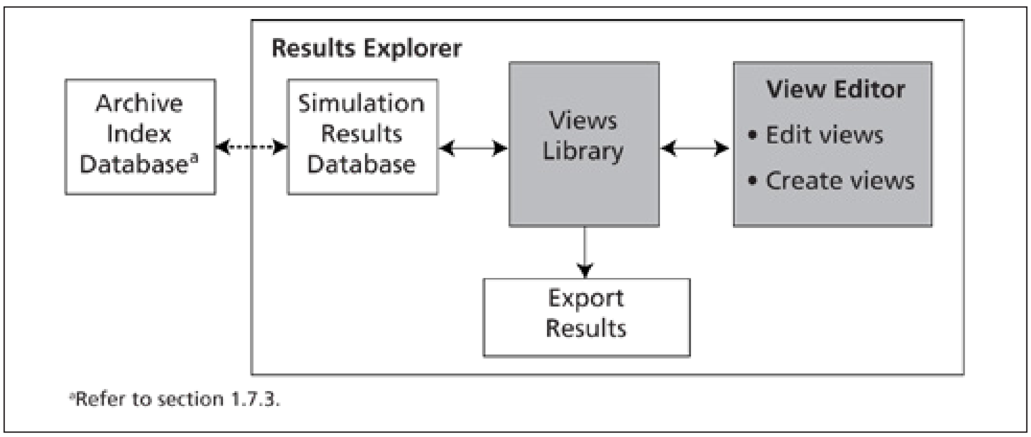


Figure 1-5. Postprocessing tools (gray boxes) of the Carbon Budget Model of the Canadian Forest Sector.

Simulation Results Database

The results for each model simulation are stored in a separate Simulation Results Database. The Archive Index Database maintains the relations between input files, scenario assumptions, and Simulation Results Databases. Users can archive Simulation Results Databases or open them for application to views.

Results Explorer

Using the Results Explorer, the user can open and archive, browse and apply views to, and view, compare, and export results for selected Simulation Results Databases. Results can be viewed as graphs, tables, or reports. The Results Explorer is described in detail in Chapter 8.

View Editor

The View Editor allows the user to create results views or edit existing results views. These views can be saved and applied to any Simulation Results Databases. The View Editor is described in detail in Chapter 8.

Exporting

Data displayed in the Results Explorer can be exported as text or as an Excel (Microsoft 2003) file to allow further data manipulation or generation of publication-quality graphics. The export tool is described in detail in Chapter 8.

1.8 Information and Data Requirements

The CBM-CFS3 is a generic framework for forest carbon accounting that is implemented as a toolbox comprising databases, data preprocessing and postprocessing tools, user interfaces to the databases, and the core scientific model. The model, associated documentation, and tutorials guide the user through the data compilation and analysis steps. The user must provide data that are unique to a specific study area. Data and model parameters that are required to describe ecological processes are derived from the scientific literature and are provided in the model databases. All input data and parameters are open and transparent, and the user can modify input data provided with the CBM-CFS3 at any time.

Running the CBM-CFS3 requires a number of data inputs (Fig. 1-6). Many of these data are readily available as output files from some of the timber supply models used in Canada.

Other required parameters such as volume-to-biomass conversion factors and carbon cycling parameters are provided in the model. Details of the requirements for data import files are explained in more detail in Chapter 3.

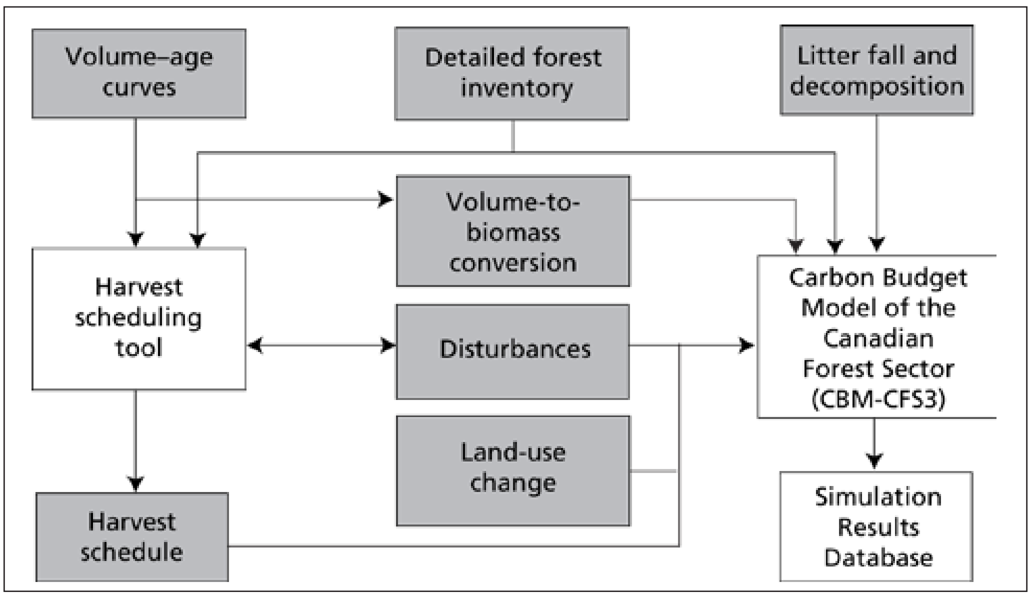


Figure 1-6. Data input (gray boxes) required by the CBM-CFS3.

1.8.1 Detailed Forest Inventory

To use the CBM-CFS3, **the user must provide a detailed forest inventory,** as described in the next paragraph (or some variation thereof).

The information in the inventory must be provided as a series of records, each of which represents a single stand or a group of stands with similar attributes. Each record must contain a series of classifiers (such as stand identifier, administrative unit, ecological region, ownership) and a series of stand attributes (such as area, age, species, forest type, volume, last disturbance type). The information in each record allows the model to select the appropriate growth-and-yield curve that applies to the record. The user provides the relations between stand classifiers and growth and yield curves in a database table.

1.8.2 Volume–Age Curves

The user must provide volume–age curves for use in the model, hereafter referred to as growth-and-yield curves. The model uses these curves to define stand dynamics. Curves are defined as data pairs of stand age and stand volume (to some predefined merchantability standards). Libraries with hundreds of growth-and yield curves can be entered by the user.

Note: Yield curves for Canadian provinces and territories

The type of yield curve that Canadian users of the model will want to employ are gross merchantable volume yield curves (i.e., volume inside the bark of the main stem, excluding tops and stumps, but including defective and decayed wood of trees or stands). International users can contact the CFS-CAT for further information and for assistance with selecting appropriate growth and yield data for use in the model or with setting up new administrative and ecological boundaries in the CBM-CFS3 software.

Note: How the CBM-CFS3 establishes the nonmerchantable portion of a growth curve provided by a user, and how to turn it off, if required

CBM-CFS3 users are required to provide the model with gross merchantable volume growth curves that describe the growth dynamics of each of their species or forest types over time. Since these curves only describe the merchantable volume, and a nonmerchantable volume accrues prior to establishing any merchantable volume, the carbon in this nonmerchantable biomass must be accounted. The CBM-CFS3 uses a smoothing algorithm described in Kurz et al. (2009) to estimate, based on the growth curves provided by the user, the nonmerchantable biomass in a stand prior to achieving any merchantable volume. Should a user wish to assess the effects of the smoothing algorithm on their biomass carbon stock results, they can turn the smoothing algorithm off in an existing CBM-CFS3 project by following these steps (Microsoft Access will be required to perform some of these steps)

1. Go into the folder for the project (folder and project name given by the user), which should be located in Operational-Scale CBM-CFS3\Projects in C:\Program Files\, C:\Program Files (x86), or C:\Users\'users name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3
2. Double-click on and open the Microsoft Access database (.mdb) file for the project
3. In Microsoft Access, open the "tblBioTotalStemwood" table
4. Find the "max_volume" column, and change all of the values in the column to a negative value (e.g., if you see 12.87, change it to -12.87)
5. Save and close the database
6. Open the CBM-CFS3 and the project, and run, or reset and rerun (if already run before) the project in the "Simulation Scheduler" window

Various degrees of sophistication can be used for the implementation of these curves. The model can accommodate natural and "managed" growth-and-yield curves, as well as various transitions between curves after certain events. "Managed" curves should not incorporate transitions resulting from disturbance events. Instead, these transitions should be represented as a switch to a new growth-and-yield curve that describes how the stand type grows after the disturbance event.

Multiple yield curves can be entered for a specific stand type, each representing the volume associated with a particular leading species.

Note: How the CBM-CFS3 handles multiple species components in a stand type

The way in which the CBM-CFS3 handles multiple species components in a stand type will depend on the particular situation, i.e., whether the species components are strictly softwood or hardwood or, whether the components include both softwood and hardwood species. In the situation of strictly softwood or hardwood species, the model uses the identified leading species with the highest percentage of the total merchantable volume component, the administrative boundary (provincial or territorial), and the ecological boundary to select the appropriate volume-to-biomass conversion equation to apply to the combined merchantable volumes of all of the stand components. In the situation of a combination of softwood and hardwood species, the model calculates the total merchantable volume of both the softwood and hardwood components associated with the stand type. It converts the total merchantable volume to biomass using an equation appropriate to the leading softwood species component (with the highest percentage of the softwood volume) and multiplies it by the softwood fraction (softwood volume / total volume). Then, the total merchantable volume is converted to biomass using an equation appropriate to the leading hardwood species component (with the highest percentage of the hardwood volume), and multiplied by the hardwood fraction (hardwood volume / total volume).

The merchantability limits employed by the CBM-CFS3 for softwood and hardwood are defined by province and territory in Appendix 2.

Note: What to do if the user's yield curves are not formulated according to the CBM-CFS3 merchantability limits for a specific province or territory and region

It may happen that a user's yield curves have been formulated according to different merchantability limits than what the CBM-CFS3 uses. In this type of circumstance, the user has two options: 1) document the use of yields formulated with an inappropriate merchantability limit, which may increase the uncertainty of the results obtained with the model, or 2) reconfigure the yield curves according to the merchantability limit applied by the CBM-CFS3 and, if commercial harvesting is planned for diameters below this limit, create and apply an alternative harvesting disturbance matrix to those events that transfer a percentage of the Other pool to the Forest Products pool. The user must decide between these options.

Ideally, users should employ yield curves with a maximum age equivalent to the natural stand-replacing disturbance interval associated with the administrative and ecological boundary combination that they have selected for the stand(s) represented by their growth-and-yield curves. The default stand-replacing disturbance intervals, by administrative and ecological boundary, are defined in Appendix 3. Should a user employ a growth-and-yield curve with a lower maximum age than the default stand-replacing disturbance interval, the model will assume that the merchantable volume per hectare for any stand represented by that curve, beyond the maximum age, will be the same as the last non-zero merchantable volume per hectare entered on that curve.

If the user employs a growth-and-yield curve for a stand that ends with a merchantable volume per hectare value equivalent to zero and the stand (or stand component) growing on this curve is modeled to grow to or beyond the age represented by the zero value, the CBM-CFS3 will replace the zero value (and any subsequent zero values) with the last non-zero merchantable volume per hectare value on the curve. If the user actually wants the zero value to be recognized as zero, for example, in the case where a pioneer species in the understory (represented by its own yield curve) dies out, the user should employ a merchantable volume per hectare value of 0.01 instead of 0.

1.8.3 Volume-to-Biomass Conversions

Volume curves provide information about the merchantable stem volume. The CBM-CFS3 requires information about all aboveground and belowground tree biomass components. The model uses a sophisticated system of equations and supporting parameter sets to convert merchantable volume to all aboveground biomass components such as stemwood, other (branches, tops, and submerchantable-size tree biomass), and foliage.

Details of the methods used to develop the volume-to-biomass conversion equations have been published elsewhere (Boudewyn et al. 2007). New conversion factors were developed in 2014 using the same methods, but included more stand-level data, particularly for British Columbia, and updated tree-level equations to estimate tree biomass components. Additional updates occurred in December 2019 and June 2020 (British Columbia only). Details are available on Canada's National Forest Information System website (https://nfi.nfis.org/en/biomass_models).

Belowground biomass of fine and coarse roots is estimated from published regression equations and methods developed specifically for the CBM-CFS3 (Kurz et al. 1996; Li et al. 2003).

1.8.4 Litterfall and Decomposition

The reporting guidelines of the IPCC (Penman et al. 2003) specify that carbon be accounted for in aboveground and belowground biomass and DOM pools such as litter, woody debris, and soil carbon. Forest inventories have traditionally not addressed these nontimber components, although such information is becoming more readily available. The size and dynamics of DOM pools are related to the stage of stand development and the disturbance and management history of the stand. The approach of the CBM-CFS3 is to simulate the dynamics of DOM pools on the basis of available information for the stand, its history, and its ecological characteristics.

Scientific analysis of the approaches and calibration of the DOM parameters of the model is continuing. The parameters currently used are similar to those described by Kurz and Apps (1999). The number of individual DOM pools in the model has been increased, however, to account for aboveground and belowground DOM components separately and to account for snag stem and snag branch DOM.

Parameters describing litterfall and decomposition rates are provided in the databases of the CBM-CFS3. The user has the option of either using these default values or modifying them, should more accurate values be available for the region of interest. The default values are listed for DOM turnover parameters in Appendix 3, for other DOM parameters in Appendix 4, and for nonforest initial soil conditions in Appendix

5. The CFS-CAT will continue to test and improve the DOM model parameters and to provide periodic updates to the parameter sets recommended for use with the model. The CFS-CAT will use data from a compilation of forest ecosystem carbon estimates (Shaw et al. 2005) and from the National Forest Inventory ground plots (as these become available) to further refine regional parameter sets on DOM dynamics.

1.8.5 Disturbances

The user can provide natural and anthropogenic disturbance information to the model. The CBM-CFS3 modeling framework allows considerable flexibility in the definition of such disturbances. In general, disturbances are events that occur periodically, affect certain eligible stands, have a specified impact on carbon pools at the time of disturbance, and affect the postdisturbance carbon dynamics of the stand.

Where the CBM-CFS3 is applied to estimate past changes in carbon stocks, information on the actual area disturbed must be provided in the import files or input database(s). Where future projections are to be analyzed, the disturbance regime assumptions for each scenario must be provided.

The user can specify the amount to disturb annually for each SPU or for groups of SPUs (e.g., where an administrative area is further stratified into ecological classes). Values should be specified for the disturbed area or the proportion of the eligible area that is disturbed and the volume to be removed through disturbance.

The stands eligible for disturbance are defined on the basis of classifiers, stand attributes, or past disturbance events. The user specifies the conditions a stand must meet to be eligible for a disturbance. All eligible stands are then compiled in a list and sorted according to user-specified rules. Examples of such rules might be that a proportion of all eligible stands is disturbed (as would occur with fires) or that the oldest softwood stands are affected (as would occur with specific insects).

The impact of disturbances is defined in "disturbance matrices" (Kurz et al. 1992). These define the proportion of each biomass and DOM carbon pool that is transferred to another carbon pool, the atmosphere, or the forest product sector (in the case of harvesting). Disturbance matrices for several disturbance types calibrated to specific regions are provided in the CBM-CFS3 databases.

The postdisturbance dynamics of the stand are defined primarily by the growth-and-yield curve applied to the stand. The model allows the user to define one or more new growth-and-yield curves to which proportions of the disturbed area will be allocated.

In terms of stand regrowth following stand-replacing disturbance, unless otherwise specified by a user-defined transition rule, the model will assume the stand will automatically regrow from age zero on the original growth curve identified for the stand. When partial mortality disturbances are implemented, by default, the model will not assume that biomass killed or removed will automatically regrow—if that biomass is assumed to regrow, the user will need to implement a transition rule and growth curve(s) that account for multiple growth components of the same stand. The model does contain a specific stand-replacing "Planting" disturbance type; however, this is rarely used given the above.

With this framework, the user can simulate a wide range of natural disturbances (and management actions represented using the approaches outlined in the next section).

At present, the CBM-CFS3 can represent both stand-replacing and partial stand mortality for natural and managed disturbances such as wildfire, harvesting, and insect disturbances. All default disturbance types linked to disturbance matrices in the CBM-CFS3 are described in Appendix 6, and new disturbance types and matrices can be added by the user via the Default Input Data Editor (see section 6.7). It is also possible to simulate model scenarios without disturbance (aside from the MAKELIST initialization process).

1.8.6 Harvest Schedule

The user can supply a schedule of management actions to the CBM-CFS3 to simulate any harvest or other management activities. The same principles as explained for natural disturbances apply, i.e., the user has a suite of parameter choices to determine the type and rates of management actions.

Forest management activities preprogrammed for use in the CBM-CFS3 are listed and described in Appendix 6. The model can represent planting through reductions in the regeneration delay in growth-and-yield curves or through switching to a different growth-and-yield curve.

Information on harvest rates can be provided as the amount of volume (or carbon) removed, the area harvested, or a proportion of the eligible stand records.

In all cases, certain rules for eligibility of harvest must be provided, along with sequencing rules for the eligibility of stands (e.g., oldest first, highest volume first, number of years since eligibility for harvest as specified in the growth-and-yield curves). If areas are protected from harvesting, this information must be contained as a classifier in the forest inventory information.

The information on harvest rates can be derived from timber supply models. A customized data conversion feature has been developed for the CBM Standard Import Tool for use with the Woodstock Optimization Studio timber supply model. Data from other models can also be input to the system through the CBM Standard Import Tool (Chapter 3, section 3.1.1).

When harvest schedules developed by other models are implemented in the CBM-CFS3, they are translated into a set of instructions provided at the beginning of the simulation. The simulation results of the CBM-CFS3 may not be exactly the same as those from a spatial timber supply model because the CBM-CFS3 is an aspatial model.

1.8.7 Land-Use Change

For implementation of greenhouse gas estimation and reporting, information on changes in land use from forest to nonforest (deforestation) and from nonforest to forest (afforestation or reforestation) since 1990 is also required from the user. This information should be provided as the area annually deforested or afforested. When land is afforested or reforested (as defined by the UNFCCC), the growth-and-yield curve for the afforested stand should also be provided by the user.

The current model does not track carbon stocks in deforested areas that have been converted to agricultural use. Simple postdeforestation dynamics can be assumed, but agricultural land-use details are not simulated. At this time, forest planners need not be concerned about the accounting of carbon stock changes on deforested land converted to nonforest uses because the international reporting convention is that all stock changes associated with land-use change are reported in the new land-use category.

1.9 Using this Guide

All users should read Chapter 2 of this guide, which describes system requirements, installation procedures, how to manage projects, how to access tutorials, and how to obtain help. All users should also read Chapter 3 to learn how to create import files, import data, create a project, and run a simulation for a project. Chapter 3 also describes the procedures for using the CBM-CFS3 operational-scale data import tool and the stand-level project creation tool. If a user simply wants to import data, create a project, execute a simulation, and analyze the results, another chapter of importance is Chapter 8, which describes how to use the Results Explorer tool.

Users interested in editing data and parameters and creating new assumptions within the model for any project they have created should also read Chapters 4, 6, and 7.

Chapter 5 describes some additional tools in the model for exploring project properties, messages, and summaries. Chapter 9 describes how to manage and manipulate graphs created within the CBM-CFS3.

Procedural steps in this guide appear in bold and are either numbered (required steps) or unnumbered. Unnumbered steps within a sequence of numbered steps represent optional tasks. Unnumbered steps are otherwise used where a task involves only one or two steps or where an alternate action within a step can be taken.

Fig. 1-7 displays a flow chart of potential user data inputs and the tools and databases of the CBM-CFS3.

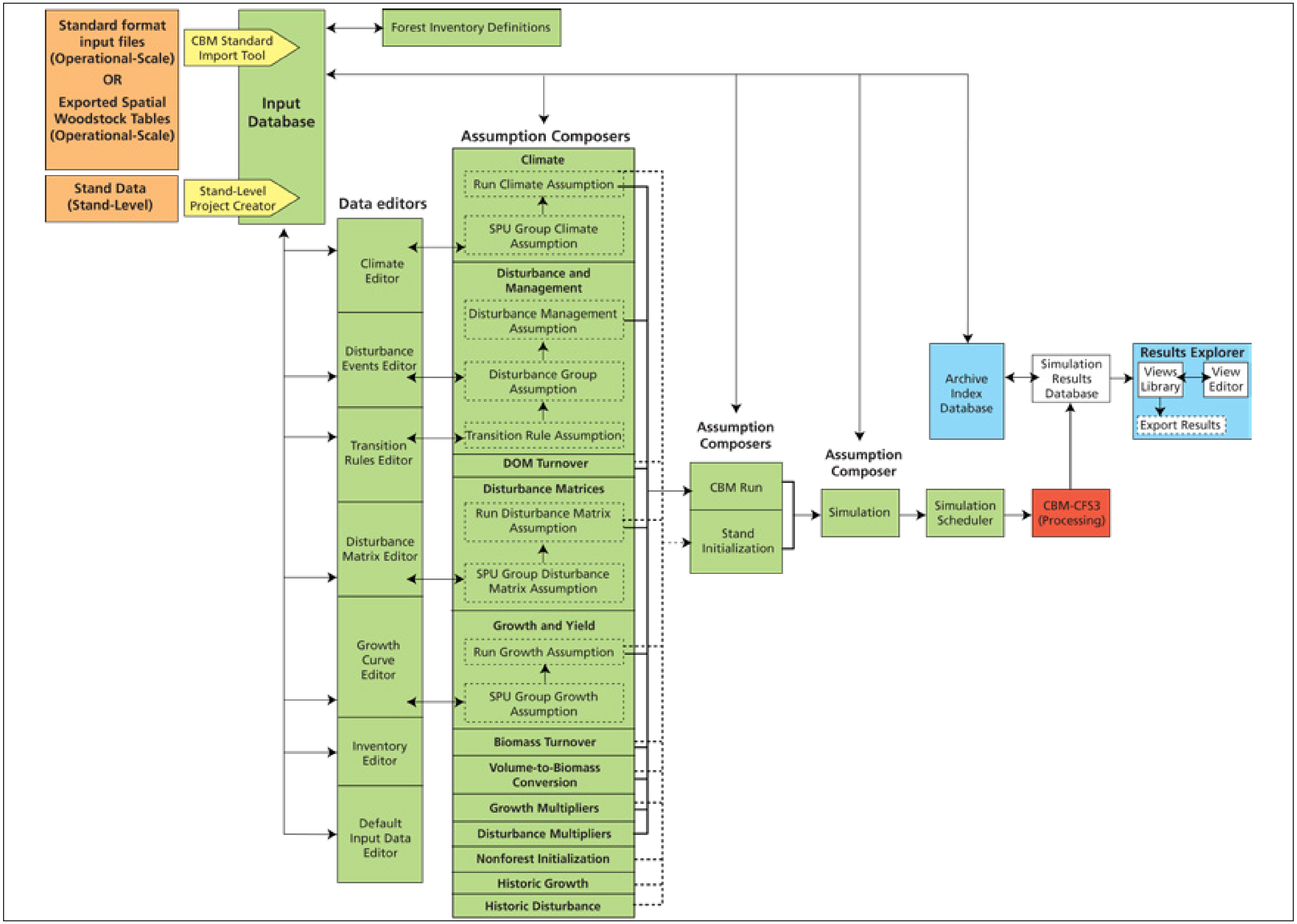


Figure 1-7. Flowchart displaying the CBM-CFS3 user data formats (orange boxes), import tools (yellow boxes), databases, data editors, assumption composers, and Simulation Scheduler(green boxes), the CBM-CFS3 processing module (red box), the Results Explorer and Archive Index Database (blue boxes), and the Results Explorer tools and database (white boxes).

CHAPTER 2

GETTING STARTED

This chapter presents system requirements, installation, software start-up, project management, software shutdown, tutorials access, help access, and known software issues access instructions.

2.1 System Requirements

The CBM-CFS3 is designed to run on high-end personal computers with the following minimum hardware requirements:

- 1.2-Ghz processor or better;
- monitor capable of 1024 X 768 resolution (small fonts highly recommended);
- display DPI setting, set to "Normal size (96DPI)";
- minimum of 512 megabytes of RAM (RAM requirements scale with the size and complexity of the input data);
- Windows (Microsoft 2015) operating system;
- hard drive with 1 gigabyte or more of available space.

Note: Language of Windows operating system

The Windows operating system language required to use the CBM-CFS3 will depend on whether the user's data uses decimal points or commas where integers fractional numbers are concerned (for example, 3.14 or 3,14). If the user's data uses decimal points, the Windows operating system language must be set to "English (Canada)" or another language that uses decimal points for this purpose. If the user's data uses commas, the Windows operating system language must be set to "French (Canada)" or another language that uses commas for this purpose.

The amount of free disk space needed will vary according to the type of analysis and the number of simulations to be conducted. More powerful systems will allow better performance of the software; regardless, a large amount of hard drive space is highly recommended.

2.2 Installation instructions

The CBM-CFS3 executable installation file (CBMToolsSetup.exe) is available for download through the National Forest Information System (NFIS) website (carbon.nfis.org/cbm). When a user creates an NFIS account in order to download the model, the e-mail address they enter for their account will be used to provide the user with notifications of software updates and training opportunities if they so choose. Before proceeding with installation instructions, the user must uninstall any previous versions of the CBM-CFS3 on their computer. The CBM-CFS3 installation file can be installed through the following steps:

1. **Double-click on the CBMToolsSetup.exe file**

A "Select Setup Install Mode" window (Fig. 2-1) will pop up. Users have the option to install the model so that it is accessible to all users (recommended) of their operating system, or only to themselves. By default, the software will install in C:\Program Files (x86)\Operational-Scale CBM-CFS3 if the software is installed for all users, and in C:\Users\'user name'\AppData\Local\Programs\Operational-Scale CBM-CFS3 if it is installed only for the user (however, the user will have the option of changing where the model is installed in either case).

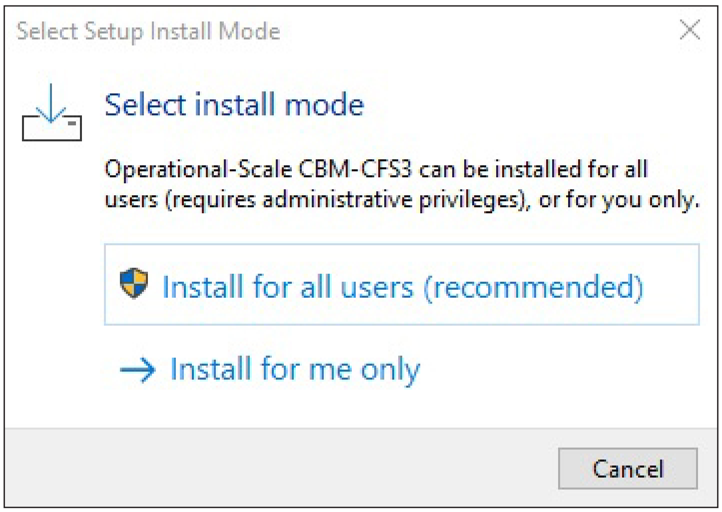


Figure 2-1. The "Select Setup Install Mode" window.

2. **Click on the "Install for all users (recommended)" option**

   or

   Click on the "Install for me only" option

   or

   Click on the "Cancel" button to cancel the process

A "Select Setup Language" window (Fig. 2-2) will pop up with options for the user to continue the installation process in English, French, Spanish, Polish, or Russian.

3. **Select a language on the drop list**
4. **Click on the "OK" button**

   or

   Click on the "Cancel" button to cancel the process

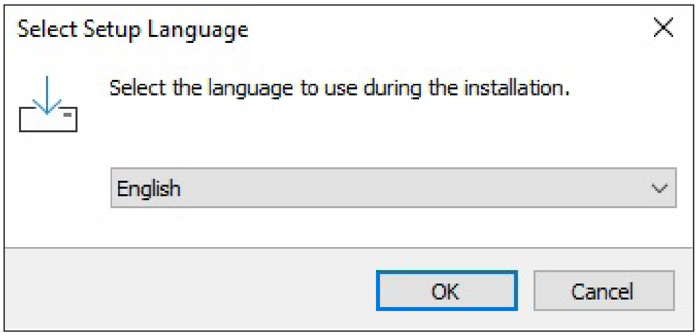


Figure 2-2. The "Select Setup Language" window.

A "Setup – Operational-Scale CBM-CFS3 version #.#.####.###" window (Fig. 2-3) will pop up where the user can browse to and select the installation folder of their choice, or proceed to install the model in the default directory location provided.

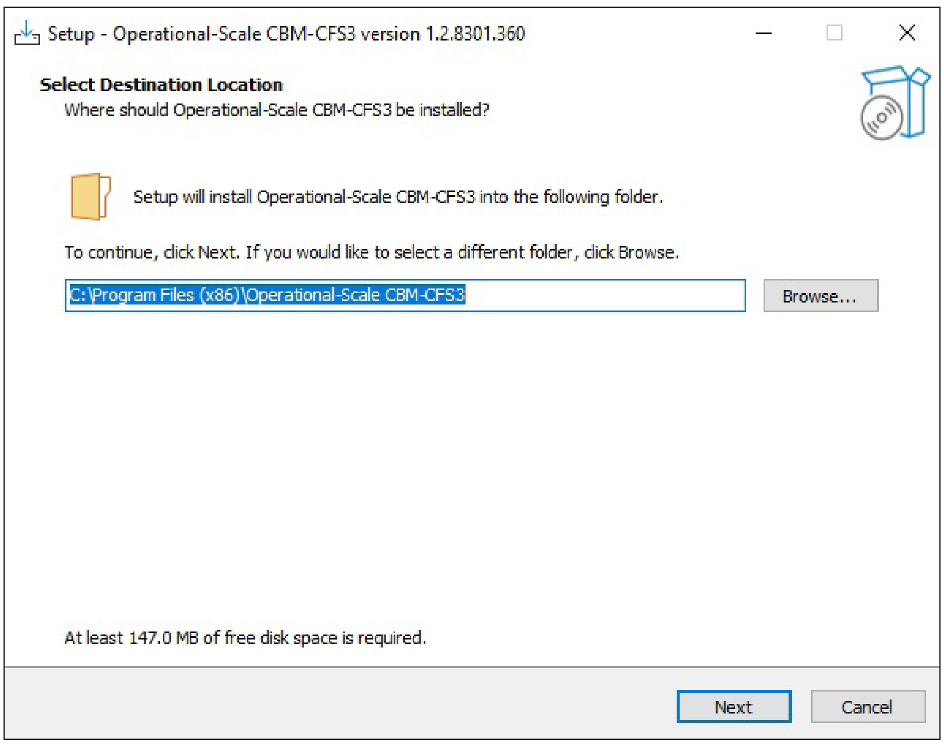


Figure 2-3. The "Setup - Operation-Scale CBM-CFS3 version #.#.####.###" window, displaying the "Select Destination Location" options.

5. **Click on the "Browse" button to browse to and select the intended installation folder for the model (optional)**
6. **Click on the "Next" button**

   or

   Click on the "Cancel" button to cancel the process

If this is the first time the user is installing the CBM-CFS3 on their computer, they can proceed to step 7. Otherwise, for any user who previously had a copy of the CBM-CFS3 installed in the same directory, a "Folder Exists" window (Fig. 2-4) will pop up, asking the user if they would like to continue installing the model in the same directory (doing so will not overwrite existing projects; however, it will overwrite any Archive Index Database [AIDB] previously modified by the user that still employs a default AIDB name in that directory). These users must

Click on the "Yes" button to proceed, or the "No" button to go back and select a different installation directory

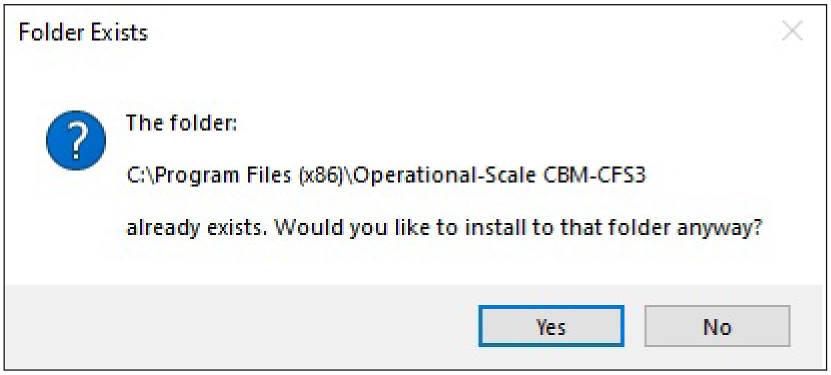


Figure 2-4. The "Folder Exists" window.

Whether the user clicks on the "Yes" button or has never had a previous version of the CBM-CFS3 installed on their computer, the next step requires the user to indicate whether they want to create a desktop shortcut for the model (see Fig. 2-5).

7. **Click on the "Create a desktop shortcut" check box to indicate that a desktop shortcut should be created (optional)**
8. **Click on the "Next" button**

   or

   Click on the "Cancel" button to cancel the process

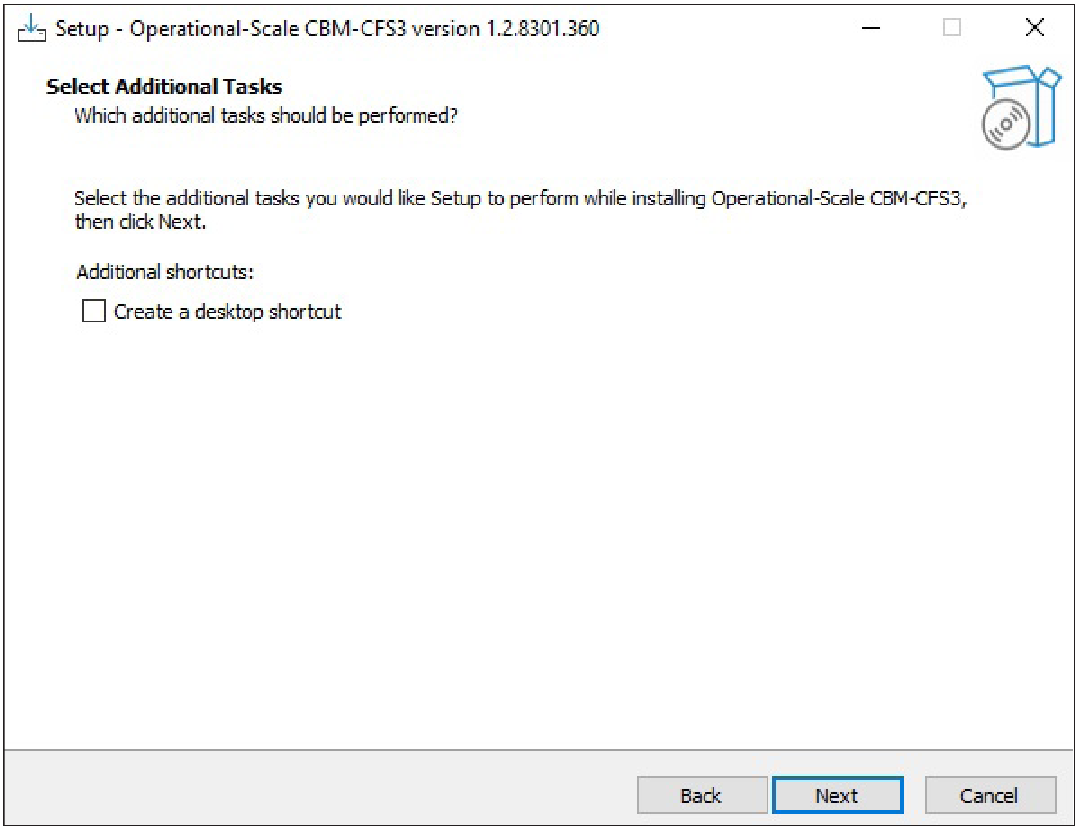


Figure 2-5. The "Setup - Operational-Scale CBM-CFS3 version #.#.####.###" window displaying the "Select Additional Tasks" options.

The software will then be ready to be installed (see Fig. 2-6)

9. **Click on the "Install" button to proceed**

   or

   Click on the "Back" button to go back and make changes

   or

   Click on the "Cancel" button to stop the installation process

If the user clicks on the "Install" button, they will see the installation process proceeding with a progress bar (see Fig. 2-7). Once the installation process has been successfully completed, a window (see Fig. 2-8) will give the user the option of launching the software or simply finishing the process.

10. **Click on the "Launch Operational-Scale CBM-CFS3" check box to open the model after completing the installation process (optional)**

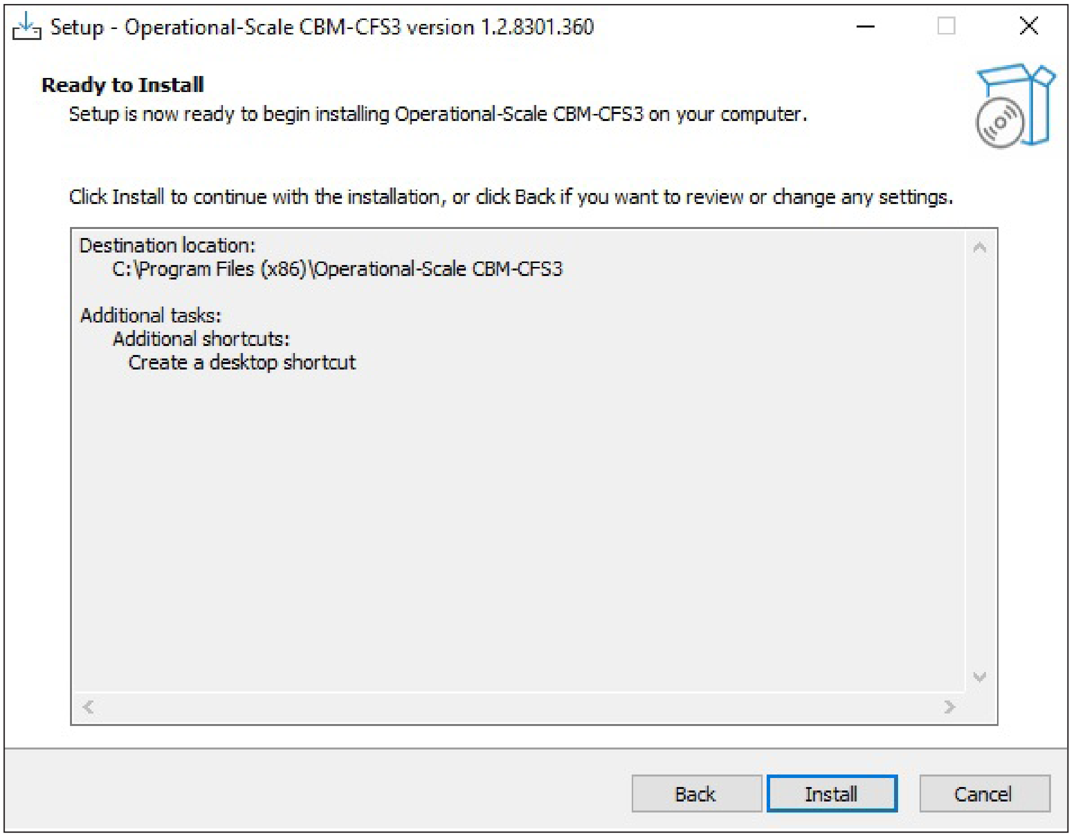


Figure 2-6. The “Setup - Operational-Scale CBM-CFS3 version #.#.####.###” window displaying the “Ready to Install” options.

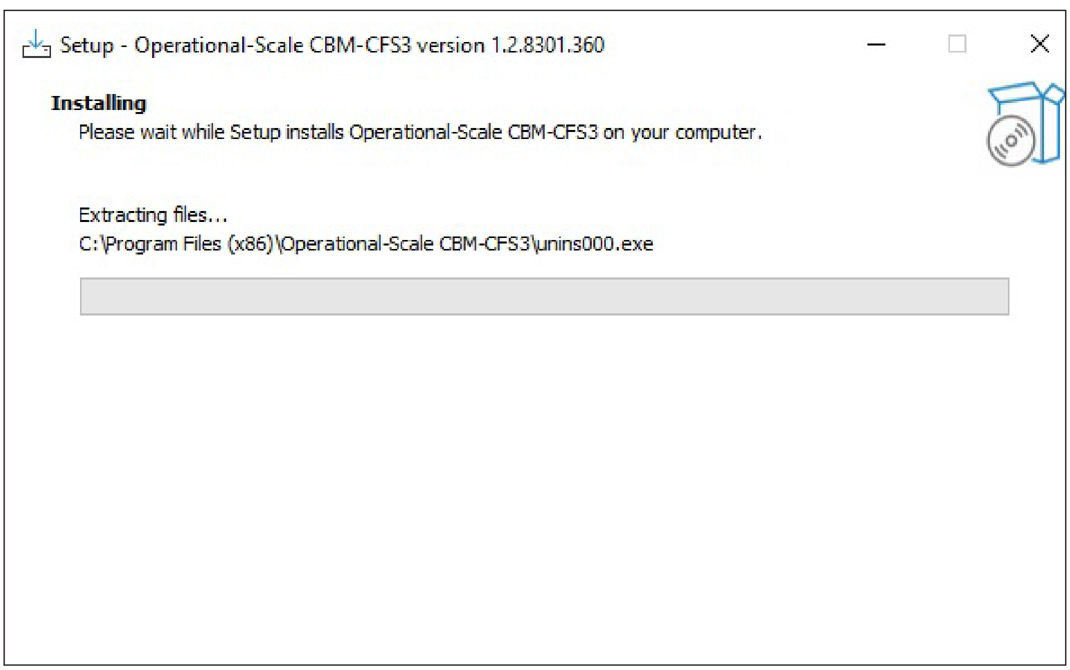


Figure 2-7. The “Setup - Operational-Scale CBM-CFS3 version #.#.####.###” window, displaying the “Installing” process.

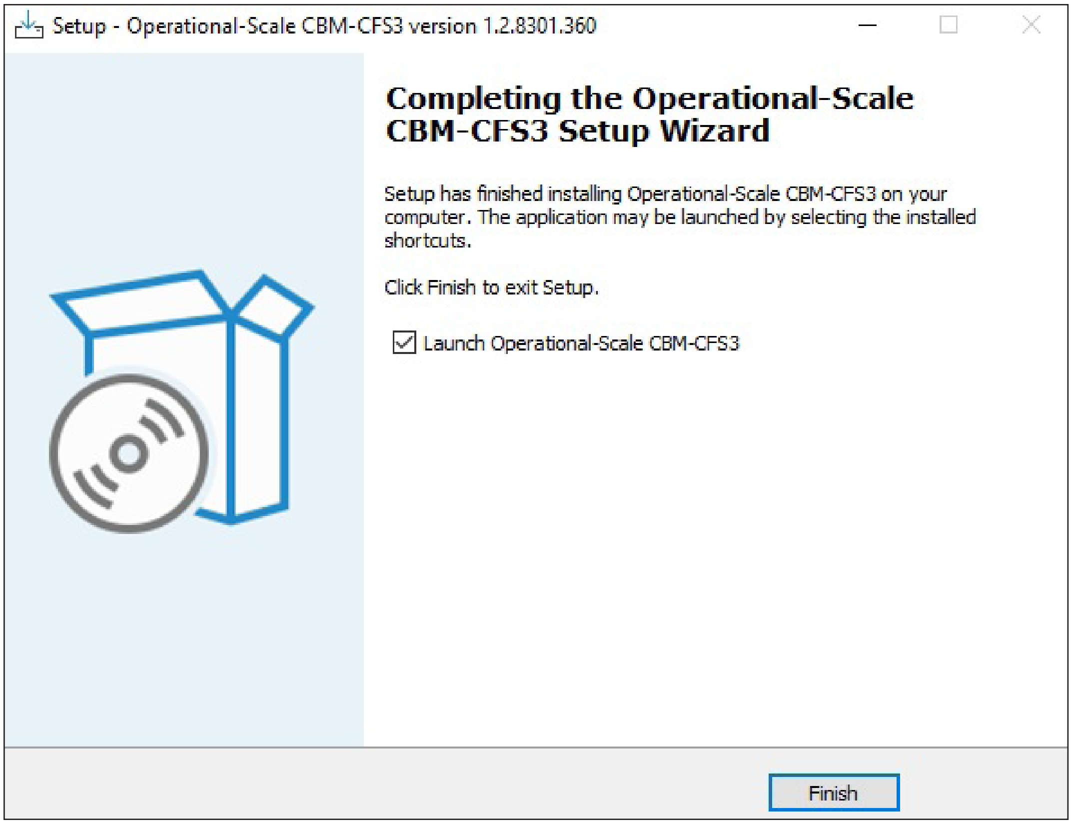


Figure 2-8. **The "Setup - Operational-Scale CBM-CFS3 version #.#.####.###" window, displaying the completion option.**

11. **Click on the "Finish" button**

2.3 Opening the CBM-CFS3

To start the CBM-CFS3

1. **Click on "Start" from the Windows "Start" menu, scroll down the list of programs, and click on "Operational-Scale CBM-CFS3"**

   or

   Click on the "Operational-Scale CBM-CFS3" icon on the Windows desktop display

A language selection window (Fig. 2-9) will pop up, asking the user to select the language in which the model will be used. In the "Language" box

2. **Click on the drop list box and select a language from the list that appears**

If the user does not want to have to make this selection every time the CBM-CFS3 is opened, a check mark should be placed in the "Don't ask me again" check box. This will ensure that this window does not appear during future software start-ups. Should it be necessary at a later time to alter a permanent language selection made in this window, the change can be made by following steps in section 2.8.

3. **Click on the "Select" button**

The "CBM-CFS3" window (Fig. 2-10) will pop up and will then be replaced by the "General Disclaimer for the CBM-CFS3 Version 1.2" window (Fig. 2-11). In this window,

4. Read the End-User Agreement

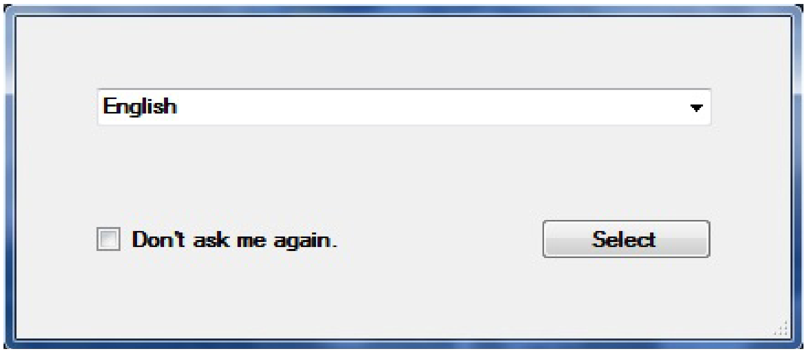


Figure 2-9. The "Language" window.

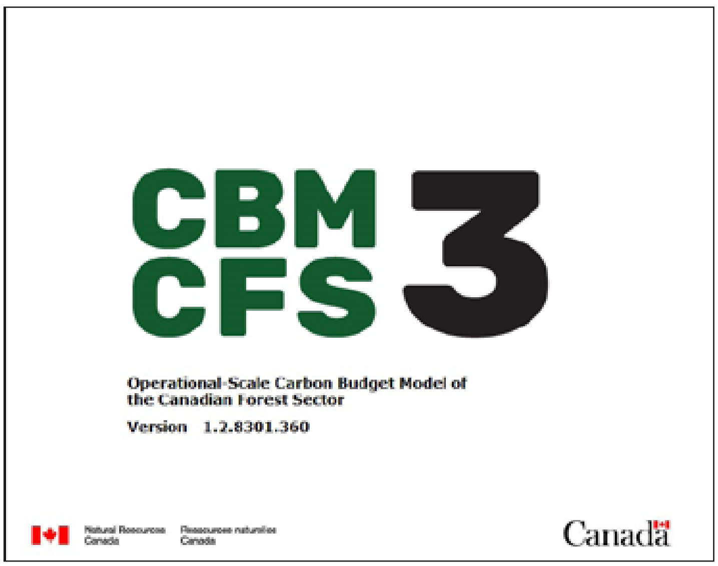


Figure 2-10. The "CBM-CFS3" window.

If the user does not want the "General Disclaimer for the CBM-CFS3 Version 1.2" window to open every time the software is opened, a check mark should be placed in the "Do not show again" check box.

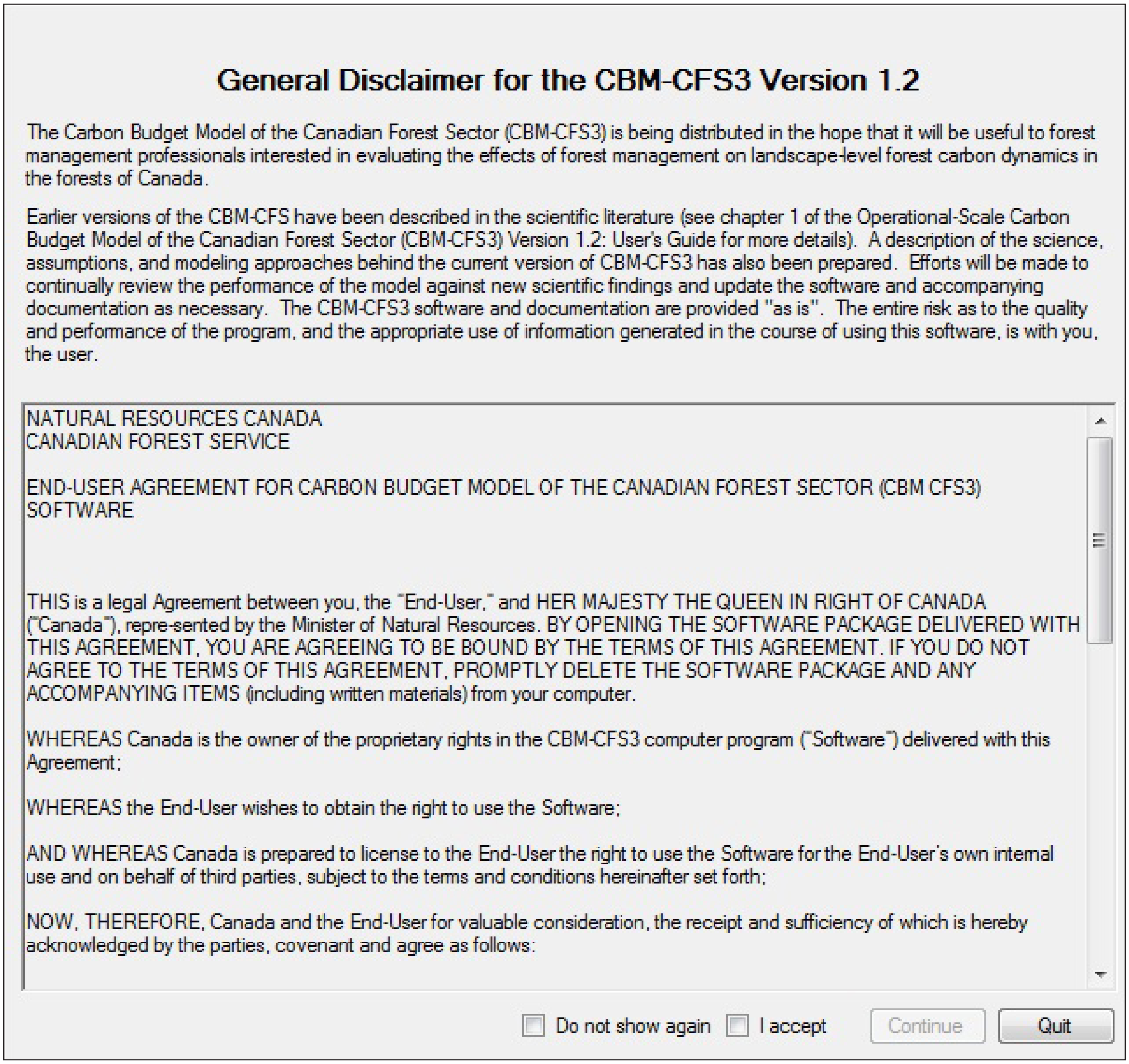


Figure 2-11. The "General Disclaimer for the CBM-CFS3 Version 1.2" window.

5. **Agree to the statements in this disclaimer window by clicking on the "I Accept" check box, and then click on the "Continue" button**

   or

   Click on the "Quit" button to exit the program

If the user accepts the disclaimer the main CBM-CFS3 window (Fig. 2-12) and then the "Project Manager" window (Fig. 2-13) will pop up.

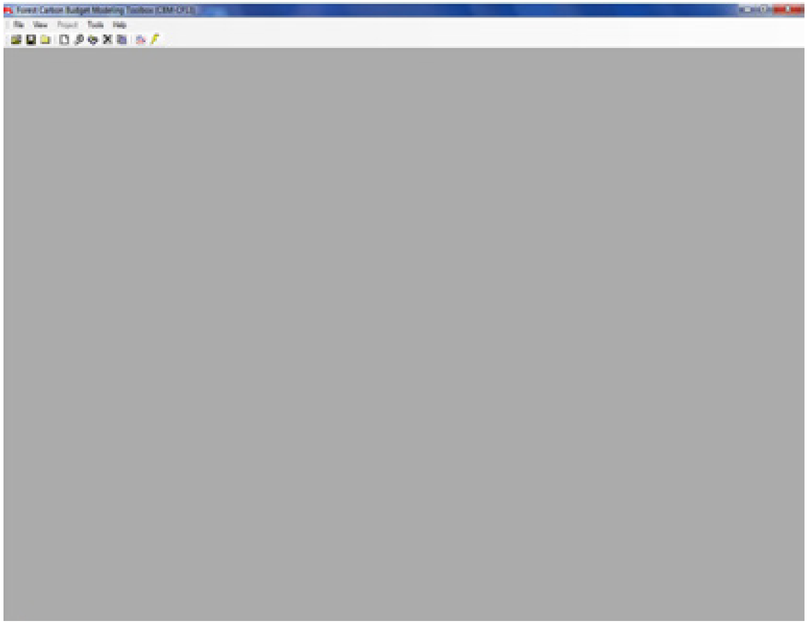


Figure 2-12. The main CBM-CFS3 window.

2.4 The Project Manager

When the CBM-CFS3 is started up, the "Project Manager" window (Fig. 2-13) will pop up in the main CBM-CFS3 window.

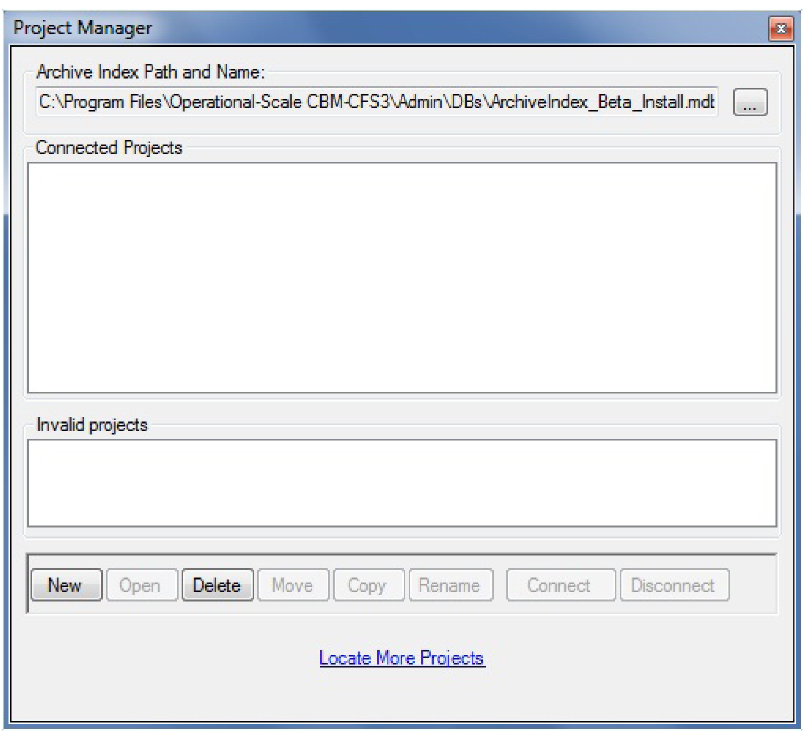


Figure 2-13. The "Project Manager" window.

Tip: Reopening the "Project Manager"

Should the user accidentally close the "Project Manager" window and want to reopen it, or if you want to open it at a later time,

1. **Click on "View" on the main CBM-CFS3 window menu bar**
2. **Select "Project Manager" from the drop list that appears**

In the "Project Manager" window, the "Archive Index Path and Name" box will automatically point to the Archive Index Database (discussed in Chapter 1).

Note: Selecting an Archive Index Database

If the "Archive Index Path and Name" box does not point to the Archive Index Database in the "Project Manager" window or if you need to point to a different Archive Index Database,

1. **Click on the "…" button beside the "Archive Index Path and Name" box**

The "Please select the archive index database under which your projects are saved" window (Fig. 2-14) will pop up.

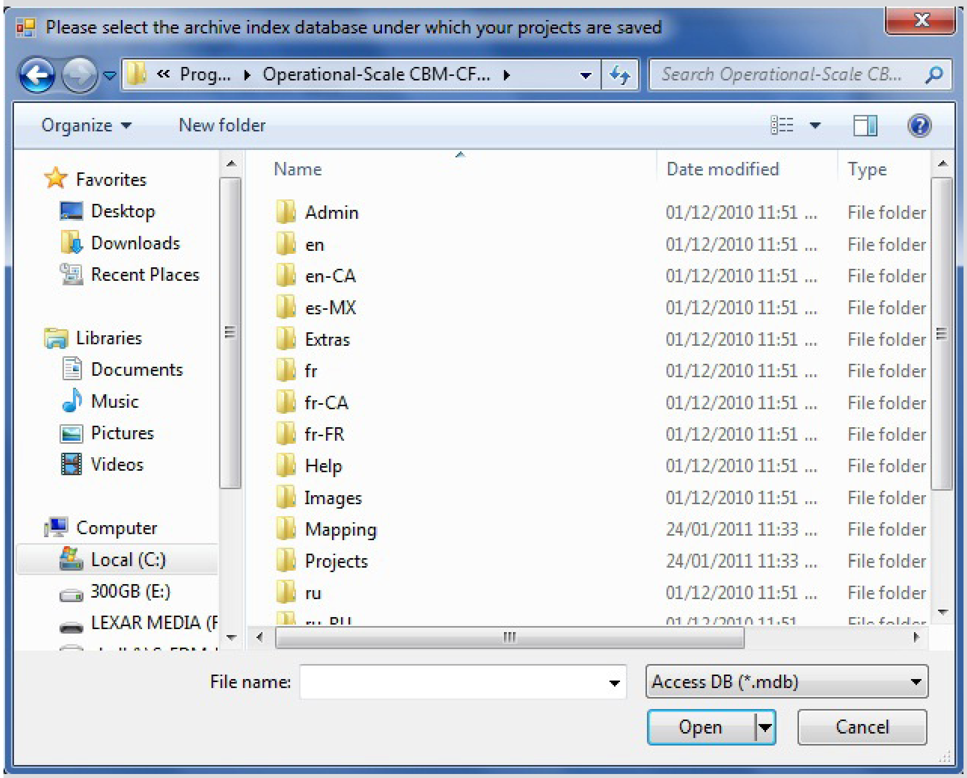


Figure 2-14. The "Please select the archive index database under which your projects are saved" window.

2. **Point to and click on the name of the appropriate database in the window that appears**
3. **Click on the "Open" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

The "Connected Projects" box of the Project Manager window (Fig. 2-13) will display the names of projects previously created by the user (if any) with that particular version of the CBM-CFS3. The "Invalid Projects" box will display projects that appear to have an invalid format (if any), for example, missing the cbmproj file (see section 2.4.2). The user can also create a new project in this window (see Chapter 3).

2.4.1 Connected Projects

Existing projects previously created by the user, which will appear in the "Connected Projects" box of the "Project Manager" window (Fig. 2-13), can be opened, renamed, moved, copied, deleted, or disconnected.

To obtain information about any project,

1. **Click on the name of the project in the "Connected Projects" box**
2. **Right-click over the name and click on "Project Info" on the menu that appears**

The "Project Information" window (Fig. 2-15) will pop up. Displayed in this window are the "Input DB" box, showing the input database path, the "Simulation" box, showing the Simulation Assumption name of the project, the "Stand Init" box, showing the Stand Initialization Assumption associated with the project, and the "CBM Run" box, displaying the name of the model run assumption associated with the project.

3. **Click on the "Done" button to close the window**

Opening an Existing Project

To open an existing project displayed in the "Connected Projects" box

Double-click on the name of the project in the "Connected Projects" box

or

Click on the name of a project, right-click over it, and click on "Open Project" on the menu that appears

or

Click on the name of the project in the "Connected Projects" box and click on the "Open" button.

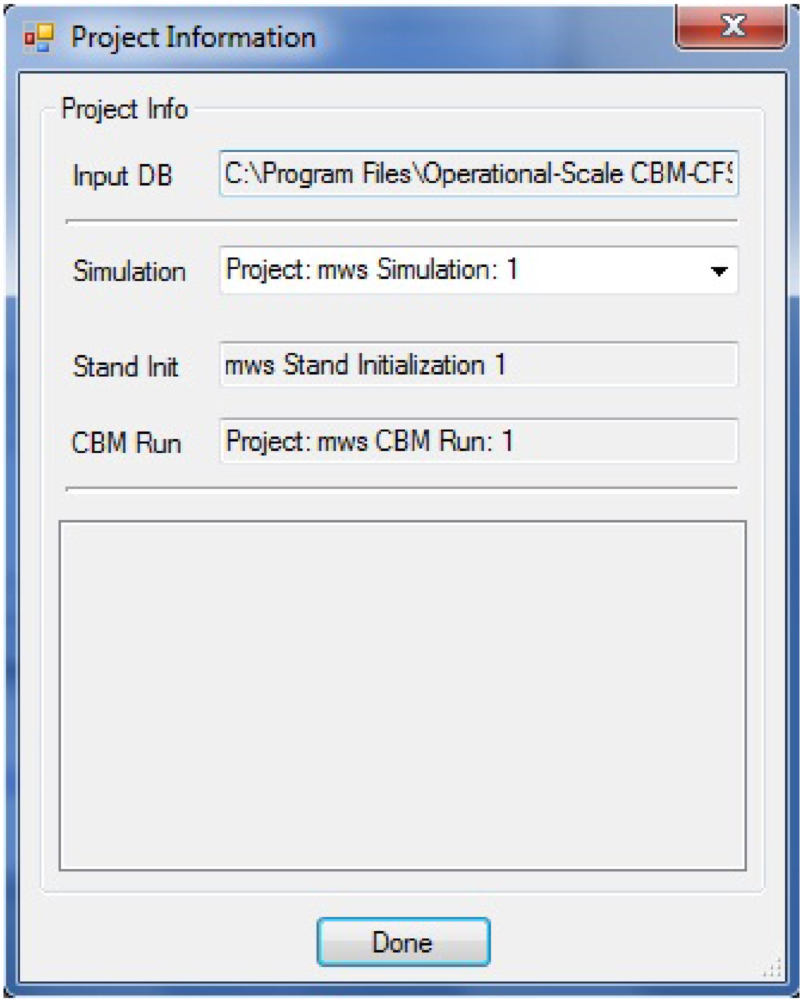


Figure 2-15. The "Project Information" window.

The project selected will be opened in the CBM-CFS3 main window. The "Results Explorer" window will pop up. Detailed information about the Results Explorer is available in Chapter 8, Using the Results Explorer. A "Message" window and "Task List" window will also pop up. For details about these windows, read Chapter 5, section 5.2.

Alternatively, if the "Project Manager" window is closed, projects can be opened from the main CBM-CFS3 window menu bar options. To open a project this way

1. **Click on "File" on the main CBM-CFS3 window menu**
2. **Click on "Open" on the drop list that appears**

A "Browse for CBM Project File" window (Fig. 2-16) will pop up.

3. **Browse to the "Projects" folder (default location is Operational-Scale CBM-CFS3\Projects in C:\Program Files\, C:\Program Files (x86)\, or C:\Users\'users name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3) and double-click on the name of the folder containing the project to be opened**

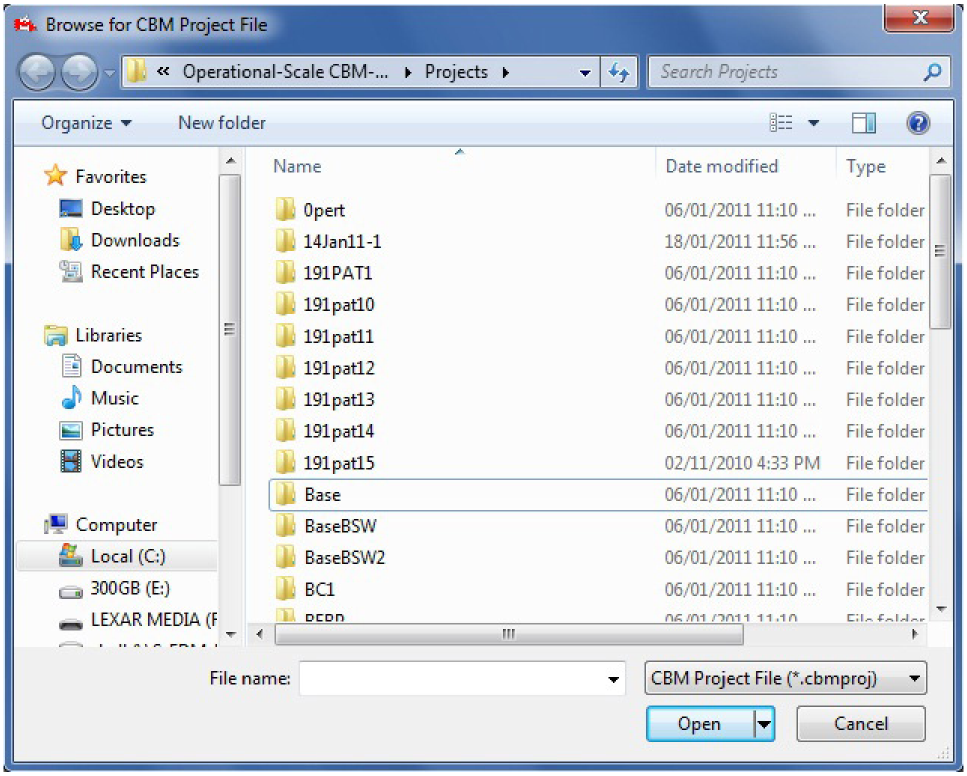


Figure 2-16. The "Browse for CBM Project File" window.

4. **Click on the project name.cbmproj file that is displayed (where "project name" represents the user-defined project name of the existing project)**
5. **Click on the "Open" button to open the project**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "Open" button, the project selected will be opened in the main CBM-CFS3 window. In addition to this way of opening projects, projects that have been opened recently and then closed in the CBM-CFS3 can be easily and quickly reopened. To do this

1. **Click on "File" on the main CBM-CFS3 window menu bar**
2. **Click on "Recent Projects" on the drop list that appears**
3. **Select the name of the appropriate project from the side drop list that appears**

Renaming an Existing Project

To rename an existing project displayed in the "Connected Projects" box

1. **Click on the name of the project in the "Connected Projects" box**
2. **Right-click over the name and click on "Rename" on the menu that appears**

   or

   Click on the "Rename" button

The "Rename" window (Fig. 2-17) will pop up with the name of the project displayed in the "Current Name" box.

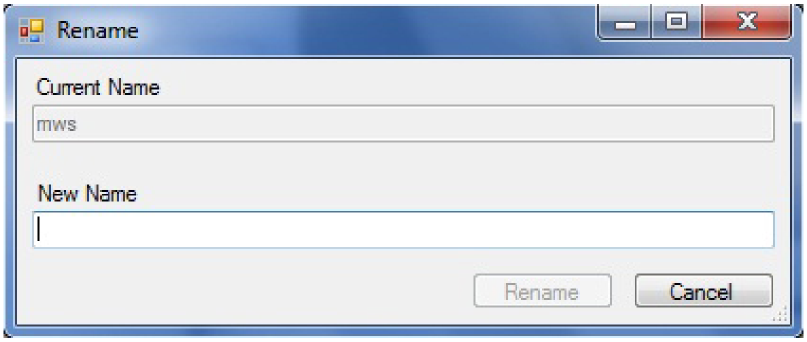


Figure 2-17. The "Rename" window.

1. **Enter a name in the "New Name" box**
2. **Click on the "Rename" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

Moving an Existing Project

To move an existing project displayed in the "Connected Projects" box

1. **Click on the name of the project in the "Connected Projects" box**
2. **Right-click over the name, and click on "Relocate" on the menu that appears**

   or

   Click on the "Move" button

The "Relocate Project" window (Fig. 2-18) will pop up. The current project location will appear in the "From" box.

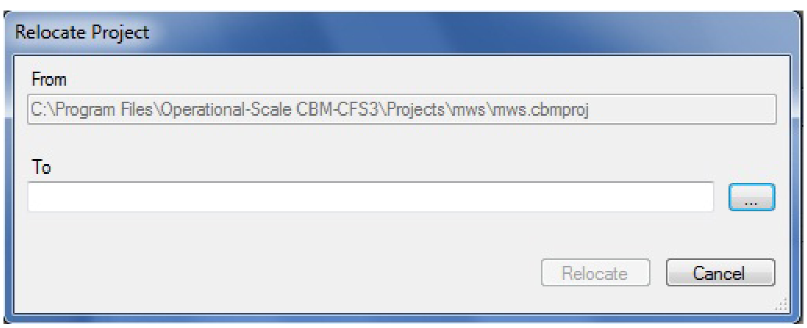


Figure 2-18. The "Relocate Project" window.

To proceed

3. **Enter the new location for the project in the "To" box and skip to step 6**

   or

   Click on the "…" button

The "Browse For Folder" window (Fig. 2-19) will pop up.

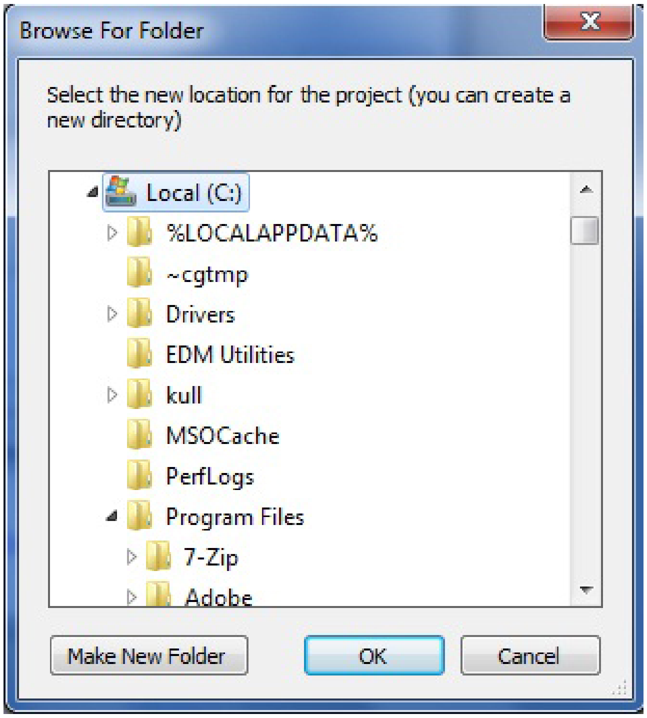


Figure 2-19. The "Browse For Folder" window prompting the user to select the path to the desired project.

4. **Browse to the appropriate new location**
5. **Click on the "OK" button to proceed,**

   or

   Click on the "Cancel" button to terminate the process

   or

   Click on the "Make New Folder" button to create a new folder

If the user clicks on the "OK" button, the "Browse for Folder" window will close.

6. **Click on the "Relocate" button to relocate the project**

   or

   Click on the "Cancel" button to terminate the process

Copying an Existing Project

To copy an existing project displayed in the "Connected Projects" box

1. **Click on the name of the project in the "Connected Projects" box**
2. **Right-click over the name, and click on "Copy" on the menu that appears**

   or

   Click on the "Copy" button

The "Copy Project" window (Fig. 2-20) will pop up. The name and location of the project to copy will appear in the "Source" box.

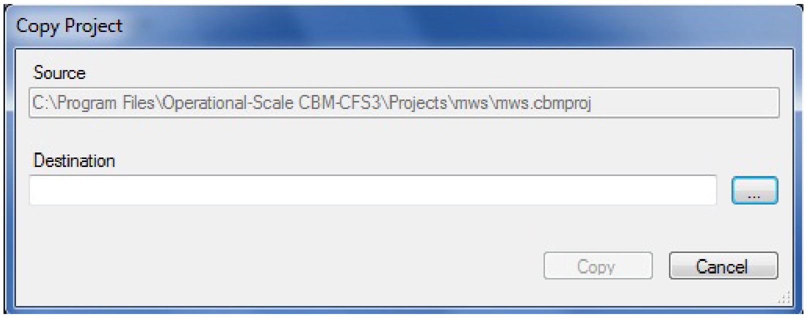


Figure 2-20. The "Copy Project" window.

3. **Type in the location for the copy of the project in the "Destination" box and skip to step 6**
   or
   Click on the "…" button

A "Browse For Folder" window (Fig. 2-21) will pop up.

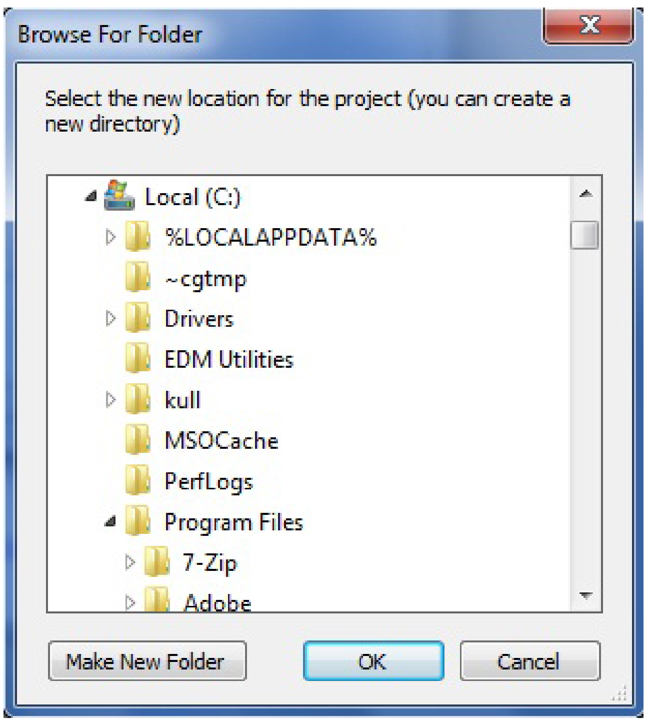


Figure 2-21. The "Browse For Folder" window prompting the user to select the new location for the project.

4. **Browse to the appropriate location where the copy can be placed**
5. **Click on the "OK" button to proceed**
   or
   Click on the "Cancel" button to terminate the process
   or
   Click on the "Make New Folder" button to create a new folder

If the user clicks on the "OK" button, the "Browse for Folder" window will close.

6. **Click on the "Copy" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

Deleting an Existing Project

To delete an existing project displayed in the "Connected Projects" box

1. **Click on the name of the project in the "Connected Projects" box**
2. **Right-click over the name, and click on "Delete" on the menu that appears**

   or

   Click on the "Delete" button

The "Delete Project?" window will pop up asking the user to confirm deletion of the selected project(s).

Click on the "Yes" button to proceed,

or

Click on the "No" button to cancel the deletion process

Disconnecting an Existing Project

By disconnecting a project, the user is not deleting it, but rather is just disconnecting it from the Archive Index Database. To disconnect an existing project displayed in the "Connected Projects" box

Click on the name of the project in the "Connected Projects" box

Right-click over the name, and click on "Disconnect" on the menu that appears

or

Click on the "Disconnect" button

The project name will disappear from the "Connected Projects" box. To learn how to reconnect a disconnected project, proceed to section 2.4.3.

2.4.2 Invalid Projects

Projects appearing in the "Invalid Projects" box of the "Project Manager" window (Fig. 2-13) must be validated before they can be connected to the Archive Index Database and made available to be opened. A project will be listed in the "Invalid Projects" box if the CBM-CFS3 cannot locate the Input Database for the project. This may occur for two reasons: either the database (.mdb) file for the project has been deleted or it has been relocated. To validate an invalid project

1. **Click on the name of the project in the "Invalid Projects" box**
2. **Right-click over the name and click on "Validate" on the menu that appears**

The CBM-CFS3 will attempt to find the input database file for the project. If it is found and validated, the project name will move to the "Connected Projects" box, and if not, the user will not be able to open the project.

2.4.3 Disconnected Projects

The "Projects" folder may include projects supplied by other users or projects that have been disconnected from the Archive Index Database either purposely or because of an update to the CBM-CFS3. These disconnected projects can be found and reconnected or deleted in a hidden section of the "Project Manager" window (Fig. 2-13). To access this hidden section

1. Click on the "Locate More Projects" link

The hidden section of the "Project Manager" window (Fig. 2-22) will pop up.

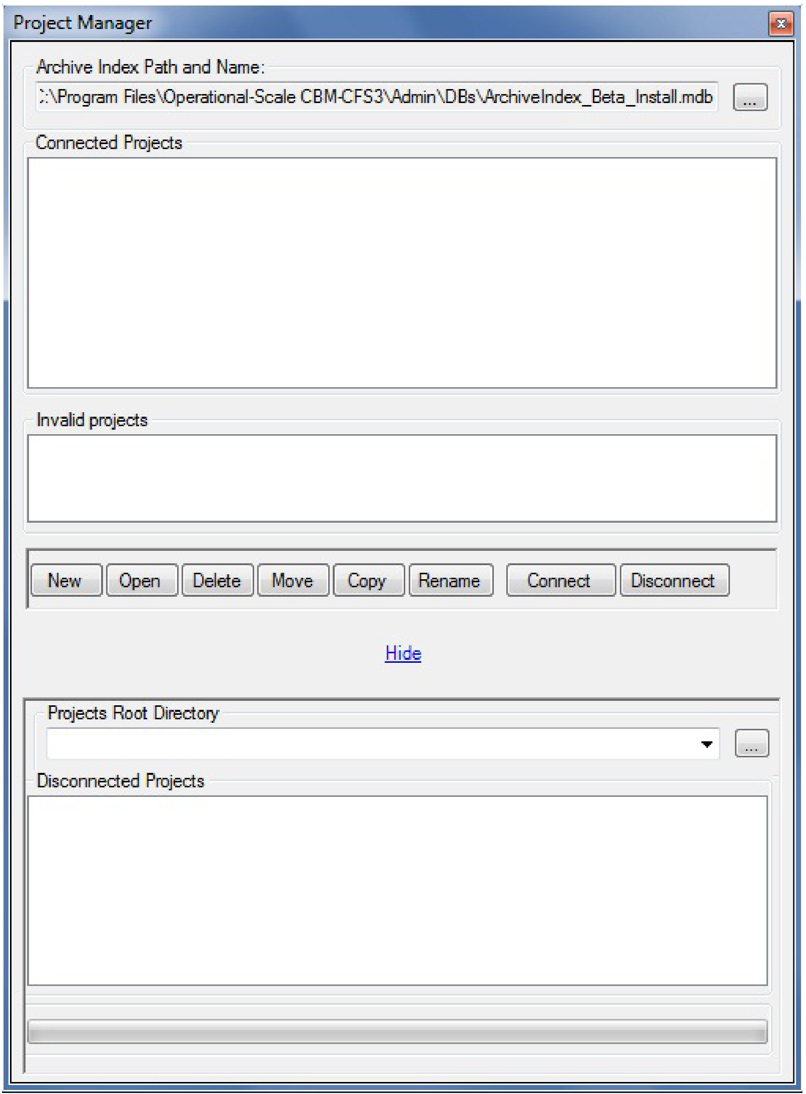


Figure 2-22. The "Project Manager" window displaying the hidden section for disconnected projects.

In this section, the user should make the "Projects Root Directory" box point to Operational-Scale CBM-CFS3\Projects (located in C:\Program Files\, C:\Program Files (x86)\ or C:\Users\ 'users name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3), where projects are usually stored, unless the projects are stored in a different folder.

2. Click on the "…" button beside the "Projects Root Directory" box

A "Browse For Folder" window (Fig. 2-19) will pop up.

3. Browse to and select the folder where the projects are stored

4. **Click on the "OK" button to proceed**
   or
   Click on the "Cancel" button to terminate the process
   or
   Click on the "Make New Folder" button to create a "Projects" folder

Reconnecting a Project

To reconnect a disconnected project

Click on the name of the project in the "Disconnected Projects" box
Right-click over the name, and select "Connect" from the menu that appears
or
Click on the "Connect" button

The project name will be reconnected to the Archive Index Database and appear in the "Connected Projects" box. To hide the disconnected projects section

Click on the "Hide" link

Note: Connecting projects created with the CBM-CFS3 version 1.0 or 1.1 (test)

Because of programming differences between versions 1.0, 1.1 (test), and 1.2 of the CBM-CFS3, users who want to connect projects created with older versions will need to perform a few additional steps. After locating and selecting a project created with an older version of the CBM-CFS3 and clicking on the "Connect" button (as per the steps listed in this subsection), a "Project update" window (Fig. 2-23) will pop up.

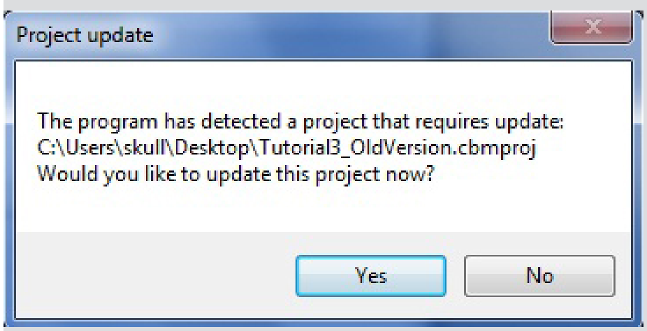


Figure 2-23. The "Project update" window.

Click on the "Yes" button to proceed with the project update and connection process
or
Click on the "No" button to cancel the process

If the user clicks on the "No" button, the "Project update" window will close, the user will return to the "Project Manager" window, and the project will not be connected. If the user clicks on the "Yes" button, the "Project update" window will close, and an "Update progress" window (Fig. 2-24) will pop up, displaying a progress bar for the update. Unless the project database was created between 2004 and 2007, and contains table tblSpeciesTypeDefault, it will complete the update, the "Update progress" window will close, and the project name will be added to the "Connected Projects" box in the "Project Manager" window.

Note (continued): Connecting projects created with CBM-CFS3 version 1.0 or 1.1 (test)

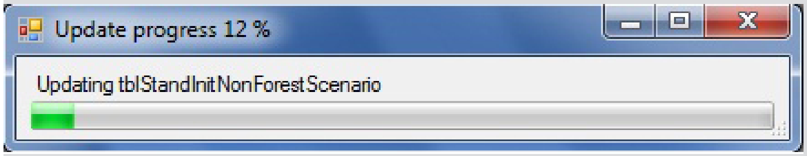


Figure 2-24. The "Update progress" window.

Otherwise, an "Update disturbance mappings for 'project location path' " window (Fig. 2-25) will pop up. This window displays the user's disturbance types ("Project disturbance type" column) beside the assumed appropriate, CBM-CFS3 disturbance types ("Default disturbance type" column), and gives the user the opportunity to review, edit (if necessary), and save the disturbance type mappings for the user's disturbance types. For each drop list box in the "Default disturbance type" column

> **Select the CBM-CFS3 version 1.2 disturbance type that most closely matches the disturbance type displayed in the same row in the "Project disturbance type" column**
>
> **Click on the "Save disturbance mappings" button**

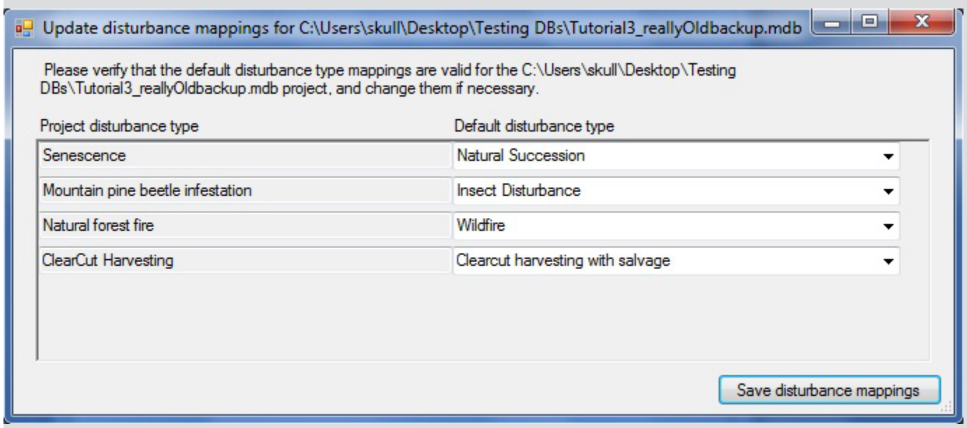


Figure 2-25. The "Update disturbance mappings for 'project location path' " window.

The "Update disturbance mappings for 'project location path' " window will close, and the project name will appear in the "Connected Projects" box in the "Project Manager" window. The user can then proceed to open the project.

Should the user encounter an error when trying to connect a project created with a previous version of the CBM-CFS3, one solution may be to delete the .cbmproj file in the folder for the project (after a backup copy has been made) and then to try reconnecting the project via the "Project Manager" window as described above. Should the error persist, the user should contact the CFS-CAT.

2.5 Closing the CBM-CFS3

If the user wants to close the CBM-CFS3

1. **Click on "File" on the main CBM-CFS3 window (Fig. 2-12) menu bar**
2. **Click on "Exit" on the drop list that appears**

The "Operational-Scale CBM-CFS3" window will pop up asking the user to confirm the request to close the application.

3. **Click on the "Yes" button to proceed or the "No" button to keep the model open**

Alternately, to close the CBM-CFS3

Click on the "X" in the top right corner of the main CBM-CFS3 window (Fig. 2-12)

The "Operational-Scale CBM-CFS3" window will pop up asking the user to confirm the request to close the application.

Click on the "Yes" button to proceed

or

Click on the "No" button to keep the model open

2.6 Tutorials

Several tutorials have been included in the model to help users learn how to import data using either of the two project set-up tools, create and edit various assumptions and data, run the model, and review results. To access the tutorials

Click on "Help" on the menu bar in the main CBM-CFS3 window (Fig. 2-12)

Click on "Tutorials" on the menu that appears

The "Tutorials" window (Fig. 2-26) will pop up. In this window, the user can access (by clicking on the links) step-by-step tutorials on how to perform a simple simulation (with each CBM-CFS3 import tool), explore the effects of disturbances and improved growth rates on forest ecosystem carbon dynamics, assess the impacts of multiple natural disturbances on the same land base, and learn how one could set up and simulate modified parameters for a project assuming the forest land base was outside of Canada.

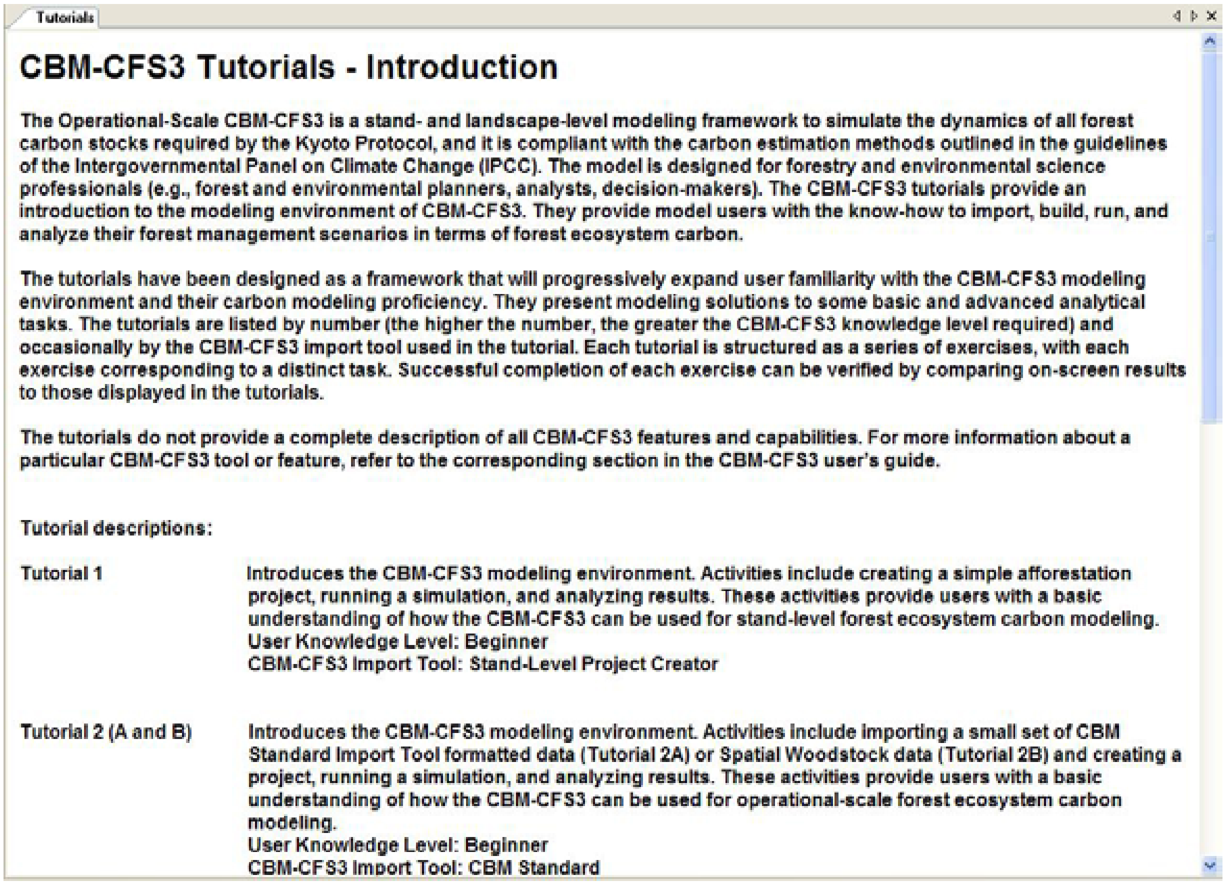


Figure 2-26. The "Tutorials" window.

2.7 Plug-ins

Software development kits or plug-ins can be created for use in the CBM-CFS3. The CBM-CFS3 only contains a single plug-in tool, the Carbon Curve Project Creator, and details about this tool and how it can be used by those interested in exporting carbon curves from the CBM-CFS3 to other models, are found in Appendix 7. To access plug-ins in the CBM-CFS3

Click on "Tools" on the menu bar in the main CBM-CFS3 window (Fig. 2-12)

Click on "Plug-ins" on the menu that appears

Click on a plug-in tool name on the side menu that appears

2.8 Language

Text in the CBM-CFS3 can be displayed in a number of languages. The model language is selected during software start-up in the "Language" window (see section 2.3). This window permits the user to select a language and to make the selection semi-permanent by placing a check mark in the "Don't ask me again" check box. If this check box is checked, the "Language" window will not appear during future software start-ups. To change a permanent language selection made in this window at a later time,

1. **Click on "Help" on the menu bar in the main CBM-CFS3 window (Fig. 2-12)**
2. **Click on "Language / Langue" on the menu that appears**

The "To change language" window (Fig. 2-27) will pop up.

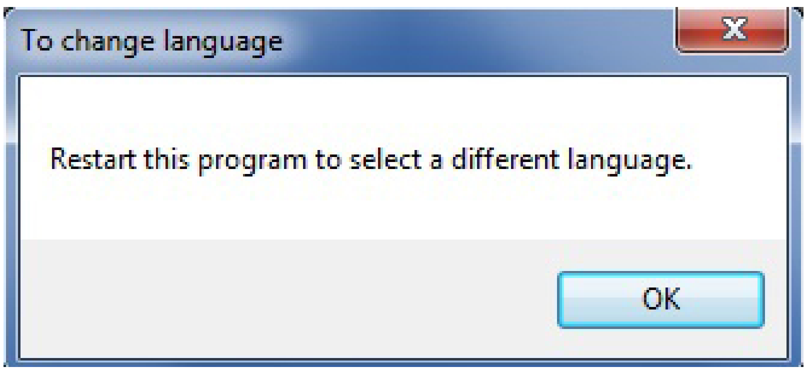


Figure 2-27. The "To change language" window.

3. **Click on the "OK" button and close the CBM-CFS3**

When the user restarts the CBM-CFS3, the "Language" window (Fig. 2-9) will appear once again, permitting a change of language.

2.9 Getting Help

There are several ways for users to obtain help in using the CBM-CFS3. Many questions about the CBM-CFS3 are answered in this user's guide. Answers to technical questions can also be obtained by consulting the "Frequently Asked Questions about the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3)" document (https://ostrnrcan-dostrncan.canada.ca/entities/publication/549f0bd3-6565-4083-bd43-423e81c88755?fromSearchPage=true), or by contacting Stephen Kull at the Canadian Forest Service, Northern Forestry Centre in Edmonton, Alberta.

Telephone: 825-510-1260
E-mail: cbm-mbc@nrcan-rncan.gc.ca

Technical support by telephone and e-mail is limited to troubleshooting problems related to data import and simulation and to answering general questions about the model and forest carbon accounting. Support is available only in English and French. The CFS-CAT is very interested in your comments and feedback. Your suggestions will enable us to fine-tune this model.

Relevant publications related to the CBM-CFS3 can be found in the "Literature cited" section of this user's guide, and in a publication called "A Compiled List of Technical and Research Publications Involving the Carbon Budget Model of the Canadian Forest Sector (2024)" (https://ostrnrcan-dostrncan.canada.ca/entities/publication/b3735592-a7b1-43a5-9e41-e2297a972262?fromSearchPage=true; annual updates may be made available).

2.10 About the CBM-CFS3

To find the CBM-CFS3 version and build number and to view the acknowledgments for the software

1. **Click on "Help" on main CBM-CFS3 window menu bar (Fig. 2-12)**
2. **Click on "About" on the drop list that appears**

The "About the Operational-Scale Carbon Budget Model" window (Fig. 2-28) will pop up, displaying the previously described information.

Figure 2-28. The "About the Operational-Scale Carbon Budget Model" window.

2.11 Known CBM-CFS3 Issues

To read about any known issues in the CBM-CFS3 software (e.g., relating to functionality, scientific deficiencies or programming)

1. **Click on "Help" on main CBM-CFS3 window menu bar (Figure 2-12)**
2. **Click on "Known Issues" on the drop list that appears**

A portable document format (PDF) file will pop up describing any issues related to that version of the CBM-CFS3.

CHAPTER 3

PREPARING IMPORT FILES, IMPORTING DATA, AND RUNNING A SIMULATION

This chapter guides the CBM-CFS3 user through the basic steps in creating a project, importing or entering data and information into the model, and running a simulation.

3.1 Preparing Data for Import

The following subsections describe the types of import data and files required for the CBM Standard Import Tool, whether the source is the Woodstock Optimization Studio, other timber supply models, or inventories. The Stand-Level Project Creator, which requires manual data entry, is discussed in section 3.2.2. Regardless of the import tool that will be used, the user is advised to read section 3.1.1 to gain an understanding of the types of data and information used by the CBM-CFS3.

Note: The Windows Regional Options and the use of commas versus decimals in import data

The CBM-CFS3 will function on a Windows operating system (see section 2.1 for eligible Windows operating systems). The model will also accommodate import data with decimals delimited by periods or commas; however, the user may be required to adjust their Windows Regional Options to accommodate either of these (the user should verify their settings regardless). A user with period-delimited decimal import data (for example, 0.5) should have their Windows Regional Options set to "English (Canada)" before starting the CBM-CFS3. A user with comma-delimited decimal import data (for example, 0,5) should have their Windows Regional Options set to "French (Canada)" before starting the CBM-CFS3. The user should note that the CBM-CFS3 will display delimited data and results based on the Windows Regional Options selected on the user's computer; however, text-based results files will always use period-delimited decimals.

3.1.1 CBM Standard Import Tool

Any CBM-CFS3 user who wishes to use the model to create operational-scale projects with tens to thousands of stands must prepare the import data to meet the format requirements of the CBM Standard Import Tool. This import tool allows import of data in a variety of formats, including text files, comma-separated values (CSV) files, Excel (Microsoft 2003) spreadsheets, and Access (Microsoft 2000b) database tables. Users of the Woodstock Optimization Studio timber supply model must also use the CBM Standard Import Tool (see section 3.1.2 for data and file requirements). Future development of the CBM Standard Import Tool will be guided by feedback from users, so that the CBM Standard Import Tool will capture more of the functionality and capability desired by users as it evolves.

The CBM Standard Import Tool accepts only data that is provided in a specific format. It is crucial that the user understand the requirements of the CBM Standard Import Tool outlined in this manual to meet these requirements. The instructions are divided into the following seven sections, which correspond to the data groupings required by the CBM Standard Import Tool:

1. Age Classes
2. Disturbance Types
3. Classifiers and Values
4. Inventory
5. Growth and Yields
6. Transition Rules
7. Disturbance Events

Basic Requirements for Creating Text Files for Import

For data that is to be imported in text files (files with extension .txt), or comma-separated values files (files with extension .csv), the user must adhere to the following format requirements:

- The items must be in plain text format.
- The items must be delimited by one or more spaces or tabs.
- Empty lines are ignored and are therefore allowed.
- Lines beginning with an exclamation mark (!) are ignored and can be used for comments.
- Lines other than empty lines and those beginning with an exclamation mark (!) must contain data in the specified format.
- Identification (ID) fields may be alphanumeric but may not contain any spaces and may not be enclosed within single quotes.
- Non-ID fields may be alphanumeric and may contain spaces and must be enclosed within single quotes (e.g., 'Clear-cut harvesting').
- Single quote characters are reserved and cannot be used within any field (e.g., 'First seasons cuts' not 'First season's cut').

Note: Importing .txt files containing accents

The CBM Standard Import Tool will import .txt files containing text with accents commonly used in French and Spanish; however, this text may not display properly in the CBM-CFS3 graphic user interface. To avoid this problem, save .txt files containing text with accents using UTF-8 encoding.

Basic Requirements for Creating Microsoft Access Database Files or Microsoft Excel Spreadsheet Files for Import

For data that is to be imported in the form of Microsoft Access database files (with extension .mdb) or Microsoft Excel spreadsheet files (with extension .xls), the user must adhere to the following format requirements:

- The name of the table (or worksheet) is not important, since the user explicitly selects the table (or worksheet) from a list once the source file has been selected.
- If the column positions are identical with their default positions, the column-mapping step can be skipped. However, if the column positions are different from their default positions, column mapping is required. The default column positions are given in the discussion of each import file.
- Where indicated, row ordering is important for groupings of data for import.
- In the first row of a Microsoft Excel worksheet, each column used must have a unique column name.

These names must not contain spaces.

- For each table or worksheet in which the user wishes to override the default column positions, all of the columns for the table or worksheet must be mapped.
- A question mark (?) can be used as a classifier value wildcard (i.e., it represents all possible classifier values) in the Growth and Yield, Transition Rules, and Disturbance Events import files.

Note: Wildcards and their proper use

As many CBM-CFS3 users are aware, a question mark (?) can be used as a classifier value wildcard (i.e., it represents all possible classifier values for a classifier) in the Growth and Yield, Transition Rules, and Disturbance Events import files. However, to avoid incorrect stand transitions and errors, there are a few rules to follow regarding their correct application.

When using wildcards in a targeted classifier set in a disturbance event record, the user must ensure that, whatever potential classifier set(s) could be disturbed according to the classifier set targeted by the event, only one or no transition rule exists to accommodate and properly transition the actual disturbed classifier set(s); otherwise, an error will be triggered during set-up in the CBM Standard Import Tool or in the Stand-Level Project Creator. In other words, only a single transition rule should apply to any classifier set potentially disturbed by the event.

When using wildcards in a targeted classifier set in a transition rule record, the user must be aware of all potential targeted classifier sets in their disturbance event records that could potentially use the transition rule, and ensure that the transition rule is not redundant with respect to other transition rules they may have already established for specific classifier sets targeted by specific disturbance events, i.e., ensure that when the model assesses applicable transition rules for a classifier set targeted by a disturbance, only one or no transition rule applies.

Table 3-1 shows examples of the use of wildcards in targeted classifier sets for disturbance events, in combination with transition rules that are supported by the model, some of which have conditions and aspects that the user needs to be aware of.

Table 3-1. Examples of the use of wildcards in disturbance event and transition rule record target classifier sets, whether they are supported, and what the user may need to consider when applying them.

Disturbance event classifier set(s)	Transition rule classifier set(s)	Support in CBM-CFS3
BF, GOOD, D1, W	BF, GOOD, D1, W	Supported
BF, GOOD, D1, W; BF, POOR, D1, W	BF, ?, D1, W	Supported
BF, ?, D1, ?	BF,?, D1,?	Supported
BF, GOOD, D1, W; BF, POOR, D1, R	BF, ?, D1, ?	Supported

Note: (continued): Wildcards and their proper use

Table 3-1. Concluded

Disturbance event classifier set(s)	Transition rule classifier set(s)	Support in CBM-CFS3
BF, ?, D1, W	BF, GOOD, D1, W	The transition rule will be supported if only this transition rule matches the disturbance event classifier set, meaning that only the "BF, GOOD, D1, W" classifier set can be disturbed. If another transition rule also exists targeting the "BF, POOR, D1, W" classifier set, an error will be triggered during import because one disturbance event classifier set could be linked to two transition rules, which is not permitted.
BF, ?, D1, W	?, GOOD, ?, W	The transition rule will be supported if only this transition rule matches the disturbance event classifier set, meaning that only the "BF, GOOD, D1, W" classifier set can be disturbed. If another transition rule also exists targeting the "BF, POOR, D1, W" classifier set, an error will be triggered during import because one disturbance event classifier set could be linked to two transition rules, which is not permitted.
BF, ?, D1, ?	BF, GOOD, D1, W; BF, MEDIUM, D1, R; BF, POOR, D1, O	Not supported because one disturbance event classifier set could be linked to more than one transition rule, which is not permitted.

Figure 3-1 shows an example of the error message that will alert users to wildcard-related issues in their import files in the CBM standard Import Tool.

Note: (concluded): Wildcards and their proper use

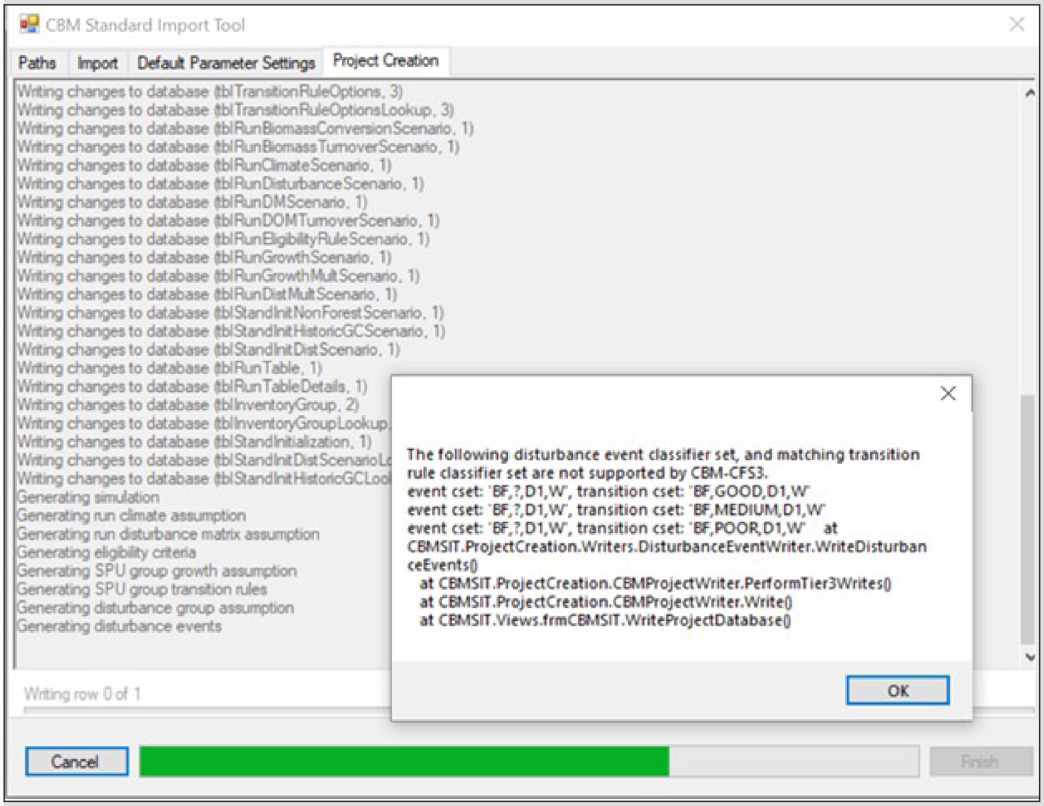


Figure 3-1. Example of the error message that will be displayed during file import using the CBM Standard Import Tool when one or more of the imported disturbance event records could be eligible for more than a single transition rule record due to misuse of wildcards.

1. Age Classes

The "Age Classes" import file contains information identifying the age classes and age class size of the user's growth and yield data, in the required column format. The first column is the ID field for the age class, which is followed by the size of the age class in years. The first age class must be an age class starting at year 0 with a size of 0. The table can include an optional "Description" column for describing age classes. Examples of the format required for the "Age Classes" import files in text or Microsoft Access table format are shown in Fig. 3-2. A Microsoft Excel worksheet (not shown) would have a format similar to that of a Microsoft Access table (Fig. 3-2b). The following are the default column positions:

1. Age class ID
2. Size of age class

a)

```
!
! Sample CBM Standard Import Tool Version 1.2 Age Classes Import File
!
!Age Class ID                    Size
AGEID0                           0
AGEID1                           10
AGEID2                           10
AGEID3                           10
AGEID4                           10
AGEID5                           10
```

b)

AgeClassID	Size
AGEID0	0
AGEID1	10
AGEID2	10
AGEID3	10
AGEID4	10
AGEID5	10

Figure 3-2. Examples of a) a text import file and b) a Microsoft Access import table for the "Age Classes" data grouping. A Microsoft Excel import worksheet would have an appearance similar to that of the Microsoft Access import table.

2. Disturbance Types

The "Disturbance Types" import file identifies the user's disturbance and management activity types in the required column format. An example of the contents of a "Disturbance Types" text file for the CBM Standard Import Tool is shown in Fig. 3-3a. The file includes a column for the ID field associated with the disturbance type and a column for the name of the disturbance type. Note that the DISTID numbers in the first column are not contained within the single quotes, whereas the disturbance type names in the second column are. The user may choose to use the disturbance type name (a single word only) as the ID rather than a DISTID number. In that case, the IDs used must not have any spaces (Fig. 3-3b); hence, the name 'Clear-cut harvesting' in the Names column might become simply "Harvesting" in the ID column.

a)

```
!
! Sample CBM Standard Import Tool Version 1.2 Disturbance Types Import File
!
DISTID1                 'Fire'
DISTID2                 'Clear-cut'
DISTID3                 'Afforestation'
DISTID4                 'Defoliating insect'
DISTID5                 'Partial cut'
```

b)

```
!
! Sample CBM Standard Import Tool Version 1.2 Disturbance Types Import File
!
Fire                    'Fire'
CC                      'Clear-cut'
AF                      'Afforestation'
DI                      'Defoliating insect'
PC                      'Partial cut'
```

c)

DisturbanceTypeID	Name
DISTID1	Fire
DISTID2	Clear-cut
DISTID3	Afforestation
DISTID4	Defoliating insect
DISTID5	Partial cut

Figure 3-3. Examples of a) a text import file with DISTID numbers in the Disturbance Type ID column, b) a text import file with names in the Disturbance Type ID column, and c) a Microsoft Access import table for the "Disturbance Types" data grouping. A Microsoft Excel import worksheet would have an appearance similar to that of the Microsoft Access import table.

A Microsoft Excel worksheet (not shown) would have a format similar to that of a Microsoft Access table (Fig. 3-3c). The order in which the rows appear is not important. The following are the default column positions:

1. Disturbance type ID
2. Disturbance type name

3. Classifiers and Values

The "Classifiers and Values" import file contains the classifiers and values describing the user's forest types in the required column format. User's importing data that includes more than one administrative boundary (province or territory) or ecological boundary (terrestrial ecozone of Canada; see Fig. 3-16) should include classifiers for each. **The CBM-CFS3 allows a maximum of 10 classifiers to describe the user's forest types, and one of these classifiers must identify tree species.**

An example of the content of a "Classifiers and Values" text file for use with the CBM Standard Import Tool is shown in Fig. 3-4. The example import text file (Fig. 3-4) displays 3 classifiers. Each group of classifier values must be preceded by a line containing a slash and an asterisk (/*) and followed by a line containing an asterisk and a slash (*/). These characters are required to identify the group and cannot appear anywhere within the group. The first line of a given group must be a string contained within single quotes and should name the classifier in question. The lines that follow in the grouping are the values of the classifier. Each additional line in the group contains the ID of the classifier value followed by the name of the value. The name must be enclosed within single quotes.

An example of a "Classifiers and Values" import table in a Microsoft Access database is shown in Fig. 3-5. The order in which the rows appear is not important. The special keyword "_CLASSIFIER" is reserved and is used in the "ClassifierValueID" column to indicate that the next column holds a classifier name and not a classifier value name. The "ClassifierNumber" column presents the classifier number if the row is a classifier name and the classifier number to which the value belongs if the row is a classifier value name.

```
!
! Sample CBM Standard Import Tool Version 1.2 Classifiers and Values Import File
!
/*
'Species'
LP                    'Lodgepole pine'
DF                    'Douglas-fir'
NF                    'Nonforest'
WS                    'White spruce'
*/
/*
'Site Quality'
EX                    'Excellent'
SQ1                   'Very good'
SQ2                   'Good'
SQ3                   'Poor'
*/
/*
'Land Ownership'
CR                    'Crown'
PV                    'Private'
FN                    'First Nations'
*/
```

Figure 3-4. Example of a text import file for the "Classifiers and Values" data grouping.

The following are the default column positions:

1. Classifier number
2. Classifier value ID (or "_CLASSIFIER" keyword)
3. Classifier name or classifier value name

ClassifierNumber	ClassifierValueID	Name
1	_CLASSIFIER	Species
2	_CLASSIFIER	Site quality
3	_CLASSIFIER	Land ownership
1	LP	Lodgepole pine
1	DF	Douglas-fir
1	NF	Nonforest
1	WS	White spruce
2	EX	Excellent
2	SQ1	Very Good
2	SQ2	Good
2	SQ3	Poor
3	CR	Crown
3	PV	Private
3	FN	First Nations

Figure 3-5. Example of a Microsoft Access import table for the "Classifiers and Values" data grouping. A Microsoft Excel import worksheet would have a similar appearance.

4. Inventory

The "Inventory" import file contains the user's forest inventory information in the required column format. An example of the contents of a CBM Standard Import Tool "Inventory" text file using age classes rather than actual ages is shown in Fig. 3-6a. Each line in the import file represents an area defined by its age class and classifier values. The first *n* columns are classifiers and their respective values, where *n* is the total number of classifiers. As a result, the number of starting columns will differ between import files depending on the number of classifiers used for that inventory. The columns contain the classifier value ID described for the "Classifier and Values" import file (Fig. 3-4).

The first column that follows the classifier values is the "UsingID" column, where a "TRUE" (or 1) entry identifies the age value in the next column ("Age") as an age class for the stand (Fig. 3-6a). The user would enter "FALSE" (or 0) in the "UsingID" column if actual ages were being entered in the "Age" column (Fig. 3-6b). In the latter case, the user would simply enter the stand age in the "Age" column and drop the "AGEID" preface. Records in the "UsingID" column must be either all "TRUE" or all "FALSE."

The "Area" column contains the area for the described classifier values and must be in hectares.

a)

```
!
! Sample CBM Standard Import Tool Version 1.2 Inventory Import File
!
!Classifiers
!1   2    3   UsingID  Age     Area  Delay  UNFCCCL  HistDist  LastDist
WS   SQ1  CR  TRUE     AGEID3  23    0      0        DISTID1   DISTID2
NF   EX   CR  TRUE     AGEID0  50    0      0        DISTID1   DISTID1
LP   SQ2  FN  TRUE     AGEID5  100   0      0        DISTID1   DISTID4
DF   SQ3  PV  TRUE     AGEID2  75    0      0        DISTID1   DISTID1
```

b)

```
!
! Sample CBM Standard Import Tool Version 1.2 Inventory Import File
!
!Classifiers
!1   2    3   UsingID  Age  Area  Delay  UNFCCCL  HistDist  LastDist
WS   SQ1  CR  FALSE    26   23    0      0        DISTID1   DISTID2
NF   EX   CR  FALSE    0    50    0      0        DISTID1   DISTID1
LP   SQ2  FN  FALSE    47   100   0      0        DISTID1   DISTID4
DF   SQ3  PV  FALSE    16   75    0      0        DISTID1   DISTID1
```

c)

1	2	3	UsingID	Age	Area	Delay	UNFCCCL	HistDist	LastDist
WS	SQ1	CR	TRUE	AGEID3	23	0	0	DISTID1	DISTID2
NF	EX	CR	TRUE	AGEID0	50	0	0	DISTID1	DISTID1
LP	SQ2	FN	TRUE	AGEID5	100	0	0	DISTID1	DISTID4
DF	SQ3	PV	TRUE	AGEID2	75	0	0	DISTID1	DISTID1

Figure 3-6. Examples of a) a text import file with three classifiers and "UsingID" set to "TRUE", b) a text import file with three classifiers and "UsingID" set to "FALSE", and c) a Microsoft Access import table for the "Inventory" data grouping. A Microsoft Excel import worksheet would have an appearance similar to that of the Microsoft Access import table.

The "Delay" column contains an integer representing the number of years to decay dead organic matter (DOM) pools after MAKELIST is run during the project simulation but before the CBM-CFS3 is run. This value is used for records with an age of zero that are known to have lain dormant without growth for some time. The default value for this column is zero.

The "UNFCCC Land Class" column, for "United Nations Framework Convention on Climate Change (UNFCCC) Land Class," contains a number representing a UNFCCC-defined land class (as listed in Table 3-2).

Table 3-2. Definitions of United Nations Framework Convention on Climate Change (UNFCCC) land classes

UNFCCC Land Class	Description
0	Forest land remaining forest land
1	Cropland remaining cropland
2	Grassland remaining grassland
3	Wetlands remaining wetlands
4	Settlements remaining settlements
5	Other remaining other
6	Cropland converted to forest land
7	Grassland converted to forest land
8	Wetlands converted to forest land
9	Settlements converted to forest land
10	Other converted to forest land
11	Forest land converted to cropland
12	Forest land converted to grassland
13	Forest land converted to wetlands
14	Forest land converted to settlements
15	Forest land converted to other
16	Unmanaged forest land
17	Unmanaged forest land converted to cropland
18	Unmanaged forest land converted to grassland
19	Unmanaged forest land converted to wetlands
20	Unmanaged forest land converted to settlements
21	Unmanaged forest land converted to other
22	Unmanaged forest land converted to managed forest

The "HistDist" column, for "Historical Disturbance ID," contains the disturbance identifier from the "Disturbance Type" import file that represents the most common stand-replacing disturbance type to have affected the stand in the past approximately 2000 years.

The "LastDist" column, for "Last Disturbance ID," contains the disturbance identifier from the "Disturbance Type" import file that represents the last (i.e., most recent) stand-replacing disturbance type to affect the stand.

For users who need to represent more than one last disturbance during the MAKELIST stand initialization process, the CBM-CFS3 now supports multiple last pass rotation disturbance types at customizable stand-replacing disturbance intervals. For instructions on how to set this up once a CBM-CFS3 project has been created (it cannot be done in the import files), see Appendix 8 of this guide.

Note: How to include nonforest area (stands) in the "Inventory" import file for a project that includes afforestation activities

If a project will include nonforest area that will eventually be converted to forest through afforestation activities during project simulation, a record for each nonforest area (future forest stand) must be included in the "Inventory" import file. As with forest stands, each nonforest stand should be defined by a classifier set. Users typically assign a nonforest species classifier value (e.g., NF) to the classifier set. Each record should be given an age of 0, a delay of 0, a UNFCCC land class value indicative of the nonforest land type (e.g. a value

Note: (Concluded) How to include nonforest area (stands)

of 1 for cropland remaining cropland – see Table 3-1 for options), and any historical and last disturbance types (these disturbance types will not be used by the model to generate the initial soil carbon values for the nonforest area, they will be assigned based on the mapping of the nonforest classifier value to a nonforest soil type). If nonforest stands are added to the "Inventory" import file, associated growth curves (with zero volume values) will need to be added to the "Growth and Yield" import file, afforestation events for these lands should be added to the "Disturbance Events" import file, and transition rules that convert the nonforest stand classifier sets to forest stand classifier sets will need to be added to the "Transition Rules" import file.

A nonforest classifier value can either be included in the user's list of species classifier values, or be placed under another classifier type (e.g., a "Land type" classifier with "Forest" and "Nonforest" classifier values).

An example of an "Inventory" import table in a Microsoft Access database is shown in Figure 3-6c.

The following are the default column positions:

1. Classifier value ID(s)
2. UsingID entry
3. Age class ID or age
4. Area
5. Delay
6. UNFCCC Land Class
7. Historical Disturbance ID
8. Last Disturbance ID

5. Growth and Yield

Each line in the "Growth and Yield" import file represents the projected merchantable volumes for a species component within a stand type, in the required column format. An example of the contents of a "Growth and Yield" text file for the CBM Standard Import Tool is shown in Fig. 3-7a.

A complete growth and yield curve is represented by the sum of its species component volumes. The curve can be identified by the set of classifier values shared by each species component. A growth and yield curve may have between 1 and 10 species components; however, these components will be aggregated into leading softwood species and leading hardwood species when the biomass expansion is performed by the CBM-CFS3. Yield curves entered that are expected to be applied to initialize stands in the MAKELIST initialization process should be complete curves (i.e., contain appropriate gross merchantable volumes from age 0 to the maximum age), and not partial curves (e.g., zero volume until age 80), and the volumes entered should not "rollercoaster," e.g., ascend, descend, and ascend again. Ideally, the curves should have been formulated with the same merchantability limits defined in Appendix 2 for the province or territory where they will be applied, as these limits were used to develop the default volume to biomass conversion coefficients in the model. Obtaining curves formulated with identical limits may not always be possible due to fiscal, time, or knowledge constraints, and in those instances, users should document this shortcoming in their results reporting as a potential source of uncertainty in their results.

The first *n* columns in the "Growth and Yield" import file are the classifier values that define the stand type associated with the growth and yield curve, where *n* is the total number of classifiers used. Three classifiers are used in the examples in Fig. 3-7a and Fig. 3-7b.

a)

```
!
! Sample CBM Standard Import Tool Version 1.2 Growth and Yield Import File
!
!Classifiers                    Species
!1        2      3                       Merchantable volumes at Age Classes
WS       SQ1    CR      WS        0     10     35     77     110     135
WS       SQ1    CR      LP        0     12     48     87     115     148
NF       EX     CR      NF        0      0      0      0       0       0
LP       SQ2    FN      LP        0      8     15     35      57      91
DF       SQ3    PV      DF        0     22     66    112     152     220
```

b)

1	2	3	SPECIES	Vol0	Vol1	Vol2	Vol3	Vol4	Voln
WS	SQ1	CR	WS	0	10	35	77	110	135
WS	SQ1	CR	LP	0	12	48	87	115	148
NF	EX	CR	NF	0	0	0	0	0	0
LP	SQ2	FN	LP	0	8	15	35	57	91
DF	SQ3	PV	DF	0	22	66	112	152	220

Figure 3-7. Examples of a) a text import file and b) a Microsoft Access import table for the "Growth and Yield" data grouping. A Microsoft Excel import worksheet would have an appearance similar to that of the Microsoft Access import table.

The first column following the classifier values is the "Species" column. This column must contain classifier value IDs representing the leading species of the stand type. In addition, the user may specify a stand type identifying more than one leading species, each with its own volume curve. For example, in Fig. 3-7a, the first two rows show the same three classifiers defining the stand type (WS, SQ1, CR), one for each of the two leading species within the stand type, WS and LP. Each of these species has a different growth and yield curve.

Merchantable volume columns (the number of columns required depending on the number of age classes created by the user in the "Age Classes" import file) follow the species type column. For each species row, the volume values listed in the merchantable volume columns should be from youngest to oldest, where each column containing a volume value corresponds to an age class defined in the "Age Classes" import file. The number entered for a volume can be either an integer (e.g., 1) or a float value (e.g., 0.111), and must be in units of cubic meters per hectare (m^3/ha). When a value of zero is entered at the end of a growth curve, the CBM-CFS3 assumes that the volume is to remain at the last positive volume entered. However, if the user intends the volume to drop to zero, the user can either enact a disturbance event that moves the stand to a new growth curve that starts with zero volume, or they can enter a value of 0.01 in the place of any zeros.

It should be noted that the column limit for this table is 255.

An example of a "Growth and Yield" import file in a Microsoft Access table is shown in Fig. 3-7b. The following are the default column positions:

1. Classifier value ID(s)
2. Species type
3. Merchantable volume(s)

6. Transition Rules

Each line in the "Transition Rules" import file represents a transition rule for a stand type, in the required column format. These transition rules allow for a change in stand type after a disturbance or management event.

An example of the contents of a "Transition Rules" text file for the CBM Standard Import Tool is shown in Fig. 3-8a. The first *n* columns are the classifier values (up to 10 permitted) that define the target forest type ("Target Classifiers"), where *n* is the total number of classifiers used to define the forest type (three in Fig. 3-8a).

The first column that follows the classifier values is the "UsingID" column, where a "TRUE" (or 1) entry indicates that values in the next four columns (SWStart, SWEnd, HWStart, HWEnd) are age class IDs and a "FALSE" (or 0) entry indicates that the values are ages rather than age classes (the same protocol as described for the "Inventory" import file). In a "Transition Rules" import file, all records in the "UsingID" column must be either "TRUE" or "FALSE."

The "SWStart" and "SWEnd" columns define the boundaries of age class (or age) eligibility for the softwood components of a forest type for the transition rule. The same applies for the "HWStart" and "HWEnd" columns, which refer to the hardwood components (Figure 3-8a). The age class (or age) boundary values entered are not included in the eligibility, so if, for example, only the softwood component of a stand between the ages of 50 and 59 is eligible for the transition rule, the "SWStart" value entered should be 49, and the "SWEnd" value entered should be 60; this will ensure that all eligible softwood components correctly follow the intended transition rule. The age class range between SWStart (or HWStart) and SWEnd (or HWEnd) cannot overlap for any two records (rows) with the same stand-type classifier values and disturbance type.

The "Disturbance Type" column contains the disturbance type ID (defined in the "Disturbance Types" import file) that causes the stand-type transition. The next group of columns ("Postdisturbance Classifiers"), which vary in number depending on the number of classifier values used, are the classifier values that define the stand type resulting from the disturbance.

The "Regen Delay" column contains a regeneration delay value, the numbers of years for the regeneration delay of the postdisturbance stand type.

The "Reset Age" column contains the age from which the postdisturbance forest type will begin growing. The reset age is not affected by the entry in the "UsingID" column. The user should enter a number representing the actual age. If the "UsingID" column contains "TRUE" (or 1), the actual age entered will be associated with the appropriate age class. If the age of the postdisturbance forest type is not expected to change from that of the target forest type, a value of –1 can be entered as the "Reset Age."

The "Percent" column contains the percentage of the original area of the target stand type that transitions to the postdisturbance stand type. A group of transition rules can be used whereby a specific combination of forest type and age class will transition to several different postdisturbance forest types when disturbed. In this case, a transition rule must be entered for each postdisturbance forest type, and the transition percentages for this group of transition rules must sum to 100%. For example, in Fig. 3-8a, the source LP, SQ2, FN stand type transitions to the postdisturbance LP, SQ2, FN stand type at age 10 (50%) and the LP, SQ2, FN stand type at age 0 (50%) following disturbance.

The CBM-CFS3 is limited to recognizing four postdisturbance transitions options per source forest type following disturbance. Any remaining proportion of disturbed area not handled by these transitions will retain the original forest type. Additional transitions will be ignored. If the user does not enter any transition rules in this "Transition Rules" import file, forest types will be assumed to transition back to the original forest type following disturbance or management events.

a)

```
!
!Sample CBM Standard Import Tool Version 1.2 Transition Rules Import File
!
!                                                                         Postdisturbance
!Target Classifiers             Age Classes                  Disturbance    Classifiers    Regen  Reset
! 1  2    3   UsingID  SWStart  SWEnd   HWStart  HWEnd        Type        1   2    3      Delay  Age    Percent
WS  SQ1  CR   TRUE     AGEID3   AGEID5  AGEID3   AGEID5       DISTID1     WS  SQ1  CR     0      0      100
NF  EX   CR   TRUE     AGEID1   AGEID5  AGEID1   AGEID5       DISTID3     WS  SQ1  CR     0      0      100
LP  SQ2  FN   TRUE     AGEID2   AGEID3  AGEID2   AGEID3       DISTID5     LP  SQ2  FN     0      10     50
LP  SQ2  FN   TRUE     AGEID2   AGEID3  AGEID2   AGEID3       DISTID5     LP  SQ2  FN     0      0      50
DF  SQ3  PV   TRUE     AGEID4   AGEID5  AGEID4   AGEID5       DISTID2     DF  SQ3  PV     2      0      100
```

b)

1	2	3	UsingID	SWStart	SWEnd	HWStart	HWEnd	Disturbance	1	2	3	Regen Delay	Reset Age	Percent
WS	SQ1	CR	TRUE	AGEID3	AGEID5	AGEID3	AGEID5	DISTID1	WS	SQ1	CR	0	0	100
NF	EX	CR	TRUE	AGEID1	AGEID5	AGEID1	AGEID5	DISTID3	WS	SQ1	CR	0	0	100
LP	SQ2	FN	TRUE	AGEID2	AGEID3	AGEID2	AGEID3	DISTID5	LP	SQ2	FN	0	10	50
LP	SQ2	FN	TRUE	AGEID2	AGEID3	AGEID2	AGEID3	DISTID5	LP	SQ2	FN	0	0	50
DF	SQ3	PV	TRUE	AGEID4	AGEID5	AGEID4	AGEID5	DISTID2	DF	SQ3	PV	2	0	100

Figure 3-8. Examples of a) a text import file and b) a Microsoft Access import table for the "Transition Rules" data grouping. A Microsoft Excel import worksheet would have an appearance similar to that of the Microsoft Access import table.

An example of a "Transition Rules" import file in a Microsoft Access table is shown in Fig. 3-8b. The following are the default column positions:

1. Source classifier value ID(s)
2. UsingID entry
3. Softwood starting age class ID
4. Softwood ending age class ID
5. Hardwood starting age class ID
6. Hardwood ending age class ID
7. Disturbance ID
8. Postdisturbance classifier value ID(s)
9. Regeneration delay
10. Reset age
11. Percentage

7. Disturbance Events

Each line in the "Disturbance Events" import file is used to represent a disturbance and/or management activity that has occurred or will occur on the user's spatial unit(s) (SPUs), in the required column format. The first *n* columns are classifier values, where *n* is the total number of classifiers. Together, these classifier values describe which stand types the model should select when executing the disturbance and management activities. The columns that follow the classifier values column are described in Table 3-3.

Table 3-3. Names and descriptions for columns that follow the classifier columns in the CBM Standard Import Tool "Disturbance Events" import file, in order of occurrence (abbreviated column names can be used in the import file)

Column name	Description
UsingID	Defines whether values in the next four columns (SWStart, SWEnd, HWStart, HWEnd) represent ages or age classes. A "TRUE" entry indicates that the values are age classes and a "FALSE" entry indicates that the values are ages (the same protocol as described for the "Inventory" import file). In a "Disturbance Events" import file, all records in the "UsingID" column must be either "TRUE" or "FALSE."
SWStart	The starting boundary age class (for example, AGEID5) or age for the softwood components of a forest type that is eligible for the disturbance event. Note that the value entered is itself not eligible. The default value is -1 (no restrictions)
SWEnd	The ending boundary age class (for example, AGEID10) or age for the softwood components of a forest type that is eligible for the disturbance event. Note that the value entered is itself not eligible. The age class range between SWStart and SWEnd cannot overlap for any two records (rows) with the same stand-type classifier values and disturbance type, in the same time step. The default value is -1 (no restrictions)
HWStart	The starting boundary age class (for example, AGEID5) or age for the hardwood components of a forest type that is eligible for the disturbance event. Note that the value entered is itself not eligible. The default value is -1 (no restrictions)
HWEnd	The ending boundary age class (for example, AGEID10) or age for the hardwood components of a forest type that is eligible for the disturbance event. Note that the value entered is itself not eligible. The age class range between HWStart and HWEnd cannot overlap for any two records (rows) with the same stand-type classifier values and disturbance type, in the same time step. The default value is -1 (no restrictions)
Minimum number of years since last disturbance	An eligibility constraint indicating the minimum acceptable number of years since a stand was last disturbed. The default value is –1 (i.e., any value).
Maximum number of years since last disturbance	An eligibility constraint indicating the maximum acceptable number of years since a stand was last disturbed. The default value is –1 (i.e., any value).

Table 3-3. Continued

Column name	Description
Last disturbance type ID	An eligibility constraint indicating the disturbance type ID number (defined in the "Disturbance Types" import file) of the last disturbance type to have had an impact on the stand. The default value is –1 (represents any disturbance).
Minimum total biomass carbon	An eligibility constraint indicating the minimum acceptable total biomass carbon in a stand. The default value is –1 (i.e., any value).
Maximum total biomass carbon	An eligibility constraint indicating the maximum acceptable total biomass carbon in a stand. The default value is –1 (i.e., any value).
Minimum merchantable softwood biomass carbon	An eligibility constraint indicating the minimum acceptable merchantable softwood biomass carbon in a stand. The default value is –1 (i.e., any value).
Maximum merchantable softwood biomass carbon	An eligibility constraint indicating the maximum acceptable merchantable softwood biomass carbon in a stand. The default value is –1 (i.e., any value).
Minimum merchantable hardwood biomass carbon	An eligibility constraint indicating the minimum acceptable merchantable hardwood biomass carbon in a stand. The default value is –1 (i.e., any value).
Maximum merchantable hardwood biomass carbon	An eligibility constraint indicating the maximum acceptable merchantable hardwood biomass carbon in a stand. The default value is –1 (i.e., any value).
Minimum total stem snag carbon	An eligibility constraint indicating the minimum acceptable total stem snag carbon in a stand. The default is value is –1 (i.e., any value).
Maximum total stem snag carbon	An eligibility constraint indicating the maximum acceptable total stem snag carbon in a stand. The default value is –1 (i.e., any value).
Minimum total softwood stem snag carbon	An eligibility constraint indicating the minimum acceptable total softwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Maximum total softwood stem snag carbon	An eligibility constraint indicating the maximum acceptable total softwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Minimum total hardwood stem snag carbon	An eligibility constraint indicating the minimum acceptable total hardwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Maximum total hardwood stem snag carbon	An eligibility constraint indicating the maximum acceptable total hardwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Minimum total merchantable stem snag carbon	An eligibility constraint indicating the minimum acceptable total merchantable stem snag carbon in a stand. The default value is –1 (i.e., any value).
Maximum total merchantable stem snag carbon	An eligibility constraint indicating the maximum acceptable total merchantable stem snag carbon in a stand. The default value is –1 (i.e., any value).
Minimum total merchantable softwood stem snag carbon	An eligibility constraint indicating the minimum acceptable total merchantable softwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Maximum total merchantable softwood stem snag carbon	An eligibility constraint indicating the maximum acceptable total merchantable softwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Minimum total merchantable hardwood stem snag carbon	An eligibility constraint indicating the minimum acceptable total merchantable hardwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Maximum total merchantable hardwood stem snag carbon	An eligibility constraint indicating the maximum acceptable total merchantable hardwood stem snag carbon in a stand. The default value is –1 (i.e., any value).
Efficiency	A value indicting how much of an eligible stand can be affected by the disturbance selected. The default value is 1 (i.e., 100%).
Sort Type	A value between 1 and 13, as defined in Table 3-4, indicating how eligible stands should be sorted. The default value is 1 (i.e., no sort).

Table 3-3. Concluded

Column name	Description
Measurement Type	The measurement type for the disturbance ("A" for area, "P" for proportion of area of all eligible records, or "M" for merchantable carbon). M targets should only be used with disturbance events that involve forest harvesting.
Amount	The amount of the stand to be disturbed, according to the measurement type indicated in the "Measurement Type" column (hectares for area, proportion [1 for 100%, 0.5 for 50%, etc.] for proportion of area of all eligible records, and tonnes of carbon for merchantable carbon).
DistTypeID	The disturbance type ID, as defined in the "Disturbance Types" import file.
Year	The annual time step at which the disturbance will occur.

Table 3-4. Sort types and their definitions

Sort type	Definition
1	No sort; a proportion of each record to disturb is calculated; only applicable to disturbance events with proportion (P) targets
2	Sort by merchantable biomass carbon (highest first); only applicable to disturbance events with merchantable carbon (M) targets
3	Sort by oldest first
5	Sort by SVO (State Variable Object) ID; used for spatially explicit projects and instructs the model to disturb 100% of a single eligible record
6	Sort randomly; only applicable to fire and insect disturbance events
7	Sort by total stem snag carbon (highest first)
8	Sort by softwood stem snag carbon (highest first)
9	Sort by hardwood stem snag carbon (highest first)
10	Sort by softwood merchantable carbon (highest first)
11	Sort by hardwood merchantable carbon (highest first)

Note: Disturbance events with merchantable carbon (M) targets cannot use sort type 6, and events with proportion of eligible records (P) targets can only use sort types 1 and 4.

At a minimum, the user must enter one event in the "Disturbance Events" import file. If the user does not want this event to have any effect, a value of zero can be entered in the "Amount" column for the event.

Note: Multiple disturbances for the same forest type in the same time step

When scheduling multiple disturbance events in the same time step for the same forest type, the user must consider an issue related to overlap of areas associated with the events. Specifically, the same area cannot be allocated to different disturbance events in the same time step. For example, if the inventory contains 100 ha of the "Black Spruce" forest type, the user cannot subject 60 hectares of this inventory to a clear-cut disturbance and 60 hectares to a commercial thinning disturbance in the same time step, because part of the area to be disturbed (20 hectares) will overlap between the two disturbances. In this instance, the user could subject 50 hectares to clear-cutting and 50 hectares to commercial thinning in the same time step, such that the total area allocated to disturbance in that time step would be equal to the total area for that forest type, 100 hectares.

Note: Sequencing of disturbance events in the same time step

In the CBM-CFS3, the order of occurrence of disturbance events within a time step is dictated by the default disturbance type ID (DistTypeID). The model processes the disturbance event with the smallest disturbance type ID first (see Appendix 6 for a list of default disturbance types and their ID values). For example, when a user maps a disturbance type called "CC" to the CBM-CFS3 default called "Clear-cut harvesting with salvage," it is assigned default disturbance type ID 4. Similarly, when the user maps a disturbance type called "CT" to the CBM-CFS3 default called "50% Commercial thinning," it is assigned default disturbance type ID 189. The model will process the clear-cutting disturbance event first in each time step in which both clear-cutting and commercial thinning events occur, because default disturbance type ID 4 is less than default disturbance type ID 189. This issue is important in situations where the sequence of disturbance events matters to users. Using the above example, if the user wants all of the area eligible for commercial thinning to be disturbed first in a time step, and whatever remains to be disturbed by clear-cutting, the default disturbance type IDs within the project database (tblDisturbanceType) would have to be modified to give "commercial thinning" a smaller default disturbance type ID than "clear-cutting." Should this issue not be realized until after the data have been imported, the user can make changes to the default disturbance type IDs in the project's Access database, which will be found in the folder for the project in Operational-Scale CBM-CFS3\Projects in C:\Program Files\, C:\Program Files (x86), or C:\Users\'users name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3. To edit a disturbance type ID in a project Access database

Go to tblDisturbanceType

Edit the values of the default disturbance type ID to obtain the disturbance sequencing required

Users should never change Land Use Change (LUC) default disturbance type IDs because these are used specifically for UNFCCC estimation and reporting methodologies. Users should also note the default disturbance type IDs for afforestation and deforestation listed in Appendix 6. These values should not be used when altering ID values to change the order of events.

Note: Fire and insect disturbance events, sort type, and the random seed number

Regardless of which sort type ID a user identifies for each of their fire or insect disturbance events in the "Disturbance Events" import file, the CBM-CFS3 will, during the data import process, convert the sort type ID value to sort type ID 6 by default. The model does this because, in general, fire and insect disturbances tend to disturb eligible stands randomly, for example, no preference to disturb the oldest stands or stands with the highest merchantable carbon, first. If a user wants to override this default assignment of sort ID 6, they can do so after they have finished creating the project. To reset sort IDs to their original values, the user can open the project database, open a table called "tblDisturbanceEvents", and change the sort IDs in the "Sorting Condition" column to what they were in the original "Disturbance Events" import file.

When a project using sortID 6 for any disturbance event is run in the model, a random seed number is generated behind the scenes in the project database. The random seed number is linked to the selection of random stands disturbed by the fire or insect events. Whenever the user re-runs the project on their computer or another (assuming they have not changed any parameters), they will obtain the same results because the random seed number is reused, and the sequence of stands to disturb for each event is consistent.

Different results for the same project (with events using sortID 6) can be obtained if the user re-imports the data and creates a new project on another computer. When the user creates the new project, a new random seed number is generated for the project, and a different random set of stands may be selected to be disturbed, resulting in different carbon results after project simulation.

The default column positions for the "Disturbance Events" are:

1. Classifier value ID(s)
2. UsingID entry
3. Softwood starting age class ID
4. Softwood ending age class ID
5. Hardwood starting age class ID
6. Hardwood ending age class ID
7. Minimum number of years since last disturbance
8. Maximum number of years since last disturbance
9. Last disturbance type ID
10. Minimum total biomass carbon
11. Maximum total biomass carbon
12. Minimum merchantable softwood biomass carbon
13. Maximum merchantable softwood biomass carbon
14. Minimum merchantable hardwood biomass carbon
15. Maximum merchantable hardwood biomass carbon
16. Minimum total stem snag carbon
17. Maximum total stem snag carbon
18. Minimum total softwood stem snag carbon
19. Maximum total softwood stem snag carbon
20. Minimum total hardwood stem snag carbon
21. Maximum total hardwood stem snag carbon
22. Minimum total merchantable stem snag carbon
23. Maximum total merchantable stem snag carbon
24. Minimum total merchantable softwood stem snag carbon
25. Maximum total merchantable softwood stem snag carbon
26. Minimum total merchantable hardwood stem snag carbon
27. Maximum total merchantable hardwood stem snag carbon
28. Efficiency
29. Sort Type
30. Measurement type
31. Amount
32. Disturbance type ID
33. Year

To begin the CBM-CFS3 data import process, proceed to section 3.2.

3.1.2 Spatially explicit modeling

The CBM-CFS3 has optional spatially explicit modelling capabilities that allow users to create one-to-one linkages between project disturbances and transitions, and the associated inventory. Any forest stand that is defined at the beginning of a simulation can be tracked with a unique identifier throughout the entire simulation. This differs from a regular CBM-CFS3 project simulation because a regular simulation has the potential to split stands and aggregate stands, and as a consequence, any spatial information associated with the original stand is lost. In order to employ the CBM-CFS3's spatially explicit capabilities, the CBM Standard Import Tool and Simulation Scheduler must be used (as they are for the creation and simulation of a regular CBM-CFS3 project); however, additional columns and data must be added to the user's Inventory, Disturbance Events, and Transition Rules project import files. When a simulation is executed for a spatially explicit project, the CBM-CFS3 will produce spatial results in output text files. For more information on modifying regular CBM Standard Import Tool import files to simulate in spatially explicit mode, consult Appendix 9.

3.1.3 Importing data from the Woodstock Optimization Studio

Once a user of the Woodstock Optimization Studio (Remsoft Inc. 2025), formerly known as Spatial Woodstock, has created a forest management scenario, the files can be exported for use in the CBM-CFS3, by means of the "CBM-CFS3 carbon budget model" tool on the "File" menu. For more information about this tool, consult the Remsoft website (www.remsoft.com) and the technical information on exporting data with this tool in Appendix 10 of this guide.

Once the appropriate Woodstock Optimization Studio files (i.e., constants [optional], themes, yields, transitions, schedule, actions, and areas) have been exported, the user must put these .dbf files into tables in a single Microsoft Access database file. In order to import the "Transitions.dbf" file, the file must be renamed to have fewer than 8 characters, for example, "Trans.dbf". In Microsoft Access

1. **Create a new database**
2. **Import the exported Woodstock Optimization Studio files as tables**

The CBM-CFS3 cannot import tables containing more than 10 themes used to describe each forest type, so the user must delete any excess themes. A user with data including more than one administrative boundary (province or territory) or ecological boundary (terrestrial ecozone of Canada; see Fig. 3-16) should keep classifiers for each. The "Actions" table must contain at least one scheduled disturbance or management event, even if that event has an impact target of zero. In addition, to reduce the size of the database, any records in the "Areas" table with a period greater than zero should be deleted. The CBM-CFS3 will not support transitions from one forest type to another based on stand volume, transitions can only be triggered by disturbance events. The Microsoft Access database tables must then be converted to CBM Standard Import Tool format using the CBM Standard Import Tool (see section 3.2.1). To begin the CBM-CFS3 data import process, proceed to section 3.2.

3.1.4 Stand-Level Projects

A user who is planning to examine single stands using the CBM-CFS3 will need to describe the stand or stands using the Stand-Level Project Creator, rather than importing data. The user should have the following information on hand: tree species, location (province or territory of Canada), nonforest soil types (if afforestation is planned), classifiers (descriptors used to define forest stand types-optional), a gross or net merchantable volume growth and yield curve (dependent on geographic location - see section 1.8.2) for each stand type, historic and/or future natural and forest management disturbance types, and a schedule of these events. The CBM-CFS3 provides default biomass and DOM turnover parameters, DOM parameters, and nonforest initial condition parameters; however, should the user have more accurate parameters for the specific land base, the default values can be replaced with those values. To begin the Stand-Level Project Creator, proceed to section 3.3.

3.2 Importing or Entering Data

To begin importing data into the CBM-CFS3 using the CBM Standard Import Tool, the user must create a new project. To proceed

In the "Project Manager" window (Fig. 2-12), right-click on the "Connected Projects" box and click on "New Project" on the menu that appears

or

In the "Project Manager" window (Fig. 2-12), click on the "New" button

or

On the menu bar of the main CBM-CFS3 window, click on "File," click on "New" on the menu that appears, and then click on Project on the side menu that appears

Any of these methods will open up the "New Project" window (Fig. 3-9). In this window, the user selects the appropriate import tool to be used to import data, which depends on the source of the data and/or the kind of project to be created. To proceed

1. **Enter a project name in the "Name" box**

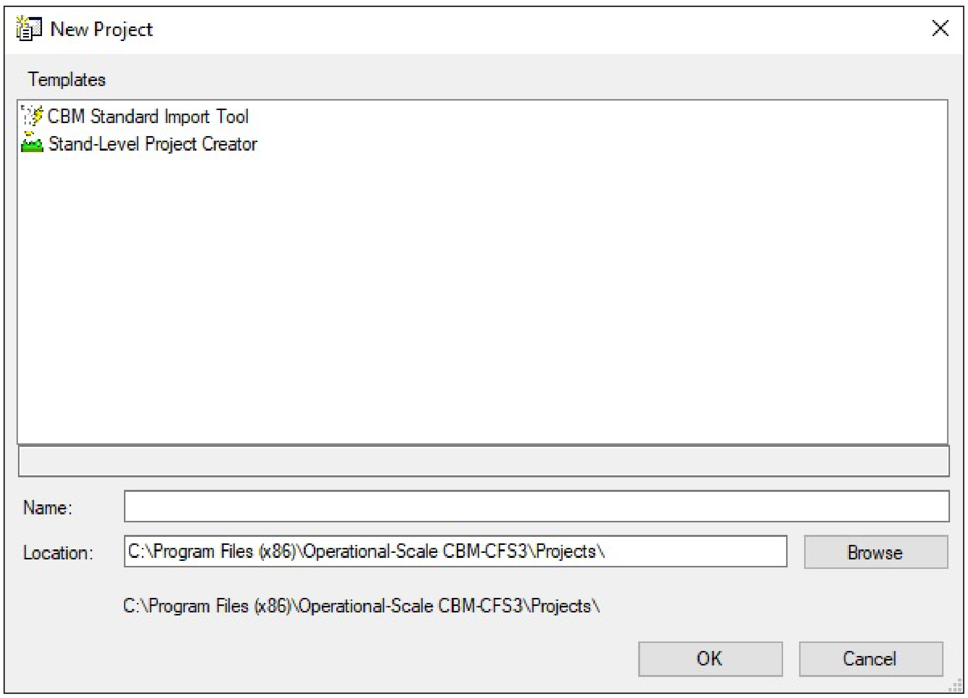


Figure 3-9. The "New Project" window.

Note: Length of project names

Project names must not exceed 260 characters.

2. **Enter a folder location for the project in the "Location" box or accept the default location (Operational-Scale CBM-CFS3\Projects in C:\Program Files\, C:\Program Files (x86)\, or C:\Users\'user's name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3), and skip to the text following step 4**

   or

   Click on the "Browse" button to browse to a location

If the user clicks on the "Browse" button, the "Browse For Folder" window (Fig. 3-10) will pop up.

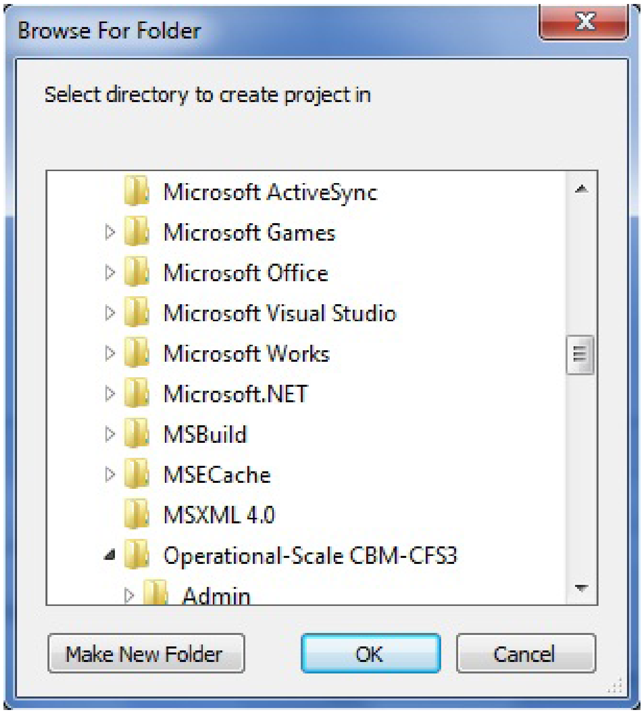


Figure 3-10. The "Browse For Folder" window prompting the user to select the directory in which to create the project.

3. **Browse to Operational-Scale CBM-CFS3\Projects in C:\Program Files\, C:\Program Files (x86), or C:\Users\'user's name'\AppData\Local\Programs\, depending on where the user installed the CBM-CFS3, or to any other folder where they want to save the project**
4. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

   or

   Click on the "New Folder" button to create a new folder

Note: Automated process for locating "Projects" folder

The CBM-CFS3 will remember the folder location when future projects are created, so this series of steps need be completed only once. However, the user must go through these steps again if a different folder is chosen for projects at a later date.

Once an appropriate location is displayed in the "Location" box, the project path and project name will be displayed below the "Location" box.

Next, the user must select the import tool. The CBM Standard Import Tool should be selected by anyone who is extracting data from timber supply models or other sources and importing files formatted for the CBM Standard Import Tool and by anyone who is importing tables that have been exported from the Woodstock Optimization Studio. The Stand-Level Project Creator should be used by anyone who wishes to create one or only a few stands in a project. To proceed

5. **In the "Templates" box of the "New Projects" window (Fig. 3-9), click on the appropriate icon for the import tool to be used**
6. **Click on the "OK" button to proceed**

or

Click on the "Cancel" button to terminate this process

or

Click on the "Help" button to access the program's help features

After clicking on the "OK" button, the user can proceed to section 3.2.1 for importing files with the CBM Standard Import Tool, or section 3.2.2 for creating stands in the Stand-Level Project Creator.

3.2.1 CBM Standard Import Tool

If the user chooses to import files using the CBM Standard Import Tool (according to the steps in the previous section), the "CBM Standard Import Tool" window (Fig. 3-11) will pop up.

Importing files with the CBM Standard Import Tool involves four steps, which correspond to the four tabs appearing in this window: Paths, Import, Default Parameter Settings, and Project Creation.

The user must begin on the "Paths" tab. This tab gives the user four options to create a project: 1) create a new import file configuration that identifies a new configuration name ("Import File Configuration" box) and the files to import ("Names and Paths of Data to Import" box) and then create and name a new set of data mapping rules ("Mapping Rules" box); 2) create a new import file configuration that identifies a new configuration name and the files to import, using an existing set of mapping rules ("Mapping Rules" box); 3) select an existing import file configuration ("Import File Configuration" box) and create and name a new set of data mapping rules; or 4) select an existing import file configuration that uses an existing set of mapping rules.

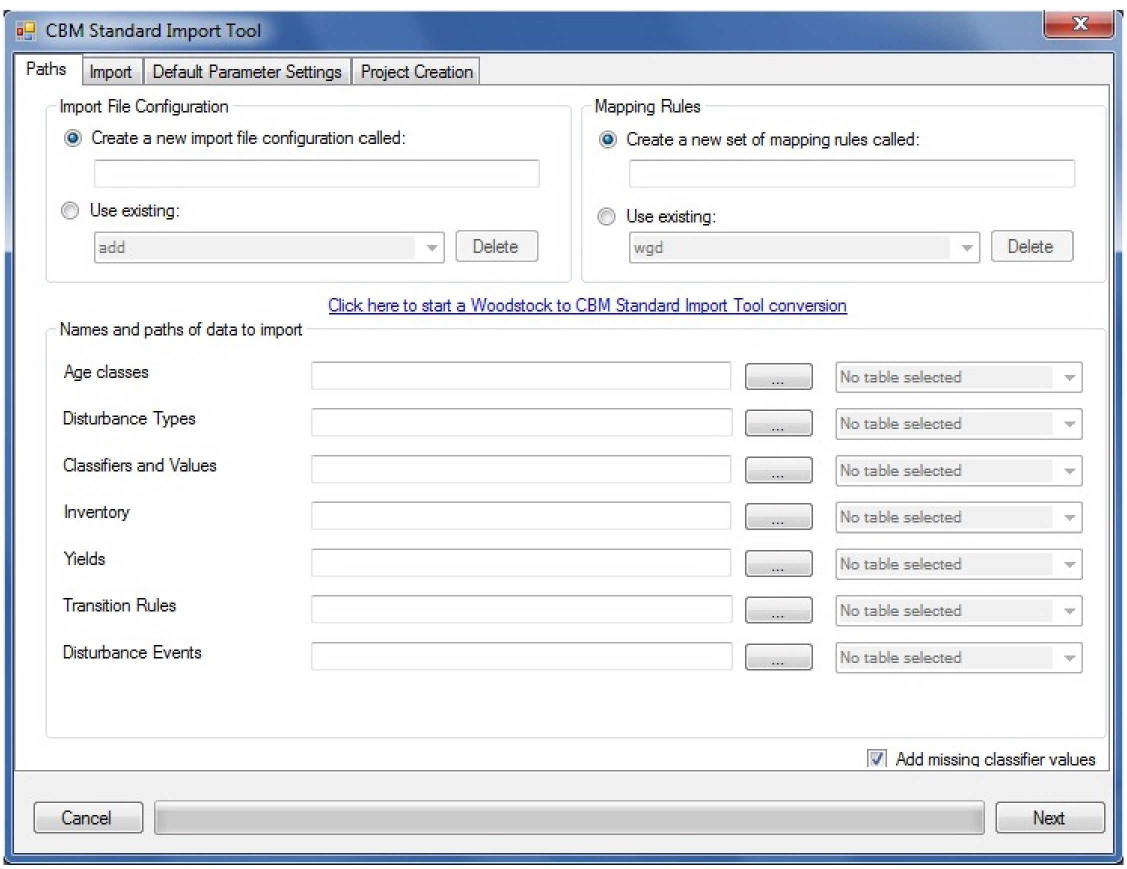


Figure 3-11. The "CBM Standard Import Tool" window with the "Paths" tab selected.

Note: Identifying and converting Woodstock Optimization Studio import data

Users of the Woodstock Optimization Studio who want to import tables containing project data in a Microsoft Access database must

Click on the "Click here to start a Woodstock to CBM Standard Import Tool conversion" link

A "Browse for a Woodstock database to import" window will pop up, where the user must identify the Microsoft Access database containing the desired Woodstock Optimization Studio project data.

Browse to and click on the appropriate Microsoft Access database

Click on the "Open" button to continue

The "Woodstock to CBM SIT Conversion" window (Fig. 3-12) will pop up.

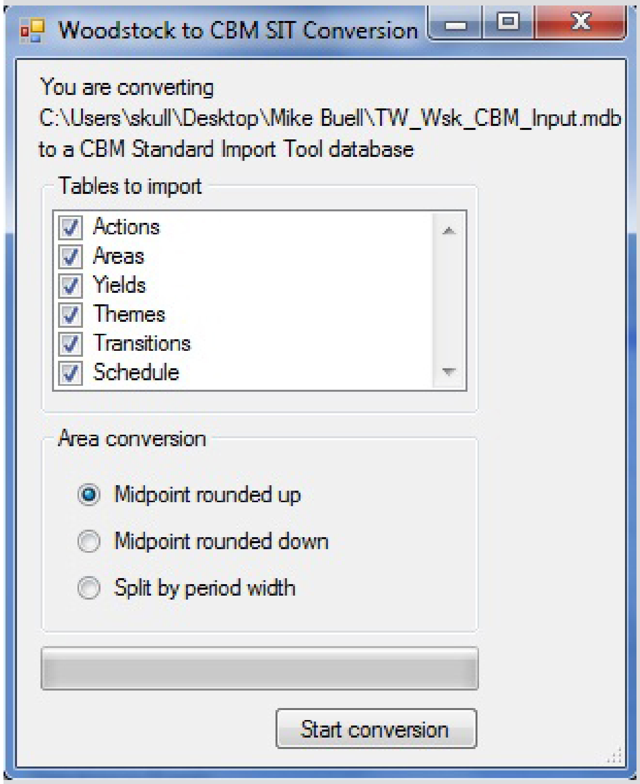


Figure 3-12. The "Woodstock to CBM SIT Conversion" window.

By default, the CBM-CF3 assumes that the user wants to import all of the tables in the Microsoft Access database and places a check mark in the check box for each table in the "Tables to import" box. If the user wants to exclude one or more tables from the import process and import them at a later time (see section 3.3), the check mark should be removed from the appropriate check box; however, the user should note that a simulation cannot be executed for the project being created until all files have been imported.

The CBM-CFS3 operates in annual time steps, so before proceeding, the user must also instruct the model on how to break up period-based area data. The user has a choice of rounding up the age of stands and associated areas within a period from the midpoint, rounding down from the midpoint, or splitting the data by period width. For example, if a period represents 5 years and the user selects "Midpoint rounded up," the CBM-CFS3 will assign an age of 3 years to all stands and their areas associated with period 1 (because 2.5

Note (continued): Identifying and converting Woodstock Optimization Studio import data

is the midpoint, and 3 is the value when 2.5 is rounded up). Similarly, for period 10 (i.e., ages 50 to 55), the CBM-CFS3 will assign an age of 53 years to all stands and their areas associated with this period. If the user chooses "Midpoint rounded down," the CBM-CFS will assign an age of 2 years to all stands and their areas associated with period 1 and an age of 52 years to those associated with period 10. If the user selects "Split by period width," the CBM-CFS3 will divide the stand areas in period 1 equally into ages 1 through 5 and those in period 10 equally into ages 51 to 55.

Click on the appropriate radio button in the "Area conversion" box

Click on the "Start conversion" button

Next, the "Species Theme Selection" window (Fig. 3-13) will pop up. In this window, the user must identify which theme contains the desired list of species.

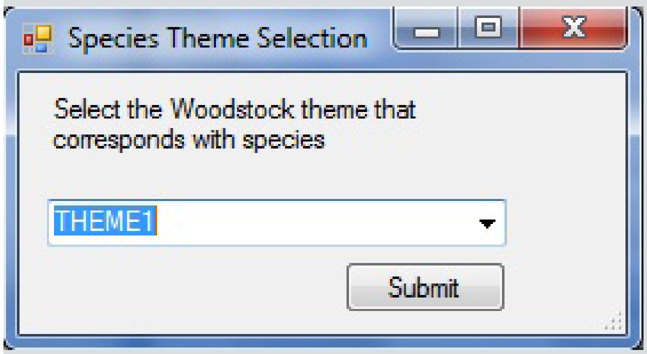


Figure 3-13. The "Species Theme Selection" window.

Click on the drop list box and select the theme that represents tree species

Click on the "Submit" button

The CBM-CFS3 will convert all of the tables in the Microsoft Access database to CBM Standard Import Tool format.

The "Woodstock to CBM SIT Conversion" window will close, and the name of the file containing the import tables will appear in the "Create a new import file configuration called:" and "Create a new set of mapping rules called:" boxes (Fig. 3-11). Users importing a single yield curve component per stand can then skip to the text following step 2 in the general CBM Standard Import Tool instructions. Those importing a YIELD table containing two yield curve components per stand (i.e., a softwood curve and a hardwood curve) will need to proceed through the following steps to ensure that their yield curve data is imported correctly into a CBM-CFS3 project. During the previous step, the model converted the user's import database into a new CBM Standard Import Tool formatted database called 'name of the project'_output.mdb, which should be located in the same place as the original import database file on the user's computer. Unfortunately, the leading species value assigned to one of the curve components will not be correct in the new CBM Standard Import Tool formatted import database that has just been created, so the user will need to follow these steps to correct the issue:

Close the CBM-CFS3, and locate the new 'name of the project'_output.mdb file (it may be located in the same folder as the original import file, or in Operational-Scale CBM-CFS3\Projects)

Open the 'name of the project'_output.mdb file, and the SIT_Yields table

Review and modify (where required) the species classifier values in the LeadingSpecies column to ensure that each of your curve components for a classifier set has the appropriate leading species

Note (continued): Identifying and converting Woodstock Optimization Studio import data

identified (this species will be used to convert the volumes to biomass)

Save and close the file

Open the CBM-CFS3 and proceed through the steps to create a regular (i.e., not Woodstock) project using the CBM Standard Import Tool with the modified 'name of the project'_output.mdb file

Begin by identifying, in the "Import File Configuration" box (Fig. 3-11), whether a new or existing set of configured import files will be imported.

1. **If a new configuration of files is to be imported, click on the "Create a new import file configuration called:" radio button and type a name for the configuration in the box below**

   or

   If an existing configuration of files is to be imported, click on the "Use existing:" radio button and select the name of an existing import file configuration in the box below

If the user chose to create a new import file configuration in the previous step, the data files to be imported must be identified in the "Names and Paths of Data to Import" box; otherwise, the user may skip to the text following this step. A user who is importing Woodstock Optimization Studio tables in a Microsoft Access database may skip this step as well but must follow the instructions in the note entitled "Identifying and converting Woodstock Optimization Studio import data."

Click on the "…" button for each import file category (i.e., Age Classes, Disturbance Types, Classifiers and Values, Inventory, Yields, Transition Rules, and Disturbance Events, and then browse to and select the appropriate file

Next, the user must identify, in the "Mapping Rules" box (Fig. 3-11), whether a new or existing set of data mapping rules will be used for the data that are being imported.

2. **If new data mapping rules are to be used, click on the "Create a new set of mapping rules called:" radio button and type a name for the rules in the box below**

   or

   If an existing set of mapping rules is to be used, click on the "Use existing:" radio button and select the name of an existing set of mapping rules in the box below

Note: Using existing mapping rules

An existing set of mapping rules should not be used unless the data being imported contain the exact number and names of classifier values that were used to create the initial set of mapping rules and no changes to the original mapping rules are expected.

In the same screen, the "Add missing classifier values" check box is checked by default. This checked box permits the CBM-CFS3 to add to the classifiers import file any classifier values found in the user's import files (other than the classifiers import file). This is helpful if an additional classifier found is supposed to be there, but it is not helpful if the additional classifier found is an erroneous entry. As such, the user should exercise caution in leaving this box checked. If the user does not want the CBM-CFS3 to perform this task, the check mark should be removed from this box.

3. **Click on the "Next" button**

The "Paths" tab will close, the "Import" tab (Fig. 3-14) will open, and the CBM-CFS3 will attempt to import the identified data files. Any problems encountered while importing the files will be displayed on this tab. If problems are identified, the user must click on the "Cancel" button, fix the problem(s) in the identified import file, and restart the import process.

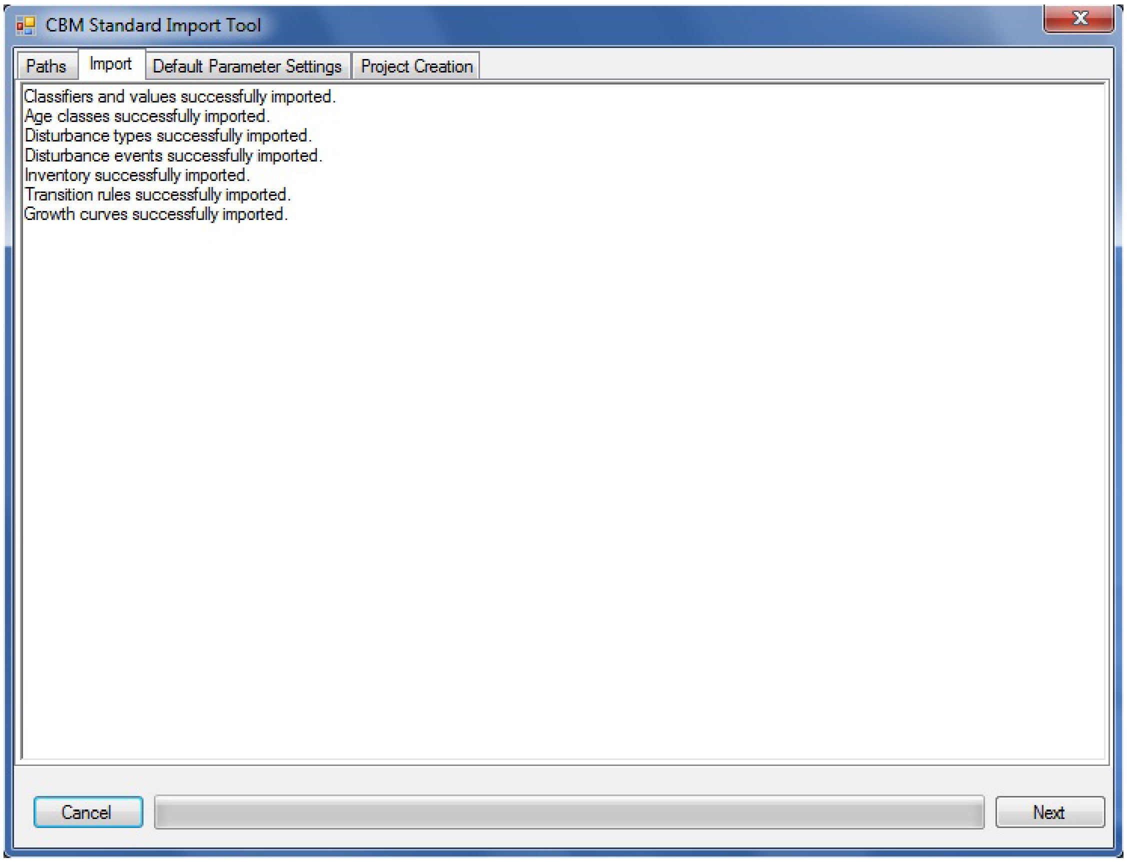


Figure 3-14. The "CBM Standard Import Tool" window with the "Import" tab selected.

If the user chose to use existing mapping rules in step 2, the user can skip to step 21. Otherwise,

4. **Click on the "Next" button**

The "Default Parameter Settings" tab (Fig. 3-15) will pop up. This tab is split into four tabs, which allow the user to select spatial units, disturbance types, species types, and nonforest cover types. By default, the "Spatial Units" tab will be automatically displayed. A spatial unit represents an area with a distinct administrative and ecological boundary.

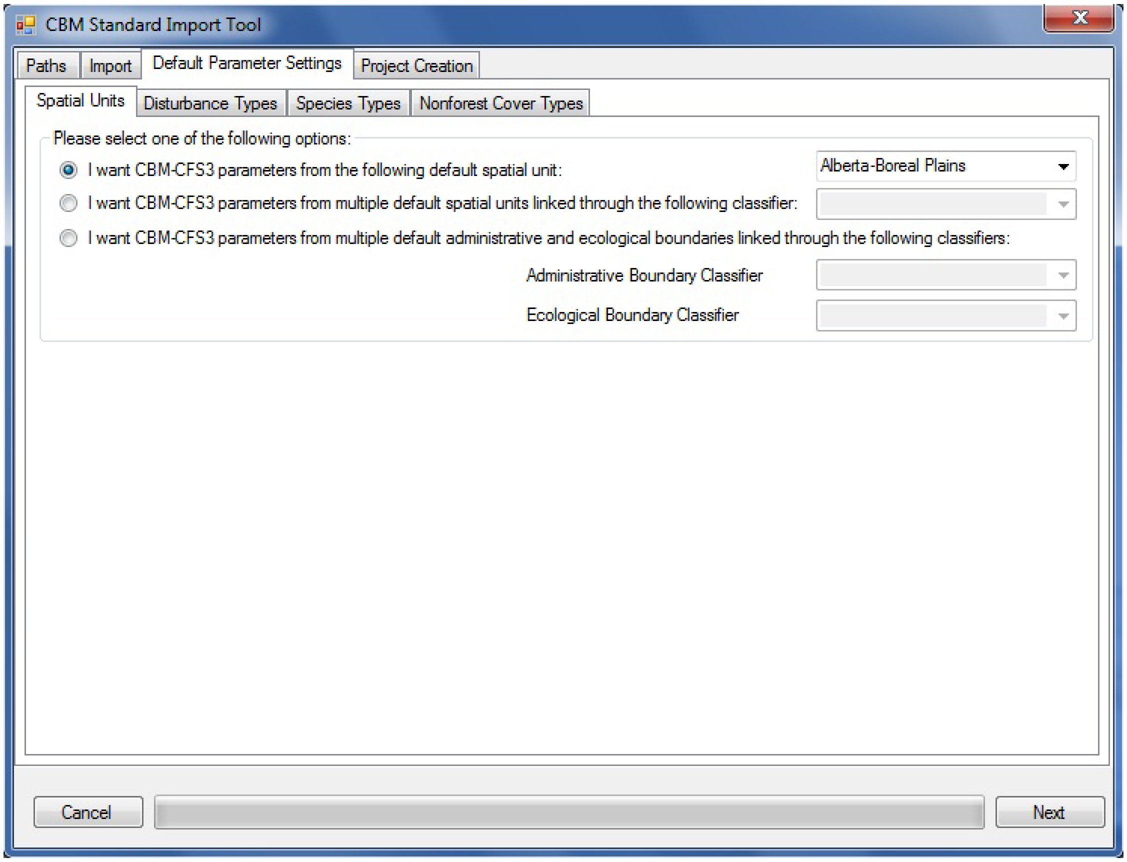


Figure 3-15. The "CBM Standard Import Tool" window with the "Default Parameter Settings" and "Spatial Units" tabs selected.

Administrative boundaries refer to Canadian provinces and territories, with the exception of Newfoundland and Labrador, which has been split for programming reasons related to fire disturbance matrices. Ecological boundaries refer to the Terrestrial Ecozones of Canada, as defined at http://www.ecozones.ca/english/zone/index.html or in Environment Canada (1996) and shown in Fig. 3-16. A CBM-CFS3 project can contain one or more administrative and ecological boundaries, and multiple boundaries can be linked to the values of one or more classifiers in the data that are being imported.

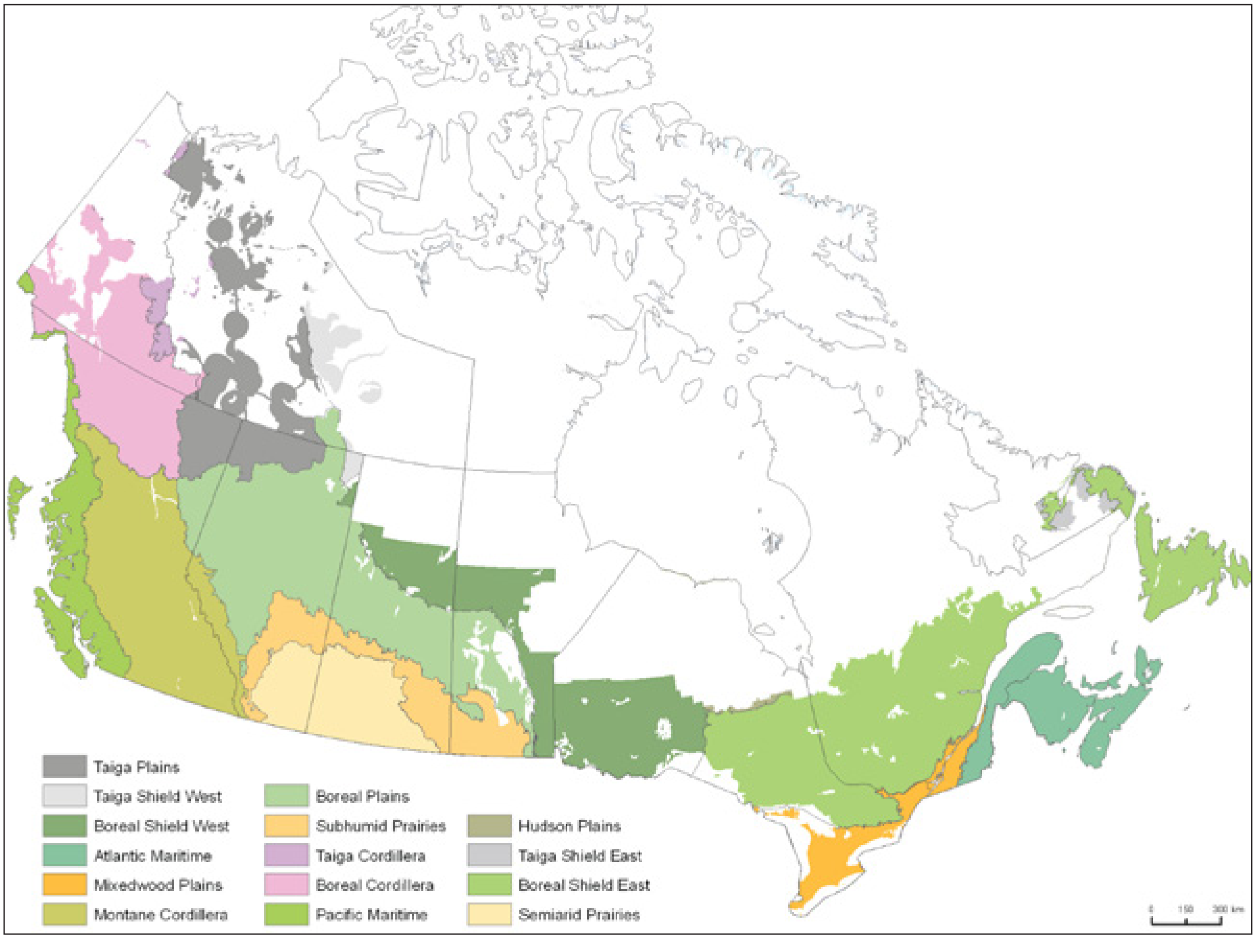


Figure 3-16. The terrestrial ecozones of Canada as used in the CBM-CFS3.

Note: Division of Boreal Shield and Taiga Shield ecozones

In the CBM-CFS3, the Boreal Shield and Taiga Shield ecozones have been divided into eastern and western parts because the west is typically colder and drier than the east. Hence, these subzones are modeled separately (Kurz et al. 1992).

5. **If the project will contain only one administrative and one ecological boundary, click on the "I want CBM parameters from the following default spatial unit:" radio button, and select an administrative and ecological boundary combination from the adjacent drop list box**

   or

   Click on the "I want CBM parameters from multiple default spatial units linked through the following classifier:" radio button, select a classifier from the adjacent drop list box, which contains values representing various spatial units, and map each value in the "Please map the inventory classifier values to the CBM-CFS3 default stratification(s)" box (Fig. 3-17) by selecting a value in the "Your classifier values" box, selecting the appropriate administrative–ecological boundary combination in the "CBM-CFS3 boundary(ies)" box, and clicking the "Map" button

   or

   Click on the "I want CBM parameters from multiple default administrative and ecological boundaries linked through the following classifiers:" radio button, select a classifier with values

representing administrative boundaries in the "Administrative Boundary Classifier" drop list box, and select a classifier with values representing ecological boundaries in the "Ecological Boundary Classifier" drop list box. In the "Please map the inventory classifier values to the CBM-CFS3 default stratification(s)" box (Fig. 3-18), select "Administrative Boundaries" in the drop list box, and map each value in the "Your classifier values" box by selecting a value, then selecting the appropriate boundary name in the "CBM-CFS3 boundary(ies)" box, and clicking the "Map" button. Then, select "Ecological Boundaries" in the drop list box, and map each value in the "Your classifier values" box by selecting a value, then selecting the appropriate boundary name in the "CBM-CFS3 boundary(ies)"box, and clicking the "Map" button

Note: Establishment of eligible spatial units

A spatial unit, which is a combination of an administrative boundary and an ecological boundary, should be created or selected on the "Spatial Units" tab (Fig. 3-18) only if it exists in the inventory that will be imported for the project. If it does not exist, the CBM-CFS3 project-creation process will fail. Furthermore, an administrative boundary should not be linked to an ecological boundary if said ecological boundary does not exist within that administrative boundary. For example, the province of Quebec cannot be linked to the Pacific Maritime ecozone to form a viable spatial unit. Trying to do so would cause the project-creation process to fail.

Next, the user must map the disturbance types in the data that is being imported to disturbance types that are represented by disturbance matrices in the CBM-CFS3. A disturbance matrix defines how carbon is distributed in the forest ecosystem as a result of a specific disturbance type. Descriptions of all of the CBM-CFS3 disturbance types and any specifics about their application can be found in Appendix 6.

To begin mapping the disturbance types to be imported

6. **Click on the "Disturbance Types" tab (Fig. 3-19)**

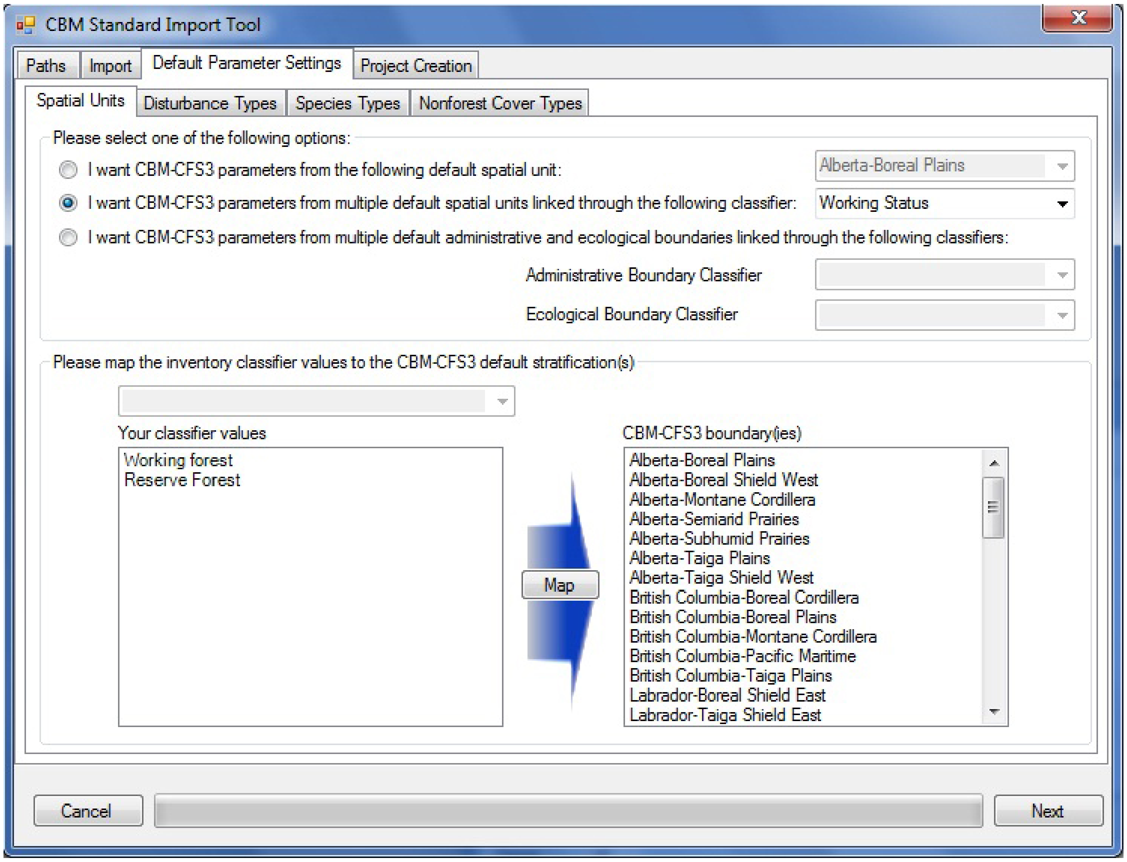


Figure 3-17. The "CBM Standard Import Tool" window, with the "Default Parameter Settings" and "Spatial Units" tabs selected, and the "Please map the inventory classifier values to the CBM-CFS3 default stratification(s)" box displayed for projects with a single classifier representing multiple spatial units.

Imported disturbance types that do not match any of the CBM-CFS3 disturbance types should each be mapped to a CBM-CFS3 disturbance type with similar impacts on carbon. Once all disturbance types being imported have been mapped to the same or a similar CBM-CFS3 disturbance type and the import process is complete, the user will be able to access the Disturbance Matrix Editor (see Chapter 6, section 6.3). If the effect of the imported disturbance types on ecosystem carbon pool transfer values is known and is different from the default transfer values provided in the CBM-CFS3, the user can use the Disturbance Matrix Editor to edit the ecosystem carbon pool transfer values resulting from the disturbances to which the imported disturbance types have been mapped.

To map a disturbance type appearing in the "Your disturbance types" box that was not automatically mapped (as indicated by gray shading) or to change the mapping for a disturbance,

7. **Click on the disturbance type of interest in the "Your disturbance types" box**

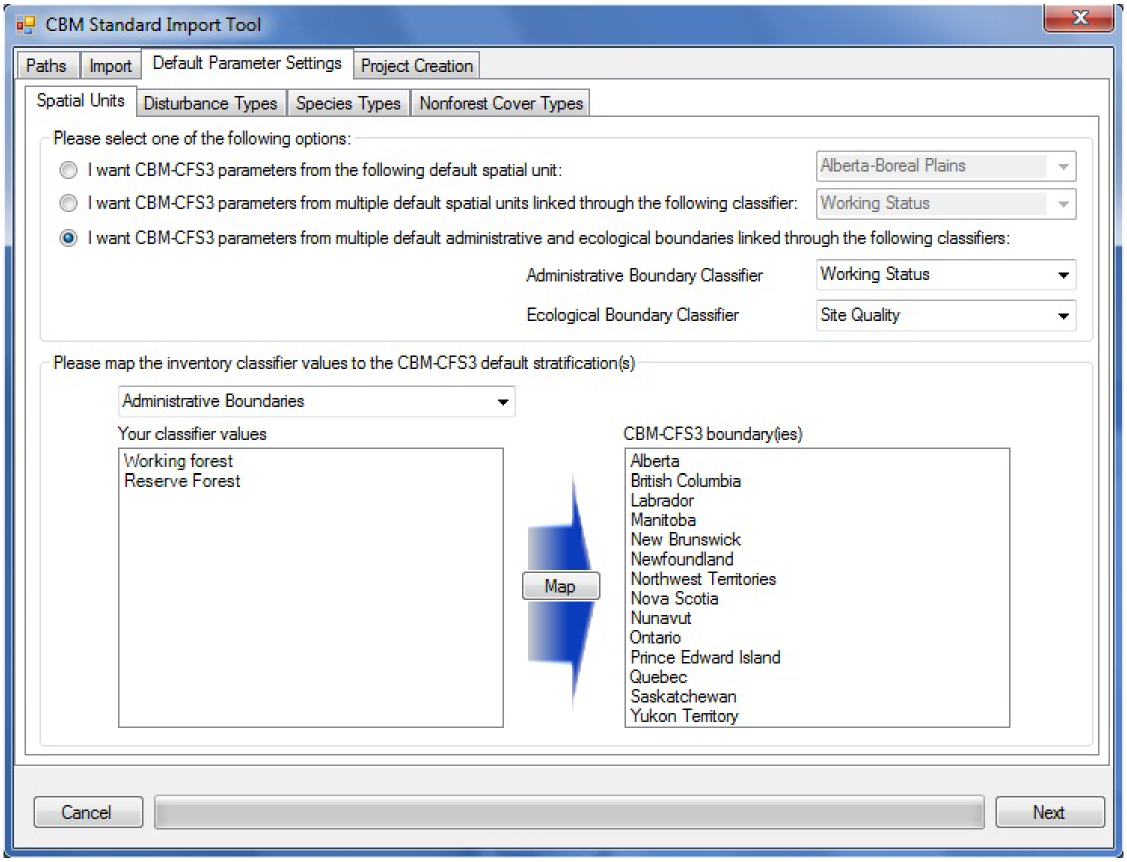


Figure 3-18. The "CBM Standard Import Tool" window, with the "Default Parameter Settings" and "Spatial Units" tabs selected, and the "Please map the inventory classifier values to the CBM-CFS3 default stratification(s)" box displayed for projects with multiple classifiers representing multiple administrative and ecological boundaries.

8. **Click on a matching or similar disturbance type in the "CBM-CFS3 disturbance types" box**
9. **Click on the "Map" button**

This process must be applied for each disturbance type that is imported. Should the user map a disturbance type incorrectly, the mapping can be overwritten by repeating the mapping steps above for the disturbance type.

Once the process of mapping disturbance types is complete, the user must map the tree species that are being imported to CBM-CFS3 tree species, which are linked to volume-to-biomass equations.

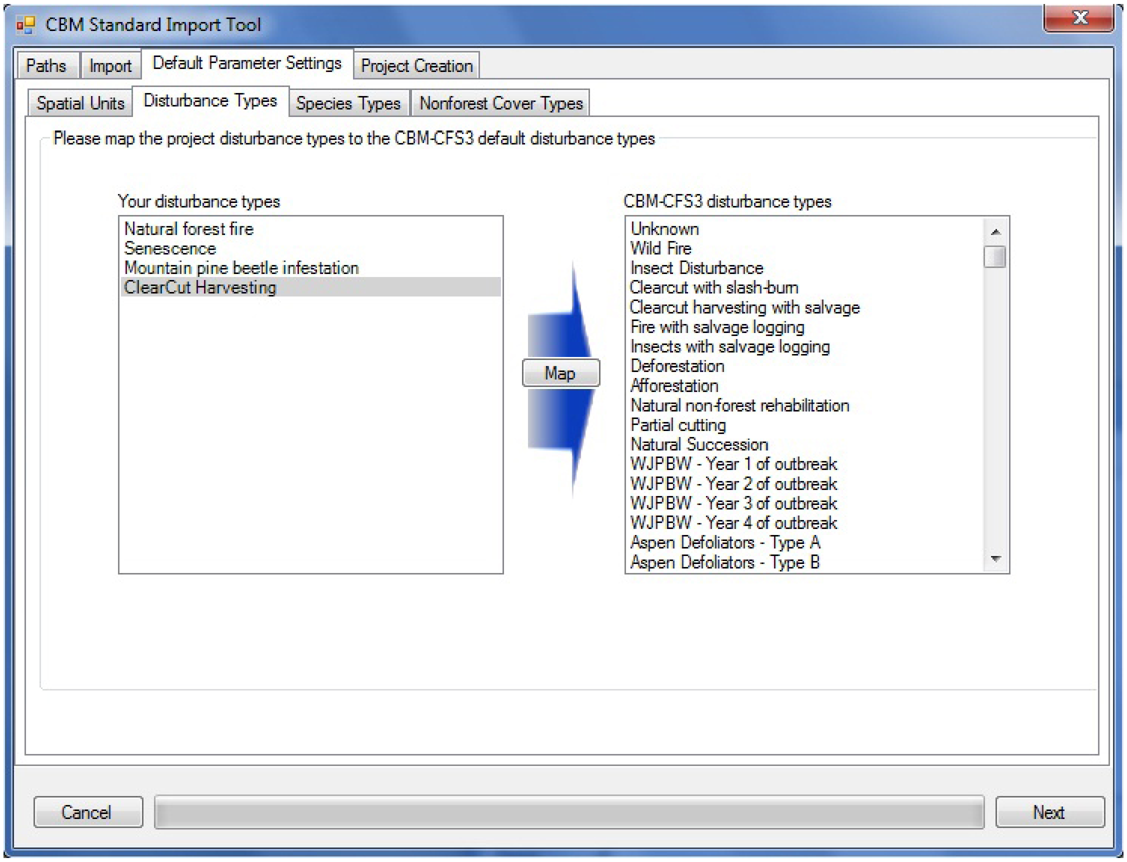


Figure 3-19. The "CBM Standard Import Tool" window with the "Default Parameter Settings" and "Disturbance Types" tabs selected.

10. Click on the "Species Types" tab (Fig. 3-20)

11. From the drop list box next to "The classifier," select the classifier name containing the names of the leading tree species or forest types that are being imported

Once the leading species classifier has been selected, a list of classifier values being imported will appear in the "Your species/forest types" box. Gray shading indicates that a value has been automatically mapped to a CBM-CFS3 species and does not need to be mapped again. It is advisable to double-check the species mapping for any automatically mapped species by clicking on each name to see which species is highlighted in the "CBM-CFS3 species/forest types" box.

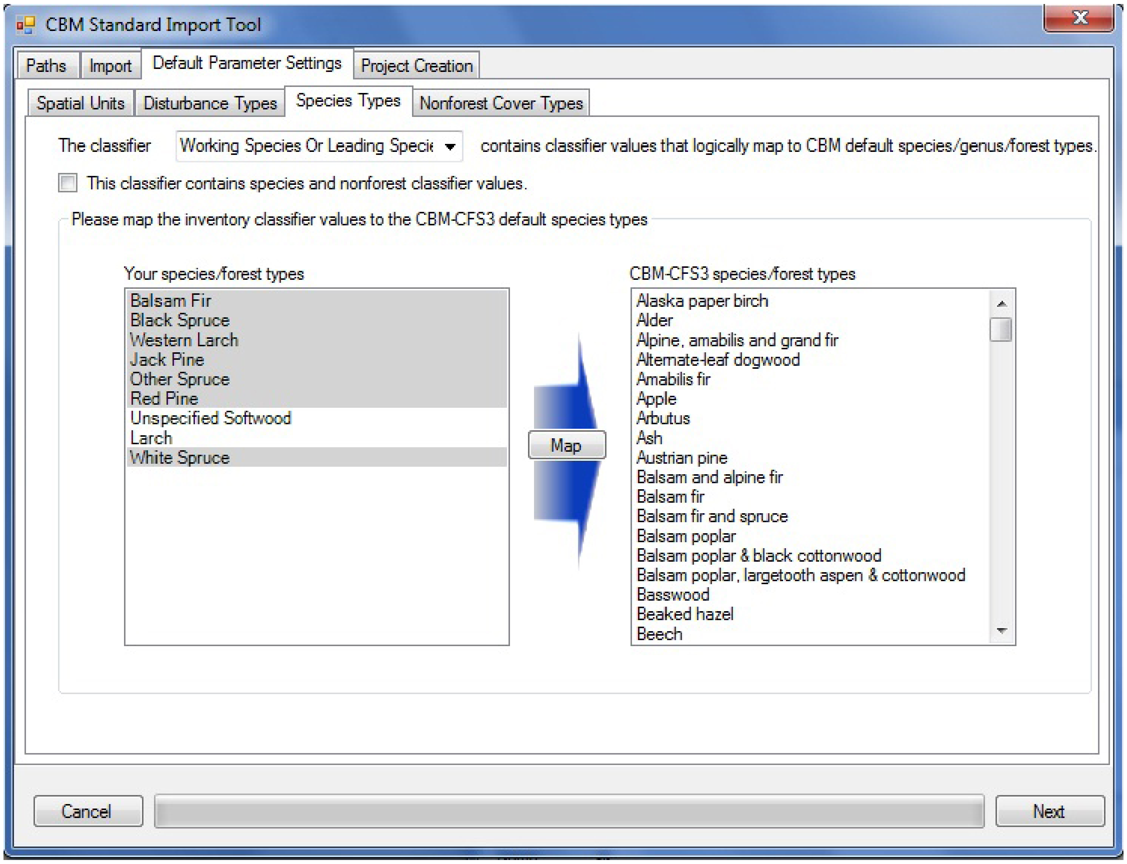


Figure 3-20. The "CBM Standard Import Tool" window with the "Default Parameter Settings" and "Species Types" tabs selected.

Note: Nonforest classifier values

If the species classifier selected on this tab also contains nonforest values, the user must

Click on the "This classifier contains species and nonforest classifier values" check box (Fig.3-20)

This step will cause nonforest soil types to be added to the list in the "CBM-CFS3 species/forest types" box, so that nonforest classifier values can be mapped to them. By default, the CBM-CFS3 assumes that a nonforested area has carbon stocks only in the belowground slow DOM soil carbon pool. The CBM-CFS3 offers a selection of possible initial values for the belowground slow DOM soil carbon pool, which are based upon the user's selection of nonforest soil type(s) during project setup. These initial values are derived from soil carbon values on cultivated lands, as listed in Janzen et al. (1997). The CBM-CFS3 also permits the user to change any initial values or to assign carbon values to other soil pools for any nonforest soil type selected. These changes can be made after the project has been created, using the "Nonforest Initialization" tab in the "Assumption Composers" window (see Chapter 7, section 7.14.2)

To map any unmapped species

12. **Select a classifier value name in the "Your species/forest types" box**
13. **Select the equivalent species or forest type in the "CBM-CFS3 species/forest types" box**
14. **Click on the "Map" button**

If any species is mapped incorrectly, it can be remapped by following the steps above.

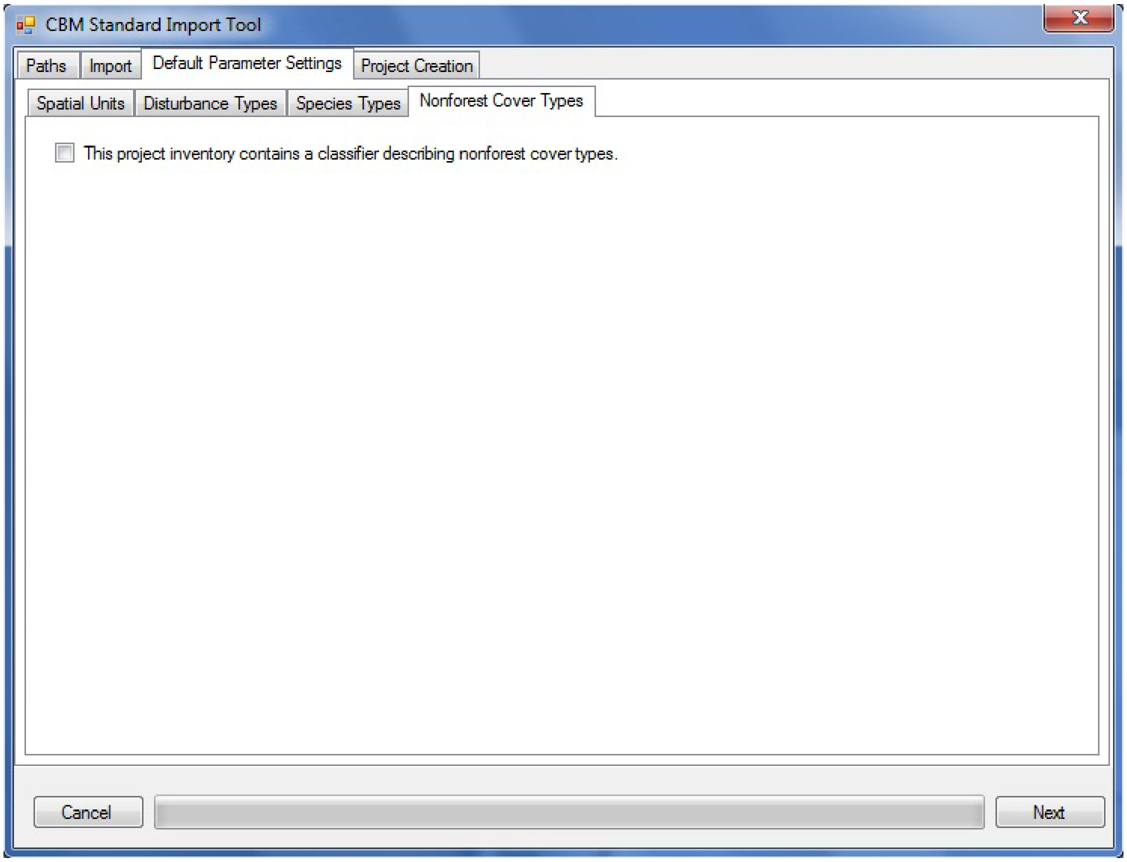


Figure 3-21. The "CBM Standard Import Tool" window with the "Default Parameter Settings" and "Nonforest Cover Types" tabs selected.

If the data being imported do not contain nonforest cover types (or the user mapped their nonforest cover types with tree species on the previous tab), the user can skip to step 21.

Otherwise,

15. Click on the "Nonforest Cover Types" tab (Fig. 3-21)

On this tab, the user must identify the nonforest cover types in the data being imported and map each cover type to a CBM-CFS3 nonforest soil type that is associated with specific initial soil carbon parameters (see Appendix 5).

16. Click on the "This project inventory contains a classifier describing nonforest cover types" check box

17. Select the classifier name containing nonforest cover type values in the drop list box next to "The classifier" (Fig. 3-22)

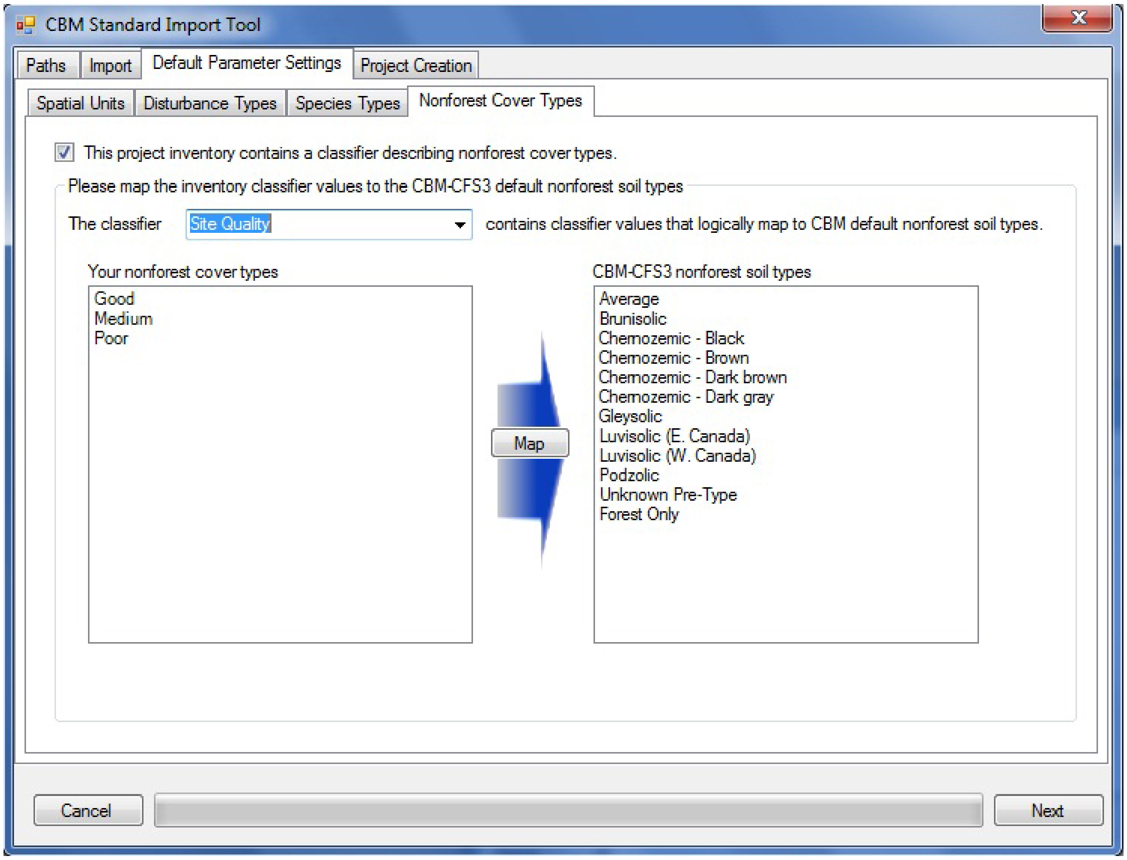


Figure 3-22. The "CBM Standard Import Tool" window with the "Default Parameter Settings" and "Nonforest Cover Types" tabs selected and the "This project inventory contains a classifier describing nonforest cover types" check box checked.

Once a classifier has been selected, a list of the classifier values that are being imported will appear in the "Your nonforest cover types" box. Gray shading indicates that a value has been automatically mapped to CBM-CFS3 nonforest soil types and does not need to be mapped again. It is advisable to double-check the nonforest cover type mapping for any automatically mapped types by clicking on each name to see which nonforest soil type is highlighted in the "CBM-CFS3 nonforest soil types" box. To map any unmapped (or incorrectly mapped) nonforest cover types

18. **Select a classifier value name in the "Your nonforest cover types" box**
19. **Select the appropriate nonforest soil type associated with the nonforest cover type in the "CBM-CFS3 nonforest soil types" box**
20. **Click on the "Map" button**

If any nonforest cover type is mapped incorrectly, it can be remapped following the steps above. This last step concludes the data-mapping process, and the user can now proceed to create the project.

21. **Click on the "Project Creation" tab (Fig. 3-23)**

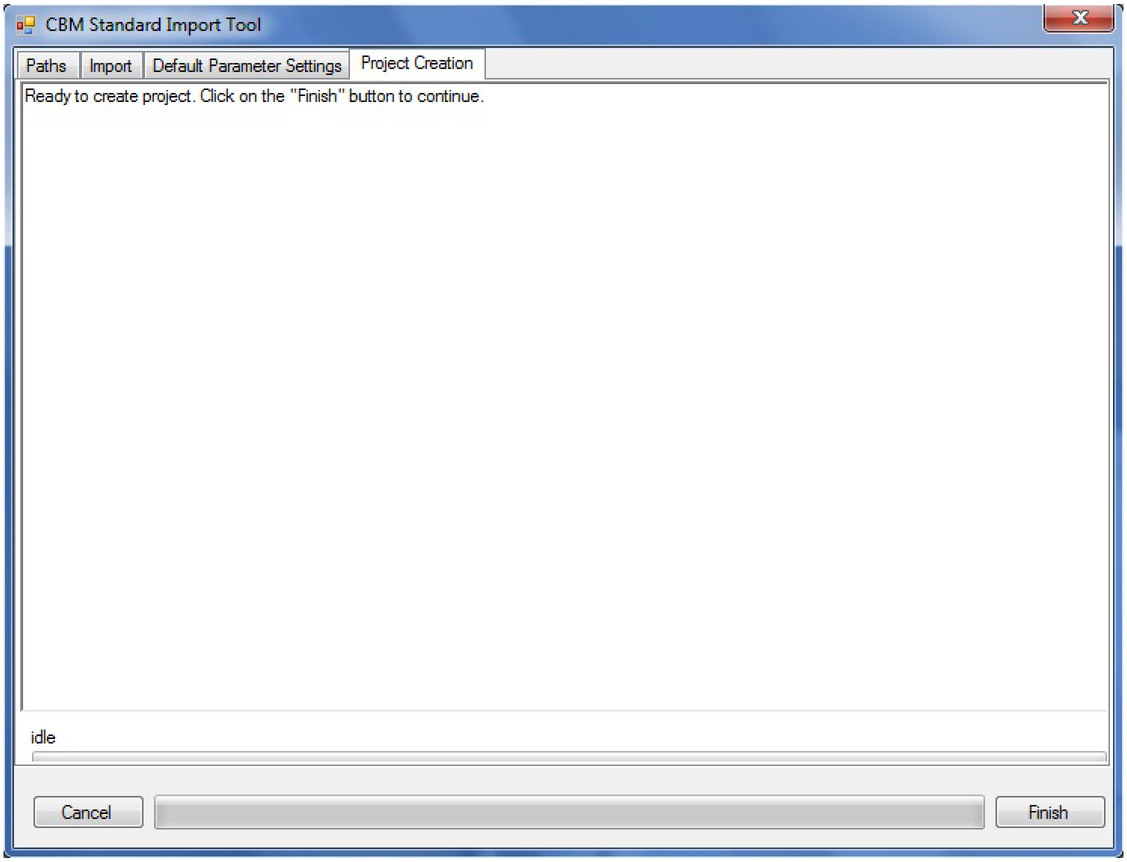


Figure 3-23. The "CBM Standard Import Tool" window with the "Project Creation" tab selected.

To complete the process

22. **Click on the "Finish" button**

The CBM-CFS3 will complete the project writing and creation process, and the CBM Standard Import Tool will close.

The "Results Explorer," "Message," and "Task List" windows will pop up. Details about the "Message" and "Task List" windows and their functions are provided in Chapter 5. Details about the "Results Explorer" window are provided in Chapter 8. Users can learn how to run the imported data through the model as a simulation in section 3.5.

3.2.2 Stand-Level Project Creator

The Stand-Level Project Creator can be used by those dealing with one or a small number of natural, managed, or afforested stands. To create a project with the Stand-Level Project Creator from the "Project Manager" window (Fig. 2-12)

1. **Right-click on the "Connected Projects" box and click on "New Project" on the menu that appears**
   or
   Click on the "New" button

or

On the menu bar of the main CBM-CFS3 window, click on "File," click on "New" on the menu that appears, and then click on "Project" on the side menu that appears

These steps will open up the "New Project" window (Fig. 3-9). In this window, the user names the project and selects the appropriate import tool for importing data, depending on the source of the data and/or the kind of project that is being created. To proceed

2. **Enter a project name in the "Name" box**
3. **Enter a folder location for the project in the "Location" box and skip to the text following step 5**

or

Click on the "Browse" button to browse to a location (if the default "Projects" folder in C:\Program Files\Operational-Scale CBM-CFS3\, C:\Program Files (x86)\Operational-Scale CBM-CFS3\, or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\ is not the appropriate location)

If the user clicks on the "Browse" button, the "Browse For Folder" window (Fig. 3-10) will pop up.

Browse to the "Projects" folder in C:\Program Files\Operational-Scale CBM-CFS3\, C:\Program Files (x86)\Operational-Scale CBM-CFS3\, C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\, or any other designated folder for the project

Click on the "OK" button to proceed

or

Click on the "Cancel" button to terminate the process

or

Click on the "New Folder" button to create a new folder

Note: Automated process for locating "Projects" folder

The CBM-CFS3 will remember the folder location when future projects are created, so this series of steps need be completed only once. However, the user must go through these steps again if a different folder is chosen for projects at a later date.

Once an appropriate location is displayed in the "Location" box, the project path and project name will be displayed below the "Location" box. To proceed

4. **Click on the Stand-Level Project Creator icon in the "Templates" box (Fig. 3-9)**
5. **Click on the "OK" button to proceed**

or

Click on the "Cancel" button to terminate this process

If the user clicks on the "OK" button, the "Stand-Level Project Creator" window (Fig. 3-24) will pop up. This window displays the several steps the user must follow to create a project.

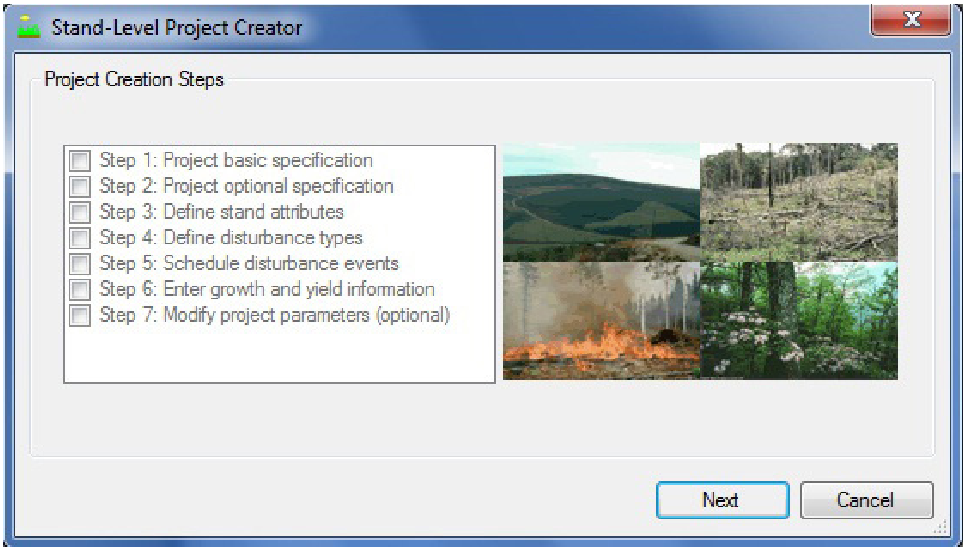


Figure 3-24. The "Stand-Level Project Creator" window.

To begin

6. **Click on the "Next" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "Next" button, the "Project Basic Specifications" window (Fig. 3-25) will pop up. In this window, the user enters details about the project location, species, and nonforest initializations (initial nonforest land cover types). To proceed

7. **Click on the "Administrative Boundary" box and make an appropriate selection from the drop list that appears**
8. **Click on the "Ecological Boundary" box and make an appropriate selection from the drop list that appears**

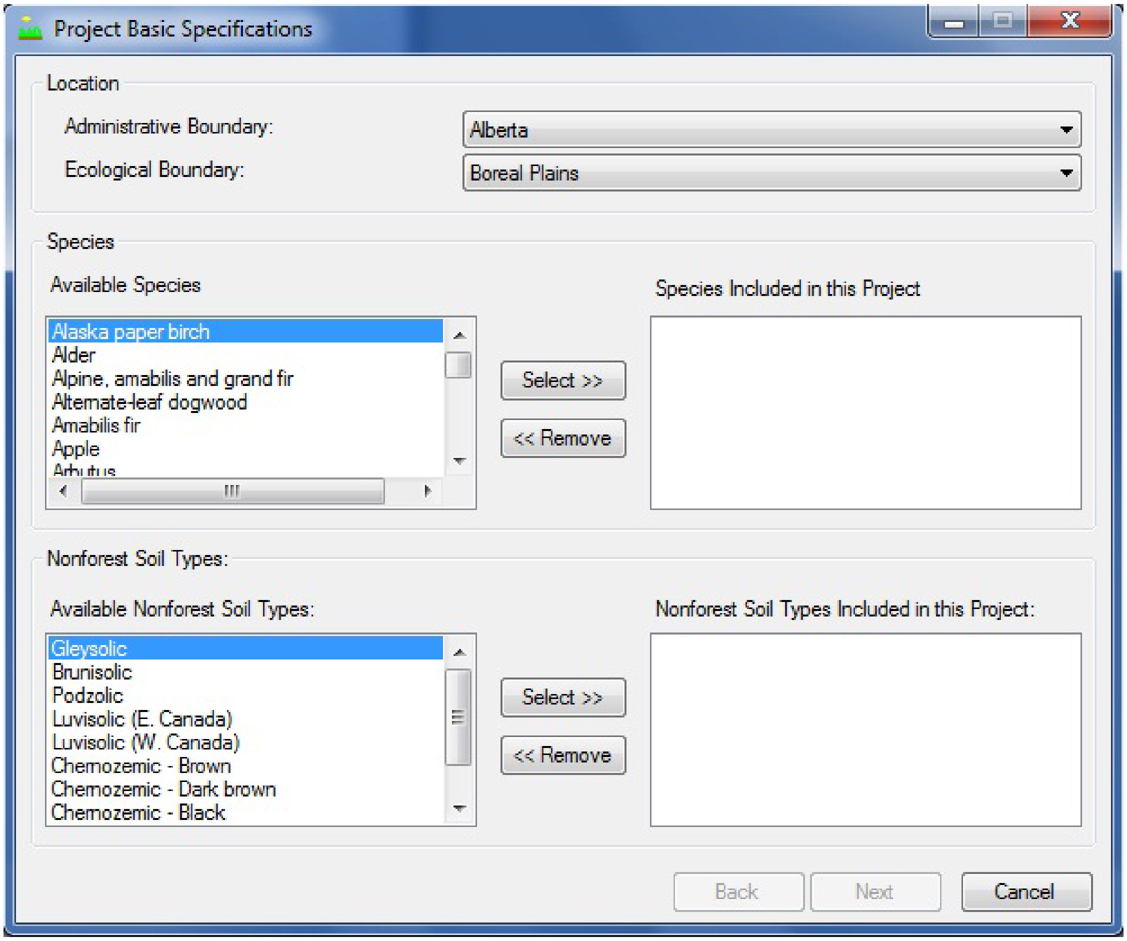


Figure 3-25. The "Project Basic Specifications" window.

Administrative boundaries refer to Canadian provinces and territories, with the exception of Newfoundland and Labrador, which has been split for programming reasons related to fire disturbance matrices. Ecological boundaries refer to the Terrestrial Ecozones of Canada, as defined at http://www.ecozones.ca/english/zone/index.html or in Environment Canada (1996). A map of the terrestrial ecozones of Canada used in the CBM-CFS3 appears as Fig. 3-16. Next, the user must indicate which species to include in the project.

9. Click on a tree species name in the "Available Species" box

10. Click on the "Select>>" button

The species name will appear in the "Species Included in this Project" box.

11. Repeat steps 9 and 10 to add more species

If the user accidentally selects an incorrect tree species, it can be removed. To do this

Click on the tree species name in the "Species Included in this Project" box

Click on the "<<Remove" button

If the project being created does not contain transitions in land-cover type from nonforest to forest (i.e., afforestation), the user should proceed to step 15; otherwise, the user must add nonforest soil types to the project, to reflect the soil types of the nonforested area. The nonforest soil types in the model are associated with specific initial soil parameters (see Appendix 5). By default, the CBM-CFS3 assumes that a nonforested area has carbon stocks only in the belowground slow DOM soil carbon pool. The CBM-CFS3 offers a selection of possible initial values for the belowground slow DOM soil carbon pool, which are based upon the user's selection of nonforest soil type(s) during project setup. These initial values are derived from soil carbon values on cultivated lands, as listed in Janzen et al. (1997). The CBM-CFS3 also permits the user to change any initial values or to assign carbon values to other soil pools for any nonforest soil type selected. These changes can be made during project setup, using the "Nonforest Initial Conditions" tab in the "Modify Regional Default Parameters" window, or after the project has been created, using the "Nonforest Initialization" tab in the "Assumption Composers" window (see Chapter 7, section 7.14.2)

In the "Available Nonforest Soil Types" box, the user must identify the soil type associated with nonforest land cover. To proceed

12. Click on the name of a soil type in the "Available Nonforest Soil types" box (if the soil type is unknown, select "Average")

13. Click on the "Select>>" button in the "Nonforest Soil Types" box

The soil type will be added to the "Nonforest Soil Types Included in this Project" box. If the user inadvertently adds an incorrect soil type, it can be removed. To do this

Click on the soil type name in the "Nonforest Soil Types Included in this Project" box

Click on the "<<Remove" button in the "Nonforest Soil Cover" box.

To proceed

14. Repeat steps 12 and 13 to add more nonforest soil types

15. Click on the "Next" button to proceed

or

Click on the "Back" button to return to the previous window

or

Click on the "Cancel" button to terminate the project creation process

If the user clicks on the "Next" button, the "Project Optional Specifications" window (Fig. 3-26) will pop up, where the user can enter simulation options and optional classifiers for the project.

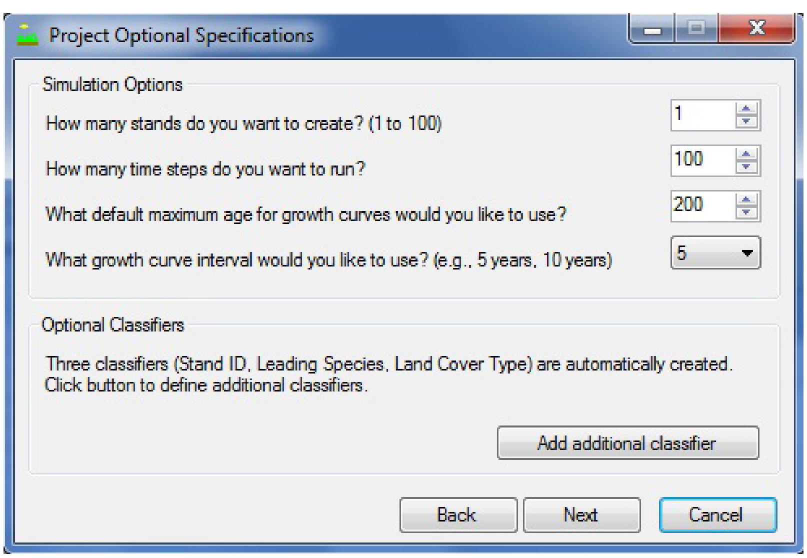


Figure 3-26. The "Project Optional Specifications" window.

To proceed

16. **Click on the "How many stands do you want to create? (1-100)" box and use the arrow buttons to select an appropriate number (or type in a number)**
17. **Click on the "How many time steps do you want to run?" box, and use the arrow buttons to select an appropriate number (or type in a number) representing the number of year(s) to run the simulation**

Next, the user will need to identify the maximum age of the longest growth curve in their project.

18. **Click on the "What default maximum age for growth curves would you like to use?" box and use the arrow buttons to select an appropriate number (or type in a number)**
19. **Click on the "What growth curve interval would you like to use? (e.g., 5 years, 10 years)" box and use the arrow buttons to select an appropriate number (or type in a number), if required**

The CBM-CFS3 automatically creates the following classifiers for the data to be imported: Stand ID, Leading Species, and Land Cover Type.

The user should note that if they plan to transition one stand type to another following specific disturbance events in their project, in the Stand-Level Project Creator specifically, they cannot transition a stand from one Stand ID (e.g., StandID 1) to another (e.g., StandID 2). If the user needs to enact complicated transition rules, they should consider whether they may need to set up additional classifiers to facilitate these transitions.

☞ *Tip: Creating additional classifiers*

To create additional classifiers

1. **Click on the "Add Additional Classifier" button**

The "Optional Classifiers" window (Fig. 3-27) will pop up. In this window, the user must name, describe, and add the new classifier(s).

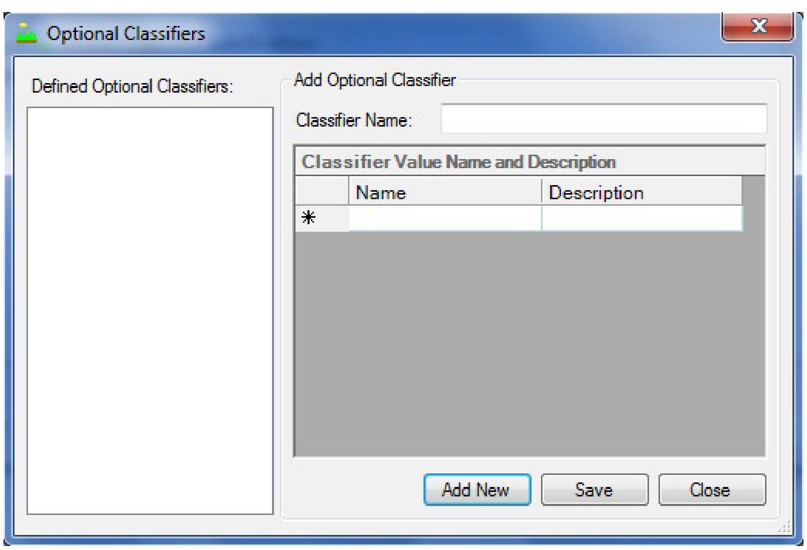


Figure 3-27. The "Optional Classifiers" window.

2. **Click on the "Add New" button.**
3. **Type a classifier name in the "Classifier Name" box**

4. **Type a classifier value name in the "Name" column of the "Classifier Value Name and Description" table**
5. **Type a description for the classifier value in the "Description" column of the "Classifier Value Name and Description" table**
6. **Click on the "Save" button**

An "Add Optional Classifier" window will pop up stating, "Optional classifier and values have been added."

7. **Click on the "OK" button**

The new classifier will then appear in the "Defined Optional Classifiers" box.

8. **Repeat steps 2 to 7 to add additional classifiers**

To delete a classifier that was added

Click on the name of the classifier in the "Defined Optional Classifiers" box

Press the "Delete" key on your keyboard

A "Delete a Classifier" window will pop up asking the user to confirm deletion of the selected classifier.

Click on the "Yes" button to proceed

or

Click on the "No" button to cancel the deletion process

To return to the "Project Optional Specifications" window

9. **Click on the "Close" button**

---

20. **Click on the "Next" button to proceed**

or

Click on the "Back" button to go back to the previous window

or

Click on the "Cancel" button to terminate the project-creation process

If the user clicks on the "Next" button, the "Define Stand Attributes" window (Fig. 3-28) will pop up. This window contains two tabs, the "Define Stand Attributes" tab (Fig. 3-28) and the "Review Stand Attributes" tab (Fig. 3-29). On the "Define Stand Attributes" tab, the user selects the stand attributes for each stand that is being created. On the "Review Stand Attributes" tab, the user can review the stand attributes selected for all of the stands that are being created. To define stand attributes on the "Define Stand Attributes" tab

21. **Click on the name of a stand in the "Stands" box**
22. **Click on the "Stand Age" box and type in a stand age**
23. **Click on the "Stand Area (ha)" box and type in the number of hectares for the stand**
24. **Click on each cell in the "Classifier Value" column of the "Stand Type Definition" table and make a selection from the drop list that appears**

Note: Defining nonforest stands

For nonforest stands that will be converted to forest, the user should select "Nonforest" as the "Leading Species" classifier value and the appropriate soil type for the "Land Cover" classifier.

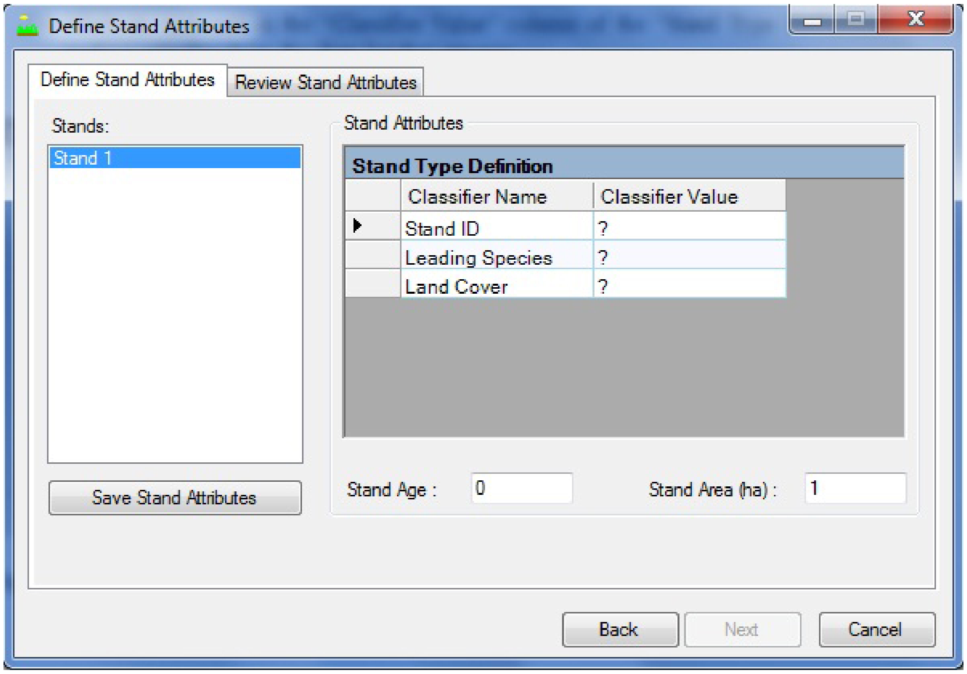


Figure 3-28. The "Define Stand Attributes" window with the "Define Stand Attributes" tab selected.

25. **Click on the "Save Stand Attributes" button**
26. **Repeat steps 21 to 25 for any remaining stands**

Note: Reviewing stand attributes

To review the attributes saved for the stand(s) that are being created

Click on the "Review Stand Attributes" tab

27. **Click on the "Next" button to proceed**

    or

    Click on the "Back" button to return to the previous window

    or

    Click on the "Cancel" button to terminate the project-creation process

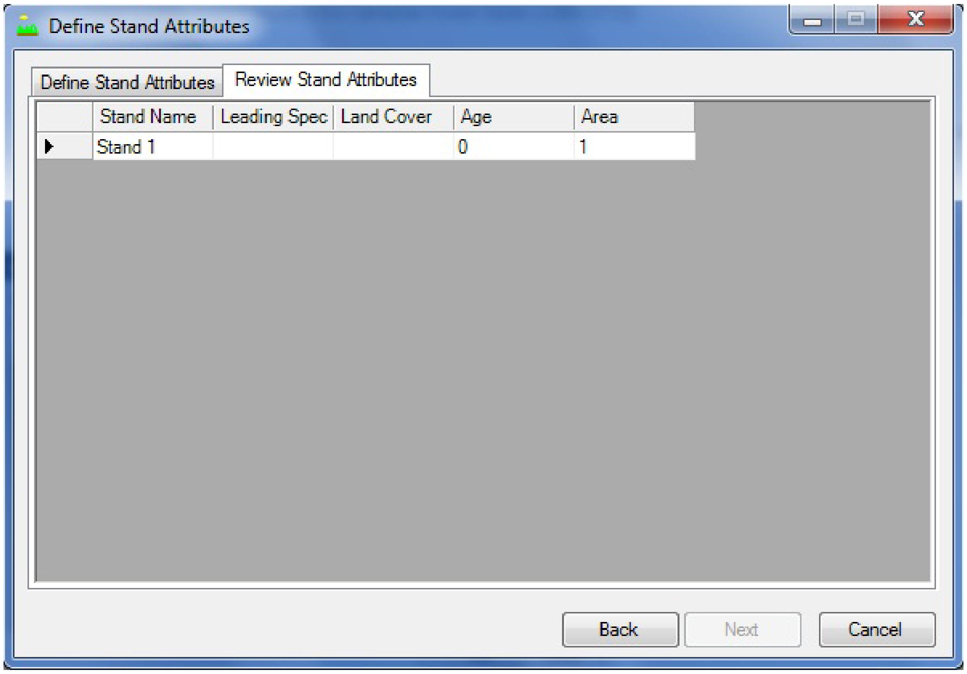


Figure 3-29. The "Define Stand Attributes" window with the "Review Stand Attributes" tab selected.

If the user clicks on the "Next" button, the "Define Disturbance Types" window (Fig. 3-30) will pop up. In this window, the user must select the disturbance type(s) to be included in the project and the options to initialize the stand(s). Fire is automatically included as a disturbance type in all projects and should not be removed; however, unless the user specifies its application during the MAKELIST carbon pool initialization process (for forest stands), or during the planned simulation period for any stands, it will not be used by the model. To select other disturbance types

28. Click on the name of a disturbance type in the "Available Default Disturbances" box

29. Click on the "Select>>" button

The disturbance type will be added to the "Selected Disturbances for This Project" box.

30. Repeat steps 28 and 29 to add more disturbance types

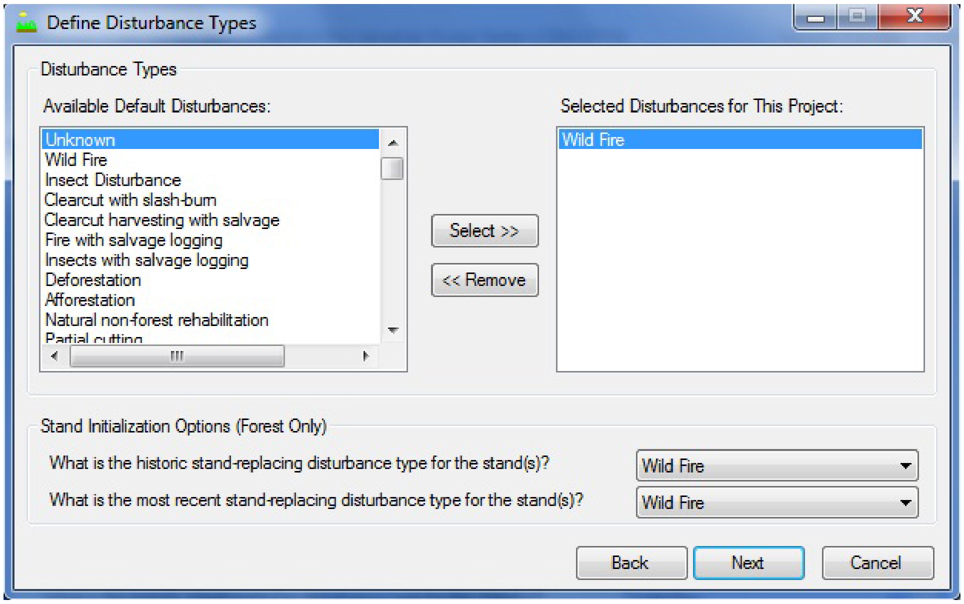


Figure 3-30. The "Define Disturbance Types" window.

If the user needs to remove a disturbance type from the "Selected Disturbances for This Project" box

> **Click on the name of the disturbance type in the "Selected Disturbances for This Project" box**
>
> **Click on the "<<Remove" button**

Note: How natural succession is handled in the model if it is not selected and modeled as a disturbance type

Users have the option of whether to model natural succession as a disturbance type. If the user does not model natural succession as a disturbance type, the model will assume that, when a simulation surpasses, in years, the last age–volume pair on a yield curve for a particular stand type, the last volume will be kept constant for the remainder of the simulation.

Next, for projects initially modeling forest stands (those starting only with nonforest stands can skip to step 33), the user must set stand initialization options, which specify the historical stand-replacing disturbance type for all stands in the project (i.e., the most frequent disturbance before the most recent disturbance over the past approximately 1000–2000 years), and the most recent stand-replacing disturbance type. This information is used to initialize carbon pools in existing forest stands before a simulation. If the user has multiple stands in a project, and each has a unique historic and last disturbance type, the user should consider either a) using the CBM Standard Import Tool so that these disturbances can be properly defined for each stand in the import files, or b) defining single disturbance types applying to all stands in this tool, adding all of the other intended disturbance types to the project, and then, once the project has been created, redefining the historic and last disturbance type for each stand in the default Historic Disturbance Type Assumption on the "Historic Disturbance Types" tab in the "Assumption Composers" window (see section 7.1.6). For users who need to represent more than one last disturbance during the MAKELIST stand initialization process, the CBM-CFS3 now supports multiple last pass rotation disturbance types at customizable stand-replacing disturbance intervals. For instructions on how to set this up once a CBM-CFS3 project has been created (it cannot be done in the Stand-Level Project Creator), see Appendix 8 of this guide. To proceed

31. **Click on the "What is the historic stand-replacing disturbance type for the stand(s)?" box and make a selection from the drop list that appears**

32. **Click on the "What is the most recent stand-replacing disturbance type for the stand(s)?" box and make a selection from the drop list that appears**
33. **Click on the "Next" button to proceed**

    or

    Click on the "Back" button to return to the previous window

    or

    Click on the "Cancel" button to terminate the project-creation process

If the user clicks on the "Next" button, the "Schedule Disturbance Events" window (Fig. 3-31) will pop up. This window contains two tabs, the "Schedule Disturbance" tab (Fig. 3-31) and the "Review Disturbance Schedule" tab (Fig. 3-32). On the "Schedule Disturbance" tab, the user can assign disturbance events to each stand that has been created and create a stand-type transition rule (the stand type to which the original stand will convert following the disturbance event, if different) for that event. The user can also delete disturbance events that have been created in error.

Note: Multiple disturbances for the same stand in the same time step

When scheduling multiple disturbance events in the same time step for the same stand, the user must consider an issue related to overlap of areas associated with the events. Specifically, the same area cannot be allocated to different disturbance events in the same time step. For example, if the stand contains 100 ha of the "Black Spruce" forest type, the user cannot subject 60 hectares of this stand to a clear-cut disturbance and 60 hectares to a commercial thinning disturbance in the same time step, because part of the area to be disturbed (20 hectares) will overlap between two disturbances. In this instance, the user could subject 50 hectares to clear-cutting and 50 hectares to commercial thinning in the same time step, such that the total area allocated to disturbance in that time step would be equal to the total area for that stand, 100 hectares.

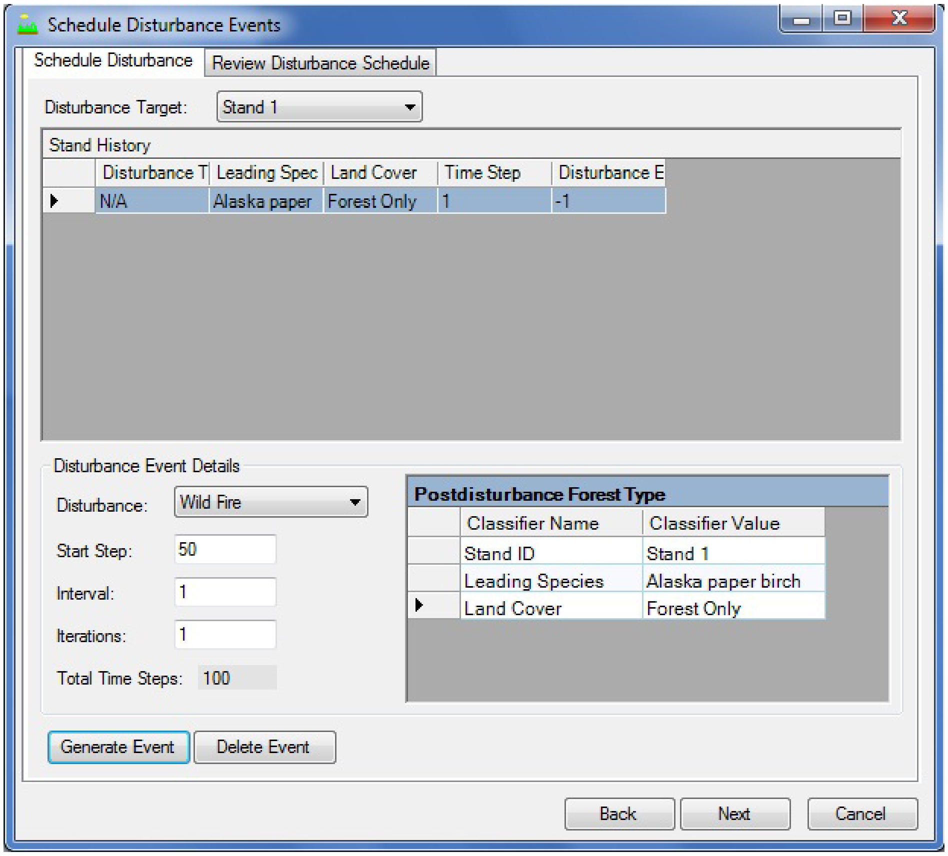


Figure 3-31. The "Schedule Disturbance Events" window with the "Schedule Disturbance" tab selected.

Note: Sequencing of disturbance events in the same time step

In the CBM-CFS3, the order of occurrence of disturbance events within a time step is dictated by the default disturbance type ID (DistTypeID). The model processes the disturbance event with the smallest disturbance type ID first (see Appendix 6 for a list of default disturbance types and their ID values). For example, when a user maps a disturbance type called "CC" to the CBM-CFS3 default called "Clear-cut harvesting with salvage," it is assigned default disturbance type ID 4. Similarly, when the user maps a disturbance type called "CT" to the CBM-CFS3 default called "50% Commercial thinning," it is assigned default disturbance type ID 189. The model will process the clear-cutting disturbance event first in each time step in which both clear-cutting and commercial thinning events occur, because default disturbance type ID 4 is less than default disturbance type ID 189. This issue is important in situations where the sequence of disturbance events matters to users. Using the above example, if the user wants all of the area eligible for commercial thinning to be disturbed first in a time step, and whatever remains to be disturbed by clear-cutting, the default disturbance type IDs within the project database (tblDisturbanceType) would have to be modified to give "50% Commercial thinning" a smaller default disturbance type ID than "Clear-cut harvesting with salvage."

Should this issue not be realized until after the data have been imported, the user can make changes to the default disturbance type IDs in the project's Access database, which, by default, will be found in the folder for the project in the Operational-Scale CBM-CFS3\Projects directory, wherever the user chose to install the model. To edit a disturbance type ID in a project Access database

Note (continued): Sequencing of disturbance events in the same time step

Go to tblDisturbanceType

Edit the values of the default disturbance type ID to obtain the disturbance sequencing required

Users should never change Land Use Change (LUC) default disturbance type IDs because these are used specifically for UNFCCC estimation and reporting methodologies. Users should also note the default disturbance type IDs for afforestation and deforestation listed in Appendix 6. These values should not be used when altering ID values to change the order of events.

If no disturbance event is created, the user can skip to step 42. Following step 42, the "Schedule Disturbance Events" window will pop up asking the user to confirm that no disturbances are to be scheduled.

Click on the "Yes" button to proceed

or

Click on the "No" button to add disturbance events

To create disturbance events and transition rules

34. Click on the "Disturbance Target" box and select a stand name from the drop list that appears

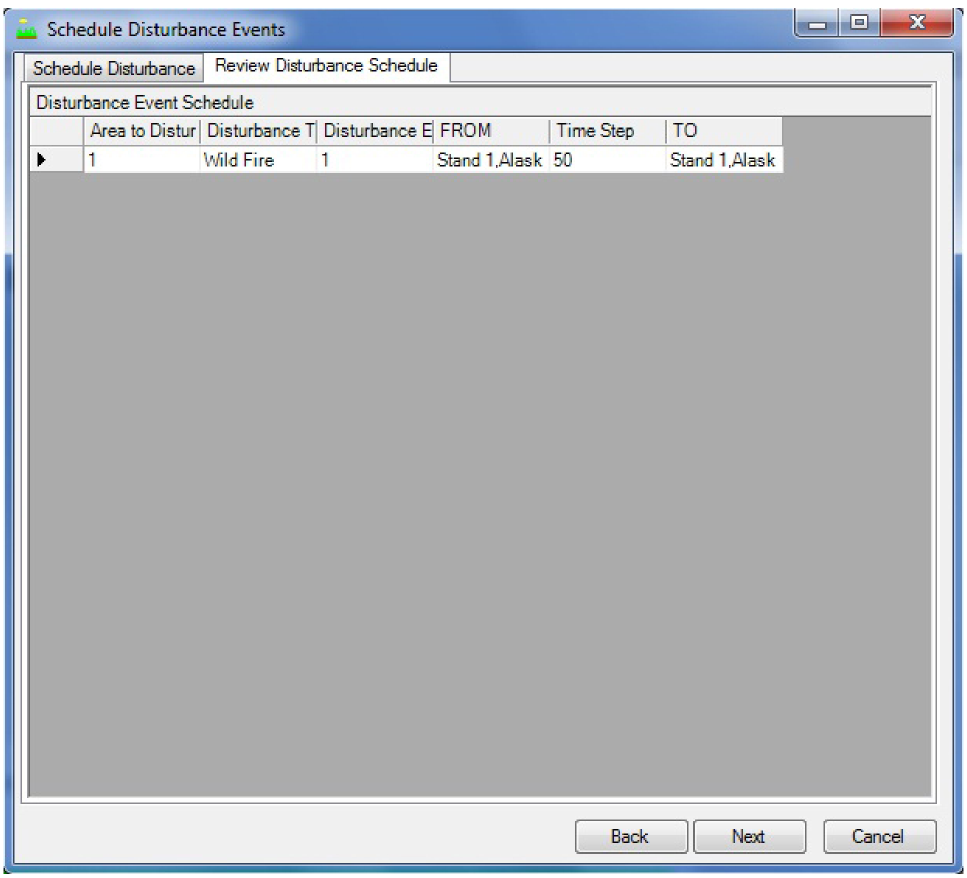


Figure 3-32. The "Schedule Disturbance Events" window with the "Review Disturbance Schedule" tab selected.

35. Click on the "Disturbance" box and select a disturbance type from the drop list that appears

Next, the user must enter a Start Step for the disturbance event. The Start Step refers to the time step from the beginning of the simulation run at which the disturbance will occur. For example, if the disturbance is to occur 50 years after the beginning of the simulation, the Start Step is 50. To proceed

36. Click on the "Start Step" box and enter an appropriate year

Next, the user must enter the number of years between disturbance events of this kind in the "Interval" box.

If the event will only occur once and no interval actually exists based on the number of iterations that will be entered, enter 1 as the default and it will be ignored in this instance.

37. Click on the "Interval" box and enter an appropriate number of years

Next, the user must enter the number of iterations, which represents the number of times the disturbance event is to be repeated.

38. Click on the "Iterations" box and type in the number of iterations

Note: Using the "Total Time Steps" box

The "Total Time Steps" box shows the number of time steps selected for simulation in the "Project Optional Specifications" window and cannot be edited in this window. This information is provided here to help users choose an appropriate Start Step, Interval, and number of iterations for each disturbance event that is created.

Next, the user must provide details about the stand type that will result after the disturbance event(s).

39. Click on each "Classifier Name" in the "Postdisturbance Forest Type" table, and select an appropriate "Classifier Value" from the drop list that appears

As previously stated, the user is not permitted to transition a stand from one stand ID value (e.g., StandID 1) to another (e.g., StandID 2).

Note: Postdisturbance selection of classifier values for afforestation events

For afforestation events involving the conversion of nonforest to forest, the user should select the appropriate tree species as the classifier value for "Leading Species" and "Forest Only" as the classifier value for "Land Cover."

40. Click on the "Generate Event" button

41. Repeat steps 34 to 40 to generate more disturbance events

If the user accidentally creates an unwanted disturbance event, it can be deleted. To delete an event

In the "Stand History" table (Fig. 3-31), click on the gray cell next to the row containing the disturbance event to be removed

Click on the "Delete Event" button

A "Delete Disturbance Events" window will pop up asking the user to confirm deletion of the selected event.

Click on the "Yes" button to proceed

or

Click on the "No" button to cancel the deletion process

Note: Reviewing disturbance events

To review all of the disturbance event details for stand(s) in one table

Click on the "Review Disturbance Schedule" tab

42. Click on the "Next" button to proceed

or

Click on the "Back" button to return to the previous window

or

Click on the "Cancel" button to terminate the process

If the user clicks on the "Next" button, the "Enter Growth and Yield Information" window (Fig. 3-33) will pop up. In this window, the user must define the volumes corresponding to the age classes for each species (if more than one) for each stand.

To add corresponding volumes to each age class for each species in a stand (if more than one species)

43. Click on a stand name in the "All Growth Curves" box

44. Click on a species name in the "Applied Species" box

45. Click on a cell in the "Volume" column of the table and enter a volume appropriate for the age class in the "Age" column

☞ *Tip: Copying or pasting volumes*

To make volume entry easier for users, volumes can be copied from a Microsoft Excel spreadsheet and pasted into the table shown in Fig. 3-33. Volumes in the table can also be copied and pasted into another age–volume table. To copy volumes in the table or paste volumes into the table

1. **Click on the gray cell next to the first age–volume pair**
2. **Right-click and click on "Copy" (to copy the age–volume pairs) or "Paste" (to paste in new age–volume pairs) on the menu that appears**

46. Repeat step 45 for each age class

47. Click on the "Save" button

Note: Entering a value of zero for merchantable volume per hectare at the end of a growth curve

Entering a value of zero for merchantable volume per hectare for an age class at the end of a growth curve in the "Enter Growth and Yield Information" window is not a problem; however, the user should note that the CBM-CFS3 will ignore the zero value and assume that the volume is the same as the last positive volume value entered for a younger age class. The CBM-CFS3 also does this when a stand grows beyond the oldest age class of its growth curve (i.e., the model assumes that the volume will be the same as the last positive volume entered for a younger age class). If the user truly wants the volume to drop to zero at the end of a growth curve, they must enter 0.01 instead of zero.

48. Repeat steps 44 to 47 for any remaining species in the "Applied Species" box

☞ *Tip: Editing volumes after they have been saved*

A user can edit the volumes after saving them by making the necessary edits and clicking on the "Save" button again.

49. Repeat steps 43 to 48 for any remaining stands in the "All Growth Curves" box

Note: Adding additional species to a stand

The user has the option of using the "Enter Growth and Yield Information" window to add additional species to a stand that has been created. Only species added to the project in the "Project Basic Specifications" window (Fig. 3-25), or a general "hardwood" or "softwood" species, can be added to a stand along with growth and yield information. To proceed

1. **Click on a stand name in the "All Growth Curves" box**
2. **Click on the "Additional Species" box and select a species name from the drop list that appears**
3. **Click on the "Add Species" button**

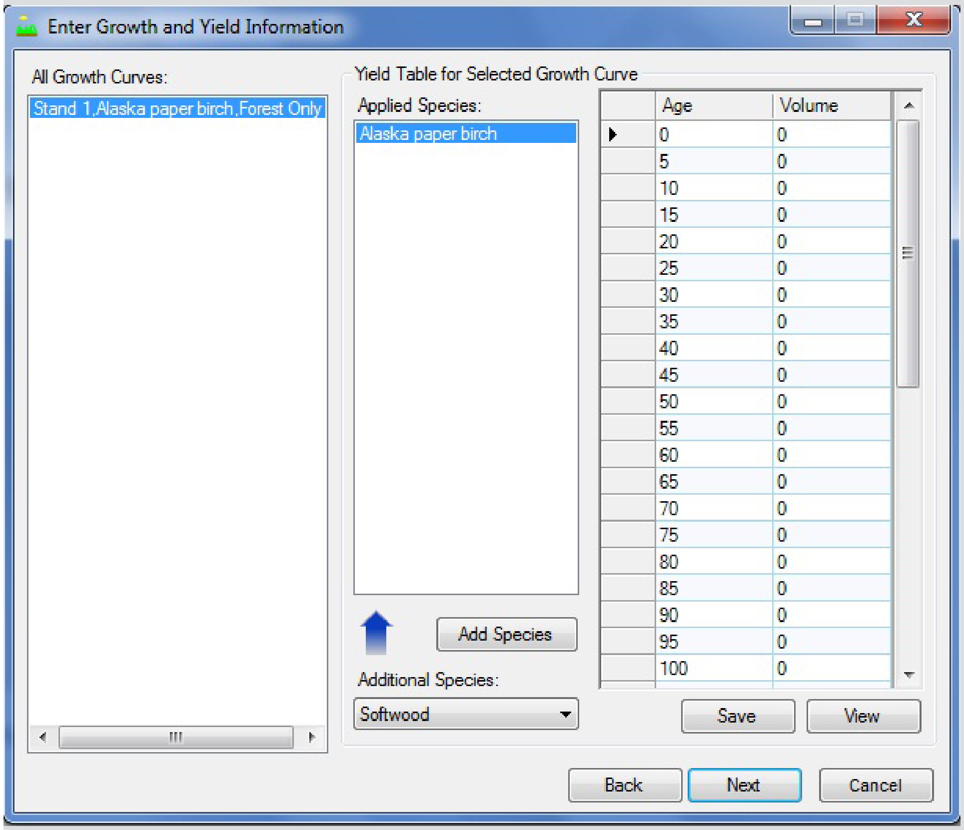


Figure 3-33. The "Enter Growth and Yield Information" window.

4. **Repeat steps 2 and 3 to add more species**

If the user adds an incorrect species to the "Applied Species" box, it can be deleted. To delete a species

Click on the name of the species in the "Applied Species" box

Press the "Delete" key on the keyboard

The "Delete Species" window (Fig. 3-34) will pop up asking the user to confirm deletion of the selected species

Click on the "Yes" button to proceed

or

Click on the "No" button to cancel the deletion

Note: (continued): Adding additional species to a stand

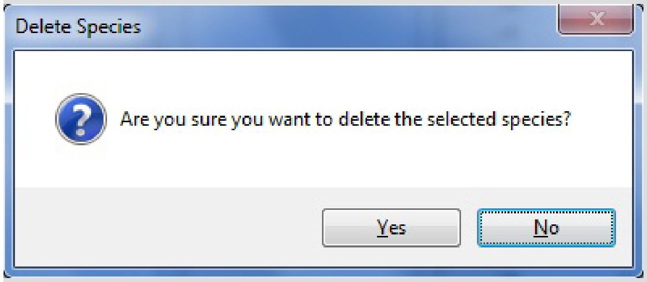


Figure 3-34. The "Delete Species" window.

To view, edit, print, save, or export the growth and yield curves created for an applied species

50. Click on a species in the "Applied Species" box

51. Click on the "View" button

The "Growth Curve – 'stand name'" window (Fig. 3-35) will pop up, displaying a graph and table of the volume–age pairs for the selected species.

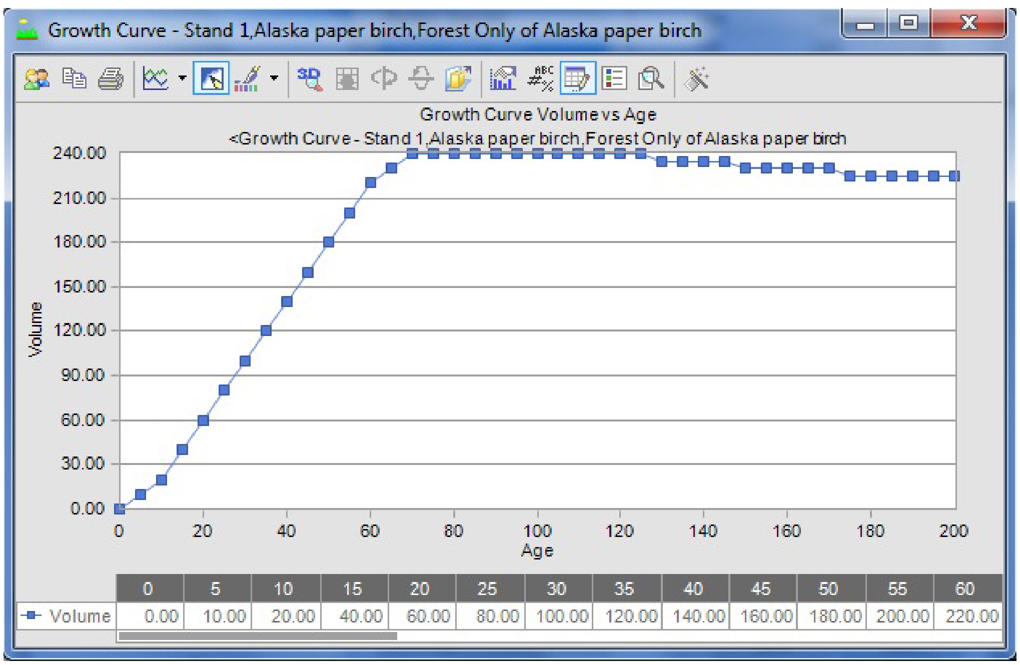


Figure 3-35. The "Growth Curve - 'stand name' " window.

The user can modify the displayed components of the graph and table, and/or print, save, or export the graph by using the icon toolbar features at the top of the graph. For more details about how to manipulate a graph or table, see Chapter 9.

To continue the project-creation process

52. Click on the "X" button to close the "Growth Curve – 'stand name' " window

53. Click on the "Next" button to proceed

or

Click on the "Back" button to return to the previous window

or

Click on the "Cancel" button to terminate the project-creation process

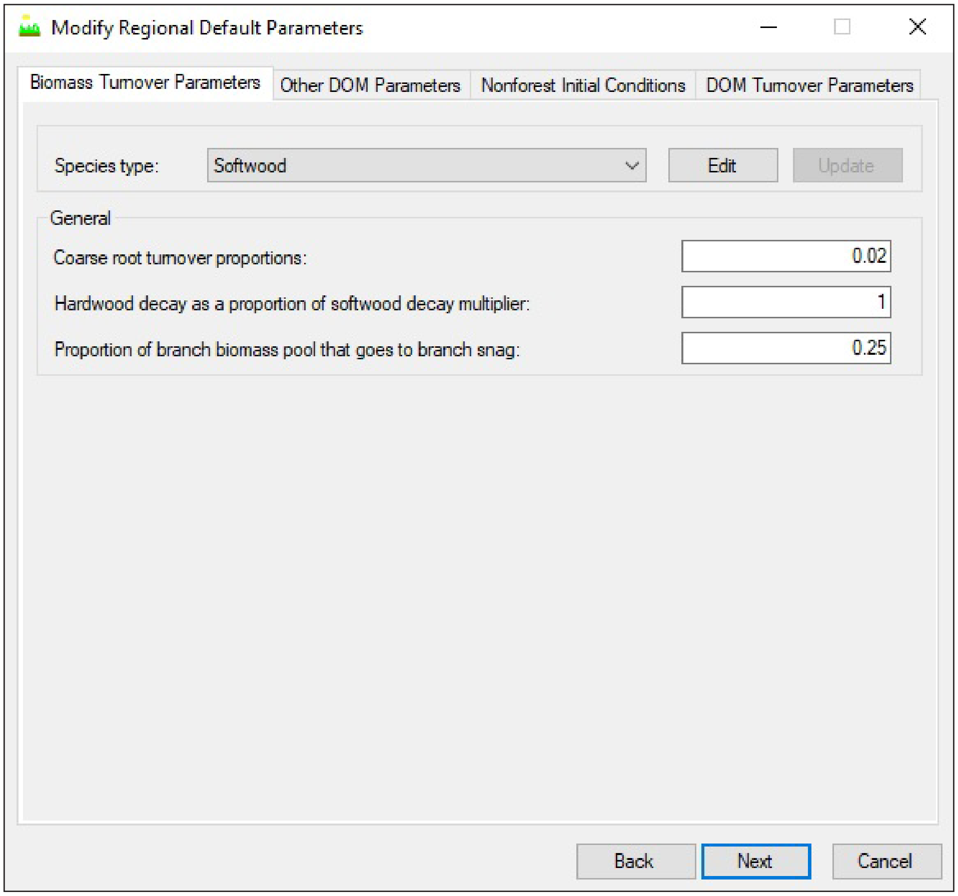


Figure 3-36. The "Modify Regional Default Parameters" window with the "Biomass Turnover Parameters" tab selected.

If the user clicks on the "Next" button, the "Modify Regional Default Parameters" window (Fig. 3-36) will pop up. In this window, the user has the option of modifying the CBM-CFS3 default biomass turnover parameters, DOM turnover parameters, other DOM parameters, and nonforest initial conditions. The parameters are described in Table 3-4, and default values are listed for DOM turnover parameters in Appendix 3, for other DOM parameters in Appendix 4, and for nonforest initial conditions in Appendix 5.

Table 3-5. Definitions of parameters and pools in the "Modify Regional Default Parameters" window (Figs. 3-36 to 3-39; units in parentheses)

Tab	Box name	Parameter or pool	Definition
Biomass Turnover Parameters	General	Coarse root turnover proportion (0 to 1)	Proportion of coarse root biomass carbon that transfers to the fast belowground DOM[a] pool annually
		Hardwood decay as a proportion of softwood decay multiplier (0 to maximum defined by user)	A number that can be used to increase or decrease decay rates of DOM pools for hardwood relative to softwood
		Proportion of branch biomass pool that goes to branch snag (0 to 1)	Proportion of branch turnover that transfers to the branch snag pool annually
DOM Turnover Parameters	Average	Slow DOM Pool (t ha^{-1})	Initial slow DOM pool value for the forest stand used by the stand initialization program (MAKELIST) that is run at the start of a simulation
		Decay Multiplier (0 to maximum defined by user)	Sensitivity analysis multiplier that alters the decay rates of all pools
		Stand-Replacing Disturbance Interval (years)	Average number of years between stand-replacing disturbances, which is used in MAKELIST to grow the stand(s) in an iterative process until equilibrium is reached in the slow DOM pool
	Turnover Rate (0 to 1)	Softwood Other	Proportion of softwood branches that die annually
		Merchantable Annual	Proportion of stems that die annually
		Hardwood Other	Proportion of hardwood branches that die annually
	Snag Fall Rate (0 to 1)	Dead Softwood Merchantable	Proportion of softwood stem snags that transfer to the medium soil pool annually
		Dead Softwood Other	Proportion of softwood branch snags that transfer to the fast aboveground pool
		Dead Hardwood Merchantable	Proportion of hardwood stem snags that transfer to the medium soil pool annually
		Dead Hardwood Other	Proportion of hardwood branch snags that transfer to the fast aboveground pool

Table 3-5. Continued

Tab	Box name	Parameter or pool	Definition
DOM Turnover Parameters	Foliage Fall Rate (0 to 1)	Softwood	Proportion of softwood foliage that transfers to the very fast aboveground pool
	Foliage Fall Rate (0 to 1)	Hardwood	Proportion of hardwood foliage that transfers to the very fast aboveground pool
Other DOM Parameters	Decay Rate	Decay rate of organic matter at the reference temperature (yr^{-1})	Annual base decay rate of organic matter at the specified reference temperature
		Maximum decay rate multiplier for the soil pool type (softwood) (≤1)	Maximum decay rate value that can be used for softwood DOM pools
		Maximum decay rate multiplier for the soil pool type (hardwood) (<1)	Maximum decay rate value that can be used for hardwood DOM pools
	General	Reference mean annual temperature for decay rate (°C)	Mean annual temperature for the base decay rate used as a reference point for application of q10
		q10 (°C) (>1)	A parameter used to modify organic matter decay rates in response to mean annual temperature (e.g., a q10 value of 2 results in a doubling of the decay rate for every 10°C increase in mean annual temperature relative to the reference temperature)
		Proportion of carbon transferred from soil pools to atmosphere (0 to 1)	Proportion of carbon in the selected soil pool that transfers to the atmosphere; default value is 0.83 for all DOM pools except the slow aboveground and belowground pools, for which the default is 1
	Carbon Flux Rate (peat only)	Rate at which carbon is added to the given soil pool	Rate at which carbon is added to the peat pool
	Carbon Flux Rate (peat only)	Rate at which carbon is lost from the given soil pool	The rate at which carbon is lost from the peat pool
		Total	Total biomass carbon in the nonforested stand; typically zero

Table 3-5. Continued

Tab	Box name	Parameter or pool	Definition
Nonforest Initial Conditions	Biomass Carbon Pool Value (t ha^{-1})	Merchantable	Carbon in merchantable stemwood and merchantable stem bark (excluding tops and stumps)
		Submerchantable	Carbon in submerchantable stemwood
		Coarse Root	Carbon in live coarse roots, approximately ≥ 5 mm diameter
		Fine Root	Carbon in live fine roots, approximately <5 mm diameter
		Foliage	Carbon in foliage
		Other	Carbon in nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
	Dead Organic Matter (DOM) Carbon Pool Value (t ha^{-1})	Total	Total DOM carbon in the nonforested stand
		Aboveground Very Fast DOM	Carbon in the L horizon with input from foliage and fine roots approximately <5 mm diameter
		Belowground Very Fast DOM	Carbon in dead fine roots approximately <5 mm diameter in the mineral soil
		Aboveground Fast DOM	Carbon in fine and small woody debris DOM including dead coarse roots in the forest floor, with a portion of inputs from the Other pool, and inputs from snag branches and coarse roots approximately ≥ 5 mm diameter
		Belowground Fast DOM	Carbon in dead coarse roots approximately ≥ 5 mm diameter in the mineral soil
		Aboveground Slow DOM	Carbon in the F, H, and O horizons with input from the Aboveground Very Fast, Fast, Medium, Snag Stem Wood and Snag Branches DOM pools; slow transfer rate
		Belowground Slow DOM	Carbon in humified organic matter in the mineral soil with input from the Belowground Very Fast, Belowground Fast, and Aboveground Slow pools

Table 3-5. Concluded

Tab	Box name	Parameter or pool	Definition
Nonforest Initial Conditions	Dead Organic Matter (DOM) Carbon Pool Value (t ha^{-1})	Softwood Stem Snag	Carbon in dead standing softwood stem wood of merchantable size, including bark, snag stem wood transfer rate
		Softwood Branch Snag	Carbon in dead softwood branches, and nominally, a portion of input from the Softwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
		Hardwood Stem Snag	Carbon in dead standing hardwood stem wood of merchantable size, including bark; snag stem wood transfer rate
		Hardwood Branch Snag	Carbon in dead hardwood branches, and nominally, a portion of input from the Hardwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
		Black Carbon	Stable carbon from incomplete combustion after fire
		Medium DOM	Carbon in coarse woody debris DOM with input from merchantable stem wood and stem snags

[a]DOM = dead organic matter.

Note: Modifying default parameters

To modify default biomass turnover parameters

1. **Click on the "Biomass Turnover Parameters" tab (Fig. 3-36)**
2. **Click on the "Edit" button**
3. **Click on the "Species Type" box and select "Softwood" or "Hardwood" from the drop list that appears**
4. **Edit the parameters**
5. **Click on the "Update" button once all edits are complete**
6. **Repeat steps 2 to 5 to edit parameters for any remaining species types for consistency**

To modify default DOM turnover parameters

1. **Click on the "DOM Turnover Parameters" tab (Fig. 3-37)**
2. **Click on the "Edit" button**
3. **Edit the parameters**
4. **Click on the "Update" button**

To modify other default DOM parameters

1. **Click on the "Other DOM Parameters" tab (Fig. 3-38)**
2. **Click on the "Edit" button**
3. **Click on the "Soil Pool" box and click on a soil pool name on the drop list that appears**

In determining the decay rate for a given DOM pool, CBM-CFS3 uses an initial decay rate for each pool referenced to 10°C. The decay rate is then recalculated for each time step to correspond to the mean annual temperature values provided by the user. The parameters on this tab are used by the CBM-CFS3 to determine the temperature-adjusted decay rates.

4. **Edit the parameters**
5. **Click on the "Update" button**
6. **Repeat steps 2 to 5 for any remaining soil types**

If the user selects one or more nonforest soil types in the "Project Basic Specifications" window (Fig. 3-25) and is creating forest from nonforest land, the initial biomass and DOM parameters can be edited for each nonforest stand. To do this

7. **Click on the "Nonforest Initial Conditions" tab (Fig. 3-39)**
8. **Click on the "Edit" button**
9. **Click on the "Stand" box and click on a stand name on the drop list that appears**

Note (continued): Modifying default parameters

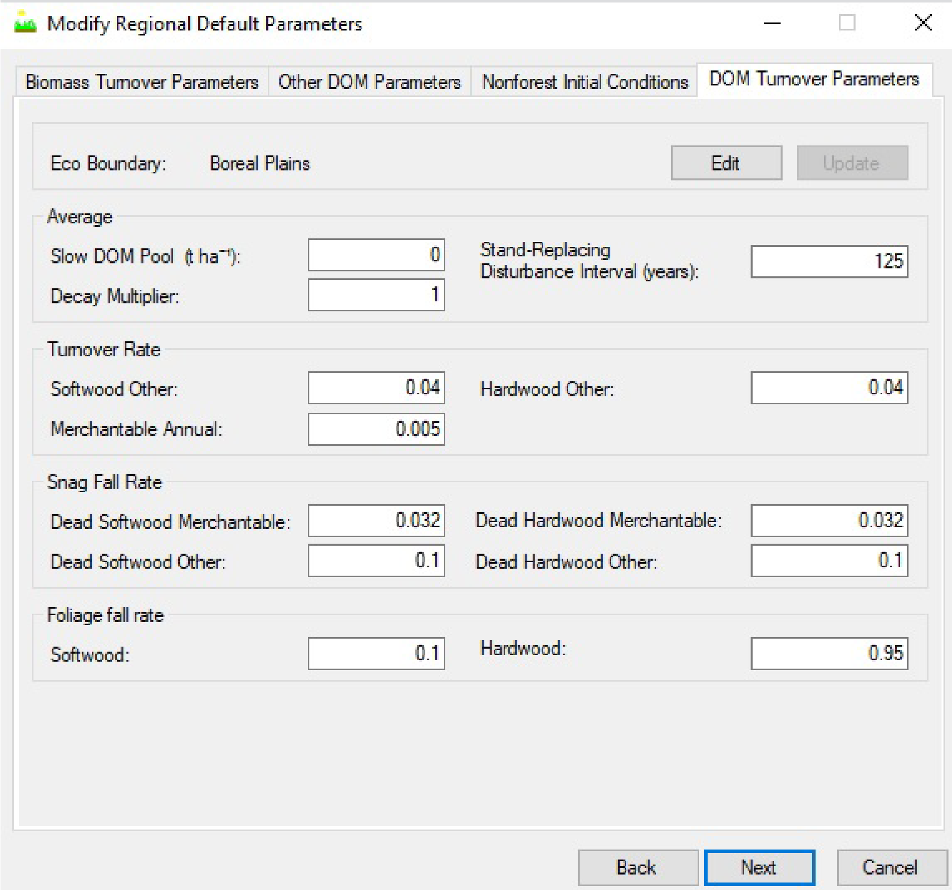


Figure 3-37. The "Modify Regional Default Parameters" window with the "DOM Turnover Parameters" tab selected.

Note (continued): Modifying default parameters

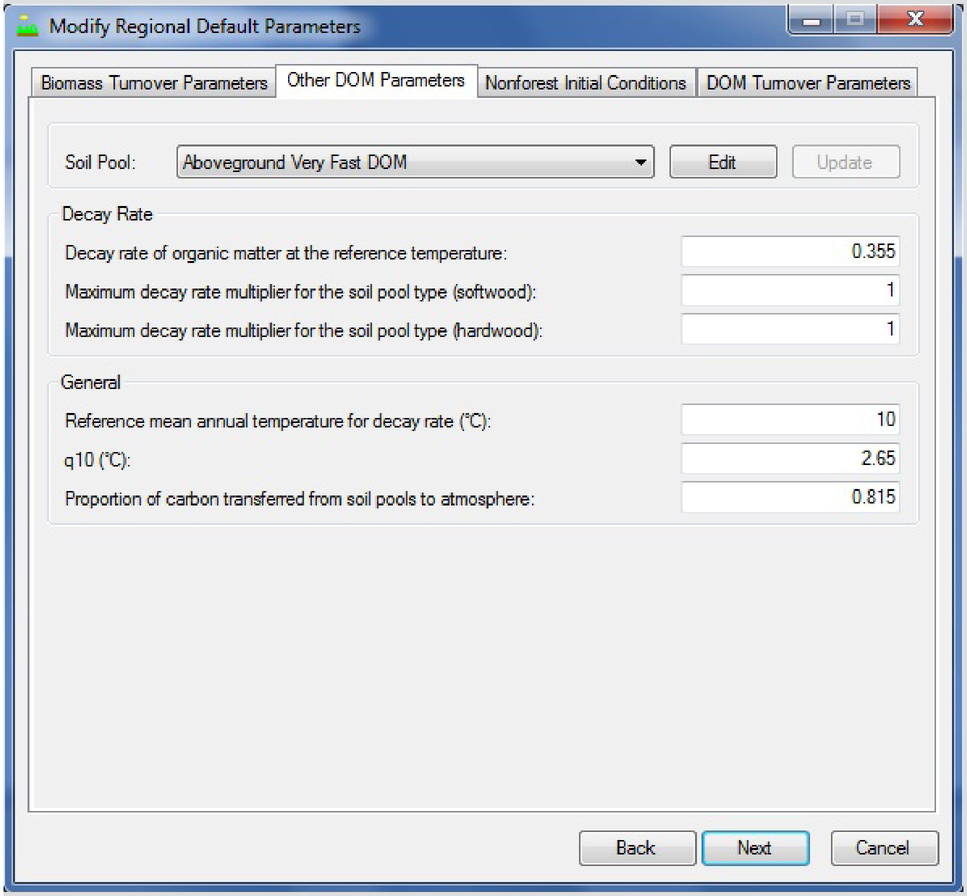


Figure 3-38. The "Modify Regional Default Parameters" window with the "Other DOM Parameters" tab selected. DOM = dead organic matter.

Definitions of the carbon parameters can be found in Table 3-5.

10. For each of the parameter boxes listed in the "Biomass Carbon Pool Value" box (Merchantable, Coarse Root, Fine Root, Foliage, and Other), type in numbers representing carbon (as tonnes per hectare) for softwood (click on the "Softwood" tab) and/or hardwood (click on the "hardwood" tab)

The user should note that any positive value entered in a biomass carbon pool will remain static within the stand, even after afforestation, will not be subject to growth or decay (because it is not linked to a growth curve), and can only be removed through a stand-replacing disturbance event that transfers all biomass carbon to DOM pools, the atmosphere, or to the forest products pool. For this reason, if tree biomass carbon is included in nonforest stands, it is recommended that a modified afforestation disturbance type and matrix be applied to that stand in order to transfer any existing biomass carbon to DOM carbon pools, the atmosphere, or the forest products pool at the time of afforestation. This is not the case for default or modified values used for DOM pools—these values will remain static until the afforestation event is executed, after which they will be subject to annual decay processes as they would be in any forest stand.

Note (continued): Modifying default parameters

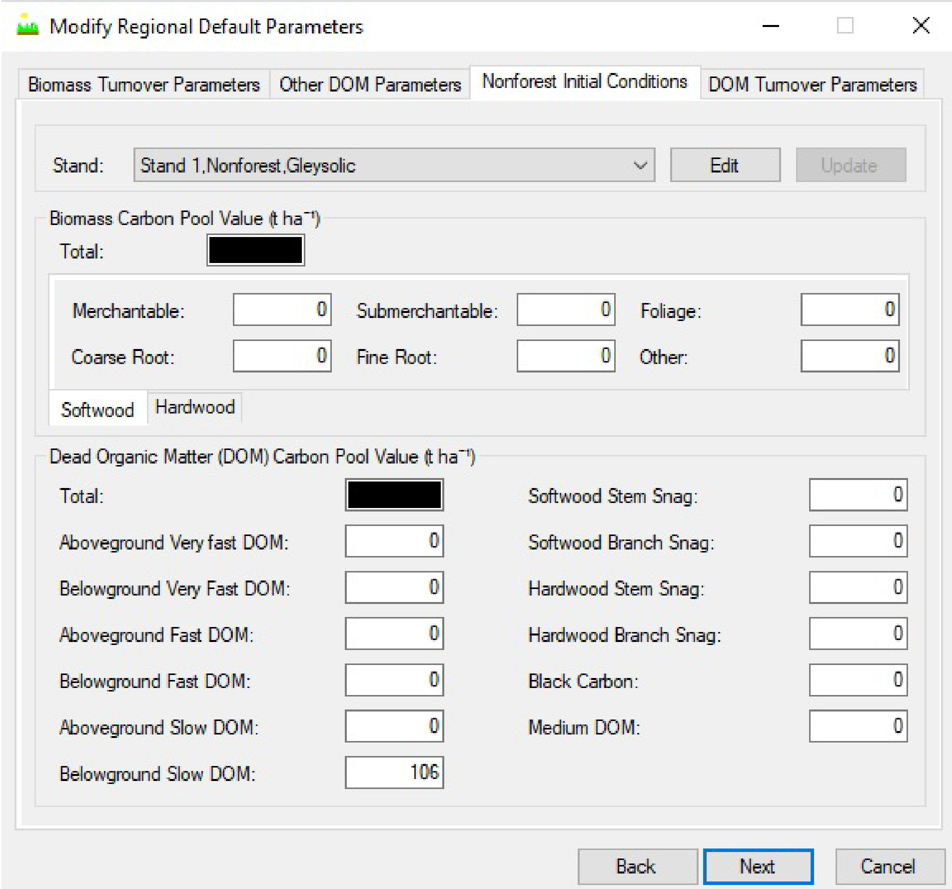


Figure 3-39. The "Modify Regional Default Parameters" window with the "Nonforest Initial Conditions" tab selected.

11. Type in numbers representing carbon (as tonnes per hectare) for each of the parameter boxes listed in the "Dead Organic Matter (DOM) Carbon Pool Value" box (Aboveground Very Fast DOM, Belowground Very Fast DOM, Aboveground Fast DOM, Belowground Fast DOM, Aboveground Slow DOM, Belowground Slow DOM, Softwood Stem Snag, Softwood Branch Snag, Hardwood Stem Snag, Hardwood Branch Snag, Black Carbon, Medium DOM, and Peat)
12. Click on the "Update" button
13. Repeat steps 8 to 12 for any remaining stands generated from nonforest initial conditions

54. Click on the "Next" button to proceed

    or

    Click on the "Back" button to return to the previous window

    or

    Click on the "Cancel" button to terminate the project-creation process

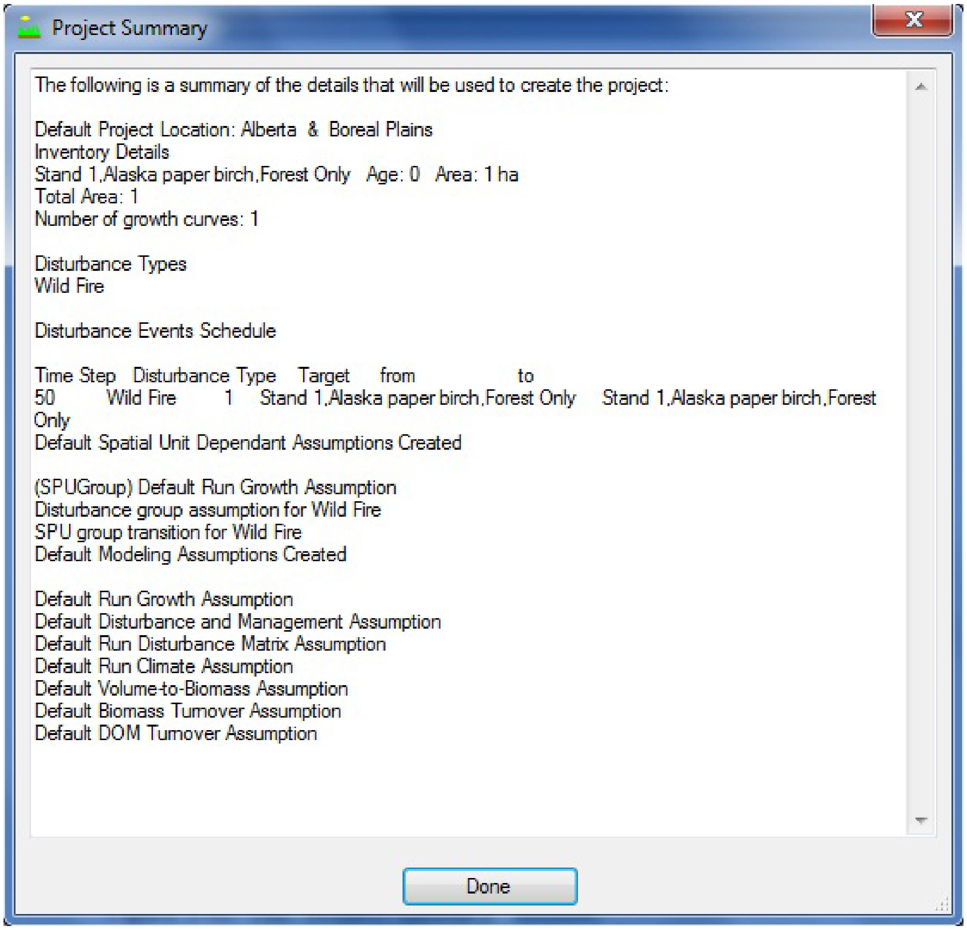


Figure 3-40. The "Project Summary" window.

If the user clicks the "Next" button, the "Project Summary" window (Fig. 3-40) will pop up, displaying a summary of details for the project that the user has created. To proceed

55. **Click on the "Done" button**

The "Results Explorer," "Message," and "Task List" windows will pop up. Details about the "Message," and "Task List" windows and their functions are provided in Chapter 5. Details about the "Results Explorer" window are provided in Chapter 8. Users can learn how to run the imported data through the model as a simulation in section 3.5.

3.3 Importing Additional Project Data

Users of the CBM Standard Import Tool may need to import additional disturbance event and transition rule data into an existing project. To do this

1. **Open a project in the CBM-CFS3**
2. **Click on "Project" on the menu bar of the main CBM-CFS3 window**
3. **Select "Add to Current Project" from the drop list that appears**

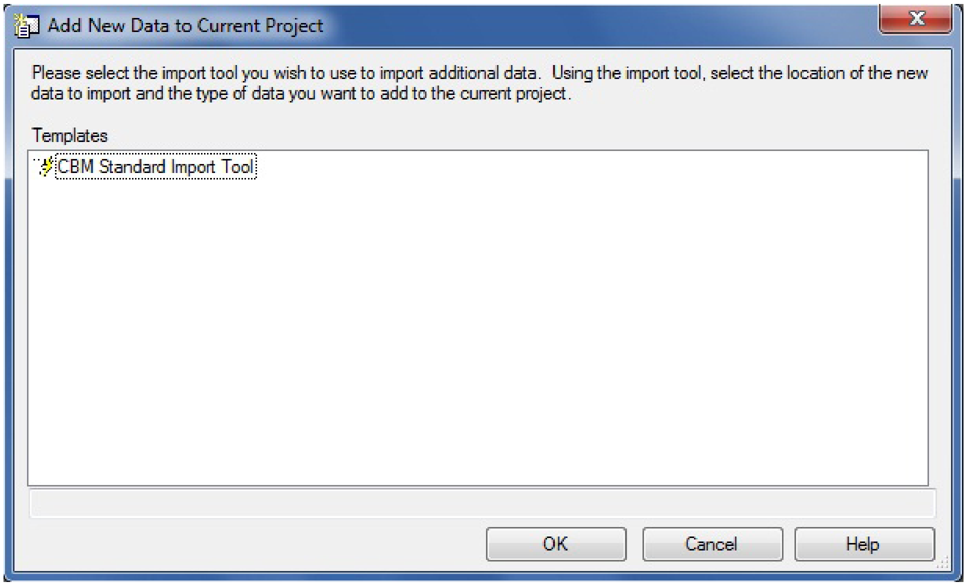


Figure 3-41. The "Add New Data to Current Project" window.

The "Add New Data to Current Project" window (Fig. 3-41) will pop up.

To import additional data

4. **Click on "CBM Standard Import Tool" in the "Templates" box**
5. **Click on the "OK" button to proceed**

    or

    Click on the "Cancel" button to terminate the process

    or

    Click on the "Help" button (currently disabled) for information on how to use features in this window

The user continues by following the steps outlined in section 3.2 for importing CBM Standard Import Tool files, creating a new import file configuration and using the previous mapping configuration that was used for the original data import. The user should then select for import, all of the previous project files, along with the new disturbance events import file and the new or previous transition rules import file. Because the previous mapping configuration is being applied, and once the project files have been imported and a successful import message has appeared on the "Import" tab in the "CBM Standard Import Tool" window (Fig. 14), the user can

Click on the "Project Creation" tab in the "CBM Standard Import Tool" window (Fig. 3-23)

Click on the "Finish" button

Once the project-creation process has been completed, the user should consider performing a quality control check on the project data, as described in section 3.4.

The user should notice that an additional set of assumptions has been added for all the assumption types in the "Assumption Composers" window in their project, each of which are linked to either new data imported or identical data assigned by the model. They can then proceed to create new simulation assumptions with underlying assumptions and data from their first or second data import.

3.4 Performing a Quality Control Check

Performing a quality control check on project data is optional, but this process can help the user to diagnose potential problems with the data before initiating a project simulation. Any user who imports additional data into a project or who edits, adds, or deletes project data or assumptions after creating a project should consider performing this check.

To perform a quality control check for a project

1. **Open a CBM-CFS3 project**
2. **Ensure that the "Task List" window is open**
3. **Click on "Project" on the main CBM-CFS3 window menu bar**
4. **Click on "Perform Quality Control Check"**

The model will perform the quality control check. If any additional tasks must be performed or problems are found, they will be displayed in the "Task List" window. The user must perform the additional tasks or fix any problems before running the project simulation.

3.5 Scheduling a Simulation

Once the data have been successfully imported (and if there are no new assumptions to be created with the Assumption Composer Tools (see Chapter 7)), the user can proceed to the "Simulation Scheduler" window (Fig. 3-42) and execute a CBM-CFS3 simulation. To proceed

1. **Click on "Tools" on the main CBM-CFS3 window menu bar**
2. **Select "Simulation Scheduler" from the drop list that appears**

When the "Simulation Scheduler" window pops up, the user should see the default name for the project simulation assumption, called "'project name' Default Simulation (#)", in the "Available Simulations" box. The number appearing at the end of the name is assigned according to how many other simulations have previously been created by the user. By clicking on a simulation name, the details about the simulation will appear on the "Simulations Details," "Stand Initialization Details," and "CBM Run Details" tabs (discussed in detail in Chapter 7, section 7.1). To select the simulation and run it through the model

3. **Click on the simulation name in the "Available Simulations" box**
4. **Click on the "Add" button to add it to the "Simulations to Process" box**
5. **Click on the "Run" button**

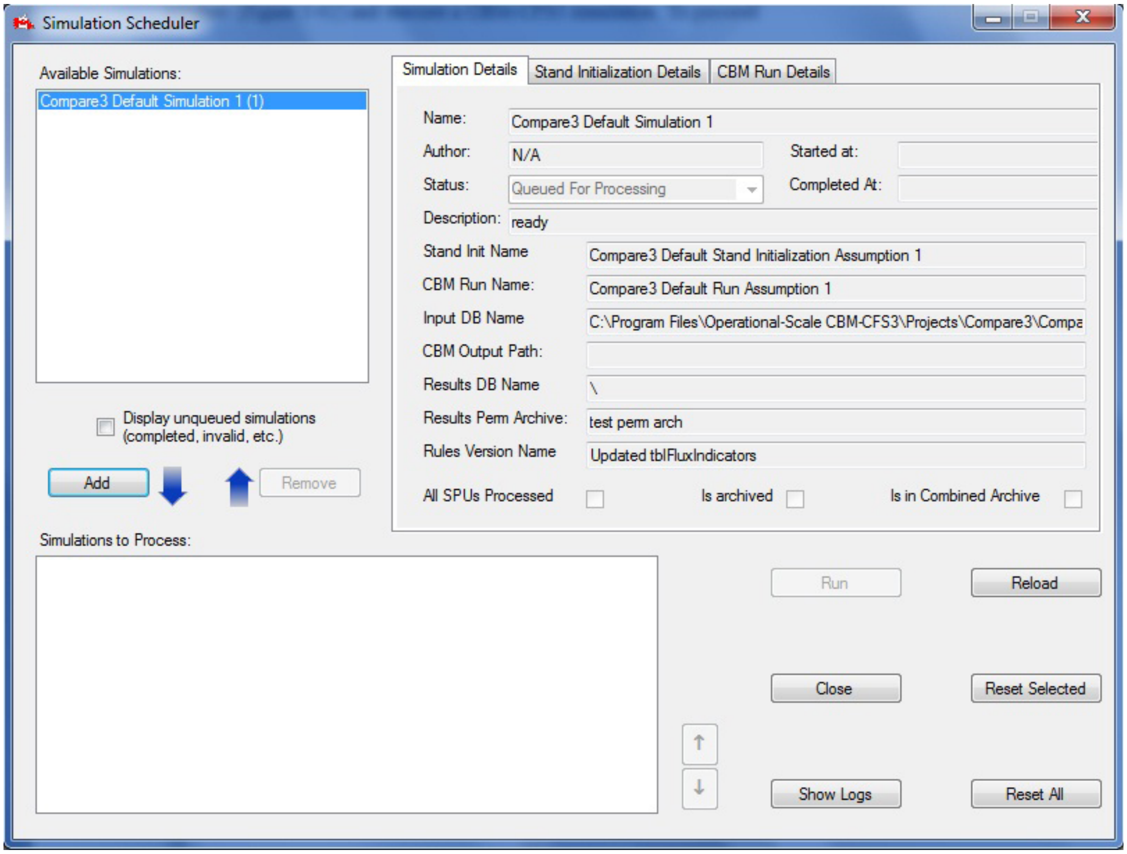


Figure 3-42. The "Simulation Scheduler" window with the "Simulation Details" tab selected.

The "Message" window (see Chapter 5, section 5.4), if open, will display the simulation progress and any errors that the model encounters while processing the user's data.

Whether or not the run is successful, a window will pop up stating "Successfully completed '#' of '#' selected simulations." The actual numbers displayed will depend on how many simulations were successfully processed through the model and how many simulations the user chose to run at once. If the simulation was successful

6. **Click on the "OK" button**
7. **Close the "Simulation Scheduler" window by clicking the "Close" button or the "X" button**

The user can then proceed to Chapter 8 to learn how to create and examine views for the results from the simulation run.

If the simulation run is unsuccessful, the user should consult the "Message" window to identify the problem, close the "Simulation Scheduler" window, and then correct the problem if possible. The user should contact the CFS-CAT for assistance if the problem persists (see Chapter 2, section 2.9).

CHAPTER 4

FOREST INVENTORY DEFINITIONS

This chapter describes the use of the Forest Inventory Definitions tool for viewing and modifying project data and information that has been opened, imported, and mapped into the CBM-CFS3 through the import process or entered using the Stand-Level Project Creator. To access the Forest Inventory Definitions tool

1. **Click on "Tools" on the menu bar in the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**
3. **Select "Forest Inventory Definitions" from the side drop list that appears**
4. **Select "Show All" or a specific inventory type from the second side drop list that appears**

The "Inventory Definition" window will pop up, displaying all of the inventory tabs if "Show All" is selected (Fig. 4-1) or an inventory-specific tab if one inventory type is selected. If the user makes changes to any of the definitions displayed, the project forest inventory must be edited in the Inventory Editor (see Chapter 6, section 6.5) to accommodate the changes.

4.1 Species Types

If the user clicks on the "Species Type" tab (Fig. 4-1) in the "Inventory Definition" window (or selects "Species Type" from the side drop list, above in step 4), the species (for example, white pine) or species types (for example, other softwoods) in the project inventory will be listed in the "Species Type Name" column in the table that appears. The user can add, edit, or delete species or species types in this table.

4.1.1 Adding a Species Type

To add a species or species type to the project data

1. **In the "Available Default Species" box, click on the name of a tree species or species type that does not already appear in the "SpeciesTypeName" column in the table (Fig. 4-1)**
2. **Click on the "Add" button**

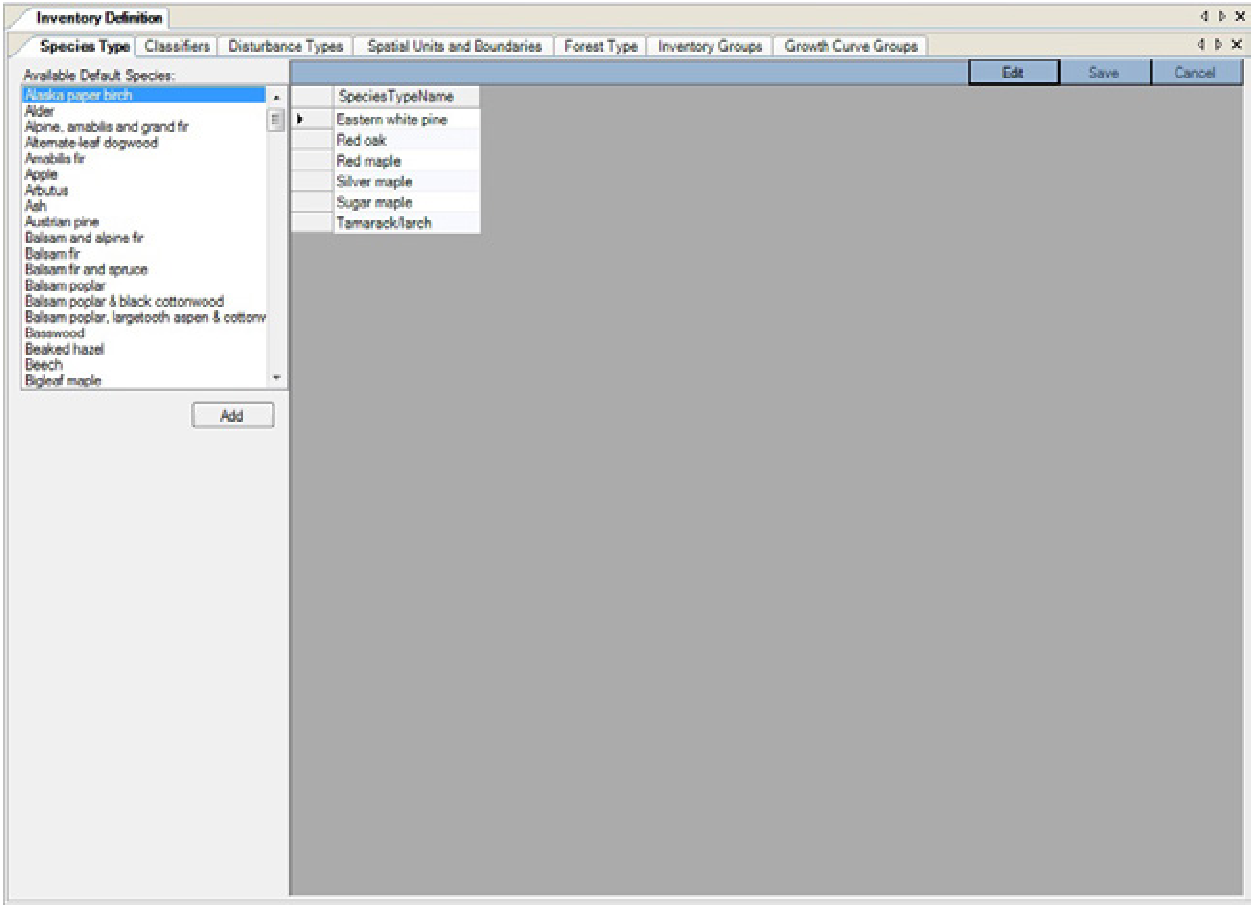


Figure 4-1. The "Inventory Definition" window with the "Species Type" tab selected.

An "Adding New Species" window (Fig. 4-2) will pop up. In this window the user must link the new species or species type to a spatial unit (SPU) and either an existing user-defined Volume-to-Biomass Assumption and Biomass-Turnover Assumption or a default Volume-to-Biomass Assumption and Biomass-Turnover Assumption. Biomass-Turnover Assumptions are described in Chapter 7, section 7.5 and Volume-to-Biomass Assumptions, in Chapter 7, section 7.11.

Linking a Species Type to User-Defined Biomass Assumptions

To link a new species or species type to an existing user-defined Volume-to-Biomass Assumption and Biomass-Turnover Assumption in the "Adding New Species" window

1. **Click on the "SPU Group" box and select an option from the drop list that appears**
2. **Click on the "User-Defined" radio button**

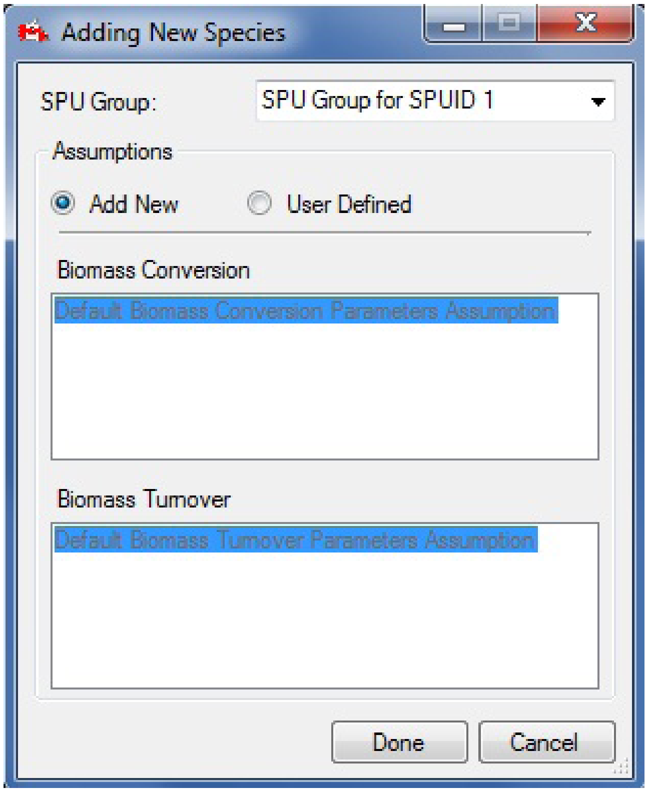


Figure 4-2. The "Adding New Species" window.

3. **Select a user-defined Volume-to-Biomass Assumption in the "Biomass Conversion" box**
4. **Select a user-defined Biomass-Turnover Assumption in the "Biomass Turnover" box**
5. **Click on the "Done" button**

The new species or species type will be added to the "SpeciesTypeName" column in the table on the "Species Type" tab (Fig. 4-1).

6. **Click on the "Save" button to save the edits**

   or

   Click on the "Cancel" button to cancel the addition

Linking a Species Type to Default Biomass Assumptions

To link a new species or species type to a default Volume-to-Biomass Assumption and Biomass-Turnover Assumption in the "Adding New Species" window

1. **Click on the "SPU Group" box and select an option from the drop list that appears**
2. **Click on the "Add New" radio button**
3. **Click on the "Done" button**

The new species or species type will be added to the "SpeciesTypeName" column in the table on the "Species Type" tab (Fig. 4-1).

4. **Click on the "Save" button to save the edits**

   or

   Click on the "Cancel" button to cancel the addition

4.1.2 Deleting a Species Type

To delete a species or species type from the "SpeciesTypeName" column in the table on the "Species Type" tab

1. **Click on the "Edit" button on the "Species Type" tab (Fig. 4-1)**
2. **Click on the gray cell next to the row containing the species or species type to be deleted from the table**

☞ *Tip: Selecting multiple species or species types*

To select multiple species or species types, left-click on one name and drag up or down to select the other species or species type (if in succession in the table), or hold down the "Ctrl" (Control) key on the keyboard and click on each species or species type in turn.

3. **Press the "Delete" key on the keyboard**
4. **Click on the "Save" button to save the edits**

   or

   Click on the "Cancel" button to cancel the deletion

4.1.3 Editing the Table on the "Species Type" Tab

To edit an entry in the table on the "Species Type" tab

1. **Click on the "Edit" button on the "Species Type" tab (Fig. 4-1)**
2. **Make the necessary edits to the table entries**
3. **Click on the "Save" button to save the edits**

   or

   Click on the "Cancel" button to cancel the edits

4.2 Classifiers

If the user clicks on the "Classifiers" tab (Fig. 4-3) in the "Inventory Definition" window (or selects "Classifiers" from the side drop list in step 4 of the opening section of this chapter) the inventory classifiers that were imported for the project will be listed in the window that appears. To observe the names and descriptions of classifier values for a particular classifier, click on the classifier in the "Defined Classifiers" box, and its values and descriptions will appear in a table under the "Name" and "Description" columns, respectively. Names and descriptions of classifiers values can be added, edited, and deleted.

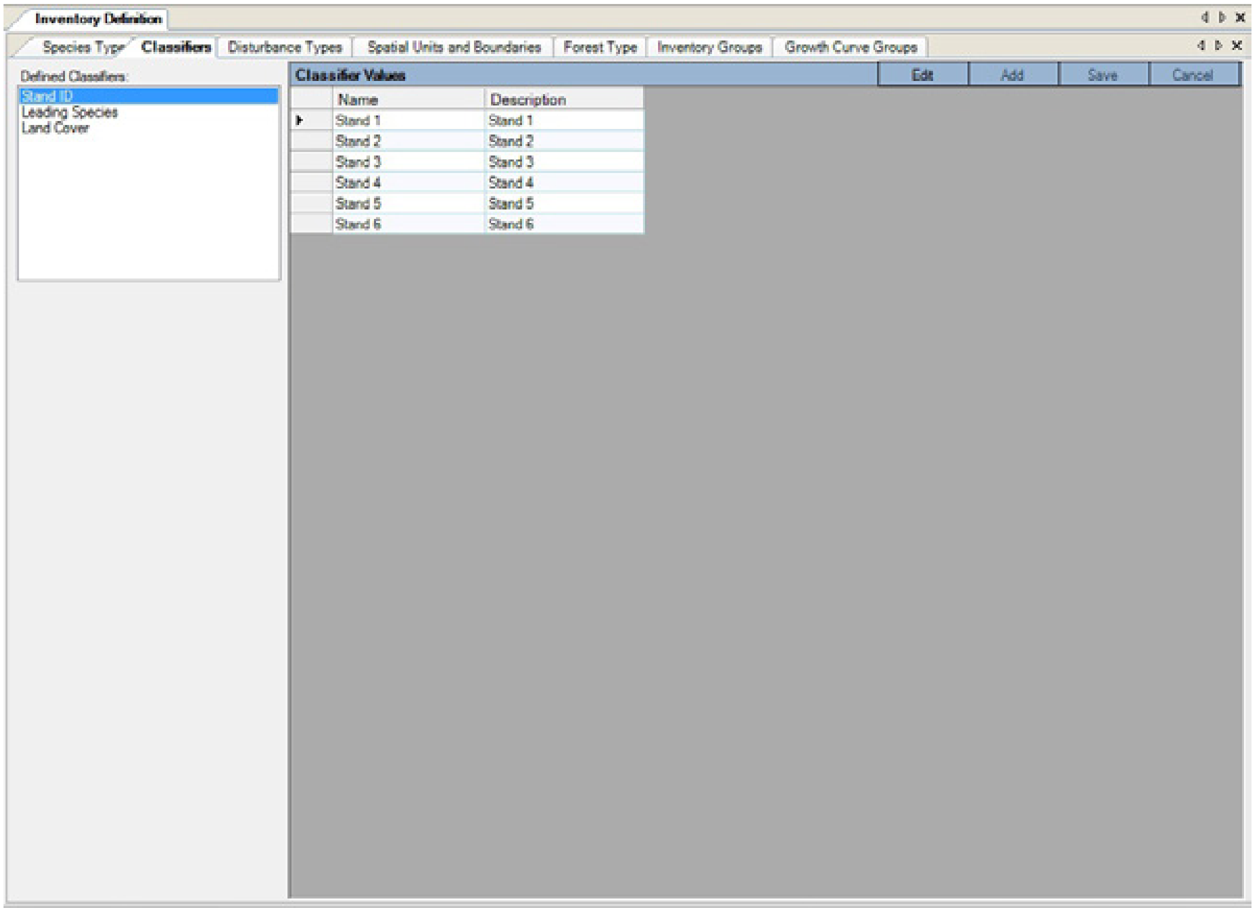


Figure 4-3. The "Inventory Definition" window with the "Classifiers" tab selected.

4.2.1 Adding Names and Descriptions of Classifier Values

To add names and descriptions of classifier values to a defined classifier

1. **Click on the name of a classifier in the "Defined Classifiers" box (Fig. 4-3)**

In the "Classifier Values" table

2. **Click on the "Edit" button**
3. **Click on the "Add" button**
4. **Type in the new name(s) and description(s) of the classifier value(s) in the "Name" and "Description" columns**
5. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to cancel the additions

4.2.2 Editing Names and Descriptions of Classifiers Values

To edit the name or description of a classifier value

1. **Click on the name of a classifier in the "Defined Classifiers" box (Fig. 4-3)**

In the “Classifier Values” table

2. **Click on the “Edit” button**
3. **Edit the values in the “Name” and “Description” columns of the table as required**
4. **Click on the “Save” button to proceed**
   or
   Click on the “Cancel” button to cancel the edits

4.2.3 Deleting Names and Descriptions of Classifier Values

To delete a classifier value and its description

1. **Click on a classifier in the “Defined Classifiers” box (Fig. 4-3)**

In the “Classifier Values” table

2. **Click on the “Edit” button**
3. **Click on the gray cell to the left of the name and description of the classifier value**
4. **Press the “Delete” key on your keyboard**
5. **Click on the “Save” button to proceed**
   or
   Click on the “Cancel” button to cancel the deletion

4.3 Disturbance Types

If the user clicks on the “Disturbance Types” tab (Fig. 4-4) in the “Inventory Definition” window (or selects “Disturbance Types” from the side drop list in step 4 of the opening section of this chapter), the CBM-CFS3 default disturbance types appear and those selected during the import process for the project appear in a table.

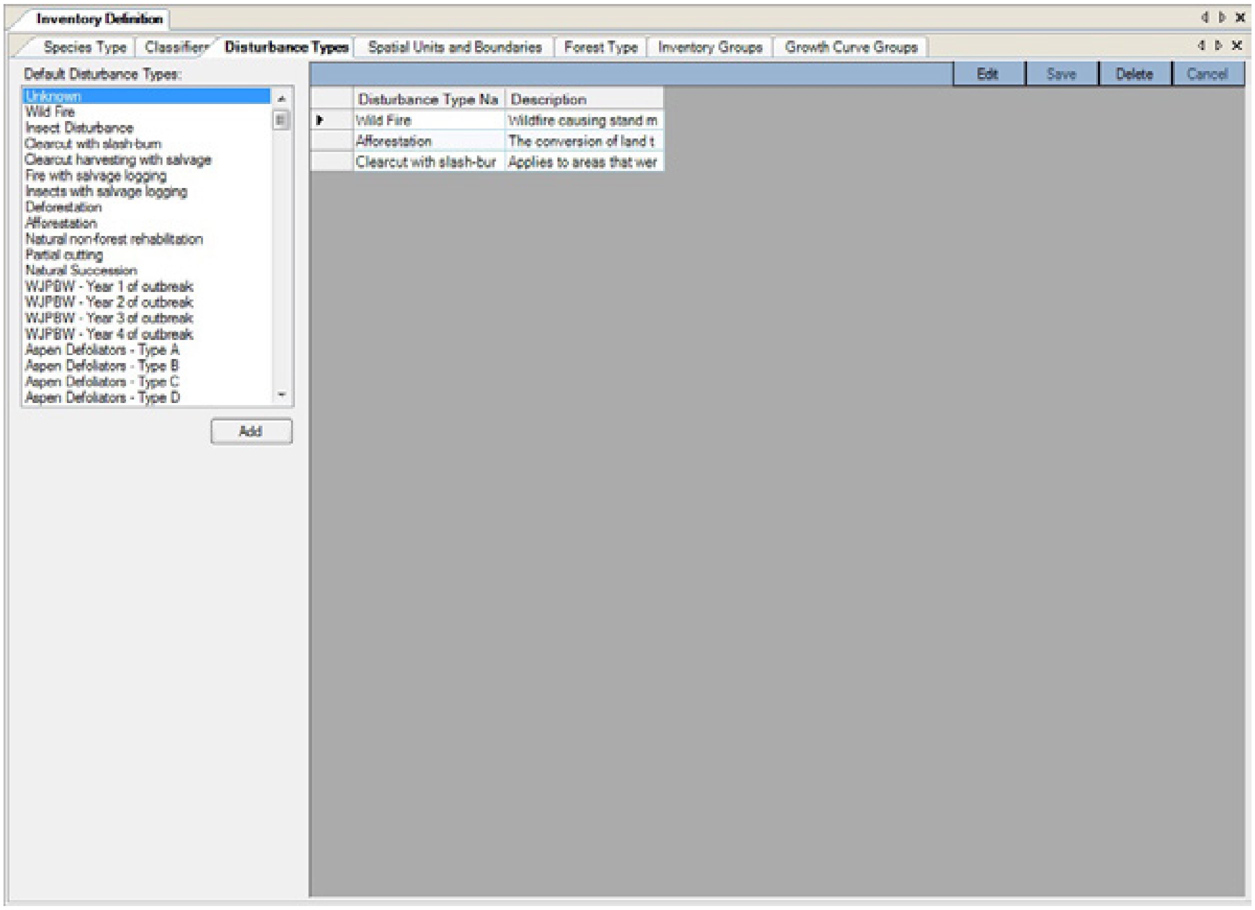


Figure 4-4. The "Inventory Definition" window with the "Disturbance Types" tab selected.

In the table (Fig. 4-4), the "Disturbance Type Name" represents the name of an imported or created disturbance type, and the "Description" represents the description of the disturbance type.

The user can add, edit, or delete disturbance types associated with the project on this tab.

4.3.1 Adding a Disturbance Type

To add a disturbance type

1. **Click on a disturbance type in the "Default Disturbance Types" box (Fig. 4-4)**
2. **Click on the "Add" button**

The "Add New Disturbance Type" window (Fig. 4-5) will pop up.

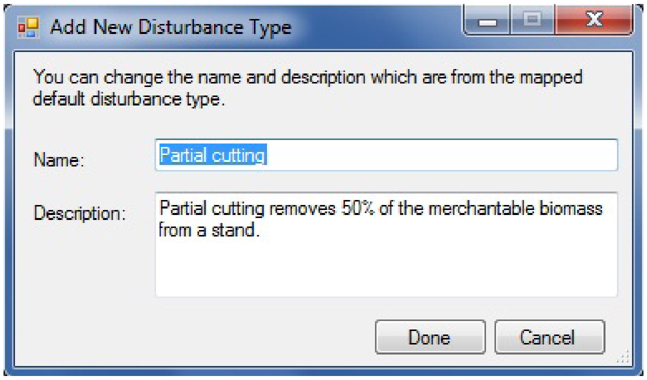


Figure 4-5. The "Add New Disturbance Type" window.

3. **Type a name for the disturbance in the "Name" box**
4. **Type a description of the disturbance in the "Description" box**
5. **Click on the "Done" button to proceed**

   or

   Click on the "Cancel" button to cancel the process
6. **Click on the "Save" button in the table**

4.3.2 Editing a Disturbance Type

To edit a disturbance type in the table

1. **Click on the "Edit" button (Fig. 4-4)**
2. **Make the necessary edits in the table**
3. **Click on the "Save" button when the edits are complete**

   or

   Click on the "Cancel" button to exit the editing process

4.3.3 Deleting a Disturbance Type

Deleting a disturbance type will also remove any associated disturbance matrix, disturbance events, and transition rules that the user has created for the disturbance type. To delete disturbance types

1. **Click on the "Edit" button (Fig. 4-4)**
2. **Click on the gray cell next to the row containing the disturbance to be deleted**
3. **Press the "Delete" key on your keyboard**
4. **Click on the "Save" button**

4.4 Spatial Units and Boundaries

The user can click on the "Spatial Units and Boundaries" tab (Fig. 4-6) in the "Inventory Definition" window (or select "Spatial Units and Boundaries" from the side drop list in step 4 of the opening section of this chapter) to assign administrative and ecological boundaries to the inventory by spatial unit(s) (SPUs) and SPU group(s).

Administrative boundaries refer to Canadian provinces and territories, with the exception of Newfoundland and Labrador, which has been split for programming reasons related to fire disturbance matrices. Ecological boundaries refer to the Terrestrial Ecozones of Canada, as defined at http://www.ecozones.ca/english/zone/index.html or in Environment Canada (1996) and shown in Fig. 3-15.

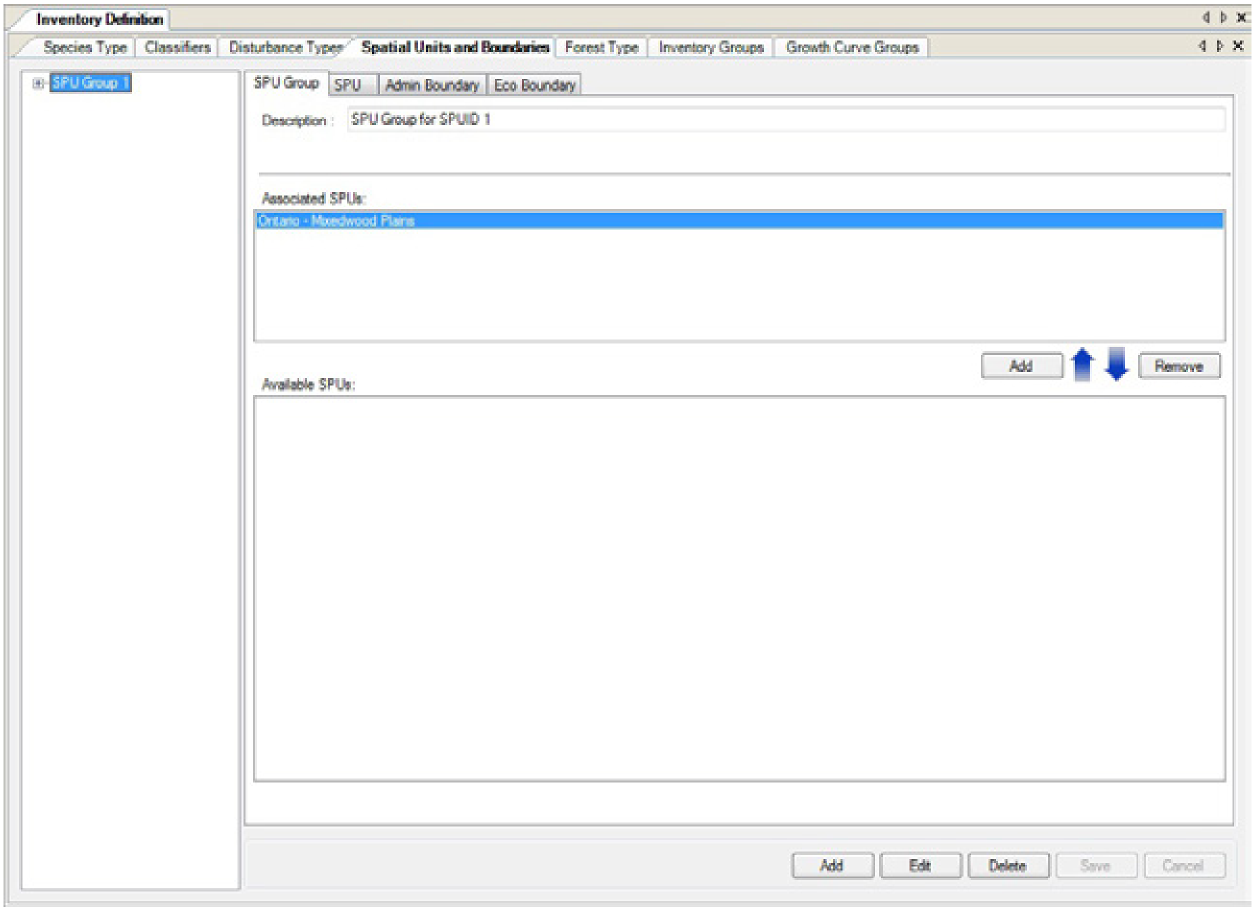


Figure 4-6. The "Inventory Definition" window with the "Spatial Units and Boundaries" and "SPU Group" tabs selected.

Note: Division of Boreal Shield and Taiga Shield ecozones

In the CBM-CFS3, the Boreal Shield and Taiga Shield ecozones have been divided into eastern and western parts because the west is typically colder and drier than the east. Hence, these subzones are modeled separately (Kurz et al. 1992).

Different parameters are applied to project data depending on the boundary types that the user applies during the import process.

SPUs are user-defined combinations of administrative and ecological boundaries that can be made applicable to all, or portions, of a user's project data. An SPU group is made up of one or more SPUs.

On the "Spatial Units and Boundaries" tab (Fig. 4-6), the box on the far left displays a hierarchical directory tree of existing SPU Groups. In the directory tree, the user can double-click on a specific SPU Group name or click on the "+" next to the SPU Group to expand the tree and see the SPU(s) associated with it. Double-clicking an SPU name in the directory tree or clicking on the "+" next to it will expand the tree to display the administrative and ecological boundaries of the SPU. Clicking on a "–" in the directory tree will collapse that section of the directory tree. The user can also right-click in the directory tree box and select "Expand" or "Collapse" to expand or collapse the directory tree.

4.4.1 Spatial Unit Groups

On the "SPU Group" tab (Fig. 4-6), the user can add, edit, or delete SPU groups or add or delete SPUs associated with an SPU group.

Adding or Removing an SPU Group

Any SPU group added by the user must be linked to one or more SPUs before it can be used by the CBM-CFS3. To add an SPU group

1. **Click on the "SPU Group" tab (Fig. 4-6)**
2. **Click on the "Add" button**
3. **Type a description for the SPU group in the "Description" box**
4. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "Save" button, the SPU group will be added to the directory tree box with the name "SPU Group '#'," where the number (#) will be assigned sequentially according to the number of pre-existing SPU groups in the directory tree box.

Next, the user must associate one or more SPUs with the SPU group. To do this

5. **Click on the name of the SPU group in the directory tree box**
6. **Click on one or more (by holding the Ctrl key while selecting) SPUs in the "Available SPUs" box**
7. **Click on the "Add" button above the "Available SPUs" box**

The SPU(s) will then appear in the "Associated SPUs" box and in the directory tree box linked to the selected SPU group. Before a new SPU group can be used by the CBM-CFS3, administrative and ecological boundaries must be associated with it and new inventory data must be entered with the Inventory Editor (see Chapter 6, section 6.5).

To remove an SPU from an SPU Group

1. **Click on the name of the SPU Group in the directory tree box**
2. **Click on the name of the SPU to be removed in the "Associated SPUs" box**
3. **Click on the "Remove" button**

Editing an SPU Group

To edit the description of an existing SPU group

1. **Click on the name of the SPU group in the directory tree box (Fig. 4-6)**
2. **Click on the "Edit" button**
3. **Type a new description in the "Description" box**
4. **Click on the "Save" button to save the edits**

   or

   Click on the "Cancel" button to terminate the edits

Deleting an SPU Group

To delete an SPU group

1. **Click on the name of the SPU group in the directory tree box (Fig. 4-6)**

Note: Warning about deleting an SPU group

Before deleting an SPU group, the user should consider the impact of this action on any inventory data to which the SPU group has been linked. Data not linked to an SPU group will be ignored during simulation and will be excluded from results.

2. **Click on the "Delete" button**

A "Delete Spatial Unit Groups" window will pop up asking the user to confirm deletion of the selected SPU group

3. **Click on the "Yes" button to proceed**
   or
   Click on the "No" button to cancel the deletion

4.4.2 Spatial Units

Spatial units are user-defined combinations of administrative and ecological boundaries that can be applied to all or portions of the data for a project. Once created, an SPU must be added to an SPU group if it is to be used during a simulation run. The user can add, edit, or delete SPUs.

Adding SPUs

To add a new SPU

1. **Click on the "SPU" tab (Fig. 4-7) of the "Spatial Units and Boundaries" tab of the "Inventory Definition" window**
2. **Click on the "Add" button**
3. **Click on the "Admin Boundary" box and make a selection from the drop list that appears**
4. **Click on the "Eco Boundary" box and make a selection from the drop list that appears**
5. **Click on the "Save" buton**

The new SPU will appear in the "List of SPUs" box and will be named according to the administrative and ecological boundaries selected. Its name will also appear in the "Available SPUs" box on the "SPU Group" tab (Fig. 4-7).

Editing SPUs

Existing SPUs displayed in the "List of SPUs" box on the "SPU" tab (Fig. 4-7) can be edited. Before editing an SPU, the user should consider the impact of this action on any inventory data to which the SPU has been linked. By editing administrative or ecological boundaries assigned to an SPU, the user will change the ecological parameters that the CBM-CFS3 will apply to the data linked to that SPU during simulation.

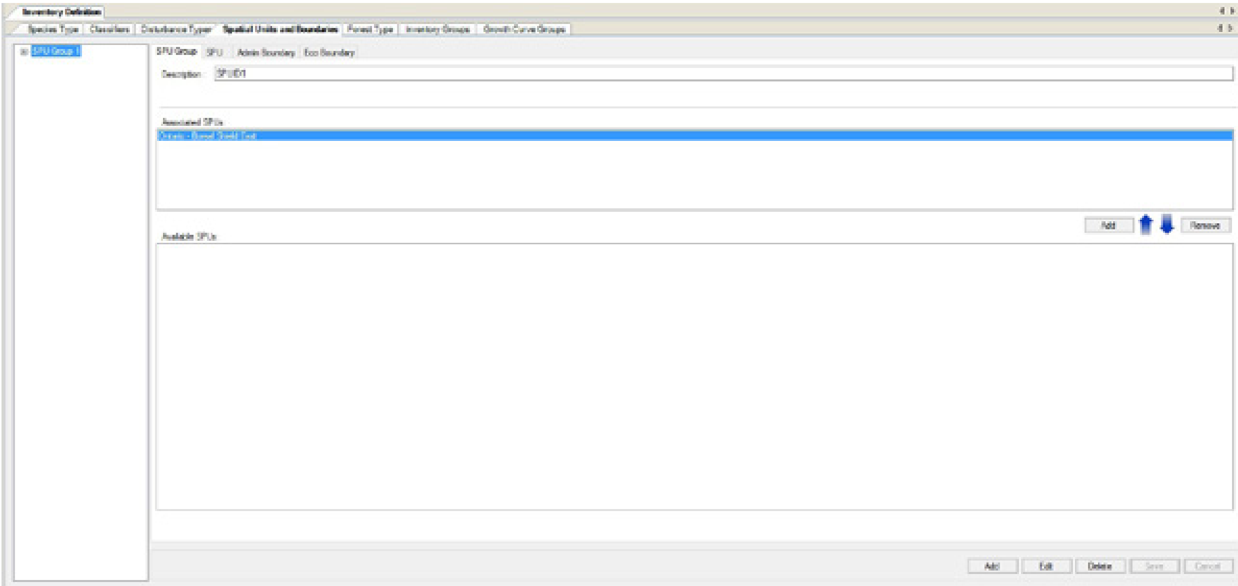


Figure 4-7. The "Inventory Definition" window with the "Spatial Units and Boundaries" and "SPU" tabs selected.

To edit an SPU

1. **Click on the "SPU" tab (Fig. 4-7)**
2. **Select an SPU name from the "List of SPUs" box**
3. **Click on the "Edit" button**
4. **Click on the "Admin Boundary" box and make a selection from the drop list that appears**
5. **Click on the "Eco Boundary" box and make a selection from the drop list that appears**
6. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the edit

Deleting SPUs

Before deleting an SPU, the user should consider the impact of this action on any SPU group(s) and inventory data to which the SPU has been linked. Data not linked to an SPU will be ignored during simulation and will be excluded from results. To delete an SPU

1. **Click on the "SPU" tab (Fig. 4-7)**
2. **Select an SPU name from the "List of SPUs" box**
3. **Click on the "Delete" button**

A "Delete Spatial Units" window will pop up asking the user to confirm deletion of the selected SPU.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

If the user clicks on the "Yes" button, the SPU will be deleted from the "List of SPUs" box.

4.4.3 Administrative Boundaries

As discussed in the opening paragraph of Section 4.4, an administrative boundary defines the geographic location of the land base. To be used in a project simulation run, an administrative boundary must be linked to an SPU (and that SPU must be linked to an SPU group). The user may add, edit, or delete administrative boundaries.

Adding an Administrative Boundary

An administrative boundary is always associated with an ecological boundary (section 4.4.4); hence, the two types of boundaries should be added at the same time. To add an administrative boundary

1. **Click on the "Admin Boundary" tab (Fig. 4-8)**

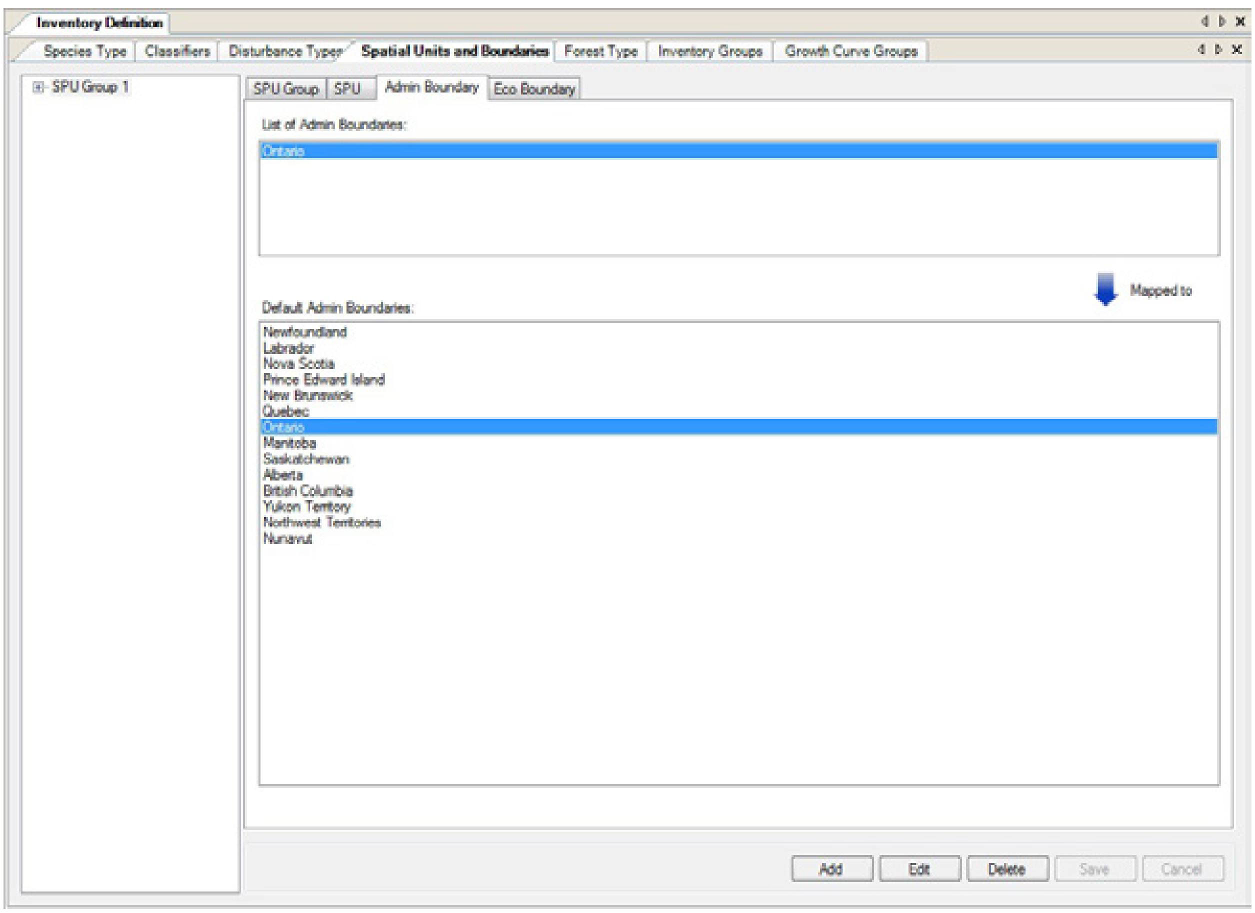


Figure 4-8. The "Inventory Definition" window with the "Spatial Units and Boundaries" and "Admin Boundary" tabs selected.

2. **Click on the "Add" button**

The "Add or Update Boundary" window (Fig. 4-9) will pop up. On the "Administrative Boundary" tab

3. **Click on the "Default Admin Boundary" box and select an administrative boundary from the drop list that appears**
4. **Type a new name for the administrative boundary in the "Name" box (optional)**
5. **Click on the "Ecological Boundary" tab (Fig. 4-10)**
6. **Click on the "Default Eco Boundary" box and select an ecological boundary from the drop list that appears**
7. **Type a new name for the ecological boundary in the "Name" box (optional)**

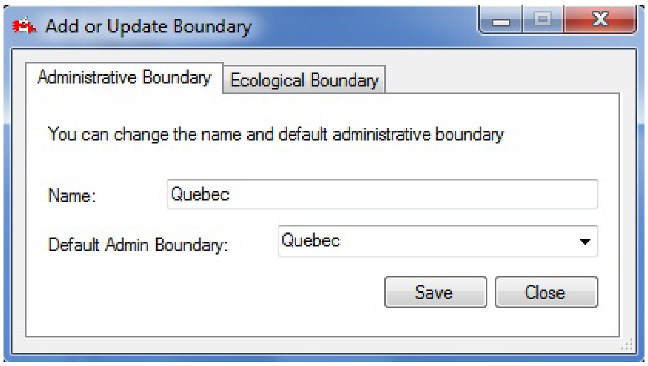


Figure 4-9. The "Add or Update Boundary" window with the "Administrative Boundary" tab selected.

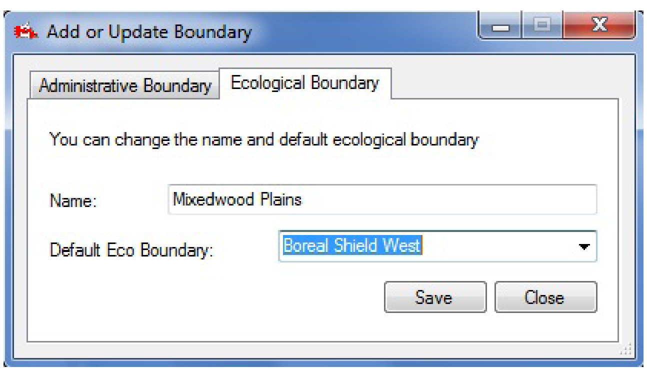


Figure 4-10. The "Add or Update Boundary" window with the "Ecological Boundary" tab selected.

8. **Click on the "Save" button to proceed**

   or

   Click on the "Close" button to cancel the addition and close the window

If the user clicks on the "Save" button, the new administrative boundary will be added to the "List of Admin Boundaries" box on the "Admin Boundary" tab, and the ecological boundary will be added to the "List of Eco Boundaries" box on the "Eco Boundary" tab (see section 4.4.4). The new administrative boundary and ecological boundary will also become available for selection in the "Admin Boundary" and "Eco Boundary" boxes on the "SPU" tab (see Fig. 4-7) so that the user can create a new SPU using these boundaries.

Editing an Administrative Boundary

To edit an administrative boundary

1. **Click on the "Admin Boundary" tab (Fig. 4-8)**
2. **In the "List of Admin Boundaries" box, click on the name of the administrative boundary to be edited**
3. **Click on the "Edit" button**

The "Add or Update Boundary" window (Fig. 4-9) will pop up. On the "Administrative Boundary" tab

4. **Click on the "Default Admin Boundary" box and select an administrative boundary from the drop list that appears**
5. **Type a new name in the "Name" box**

If a new administrative boundary was not selected in step 4, skip to step 9; if a new administrative boundary was selected in step 4, proceed as follows

6. **Click on the "Ecological Boundary" tab (Fig. 4-10)**
7. **Click on the "Default Eco Boundary" box and select an ecological boundary from the drop list that appears**
8. **Type a new name for the ecological boundary in the "Name" box**
9. **Click on the "Save" button to proceed**

   or

   Click on the "Close" button to cancel the edits and close the window

Deleting an Administrative Boundary

Before deleting an administrative boundary, the user should consider the impact of this action on any SPU(s) and inventory data to which the administrative boundary has been linked. Data that are not linked to an administrative boundary will be ignored during any simulations and will be excluded from results. To delete an administrative boundary

1. **Click on the "Admin Boundary" tab (Fig. 4-8)**
2. **Click on the name of an administrative boundary in the "List of Admin Boundaries" box**
3. **Click on the "Delete" button**

A "Delete Administrative Boundaries" box will pop up asking the user to confirm deletion of the selected administrative boundary.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

If the user clicks on the "Yes" button, the administrative boundary will be deleted from the "List of Admin Boundaries" box.

4.4.4 Ecological Boundaries

As discussed in the opening paragraph of Section 4.4, an ecological boundary defines the ecological location of a land base within an administrative boundary. To be used in a project simulation run, an ecological boundary must be linked to an SPU (and that SPU must be linked to an SPU group). The user may add, edit, or delete ecological boundaries.

Adding an Ecological Boundary

An ecological boundary is always associated with an administrative boundary (section 4.4.3); hence, the two types of boundaries should be added at the same time. To add an ecological boundary

1. **Click on the "Eco Boundary" tab (Fig. 4-11)**

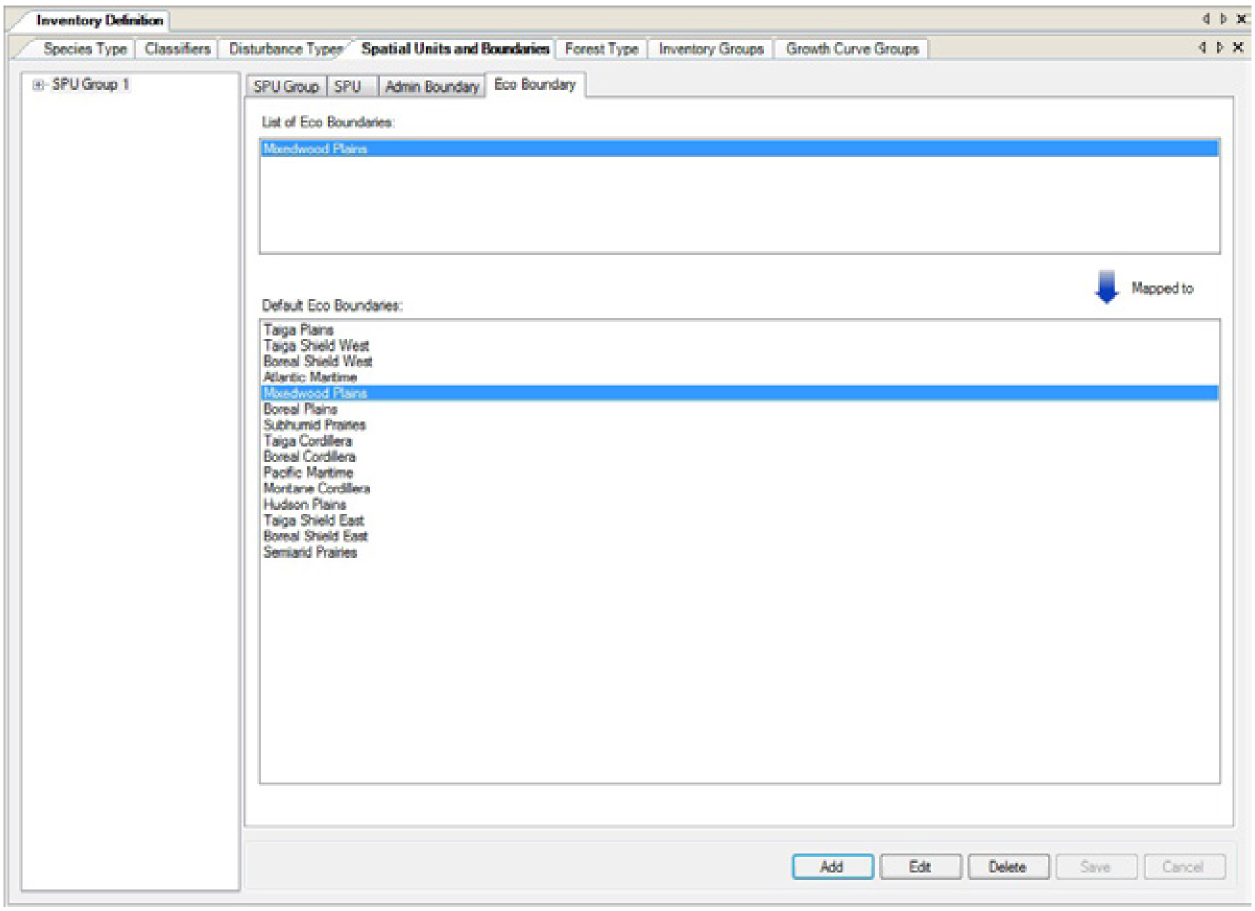


Figure 4-11. The "Inventory Definition" window with the "Spatial Units and Boundaries" and "Eco Boundary" tabs selected.

2. **Click on the "Add" button**

The "Add or Update Boundary" window (Fig. 4-10) will pop up. Because the administrative boundary selected affects the ecological boundary options, the appropriate administrative boundary should be selected first.

3. **Click on the "Administrative Boundary" tab (Fig. 4-9)**
4. **Click on the "Default Admin Boundary" box and select an administrative boundary from the drop list that appears**

5. **Type a new name for the administrative boundary in the "Name" box (optional)**
6. **Click back on the "Ecological Boundary" tab (Fig. 4-10)**
7. **Click on the name of an ecological boundary in the "Default Eco Boundary" box**

Note: Selecting an ecological boundary

In case of uncertainty about which ecological boundary to select, consult http://www.ecozones.ca/english/zone/index.html or Environment Canada (1996) or the map of the terrestrial ecozones of Canada used in the CBM-CFS3 (Fig. 3-15).

8. **Type a new name for the ecological boundary in the "Name" box (optional)**
9. **Click on the "Save" button to proceed**

   or

   Click on the "Close" button to cancel the addition and close the window

If the user clicks on the "Save" button, the new ecological boundary will be added to the "List of Eco Boundaries" box on the "Eco Boundary" tab, and the administrative boundary will be added to the "List of Admin Boundaries" box on the "Admin Boundary" tab (see section 4.4.3). The new ecological boundary and administrative boundary will also become available for selection in the "Eco Boundary" and "Admin Boundary" boxes on the "SPU" tab (see Fig. 4-7) so that the user can create a new SPU using these boundaries.

Editing an Ecological Boundary

To edit an ecological boundary

1. **Click on the "Eco Boundary" tab (Fig. 4-11)**
2. **Click on the name of an ecological boundary in the "List of Eco Boundaries" box**
3. **Click on the "Edit" button**

The "Add or Update Boundary" window (Fig. 4-10) will pop up. To change the user-defined name, skip to step 9. To change the ecological boundary

4. **Click on the "Administrative Boundary" tab (Fig. 4-9)**
5. **Click on the "Default Admin Boundary" box and select an administrative boundary from the drop list that appears**
6. **Type a new name in the "Name" box**
7. **Click on the "Ecological Boundary" tab (Fig. 4-10)**
8. **Click on the "Default Eco Boundary" box and select an ecological boundary from the drop list that appears**
9. **Type a new name in the "Name" box**
10. **Click on the "Save" button to proceed**

    or

    Click on the "Close" button to cancel the edit and close the window

Deleting an Ecological Boundary

To delete an ecological boundary

1. **Click on the "Eco Boundary" tab (Fig. 4-11)**
2. **Click on the name of an ecological boundary in the "List of Eco Boundaries" box**

Note: Warning about deleting an ecological boundary

Before deleting an ecological boundary, the user should consider the impact of this action on any SPU(s) and inventory data to which the ecological boundary has been linked. Data not linked to an ecological boundary will be ignored during simulations and will be excluded from results.

3. **Click on the "Delete" button**

A "Delete Ecological Boundaries" box will pop up asking the user to confirm deletion of the selected ecological boundary.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the process

If the user clicks on the "Yes" button, the ecological boundary will be deleted from the "List of Eco Boundaries."

4.5 Forest Types

If the user clicks on the "Forest Type" tab (Fig. 4-12) in the "Inventory Definition" window (or selects "Forest Type" from the side drop list in step 4 of the opening section of this chapter), the forest types (named according to the classifiers that identify them) assigned to the inventory appear in a table. On this tab, the user can add a new forest type or delete an existing one

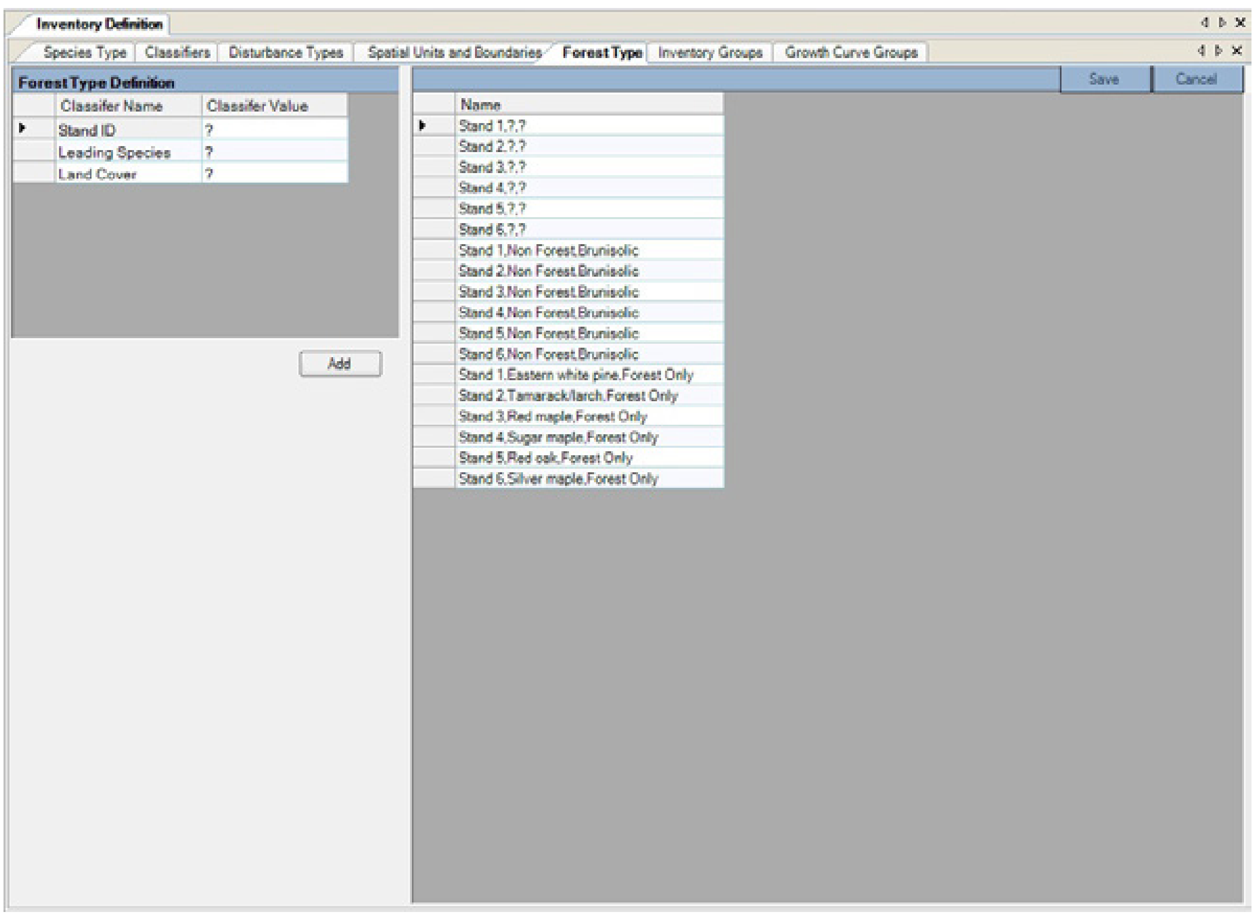


Figure 4-12. The "Inventory Definition" window with the "Forest Type" tab selected.

4.5.1 Adding a Forest Type

To add a forest type, the user must select the appropriate classifier value for each classifier that will define the new forest type. To proceed

1. **Leave the value set to "?" to obtain all values for a classifier**

   or

   Click as required on each cell in the "Classifier Value" column beside a classifier name in the "Forest Type Definition" table, and click on a value on the drop list that appears
2. **Click on the "Add" button**

The new forest type will appear in the "Name" field of the window table at the bottom of the list of forest types.

3. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

4.5.2 Deleting a Forest Type

To delete a forest type

1. **In the table of added forest types (Fig. 4-12), click on the gray cell beside the name of the forest type to be deleted**
2. **Press the "Delete" key on your keyboard**
3. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

4.6 Inventory Groups

Inventory groups are collections of one or more groups of inventory records (stands), which are used to simplify the assignment of various parameters at the stand level. If the user clicks on the "Inventory Groups" tab in the "Inventory Definition" window (Fig. 4-13) (or selects "Inventory Groups" from the side drop list in step 4 of the opening section of this chapter), the inventory groups assigned to the user's inventory will appear in the "Inventory Groups" box. To see which Inventory Group ID(s) and which Inventory ID(s) have been assigned to an inventory group, click on the name of the inventory group in this box. Also on this tab, the user can delete an existing inventory group.

To delete an inventory group

1. **In the "Inventory Groups" table (Fig. 4-13), click on the gray cell to the left of the record containing the inventory group to be deleted**
2. **Click on the "Delete" button**

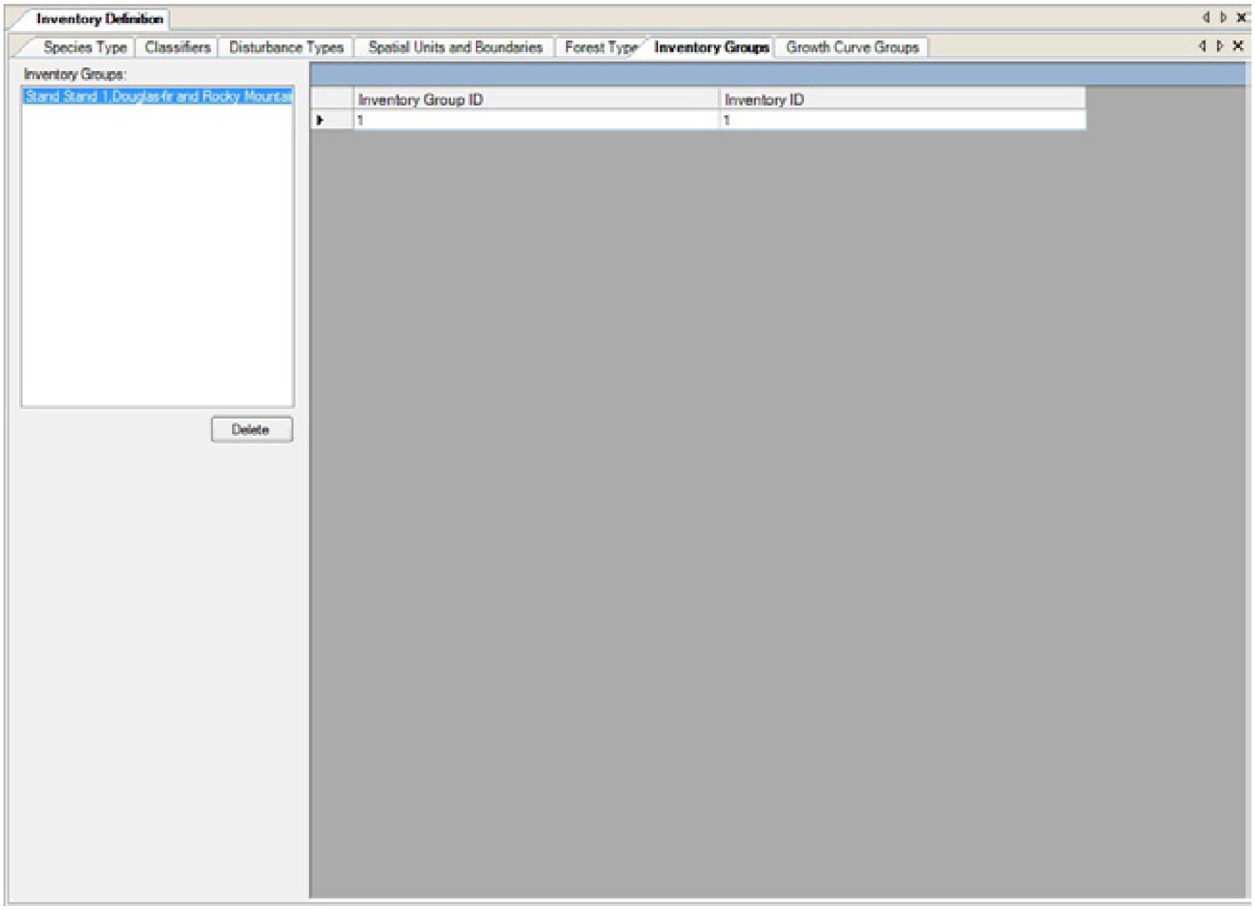


Figure 4-13. The "Inventory Definition" window with the "Inventory Groups" tab selected.

A "Delete Inventory Group" window will pop up, asking the user to confirm that the selected inventory group is to be deleted.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to terminate the process

4.7 Growth Curve Groups

Growth curve groups are collections of one or more groups of growth curves, which are used to simplify their assignment in growth-related assumptions. If the user clicks on the "Growth Curve Groups" tab in the "Inventory Definition" window (Fig. 4-14) (or selects "Growth Curves" from the side drop list in step 4 of the opening section of this chapter), the growth curve groups assigned to the inventory will appear in the "Growth Curve Groups" box. To see which Growth Curve Group ID(s) and which Growth Curve ID(s) have been assigned to a particular growth curve group, click on the name of the growth curve group in this box. Also on this tab, the user can delete a growth curve group.

To delete a growth curve group

1. **In the "Growth Curve Groups" table (Fig. 4-14), click on the gray cell to the left of the record containing the growth curve group to be deleted**
2. **Click on the "Delete" button**

A "Delete Growth Curve Group" window will pop up, asking the user to confirm that the selected growth curve group is to be deleted.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to terminate the process

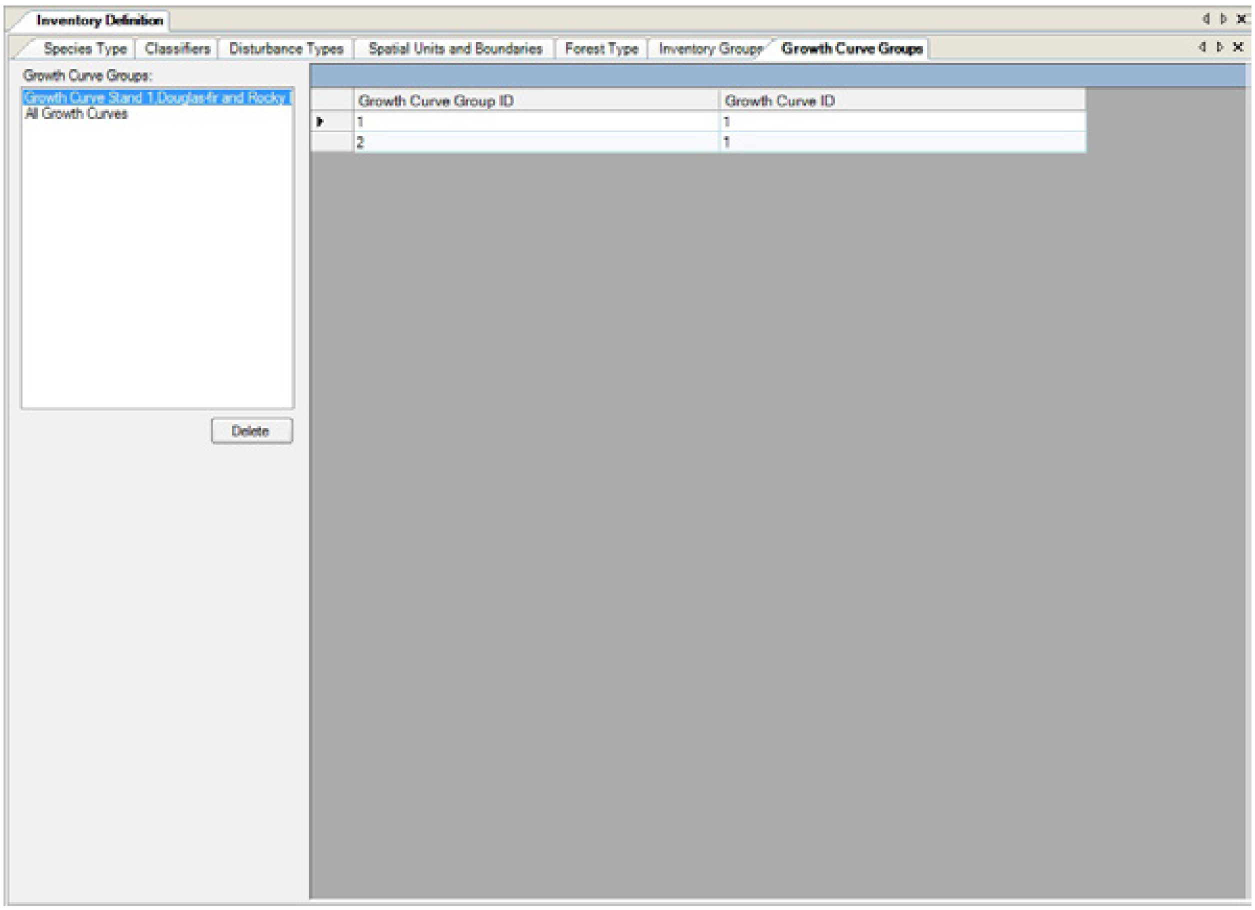


Figure 4-14. The "Inventory Definition" window with the "Growth Curve Groups" tab selected.

CHAPTER 5

PROJECT PROPERTIES, MESSAGES, AND SUMMARIES

This chapter introduces and describes how to use the Toolbox Properties tool, and the "Message," "Task List," and "Project Summary" windows. The Toolbox Properties allows the user to view and select databases, executable files, and templates that are opened in the CBM-CFS3 and to apply advanced features. The "Message" window displays output information resulting from simulation processing. The "Task List" window displays a table of project tasks that users must complete to prepare and run a project simulation. The "Project Summary" window contains a detailed summary of the contents of a project that is opened in the CBM-CFS3.

5.1 Using the Toolbox Properties Tool

The "Properties" window (Fig. 5-1) can be used to quickly view and edit advanced properties, databases, executable files, or templates associated with an open project in the CBM-CFS3.

To access the "Toolbox Properties" window

1. **Click "View" on the main CBM-CFS3 window menu bar**
2. **Select "Toolbox Properties" from the drop list that appears**

The "Properties" window will pop up. The user can display the elements within the "Properties" window alphabetically by clicking the "" icon. If the user places the cursor over an icon, a box will pop up revealing the display type. Each of the directory sections displayed can be minimized or expanded by clicking on the "-" or "+" symbols in the directory beside the appropriate section. If the user clicks on any row in the window, a description of what that row contains will appear at the bottom of the window.

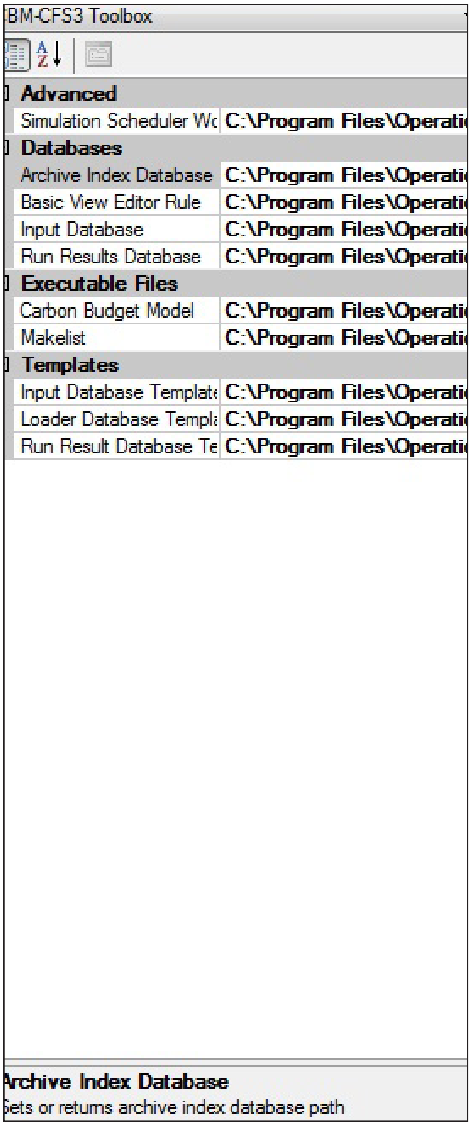


Figure 5-1. The "Properties" window.

5.1.1 Advanced

The "Advanced" section of the "Properties" window allows users to view and/or choose the location of the Simulation Scheduler Working Directory.

The CBM-CFS3 will automatically point to C:\Program Files\Operational-Scale CBM-CFS3\Temp, C:\Program Files (x86)\Operational-Scale CBM-CFS3\Temp, or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Temp (depending on where the user installed the model) as the location for the Simulation Scheduler Working Directory. To change the location of this directory

1. **Click on the "Simulation Scheduler" cell**

The "…" button should appear.

2. **Click on the "…" button beside the cell indicating the location of the Simulation Scheduler Working Directory**

A "Browse for Folder" window (Fig. 5-2) will pop up.

3. **Select the appropriate folder or click on the "New Folder" button to create a new folder**
4. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

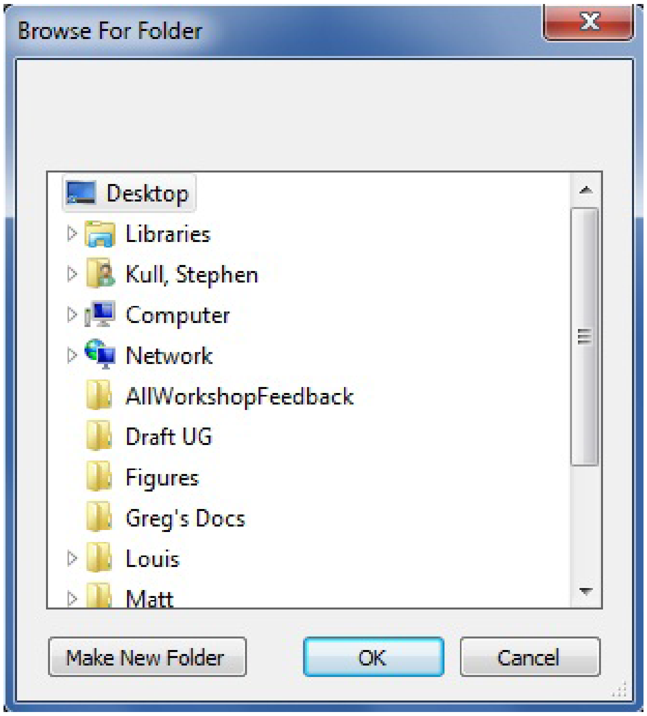


Figure 5-2. The "Browse For Folder" window permitting the user to select the location of the Simulation Scheduler Working Directory.

5.1.2 Databases

The "Databases" section (Fig. 5-1) displays a list of database file names linked to a project that is open in the CBM-CFS3: the "Archive Index Database," the "Basic View Editor Rule," the "Input Database," and the "Run Result Database." The CBM-CFS3 will automatically point to the appropriate file names for all of these databases in the "DBs" folder in C:\Program Files\Operational-Scale CBM-CFS3\Admin\, C:\Program Files (x86)\Operational-Scale CBM-CFS3\Admin\, or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Admin\ (depending on where the user installed the model) as the user proceeds through the model from importing data or opening a project to simulation and/or viewing results.

To change or open any of these files

1. **Click on the row associated with the appropriate database or rule**
2. **Click on the "…" button**

An "Open File" window will pop up where the user can point to the appropriate directory, folder, and file. Once a file has been selected

3. **Click on the "Open" button**

The selected file path will be displayed in the chosen database or rule drop list box in the "Properties" window.

5.1.3 Executable Files

The "Executable Files" section (Fig. 5-1) displays any executable files being used by the "Carbon Budget Model" or "MAKELIST". The CBM-CFS3 will automatically point to the appropriate file names for all of these executable files in the "Executable Files" folder in C:\Program Files\Operational-Scale CBM-CFS3\Admin\, C:\Program Files (x86)\Operational-Scale CBM-CFS3\Admin\, or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Admin\ (depending on where the user installed the model) as the user proceeds through the model from importing data or opening a project to simulation and/or viewing results.

To change either of these application paths

1. **Click on the row associated with the appropriate executable file**
2. **Click on the "…" button**

An "Open File" window will pop up where the user can point to the appropriate directory, folder, and file. Once a file is selected

3. **Click on the "Open" button**

The selected file path will then be displayed in the chosen drop list box in the "Properties" window.

5.1.4 Templates

The "Templates" section (Fig. 5-3) displays any template files that are open in the CBM-CFS3 for the "Input Database Template," the "Loader Database Template," and the "Run Result Database Template." The CBM-CFS3 will automatically point to the appropriate template files in the "DBs" folder in C:\Program Files\Operational-Scale CBM-CFS3\Admin\, C:\Program Files (x86)\Operational-Scale CBM-CFS3\Admin\, or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Admin\ (depending on where the user installed the model) as the user proceeds through the model from importing data or opening a project to simulation and/or viewing results.

To change any of these template files

1. **Click on the row associated with the appropriate template**
2. **Click on the "…" button**

An "Open File" window will pop up where the user can point to the appropriate directory, folder, and template file. Once the file has been selected

3. **Click on the "Open" button**

The selected file path will then be displayed in the chosen template drop list box in the "Properties" window.

5.2 Message and Task List Windows

The "Message" window (Fig. 5-3) and the "Task List" window (Fig. 5-4) will automatically pop up whenever the user successfully imports, creates, or opens a project.

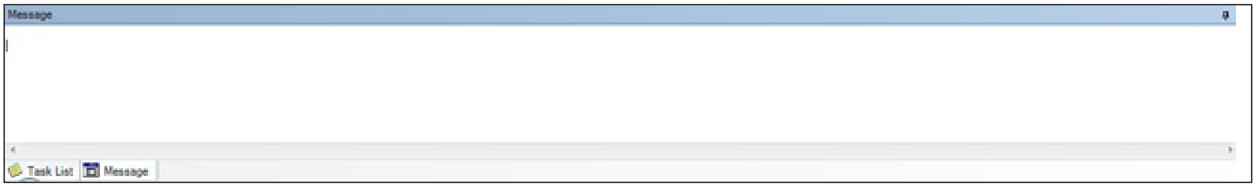


Figure 5-3. The "Message" window.

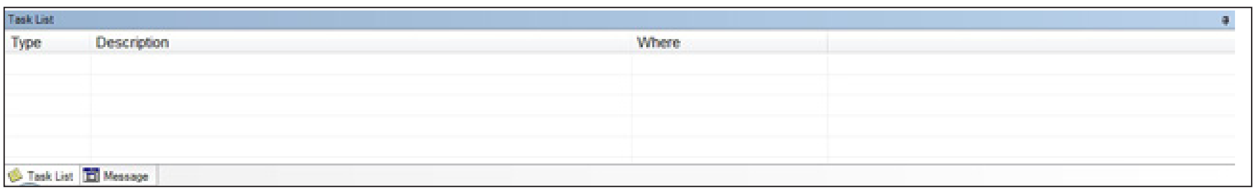


Figure 5-4. The "Task List" window.

To open the "Message" window in other situations

1. **Click "View" on the CBM-CFS3 main window menu bar**
2. **Select "Message Window" from the drop list that appears**

To open the "Task List" window in other situations

1. **Click "View" on the CBM-CFS3 main window menu bar**
2. **Select "Task List" from the drop list that appears**

The user can switch between the two windows when they are both open by clicking the appropriate tab located at the bottom of each window.

The "Message" window displays details on simulation processing by the CBM-CFS3 for a project (i.e., details about any errors encountered during processing). The "Task List" window displays a list of tasks required to complete a simulation for the project that is open. Tasks are described by type, description, and location in the model where users must go to complete the task. The "Message" and "Task List" windows can be closed by clicking the "X" in the top right-hand corner of each window.

5.3 CBM-CFS3 Project Summary

The "CBM-CFS3 Project Summary" window (Fig. 5-5) contains a summary of the components for a project that is open in the CBM-CFS3, including age class definitions, inventory classifiers and classifier values, administrative and ecological boundaries, spatial units and spatial unit groups, inventory records, species types, yield curves, disturbance types, and disturbance matrices. To access the "CBM-CFS3 Project Summary" window

1. **Click "View" on the CBM-CFS3 main window menu bar**
2. **Select "Project Summary" from the drop list that appears**

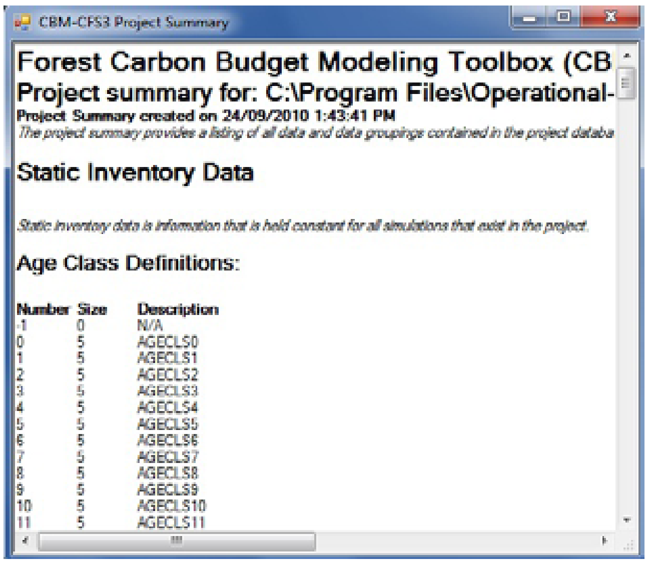


Figure 5-5. The "CBM-CFS3 Project Summary" window.

CHAPTER 6

DATA EDITING TOOLS

This chapter introduces the various data editing and modeling tools available in the CBM-CFS3, specifically the data editors for climate, disturbance events and management activities, disturbance matrices, growth and yield curves, inventory, transition rules, and default data. After the user has imported data for a project into the model, the data can be accessed and modified through these editors. Five of the editing tools — the Climate Data Editor, the Disturbance Events Editor, the Disturbance Matrix Editor, the Growth Curve Editor, and the Transition Rules Editor — are linked to specific assumption composer tools (Fig. 1-4), so that specific assumptions can be created using the appropriate data.

6.1 Climate Editor

The Climate Editor can be used to edit the time series of mean annual temperature (°C) and precipitation (mm) data that are linked to various spatial- and run-level climate assumptions (Fig. 6-1). The default climate data for a project are determined by the CBM-CFS3 according to the administrative and ecological boundaries selected by the user during data import. Default mean annual temperature and precipitation values are listed in Appendix 12.

Note: Mean annual temperature and mean annual precipitation

In the CBM-CFS3, mean annual temperature is used to model decay rates and can be edited. Research on proper integration of mean annual precipitation into the model is incomplete at this time; therefore, it is not used in the calculation of simulation results.

To access the "Climate Editor" window

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**
3. **Select "Climate" from the side drop list that appears**

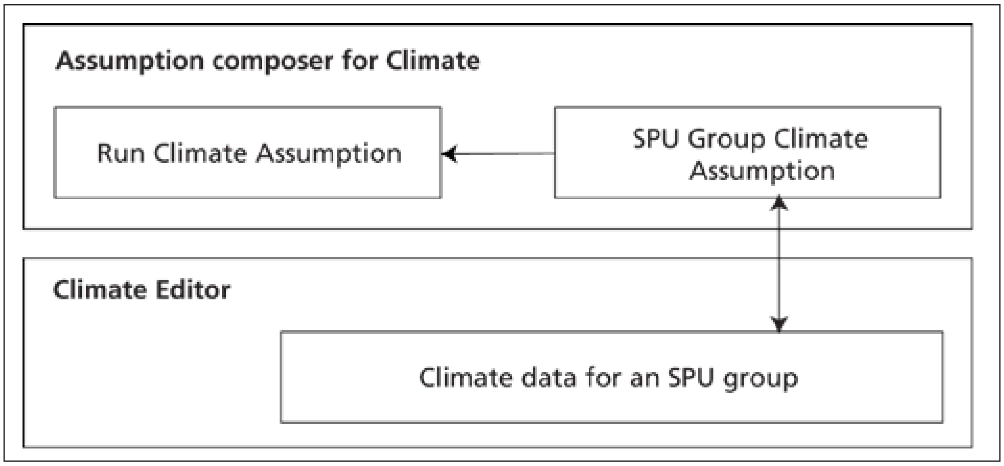


Figure 6-1. Link between the Assumption Composer for Climate and the Climate Editor.

☞ *Tip: Alternative access to the "Climate Editor" window*

The "Climate Editor" window can also be accessed by clicking on the "Add/Edit Climate Data" button on the "SPU Group Climate Assumption" tab (Fig. 7-11) on the "Climate" tab within the "Assumption Composers" window (see section 7.6.5, "Adding an SPU Group Climate Assumption"). Users should ensure that they have the correct "SPU Group Climate Assumption" selected before clicking on the "Add/Edit Climate Data" button to add or edit climate data.

The "Search for Climate Assumptions" window (Fig. 6-2) will pop up.

To locate a particular Run Climate Assumption for editing

4. **If the imported data contain more than one SPU, click on the "Location (SPUs)" box and select an SPU from the drop list that appears**
5. **Click on the "Search" button**
6. **Click on the name of a Run Climate Assumption in the "Available Climate Assumptions" box**
7. **Click on the "Edit" button**

The "Climate Editor" window (Fig. 6-3) will pop up, displaying a table with the following fields: "Annual Temperature (°C)" (for the mean annual temperature), "Annual Precipitation (mm)" (for the mean annual precipitation), and "Time Step" (for the annual time step).

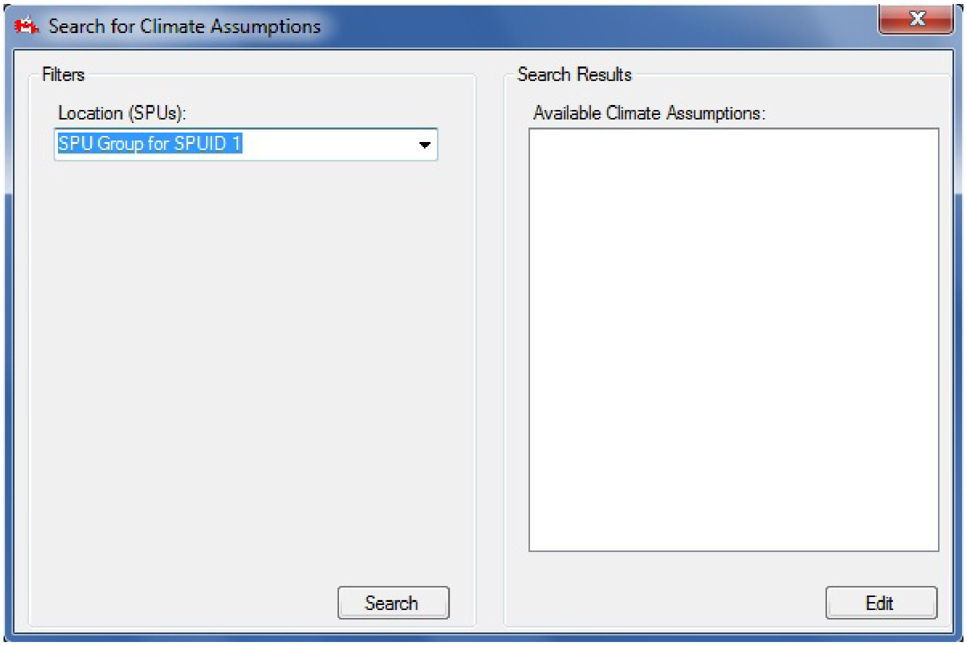


Figure 6-2. The "Search for Climate Assumptions" window.

To edit data in the "Climate Editor" window

1. **Click on the "Edit" button**
2. **Change or add data**

Note: Time step 0, time step 1, and unchanging climate data for the simulation period

The temperature and precipitation values for time step 0 represent the historical constant climate data used to initialize soil carbon pools. The temperature and precipitation data for all time steps greater than or equal to 1 represent the annual values to be used during the simulated timeframe. Where constant climate is to be assumed (i.e., the default assumption) the user enters identical values for time steps 0 and 1. The model will use these data for all subsequent time steps. Where a variable climate is to be simulated, the user must specify mean annual temperature and precipitation values for every spatial unit and time step combination to be simulated. If the user designs a simulation that exceeds the time span of the variable climate data, then the model will assume constant climate from the end point of the variable climate data.

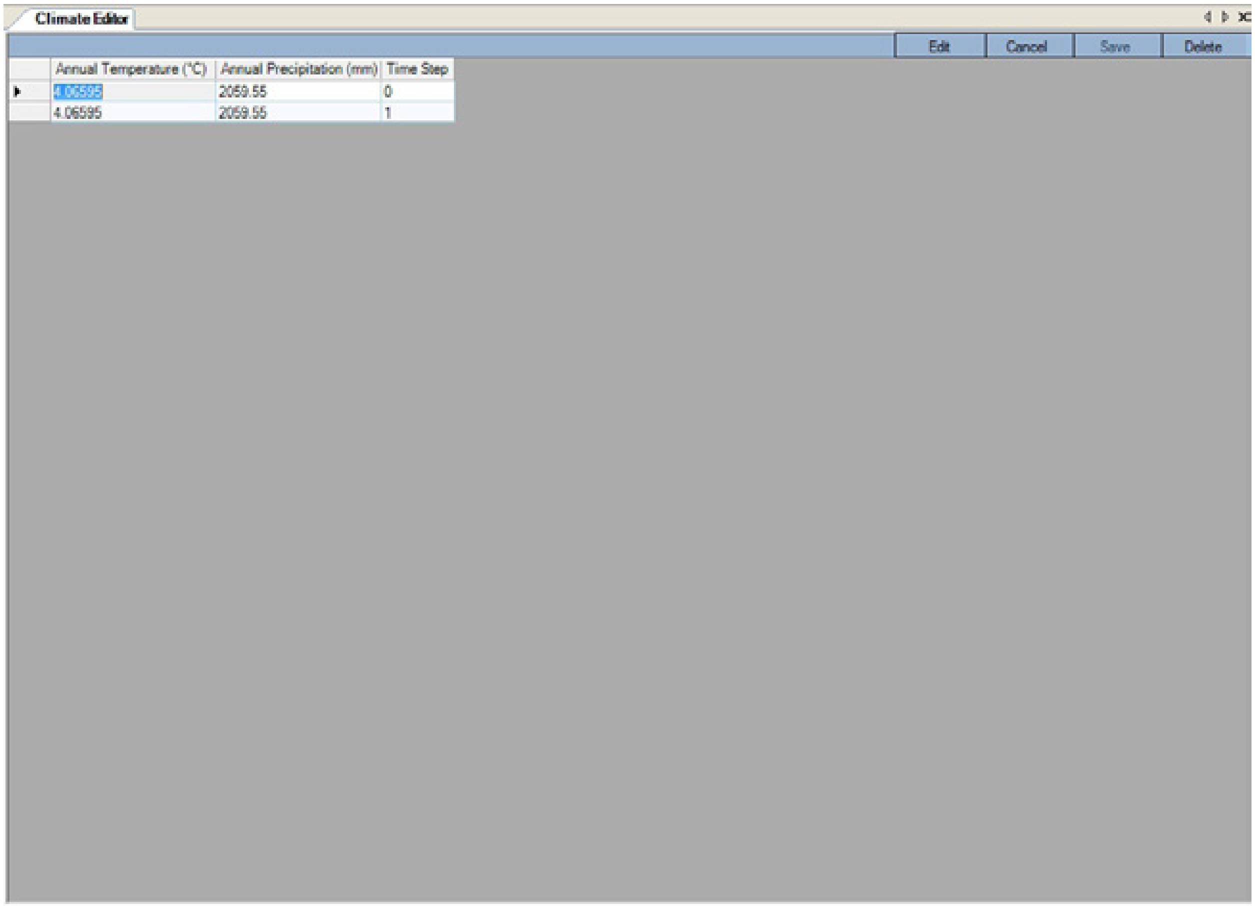


Figure 6-3. The "Climate Editor" window.

3. **Click on the "Save" button to save the changes**
   or
   Click on the "Cancel" button to terminate the editing process

Note: Permanently changing default climate values for spatial units

Instead of updating the default climate values to reflect the user's own data every time a CBM-CFS3 project is created, the user has the option of permanently modifying the default values assigned by the model. These permanent changes can be made in the Archive Index Database (ArchiveIndex_Beta_Install.mdb), which is located in C:\Program Files\Operational-Scale CBM-CFS3\Admin\DBs, C:\Program Files (x86)\Operational-Scale CBM-CFS3\Admin\DBs), or C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Admin\, depending on where the user installed the model.

In the Archive Index Database, the table "tblClimateDefault" contains values of mean annual temperature and mean annual precipitation for the default spatial units (example in Figure 6-4). Three other tables can be used to identify the appropriate SPU data to be modified, "tblAdminBoundaryDefault", "tblEcoBoundaryDefault", and "tblSPUDefault". A user who is modifying the data for a default SPU must do so by entering data for at least two time steps. The current CBM-CFS3 defaults treat 1980 as the base year for stand initialization (for the purpose of initializing the DOM pools) and use 1981 data as the climate data for the simulation period. Any additional climate data will be used in calculations. If the simulation is longer than the climate series, the model will hold the climate constant once it reaches the end of the climate series.

Note (continued): Permanently changing default climate values for spatial units

tblClimateDefault

DefaultSPUID	Year	Mean Annual Temp	Mean Annual Precip
1	1980	3.34954	1119.57
1	1981	3.34954	1119.57
2	1980	–6.84317	542.25
2	1981	–6.84317	542.25
3	1980	–3.51436	866.05
3	1981	–3.51436	866.05
4	1980	–1.34197	1119.57
4	1981	–1.34197	1119.57

Figure 6-4. An example of the "tblClimateDefault" table in the Archive Index Database, containing climate data for initialization (1980) and simulation (1981), by SPU.

Should the user uninstall the CBM-CFS3 for any reason after making changes to this database, the changes must be reinstituted (if required) after the software is re-installed.

To delete a row of data in the "Climate Editor" window

1. **Click on the gray cell at the beginning of a row in the table**
2. **Click on the "Delete" button**

6.2 Disturbance Events Editor

The Disturbance Events Editor can be used to find, edit, create, or delete disturbance and/or management events and rules for any single or repeated disturbance or management activity that the user has imported or created. These disturbance events are linked to Disturbance and Management Assumptions using the Assumption Composer for Disturbance and Management (Fig. 6-5).

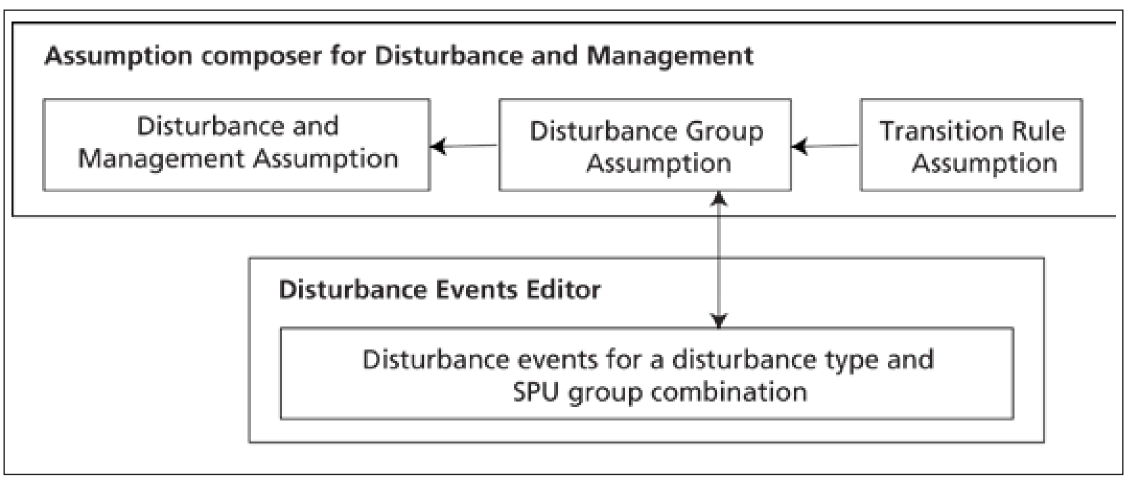


Figure 6-5. Link between the assumption composer for Disturbance and Management and the Disturbance Events Editor.

To access the "Disturbance Events Editor" window

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**

3. **Select "Disturbance Events and Management Activities" from the side drop list that appears**

This will open the "Search for Disturbance Information" window (Fig. 6-6). In this window, the user has the option of filtering by an SPU and/or disturbance type to retrieve specific user-defined or default Disturbance Group Assumptions (see section 7.9), which can be modified by editing or adding rules. To use the filters

4. **Click on the "SPU Group" check box and select an SPU from the drop list that appears**
5. **Click on the "Disturbance Type" check box and select a disturbance type from the drop list that appears**
6. **Click on the "Search" button**

The Disturbance Group Assumptions identified by the filters will appear in the "Resulting Disturbance Group Assumptions" box.

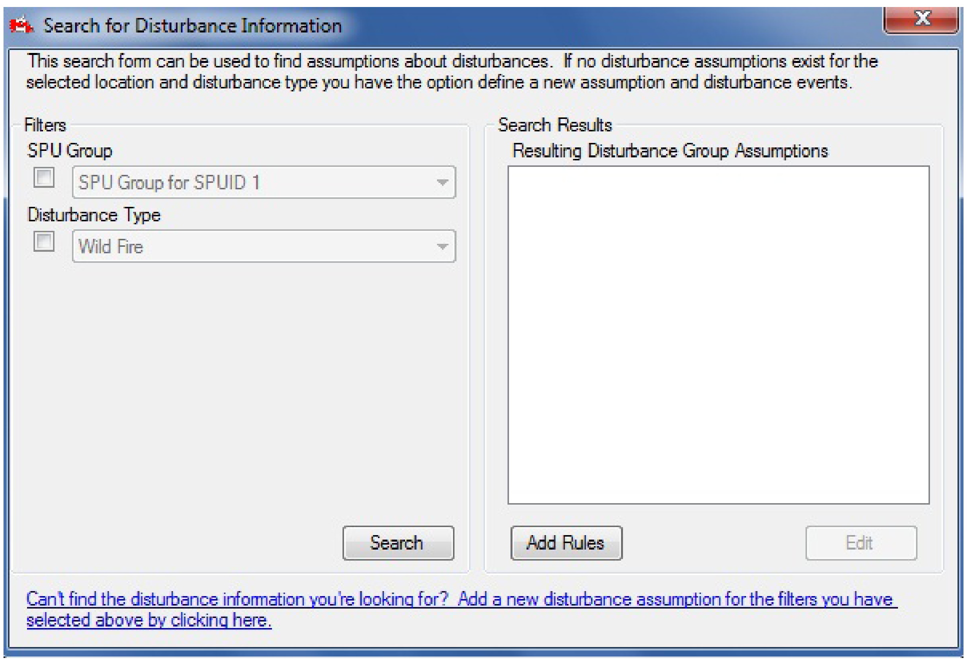


Figure 6-6. The "Search for Disturbance Information" window.

Note: Adding a New Disturbance Group Assumption

To create a new Disturbance Group Assumption if none were retrieved

Click on the "Add a new disturbance assumption for the filters you have selected above by clicking here" link

The "Disturbance and Management" tab of the "Assumption Composers" window (Fig. 7-16) will appear, where the user can create a new Disturbance Group Assumption (see section 7.9.5).

6.2.1 Viewing Disturbance Events

The impact of disturbance events is quantified by area, merchantable carbon, or proportion of eligible records disturbed. This information is specified by the user in the Disturbance Events import file or in the Disturbance Events Editor. The quantified impacts for the disturbance events are displayed graphically and summarized in a table (with each row representing a disturbance event) in the Disturbance Events

Editor. Disturbance event data are also displayed in a tabular view that contains eligibility criteria for the disturbance event and the related transition rules for each event.

To view the disturbance events for a Disturbance Group Assumption that is displayed in the "Resulting Disturbance Group Assumptions" box in the "Search for Disturbance Information" window (Fig. 6-6)

1. **Click on a Disturbance Group Assumption name in the "Resulting Disturbance Group Assumptions" box**
2. **Click on the "Edit" button**

The "Disturbance Events Editor" window will pop up, showing the "Graph" view (Fig. 6-7). Placing the cursor over any point on the graph will highlight the associated value in the table and vice versa. The user may move between the "Graph" and "Summary" views by clicking on the appropriate radio button.

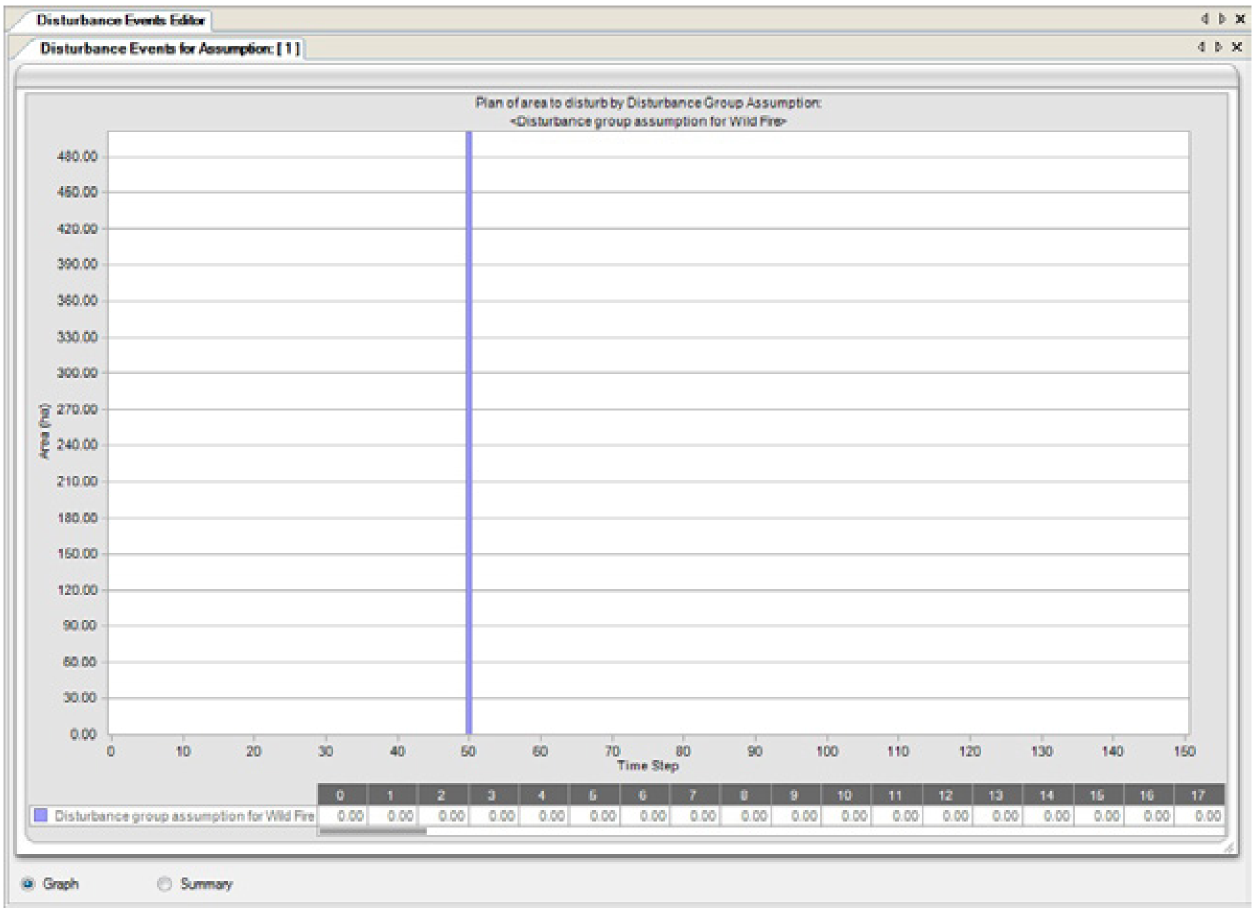


Figure 6-7. The "Disturbance Events Editor" window with the "Graph" view selected.

Note: Modifying graphs and tables

The way in which both the graph and the table is displayed can be modified. For instructions on how to modify the display of a graph or a table, see Chapter 9.

6.2.2 Editing and Deleting Disturbance Events

The “Summary” view in the “Disturbance Events Editor” (Fig. 6-8) is used to edit or delete disturbance event rules for a Disturbance Group Assumption. To access the “Summary” view

1. **Click on a Disturbance Group Assumption name in the “Resulting Disturbance Group Assumptions” box**

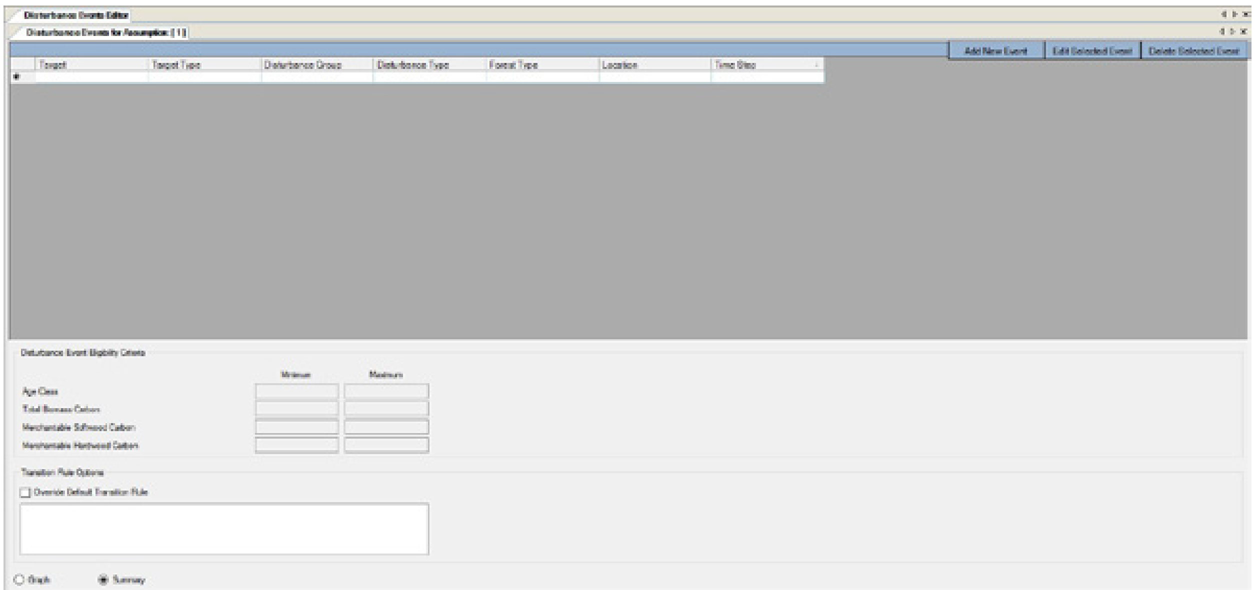


Figure 6-8. The “Disturbance Events Editor” window with the “Summary” view selected.

2. **Click on the “Edit” button**

The “Disturbance Events Editor” window will pop up, showing the “Graph” view (Fig. 6-7).

3. **Click on the “Summary” radio button**

The “Summary” view (Fig. 6-8) will appear, containing a table in which each row represents a disturbance event; this table is linked to disturbance event eligibility criteria and a set of one or more transition rule options.

Editing Disturbance Events

To edit a disturbance event

1. **In the table shown in the “Summary” view, click on the gray cell at the beginning of the row to be edited**

The “Disturbance Event Eligibility Criteria” box will display eligibility limits in the “Minimum” and “Maximum” boxes for each of the criteria for the event. The “Transition Rule Options” box will display any existing transition rules (if none, the forest type will convert back to the same forest type following disturbance) and whether the user’s default transition rules have been overridden with different rules for that event (a check mark in the “Override Default Transition Rules” check box indicates that the default rules have been overridden).

Note: **Removing the default transition rule override**

If the "Override Default Transition Rule" box is checked for an event, the user has the option of reverting to the default transition rules. To do this, click on the "Override Default Transition Rule" check box so that no check mark is displayed.

2. **Click on the "Edit Selected Event" button**

The "Individual Disturbance Event Editor" window (Fig. 6-9) will pop up. This window displays information for the selected disturbance event in the "Disturbance Event Details" and "Transition(s) Following the Disturbance" boxes. Disturbance event details that can be edited are found in the "Target Forest Type" table (Fig. 6-9 and 6-10) and are displayed on two tabs: the "Disturbance Settings Tab" (Fig. 6-9) and the "Disturbance Event Eligibility Criteria" tab (Fig. 6-10). Descriptions for all of the fields in the "Individual Disturbance Event Editor" are presented in Table 6-1.

To edit the classifier values in the "Target Forest Type" table (Fig. 6-9)

1. **Click on any of the cells in the "Classifier Value" column of the "Target Forest Type" table and select an option from the drop list that appears**
2. **Click on the "Save" button to save the event**

   or

   Click on the "Close" button to cancel any edits and leave the "Individual Disturbance Event Editor"

   or

   Proceed with further edits

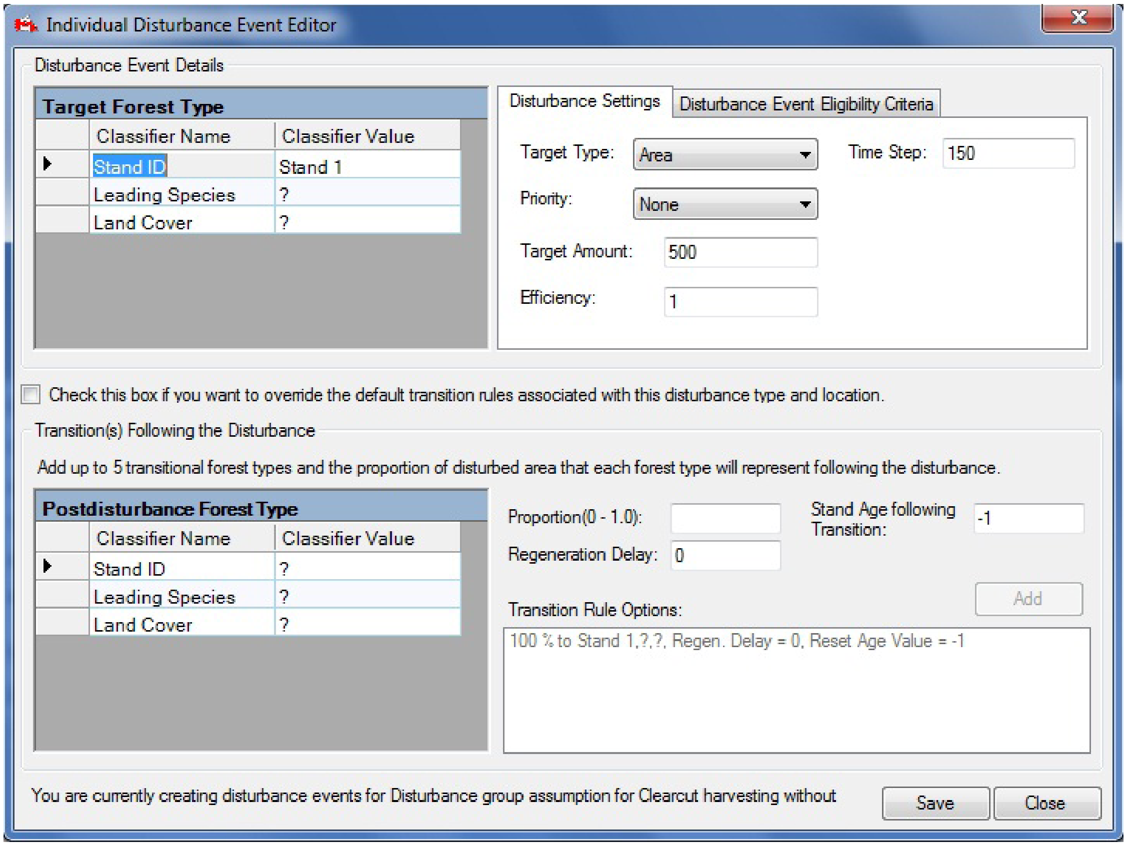


Figure 6-9. The "Individual Disturbance Event Editor" window with the "Disturbance Settings" tab selected.

To edit information on the "Disturbance Settings" tab

1. **Click on the "Disturbance Settings" tab**
2. **Click on the "Target Type" box and select an item from the drop list that appears**
3. **Click on the "Priority" box and select an item from the drop list that appears**

Note: Selection of "Priority" option and "Target Amount" units if the "Target Type" is a proportion

If the user selects "Proportion of records" in the "Target Type" box, the choice from the drop list for the "Priority" box must be "None." This will ensure that a proportion of records containing the classifiers for a target forest type identified by the user will be disturbed. The units entered for the proportion of records to disturb in the "Target Amounts" box should be a proportion (e.g., 1 for 100%, 0.5 for 50%).

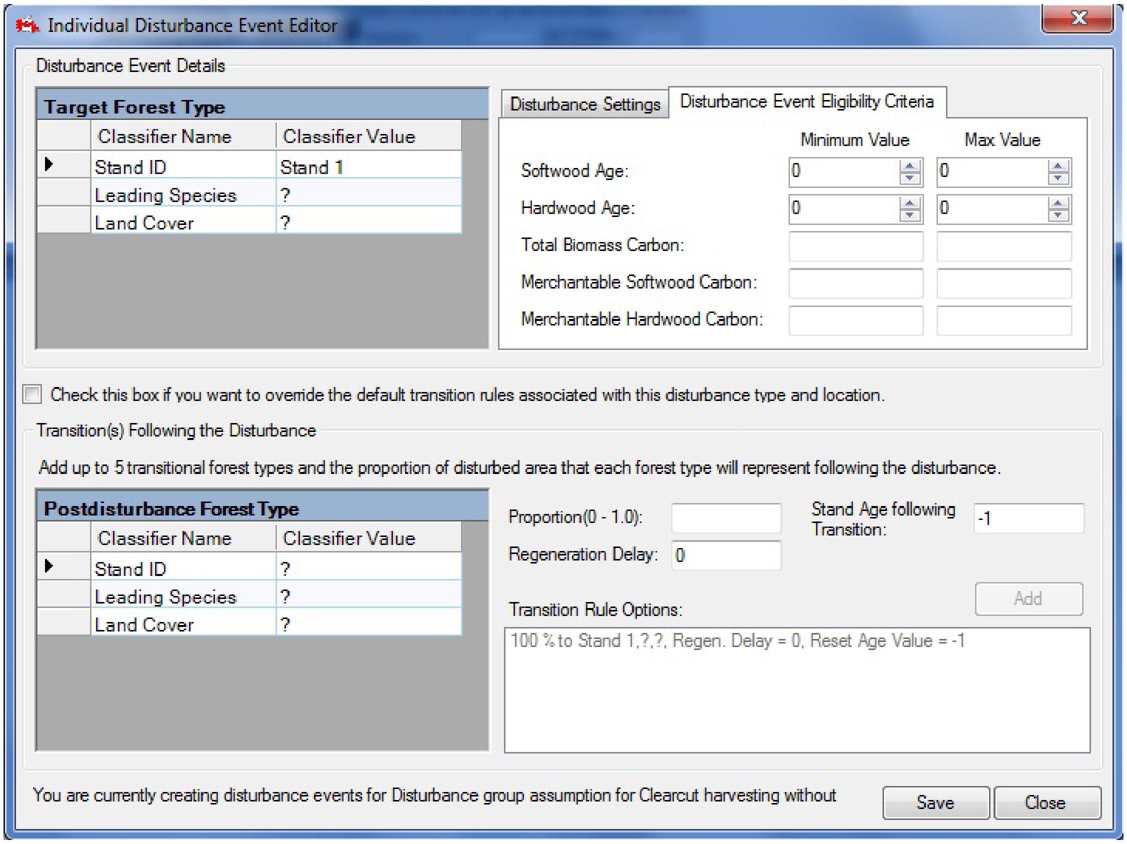


Figure 6-10. The "Individual Disturbance Event Editor" window with the "Disturbance Event Eligibility Criteria" tab selected.

4. **Click on the "Target Amount" box and enter an amount**
5. **Click on the "Efficiency" box and enter a number (1 for 100%, 0.5 for 50%, etc.)**
6. **Click on the "Time Step" box and enter a number**

Note: Entering a time step

The time step should be the year in which the event occurs. For example, if "50" is entered as the time step, the disturbance event will occur in year 50 of the simulation.

7. **Click on the "Save" button to save the event**

   or

   Click on the "Close" button to cancel any edits and leave the "Individual Disturbance Event Editor"

   or

   Proceed with further edits

Table 6-1. Field descriptions for the “Disturbance Settings” and “Disturbance Event Eligibility Criteria” tabs in the “Individual Disturbance Event Editor” window (Figs. 6-9 and 6-10) and the “Disturbance Rules Generator” window (Figs. 6-11 and 6-12)

Field name	Description
Target Forest Type	Forest type targeted by a disturbance event, as defined by classifiers and classifier values
Target Type	The type of impact a disturbance will have on a Target Forest Type. Options include “Area”, “Merchantable Carbon”, or the “Proportion of records”
Priority	Defines which inventory records to select first for the disturbance event. Options include “None”, “Highest Merchantable Carbon”, “Age – Oldest First”, “Time Since Last Disturbance”, and “Random”
Target Amount	Amount of area, amount of merchantable carbon, or proportion of records to disturb
Efficiency	The maximum proportion a record can be disturbed. Indicates the model’s efficiency in achieving the disturbance target from a given stand.
Time Step	Planning year when the disturbance event can begin
Start Step	Planning year when the disturbance event can begin
Interval	Number of years between one disturbance event and the next of its kind
Iterations	Number of times to repeat the disturbance event
Softwood Age	Boundary ages of softwood component eligible to be disturbed. Note that the values entered are themselves not eligible.
Hardwood Age	Boundary ages of hardwood component eligible to be disturbed. Note that the values entered are themselves not eligible
Total Biomass Carbon	Range of amount of biomass carbon required in a forest type for a disturbance to occur
Merchantable Softwood Carbon	Range of amount of carbon required in merchantable softwoods for a given forest type for a disturbance to occur
Merchantable Hardwood Carbon	Range of amount of carbon required in merchantable hardwoods for a given forest type for a disturbance to occur
Postdisturbance Forest Type	Resulting forest type following a disturbance event; defined by classifiers and classifier values
Proportion	Percentage of a predisturbance forest type that converts to the selected transition forest type; enter 1 for 100%, 0.5 for 50%, etc.
Regeneration Delay	Delay in forest regeneration following a disturbance event, expressed in years. Must be a positive number.
Stand Age Following Transition	Stand age of selected forest type after the disturbance event. Can be used to move the stand to a different trajectory of growth after a disturbance. In this situation, carbon is conserved, because only the growth increment (not the absolute volume from the yield curve) is used for simulating stand growth.

To edit information on the "Disturbance Event Eligibility Criteria" tab

1. **Click on the "Disturbance Event Eligibility Criteria" tab (Fig. 6-10)**
2. **Click on the "Min Value" box and/or the "Max Value" box next to "Softwood Age" and then click on the arrow buttons to select appropriate minimum and maximum ages**
3. **Click on the "Min Value" box and/or the "Max Value" box next to "Hardwood Age" and then click on the arrow buttons to select appropriate minimum and maximum ages**
4. **Click on the "Min Value" box and/or the "Max Value" box next to "Total Biomass Carbon" and then type in an amount**
5. **Click on the "Min Value" box and/or the "Max Value" box next to "Merchantable Softwood Carbon" and then type in an amount**
6. **Click on the "Min Value" box and/or the "Max Value" box next to "Merchantable Hardwood Carbon" and type in an amount**
7. **Click on the "Save" button to save the event**

   or

   Click on the "Close" button to cancel any edits and leave the "Individual Disturbance Event Editor"

   or

   Proceed with further edits

Once the edits on the "Disturbance Event Eligibility Criteria" tab are complete, the user can create or delete existing transition rules in the "Transition(s) Following the Disturbance" box (Fig. 6-9 and 6-10). If the "Click this box if you want to override the default transition rules associated with this disturbance type and location" box contains a check mark, any transition rules in the "Transition(s) Following the Disturbance" box will override those in the Transition Rules Editor for the selected target forest type. To create transition rules that will override the default rules

1. **Click on the "Click this box if you want to override the default transition rules associated with this disturbance type and location" box, so that a check mark appears**

Next, the user must select the forest type to which the disturbed forest type will convert following the disturbance.

2. **Click on any of the cells in the "Classifier Value" column associated with a particular classifier in the "Classifier Name" column of the "Postdisturbance Forest Type" table, and select a value from the drop list that appears**
3. **Click on the "Proportion" box and enter a number**

Note: Entering a proportion

If only one transition forest type is created for the disturbance event, the proportion is 100% and the value entered must be "1." If more than one transition forest type is created for the disturbance event, the proportions entered must sum to 1. If the sum of proportions for the given transition rule options is less than 1 (i.e., less than 100%), then the remainder is assumed to revert back to the original forest type.

4. **Click on the "Regeneration Delay" box and enter a number**
5. **Click on the "Age following Disturbance" box and enter a number**
6. **Click on the "Add" button**

The new transition rule will appear in the "Transition Rule Options" box. To delete a transition rule that appears in this box, click on the name of the rule in the box and press the "Delete" key on the keyboard.

Once all edits to a disturbance event are complete

7. **Click on the "Save" button to save the event**

   or

   Click the "Close" button to cancel any edits and leave the "Individual Disturbance Event Editor"

After clicking on the "Save" button

8. **Click on the "Close" button to close this window**

Deleting Disturbance Events

To delete individual disturbance events in the table shown in the "Summary" view of the "Disturbance Events Editor" window (Fig. 6-8)

1. **Click on the gray cell at the beginning of a row in the table**
2. **Click on the "Delete Selected Event" button**

A "Delete Disturbance Events" window will pop up asking the user to confirm deletion of the selected event.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion process

If the user clicks on the "Yes" button, the disturbance event will be deleted from the table.

6.2.3 Adding Single Disturbance Events

To add multiple disturbance events to a Disturbance Group Assumption, go to section 6.2.4. To add single disturbance events to a Disturbance Group Assumption displayed in the "Resulting Disturbance Group Assumptions" box in the "Search for Disturbance Information" window (Fig. 6-6)

1. **Click on the name of a Disturbance Group Assumption in the "Resulting Disturbance Group Assumptions" box**
2. **Click on the "Edit" button**

The "Disturbance Events Editor" window will pop up, showing the "Graph" view (Fig. 6-7).

3. **Click on the "Summary" radio button**

The "Summary" view (Fig. 6-8) contains a table of existing disturbance event rules as well as disturbance event eligibility criteria and transition rule options. To add a single disturbance event

4. **Click on the "Add New Event" button**

The "Individual Disturbance Event Editor" window (Fig. 6-9) will pop up. The procedures for entering rules for a new disturbance event are the same as those described in section 6.2.2 (for editing and deleting disturbance events), starting at step 1.

6.2.4 Adding Multiple Disturbance Events

To add multiple disturbance events to a Disturbance Group Assumption displayed in the "Resulting Disturbance Group Assumptions" box in the "Search for Disturbance Information" window (Fig. 6-6)

1. **Click on the name of a Disturbance Group Assumption in the "Resulting Disturbance Group Assumptions" box**
2. **Click on the "Add Rules" button**

The "Disturbance Rules Generator'" window (Figs. 6-11) will pop up. This window displays fields in the "Disturbance Rule Details" and "Transition(s) Following the Disturbance" boxes where disturbance event rules can be entered. Disturbance event details that can be entered are found in the "Target Forest Type" table (Figs. 6-11 and 6-12) and are displayed on two tabs: the "Disturbance Settings" tab (Figs. 6-11) and the "Disturbance Event Eligibility Criteria" tab (Figs. 6-12). Descriptions for all of the fields in the "Disturbance Rules Generator" window are presented in Table 6-1.

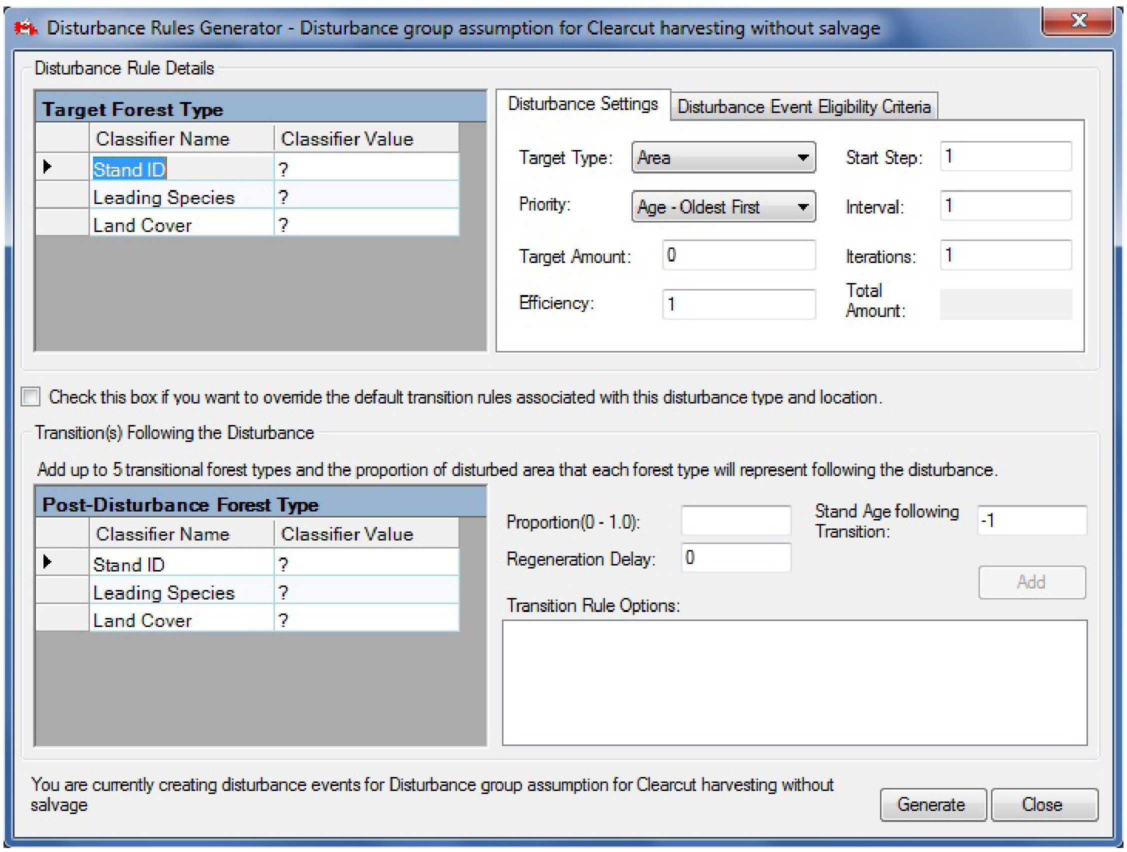


Figure 6-11. The "Disturbance Rules Generator" window with the "Disturbance Settings" tab selected.

To add disturbance event rules

1. **Click on any of the cells in the "Classifier Value" column of the "Target Forest Type" table, and select an option from the drop list that appears**

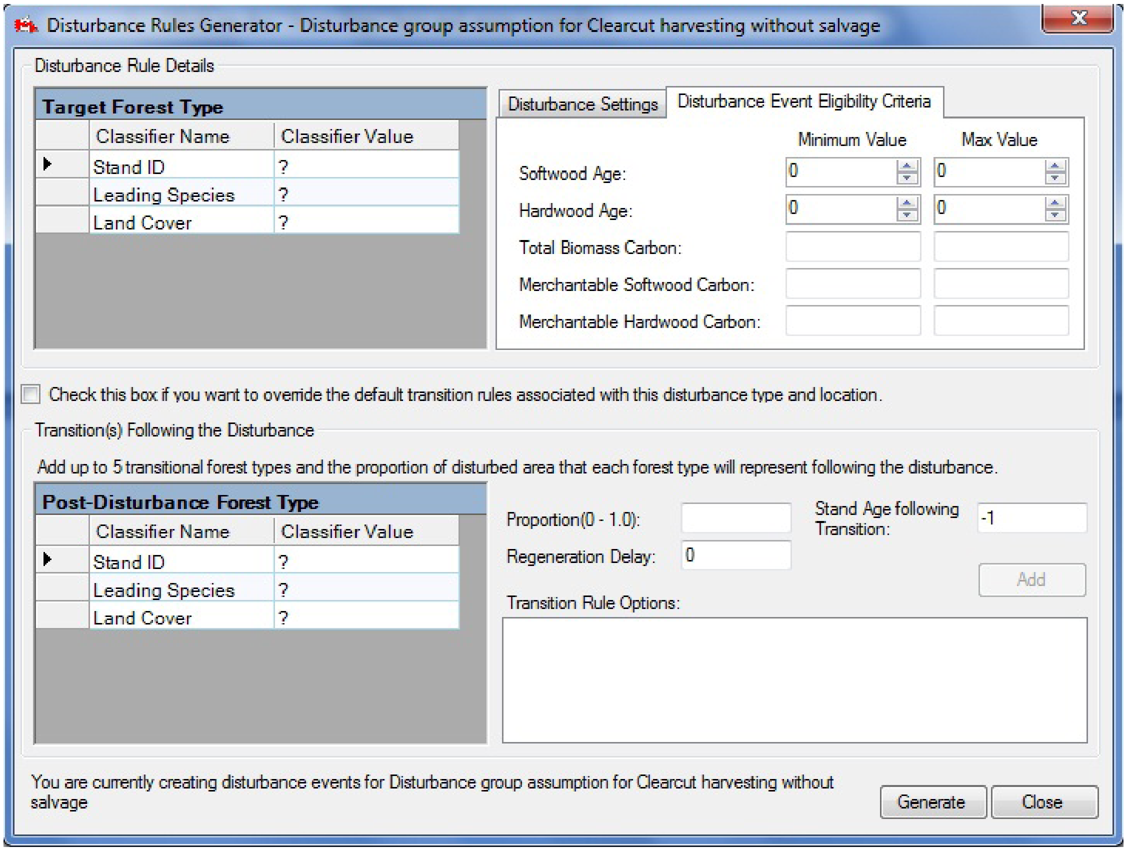


Figure 6-12. The "Disturbance Rules Generator" window with the "Disturbance Event Eligibility Criteria" tab selected.

2. **Click on the "Disturbance Settings" tab**
3. **Click on the "Target Type" box and select an item from the drop list that appears**
4. **Click on the "Priority" box and select an item from the drop list that appears**
5. **Click on the "Target Amount" box and enter an amount**
6. **Click on the "Efficiency" box and enter a number (1 for 100%, 0.5 for 50%, etc.)**
7. **Click on the "Start Step" box and enter a number**

Note: Entering a start step

The starting time step should be the year in which the event occurs. For example, if "50" is entered as the start step, the disturbance event will occur in year 50 of the simulation.

8. **Click on the "Interval" box and enter a number**
9. **Click on the "Iterations" box and enter a number**
10. **Click on the "Disturbance Event Eligibility Criteria" tab (Fig. 6-12)**
11. **Click on the "Min Value" box and/or "Max Value" box beside "Softwood Age" and then click the arrow buttons to select appropriate minimum and maximum ages (optional)**
12. **Click on the "Min Value" box and/or the "Max Value" box beside "Hardwood Age" and then click the arrow buttons to select appropriate minimum and maximum ages (optional)**

13. **Click on the "Min Value" box and/or the "Max Value" box beside "Total Biomass Carbon" and then enter an amount (optional)**
14. **Click on the "Min Value" box and/or the "Max Value" box beside "Merchantable Softwood Carbon" and then enter an amount (optional)**
15. **Click on the "Min Value" box and/or the "Max Value" box beside "Merchantable Hardwood Carbon" and then enter an amount (optional)**

Once information has been entered on the "Disturbance Event Eligibility Criteria" tab, the user can create transition rules in the "Transition(s) Following the Disturbance" box (Fig. 6-11). If the "Click this box if you want to override the default transition rules associated with this disturbance type and location" box contains a check mark, any transition rules in the "Transition(s) Following the Disturbance" box will override those in the Transition Rules Editor for the selected target forest type. To create transition rules that will override the default rules

1. **Click on the "Check this box if you want to override the default transition rules associated with this disturbance type and location" box, so that a check mark appears**

Next, the user must select the forest type to which the disturbed forest type will be converted following the disturbance.

2. **Click on any of the cells in the "Classifier Value" column associated with a particular classifier in the "Classifier Name" column of the "Postdisturbance Forest Type" table, and select a value from the drop list that appears**
3. **Click on the "Proportion" box and enter a number**

Note: Entering the proportion

If only one transition forest type is created for the disturbance event, the proportion is 100% and the value entered must be "1." If more than one transition forest type is created for the disturbance event, the proportions entered must sum to 1.

4. **Click on the "Regeneration Delay" box and enter a number**
5. **Click on the "Stand Age following Transition" box and type in a number**
6. **Click on the "Add" button**
7. **Repeat steps 2 to 6 to add more transition forest types**

The new transition rule(s) will appear in the "Transition Rule Options" box. To delete a transition rule that appears in this box, click on the name of the rule in the box and press the "Delete" key on the keyboard.

Once all transition rules for the disturbance event have been entered

8. **Click on the "Generate" button to save the rules**
9. **Click on the "Close" button to close this window**

6.3 Disturbance Matrix Editor

A disturbance matrix is a look-up table describing the flow of carbon among various pools (Fig. 1-1) caused by a disturbance or management event. The Disturbance Matrix Editor can be used to view, copy, or edit default or user-defined disturbance matrices and to modify disturbance matrix associations indicating which disturbance matrix is associated with a given disturbance type in a given region. A particular disturbance type may be associated with any disturbance matrix.

The disturbance type or types and locations(s) associated with a disturbance matrix can also be modified. The user can search for disturbance matrices in the "Search for Disturbance Matrices" window (Figure 6-13). Any disturbance matrices contained within the project database will appear in the "Search Results" box in this window. The "Disturbance Matrix Associations" box allows the user to view and modify the association of a disturbance matrix with a given disturbance type and location.

To access the "Search for Disturbance Matrices" window

Click on "Tools" on the menu bar of the main CBM-CFS3 window

Select "Data Editors" from the drop list that appears

Select "Disturbance Matrices" from the side drop list that appears

6.3.1 Editing or Copying a Disturbance Matrix

In the "Search for Disturbance Matrices" window (Fig. 6-13), the user can search for, edit, or copy a disturbance matrix associated with an open project.

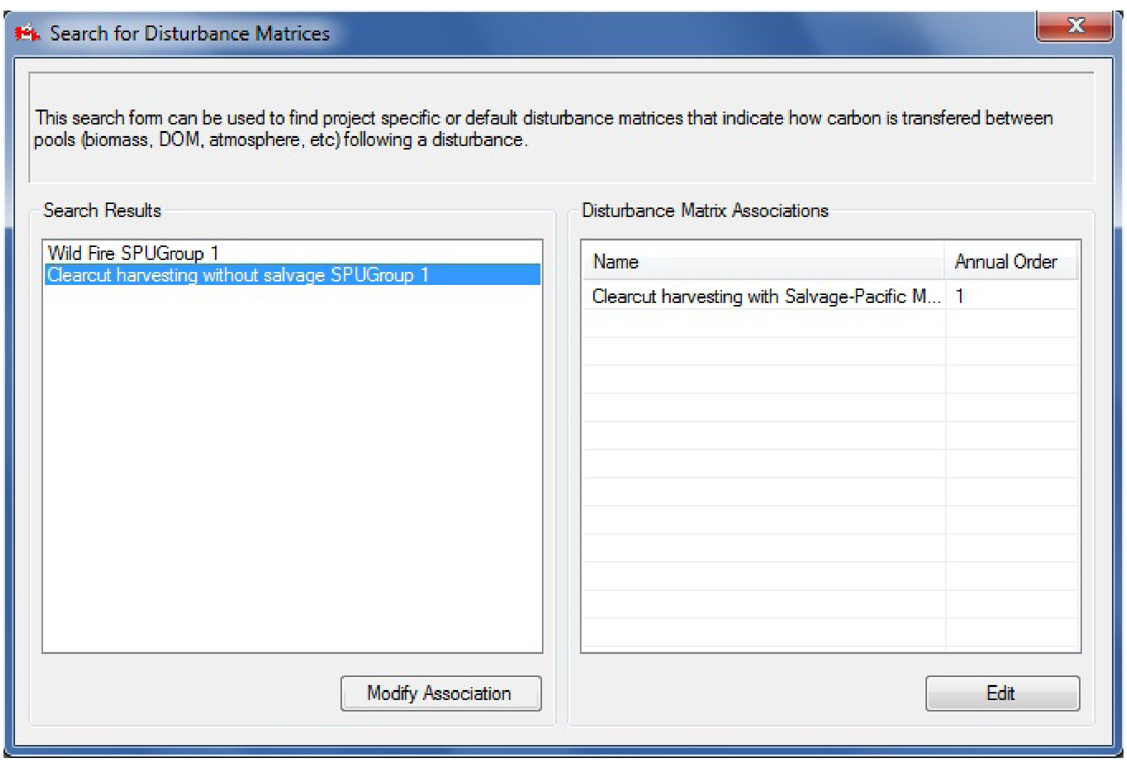


Figure 6-13. The "Search for Disturbance Matrices" window.

Editing a Disturbance Matrix

To edit a disturbance matrix displayed in the "Search Results" box in the "Search for Disturbance Matrices" window

1. **Click on the name of the disturbance matrix in the "Search Results" box**
2. **Click on the "Edit" button**

The "Edit Disturbance Matrix" warning window (Fig. 6-14) will pop up, reminding the user that a given disturbance matrix may be associated with more than one disturbance type and that any edits made could affect carbon transfers associated with other disturbance types. The user is given the choice of making a copy of the matrix for editing or proceeding to edit the original matrix.

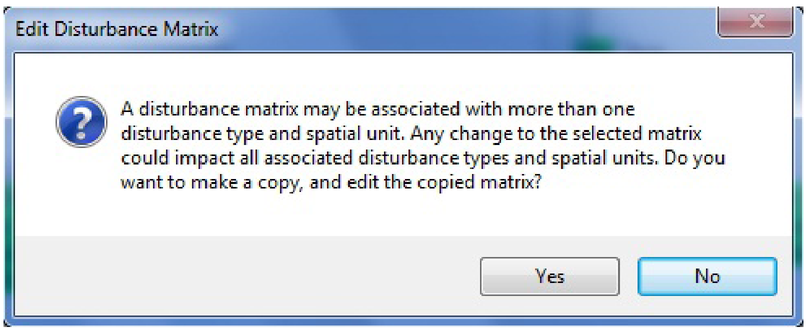


Figure 6-14. The "Edit Disturbance Matrix" warning window.

To proceed to view and edit the original matrix

3. **Click on the "No" button**

The "Disturbance Matrix Editor" window will pop up. This window can display two different views: "List View" (Fig. 6-15) and "Grid View" (Fig. 6-16).

The "List View" will be displayed automatically when the user first opens the "Disturbance Matrix Editor" window. The user can select a view by clicking on the corresponding radio button.

In the "List View," the forest carbon pools are displayed in the "From" box and the carbon pools linked to each pool are displayed in the "To" box. The percentage of carbon transferred between these pools appears in the "Value (*100%)" box. The user can click on a carbon pool in the "From" box to view the associated carbon pool(s) in the "To" box and the transfer rates in the "Value (*100%)" box. Descriptions for all of the carbon pools accessible in this window are presented in Table 6-2.

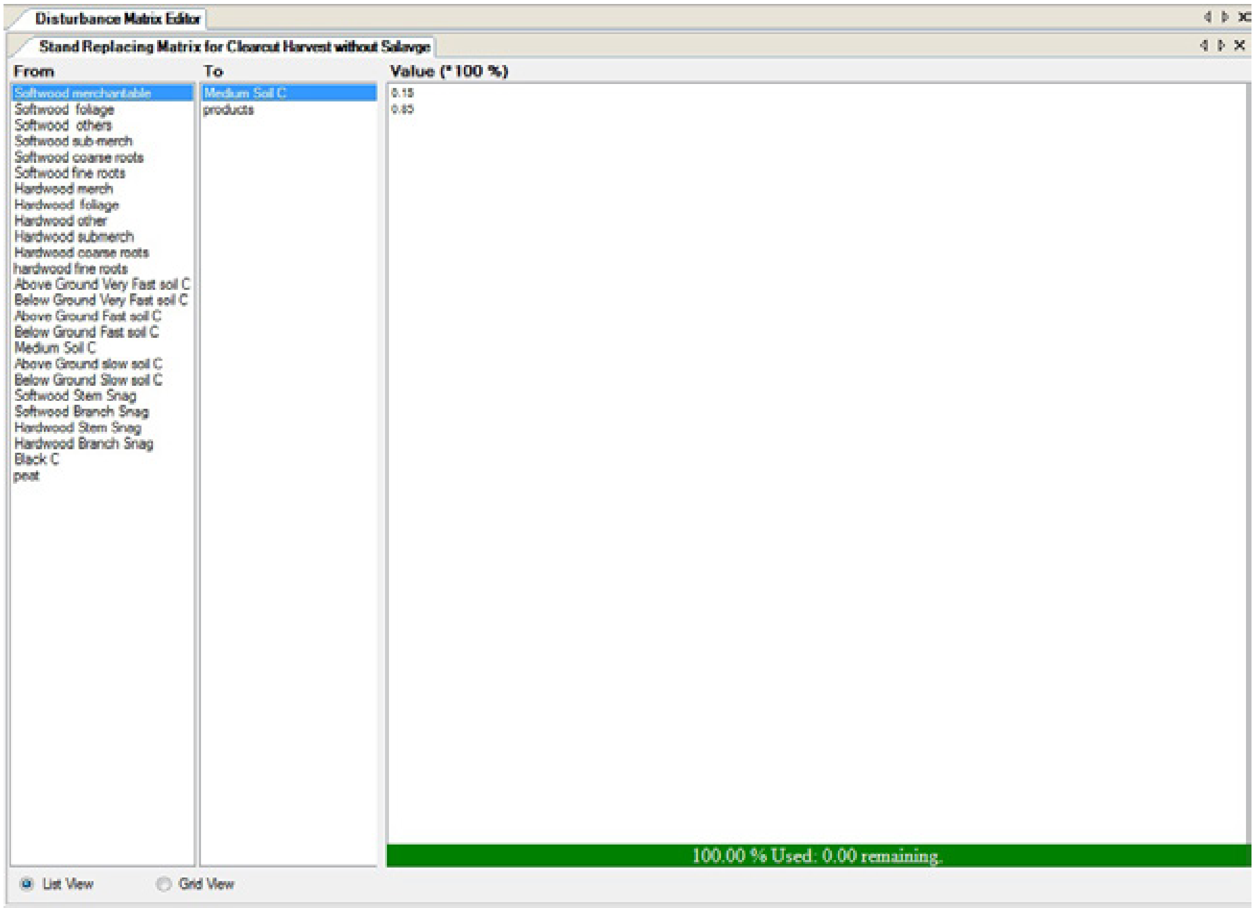


Figure 6-15. The "Disturbance Matrix Editor" window with the "List View" selected.

To edit the rate of transfer from one carbon pool to another

1. **Click on the name of a carbon pool in the "From" box**
2. **Click, pause, and click again on the value in the "Value (*100%)" box associated with a carbon pool in the "To" box**
3. **Change the value to the desired proportion**

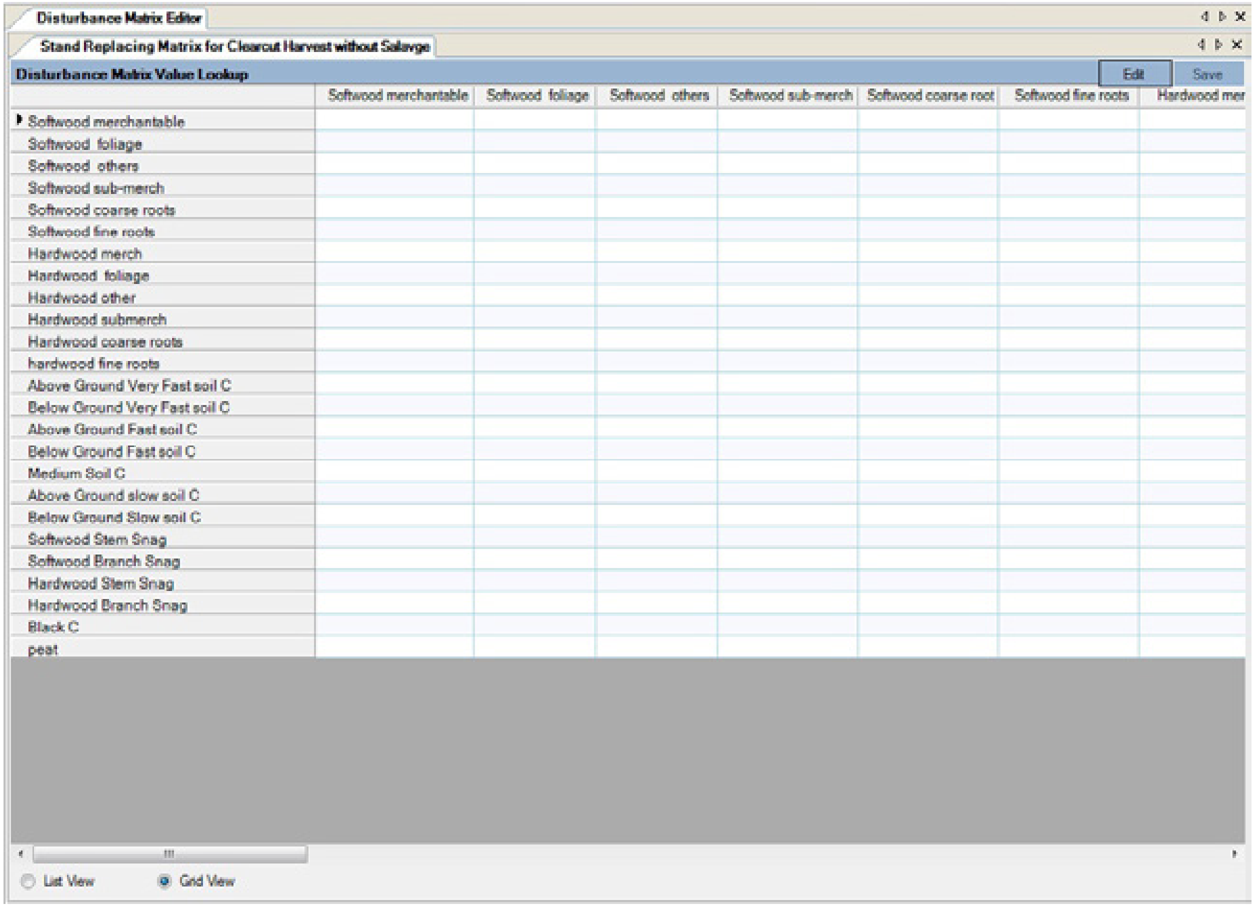


Figure 6-16. The “Disturbance Matrix Editor” window with the “Grid View” selected.

Table 6-2. Description of carbon pools in the "Disturbance Matrix Editor" window (Figs. 6-15 and 6-16)

Carbon pool name	Description
Softwood Merchantable	Carbon in the merchantable portion of softwood stem wood and stem bark (excluding tops and stumps)
Softwood Foliage	Carbon in softwood foliage
Softwood Other	Carbon in softwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
Softwood Submerchantable	By default not currently used; available as an alternate pool for use in scientific investigation of turnover rates
Softwood Coarse Roots	Carbon in live softwood coarse roots, approximately ≥ 5 mm diameter
Softwood Fine Roots	Carbon in live softwood fine roots, approximately <5 mm diameter
Hardwood Merchantable	Carbon in the merchantable portion of hardwood stem wood and stem bark (excluding tops and stumps)
Hardwood Foliage	Carbon in hardwood foliage
Hardwood Other	Carbon in hardwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
Hardwood Submerchantable	By default not currently used; available as an alternate pool for use in scientific investigation of turnover rates
Hardwood Coarse Roots	Carbon in live hardwood coarse roots, approximately ≥ 5 mm diameter
Hardwood Fine Roots	Carbon in live hardwood fine roots, approximately <5 mm diameter
Aboveground Very Fast DOM	Carbon in the L horizon with input from foliage and fine roots approximately <5 mm diameter
Belowground Very Fast DOM	Carbon in dead fine roots approximately <5 mm diameter in the mineral soil
Aboveground Fast DOM	Carbon in fine and small woody debris DOM including dead coarse roots in the forest floor, with a portion of inputs from the Other pool, and inputs from snag branches and coarse roots approximately ≥ 5 mm diameter
Belowground Fast DOM	Carbon in dead coarse roots approximately ≥ 5 mm diameter in the mineral soil
Medium DOM	Carbon in coarse woody debris DOM with input from merchantable stem wood and stem snags
Aboveground Slow DOM	Carbon in the F, H, and O horizons with input from the Aboveground Very Fast, Fast, Medium, Snag Stem Wood and Snag Branches DOM pools; slow transfer rate
Belowground Slow DOM	Carbon in humified organic matter in the mineral soil with input from the Belowground Very Fast, Belowground Fast, and Aboveground Slow pools
Softwood Stem Snag	Carbon in dead standing softwood stem wood of merchantable size, including bark; snag stem wood transfer rate
Softwood Branch Snag	Carbon in dead softwood branches, and nominally, a portion of input from the Softwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
Hardwood Stem Snag	Carbon in dead standing hardwood stem wood of merchantable size, including bark; snag stem wood transfer rate

Table 6-2. Concluded

Carbon pool name	Description
Hardwood Branch Snag	Carbon in dead hardwood branches, and nominally, a portion of input from the Hardwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
Black Carbon	Stable carbon from incomplete combustion after fire; currently not generated
Peat	Carbon in peat; currently not included in calculations
Products	Carbon directed to forest products
CO_2	Carbon emitted as carbon dioxide
CH_4	Carbon emitted as methane
CO	Carbon emitted as carbon monoxide

DOM = dead organic matter.

☞ *Tip: Adjusting the sum of values in the "Value (*100)" box*

The values listed in the "Value (*100)" box must sum to 1, but after existing transfer rates have been edited or new ones entered, the sum of the values may be greater or less than 1. If so, a bar at the bottom of the box, which normally displays in green, will display in red if the sum of values is greater than 1 or in blue if the sum of values is less than 1 and will state the sum. For example, the box may state "150.00% Used: -0.50 remaining." To correct a shortage or excess in values

Click on another value in the "Value (*100)" box and change the value so that the values in the box sum to 1

or

Right-click over a value to which the shortage should be added or from which the excess should be removed, and click on the "Add remaining value to 'carbon pool name'" box or the "Remove extra value from 'carbon pool name'" box that appears

To link a carbon pool in the "From" box to a new carbon pool in the "To" box

1. **Click on a carbon pool name in the "From" box**
2. **Place the cursor over the "To" box and right-click**

An "Add Pool" box will appear.

3. **Place the cursor over the "Add Pool" box**

A menu of carbon pools will appear.

4. **Click on the name of a carbon pool on the menu displayed**
5. **Click, pause, and click again on the zero value in the "Value (*100%)" box and type in the appropriate transfer rate**

If the sum of the values in the "Value (*100)" box is greater or less than 1, refer to the tip box "Adjusting the sum of values in the 'Values (*100)' box."

To delete a carbon pool in the "To" box

1. **Right-click on the name of the carbon pool in the "To" box**
2. **Click on the "Remove 'pool name'" box that pops up**

If the sum of the values in the "Value (*100)" box is greater or less than 1, refer to the tip box "Adjusting the sum of values in the 'Values (*100)' box."

The "Grid View" displays the same data as the "List View," but in the form of a horizontally scrollable table (Fig. 6-16). Carbon pools listed in the "From" box in the "List View" are displayed in the first column of the "Grid View" table, and carbon pools listed in the "To" box in the "List View" are displayed as column headers in the "Grid View" table. The transfer rates between specific pools appear as the points of intersection within the table. To edit any of the carbon transfer rates in the "Grid View"

1. **Click on the "Edit" button**
2. **Change transfer rate(s) in the table**
3. **Click on the "Save" button**

Copying a Disturbance Matrix

Should a user want to make a copy of a disturbance matrix associated with an open project, this can be done through the "Search for Disturbance Matrices" window (Fig. 6-14). To proceed

1. **In the "Search Results" box, click on the name of the disturbance matrix to be copied**
2. **Click on the "Edit" button**

The "Edit Disturbance Matrix" warning window (Fig. 6-14) will pop up, reminding the user that a given disturbance matrix may be associated with more than one disturbance type and that any edits made could affect carbon transfers associated with other disturbance types. The user is given the choice of making a copy of the matrix (choose this option if you want the matrix to be unique to the selected disturbance type) or proceeding to edit the original matrix (such that all disturbance types associated with the matrix will be affected). To make a copy

3. **Click on the "Yes" button**

The "Copy Disturbance Matrix" window will pop up (Fig. 6-17). This window displays the name and description of the new (copied) matrix. The user can keep the default name and description and skip to step 6 or

4. **Click on the "Name" box and enter a new name**

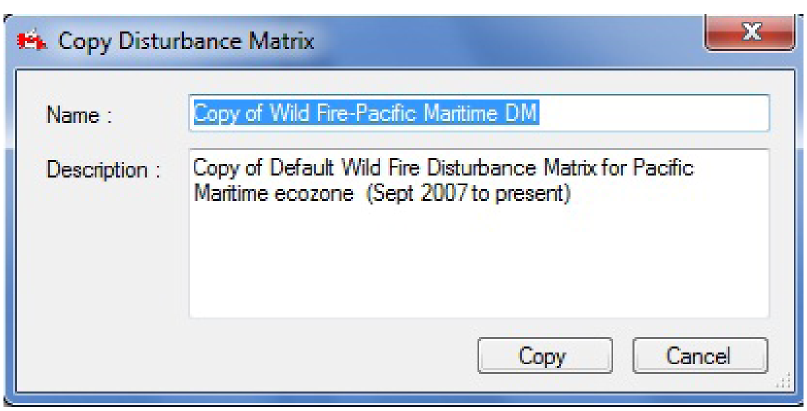


Figure 6-17. The "Copy Disturbance Matrix" window, displaying the default name and description for a copied disturbance matrix.

5. **Click on the "Description" box and enter a new description**
6. **Click on the "Copy" button to proceed**

or

Click on the "Cancel" button to terminate the process

If the user clicks on the "Copy" button, the new (copied) matrix will be created, and the "Disturbance Matrix Editor" window will pop up, displaying the new matrix for editing (for instructions, see the text following step 3 in the "Editing a Disturbance Matrix" subsection, above).

To be applied within the project, the copied matrix must first be associated with a disturbance type. Proceed to section 6.3.2 for instructions.

6.3.2 Modifying a Disturbance Matrix Association

In the "Search for Disturbance Matrices" window (Fig. 6-13), the user can modify the disturbance type with which a disturbance matrix is associated. This is usually necessary when the user creates a copy of an existing disturbance matrix and modifies it, for example, to make it more applicable to particular circumstances.

To modify a disturbance matrix association

1. **Click on the "Modify Association" button**

The "Disturbance Matrix Association" window (Fig. 6-18) will pop up. This window contains options for selecting a disturbance type and for modifying the location, annual order, and disturbance matrix associated with that disturbance type. The location refers to the SPU Group and ecozone. The annual order refers to the annual sequence in which the series of impacts will occur during the simulation. For example, if a spruce budworm disturbance is to be modeled as a series of five sequential partial-mortality disturbances commencing at time step 50, the "Annual Order" box would display "1, 2, 3, 4, 5" to indicate the 5-year ongoing disturbance, starting in time step 50 and ending in time step 54.

To modify the disturbance matrix associations for a disturbance type

2. **Click on the "Disturbance Type" drop list box and select a disturbance type**
3. **Select a different location in the "Location" box (if required)**

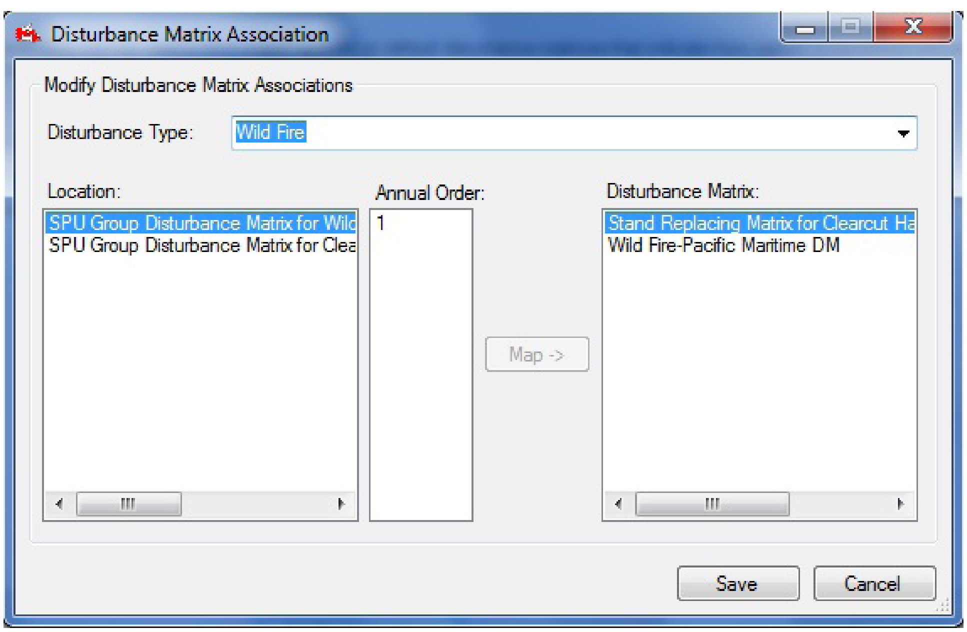


Figure 6-18. The "Disturbance Matrix Association" window.

4. **Select a different annual order in the "Annual Order" box and click on the "Map" button (if required)**
5. **Select a different disturbance matrix in the "Disturbance Matrix" box**
6. **Click on the "Save" button to proceed and then close the window**
   or
   Click on the "Cancel" button to terminate the process and close the window

6.4 Growth Curve Editor

The Growth Curve Editor can be used to create, find and view the details of, and edit growth and yield curves imported into the CBM-CFS3. Growth and yield curves in the Growth Curve Editor are, or can be, linked to Run Growth Assumptions in the Assumption Composer for Growth and Yield (Fig. 6-19).

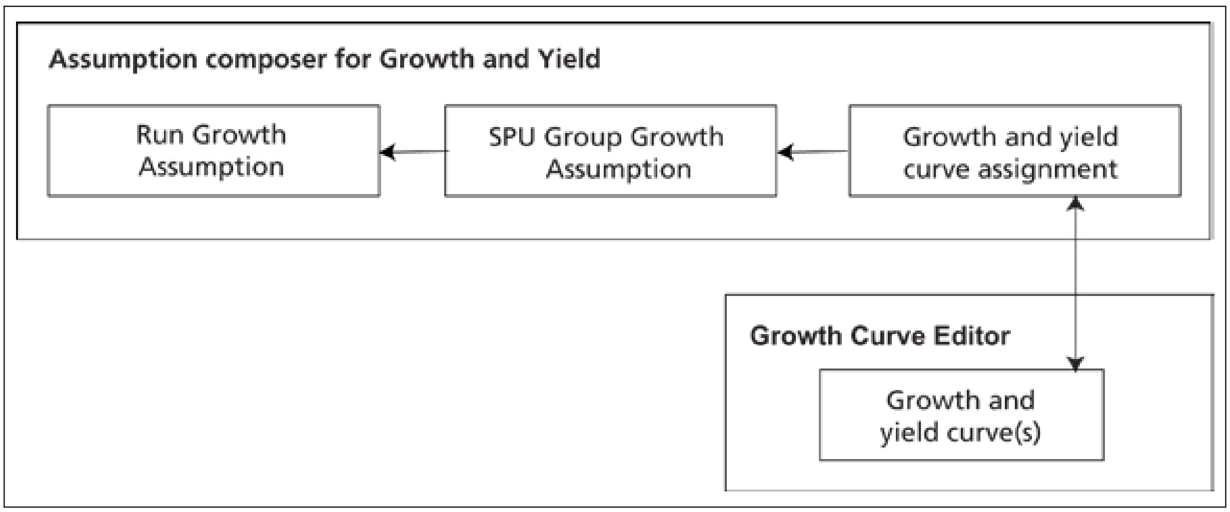


Figure 6-19. Link between the Assumption Composer for Growth and Yield and the Growth Curve Editor.

To access the Growth Curve Editor

Click on "Tools" on the menu bar of the main CBM-CFS3 window

Select "Data Editors" from the drop list that appears

Select "Growth Curve" from the side drop list that appears

The "Search for Growth and Yield Information" window (Fig. 6-20) will pop up. In this window, the user can search for and edit existing growth and yield curves or add a new growth and yield curve.

6.4.1 Searching for a Growth and Yield Curve

To locate a growth and yield curve, the user can filter the search by Default Location (SPU Group) and/or SPU Group Growth and Yield Assumption and/or Forest Type (Classifier Set). To do this

1. **Click on the "Default Location (SPU Group)" check box and select an option from the drop list that appears**
   and/or
   Click on the "SPU Group Growth and Yield Assumption" check box and select an option from

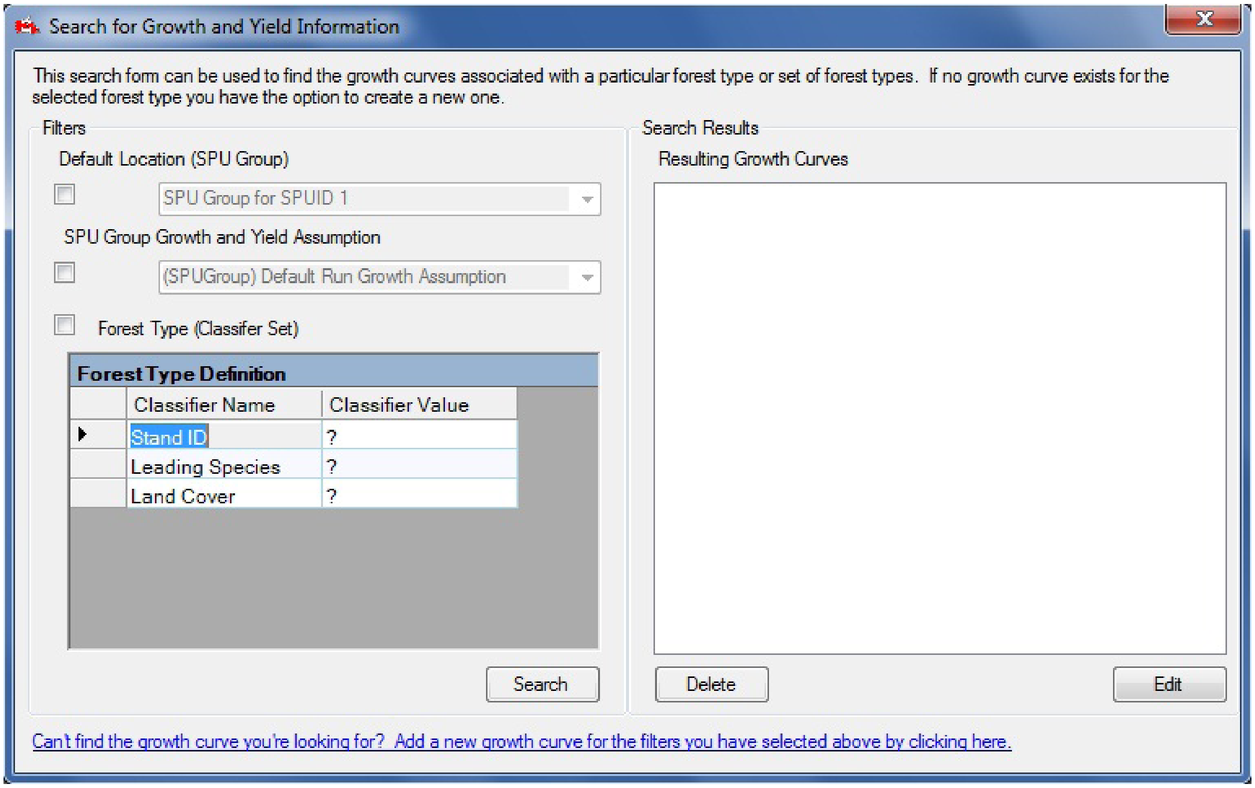


Figure 6-20. The "Search for Growth and Yield Information" window.

2. **Click on the "Search" button**

Any growth and yield curve(s) found will be displayed in the "Resulting Growth Curves" box. The user has the option of viewing and editing these growth and yield curves.

6.4.2 Editing and Viewing a Growth and Yield Curve

Once a desired growth and yield curve is displayed in the "Resulting Growth Curves" box, it can be edited. To proceed

1. **Click on the name of the curve in the "Resulting Growth Curves" box**
2. **Click on the "Edit" button**

The "Growth Curve Editor" window (Fig. 6-21) will pop up. This window can display information for a growth and yield curve in three ways: a Merchantable Volume Graph, a Biomass Carbon Graph, and a Growth Curve Details display. Growth and yield curves for merchantable volume or biomass carbon by age are displayed in a graph accompanied by a table of the data. The "Growth Curve Details" display (Fig. 6-21) shows a merchantable volume growth and yield curve for each species component by age. The "Growth Curve Details" display is used for editing data, whereas the graph displays are used for viewing data. The "Growth Curve Details" display also contains modifiable information about assumption relationships for the growth and yield curve, including the growth assumption(s) with which the curve is associated (if any) and the biomass conversion assumption associated with the curve when the Biomass Carbon Graph is displayed. Growth and yield curves can be linked to an SPU Group Growth Assumption in the Run Growth Assumption Composer (see section 7.10).

Editing a Growth and Yield Curve

To edit a growth and yield curve in the "Growth Curve Editor" window

1. **Click on the "Growth Curve Details" radio button**

To add a new species to the growth and yield curve

2. **Click on the "Available Species" box and select an option from the drop list that appears**
3. **Click on the "Add" button**

The name of the selected species will appear in the "Added Stand Species" box.

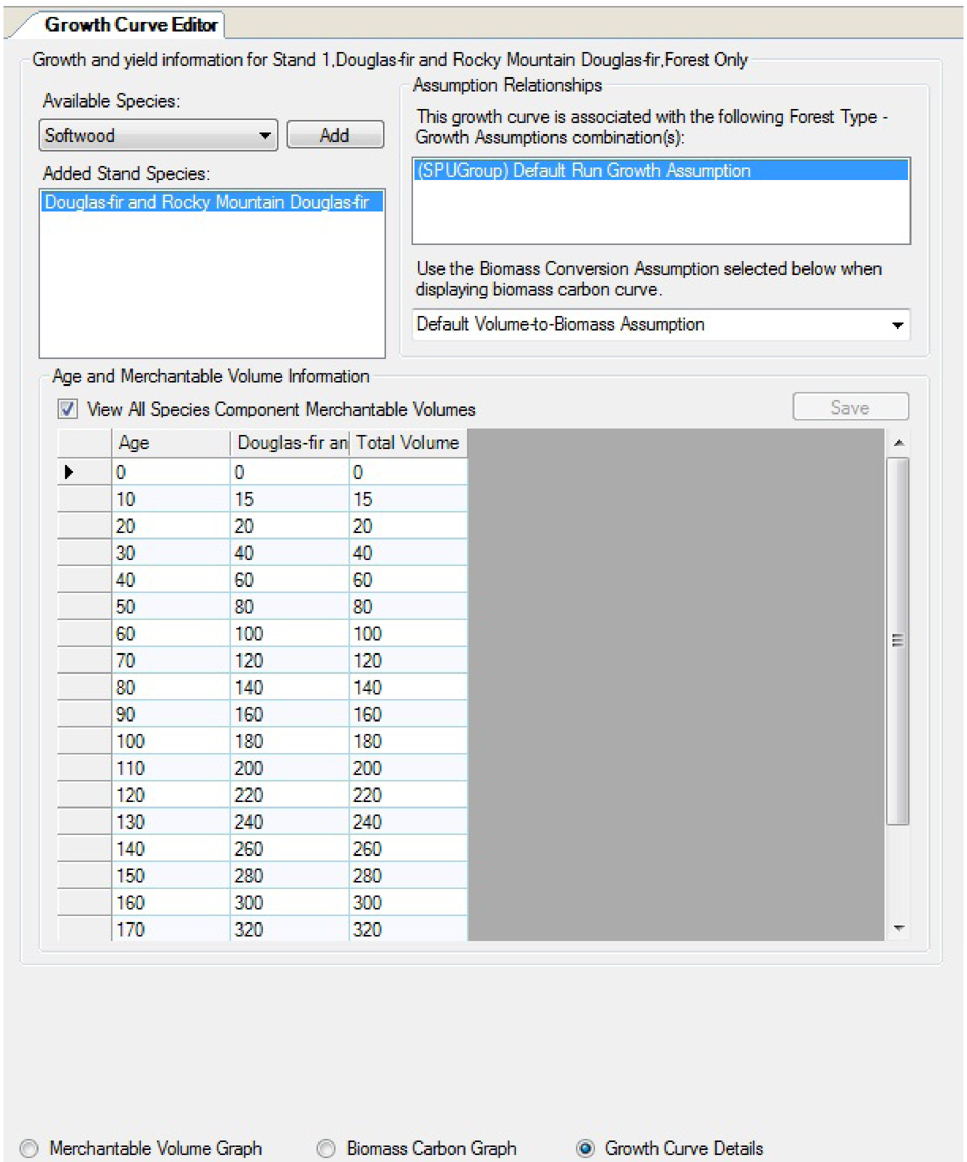


Figure 6-21. The "Growth Curve Editor" window with the "Growth Curve Details" display selected.

☞ *Tip: Deleting a species*

To remove an unwanted species from the "Added Stand Species" box

Click on the species name in the "Added Stand Species" box and press the "Delete" key on the computer keyboard

A "Delete Growth Curve Species" window will pop up asking the user to confirm deletion of the selected species.

Click on the "Yes" button to proceed

or

Click on the "Cancel" button to cancel the deletion

An age–merchantable volume table must be completed for each species appearing in the "Added Stand Species" box. To do this or to edit an existing set of age–volume pairs

4. **Click on the species name in the "Added Stand Species" box**
5. **Enter a value for merchantable volume in the "Volume" column corresponding to each age in the "Age" column**

Note: Entering a value of 0 for merchantable volume per hectare at the end of a growth curve

Within the Growth Curve Editor, it is not a problem to enter a value of zero for merchantable volume per hectare for an age class at the end of a growth curve; however, the CBM-CFS3 will ignore the zero volume entries and will carry over the last positive volume entry for an age class, either in perpetuity or until the stand or forest type is disturbed. If the user intends for volume to go to zero, the user should enter 0.01 as the volume.

6. **Click on the "Save" button**

☞ *Tip: Viewing all age–volume pairs for all species*

To view all of the age–volume pairs for all species associated with a growth and yield curve and the total volume in the "Age and Merchantable Volume Information" table

Click on the "View All Species Component Merchantable Volumes" check box, so that a check mark appears

To determine the Biomass Conversion Assumption to be used for the Biomass Carbon Graph

7. **Click on the "Use the Biomass Conversion Assumption selected below when displaying biomass carbon curve" box and select an assumption from the drop list that appears**

Viewing a Graph for a Growth and Yield Curve

To view the "Merchantable Volume Graph" (Fig. 6-22) or the "Biomass Carbon Graph" (Fig. 6-23)

Click on the "Merchantable Volume Graph" radio button or the "Biomass Carbon Graph" radio button

The "Growth Curve Editor" window will display the selected graph. The "Merchantable Volume Graph" displays the amounts of merchantable volume by age, and the "Biomass Carbon Graph" displays the amount of biomass carbon by age. Summary tables of the amounts by age are displayed below each graph. Placing the cursor over any point on a graph will highlight the associated value in the table and vice versa. The way in which both the graph and the table is displayed can be modified (see Chapter 9); however, the data represented in each can be modified only by adding (see section 6.4.3) or editing (see this section, above) the growth and yield curves in the “Growth Curve Details” display.

6.4.3 Adding a Growth and Yield Curve

To create a new growth and yield curve if a desired growth and yield curve cannot be found by the process described in section 6.4.1

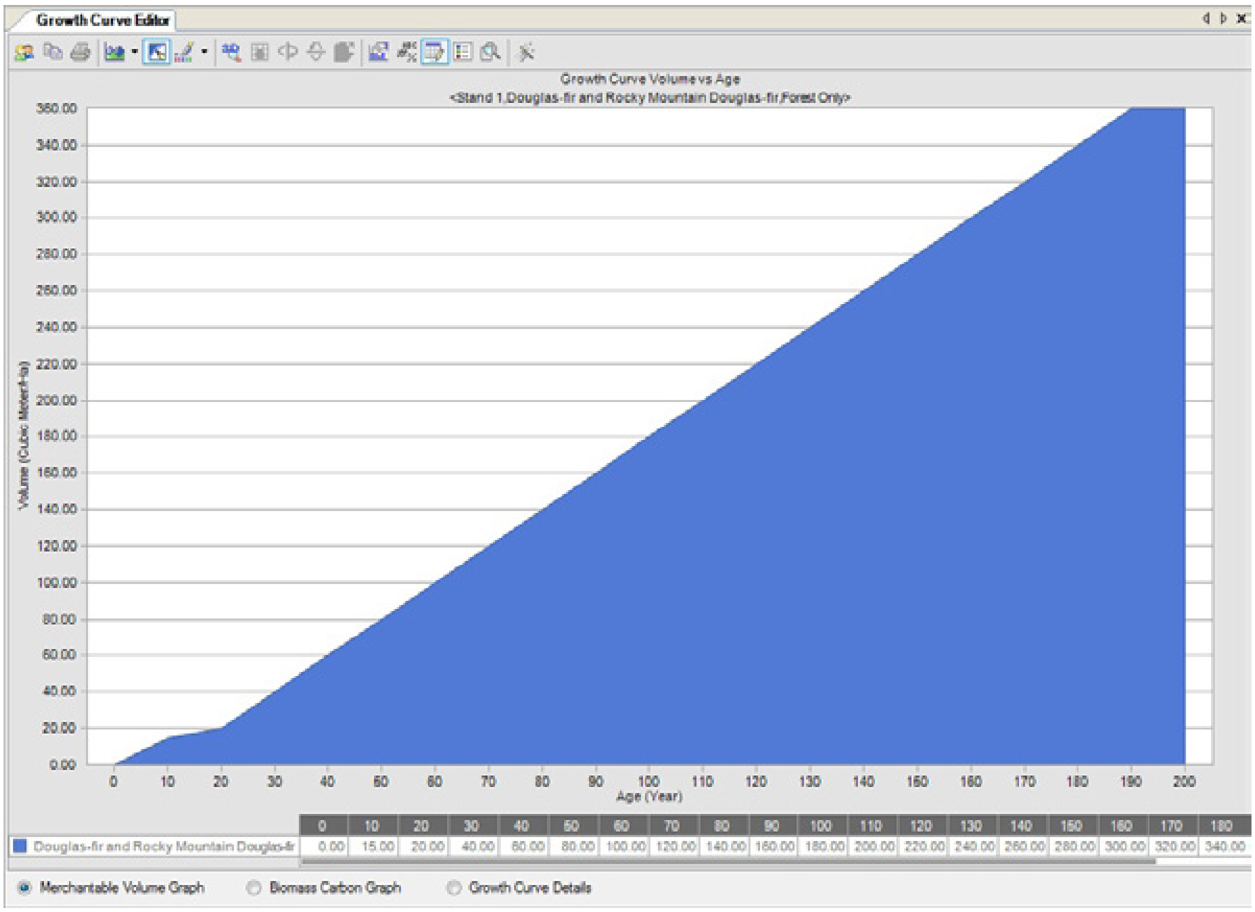


Figure 6-22. The “Growth Curve Editor” window with the “Merchantable Volume Graph” display selected.

1. **In the “Search for Growth and Yield Information” window (Fig. 6-20), click on the “Default Location (SPU Group)” check box, click on the associated drop list box, and select an option from the list that appears**

   and/or

   Click on the “SPU Group Growth and Yield Assumption” check box, click on the associated drop list box, and select an option from the drop list that appears

   and/or

   Click on the “Forest Type (Classifier Set)” check box, click on any of the cells, and select an appropriate value in the “Classifier Value” column of the “Forest Type Definition” table

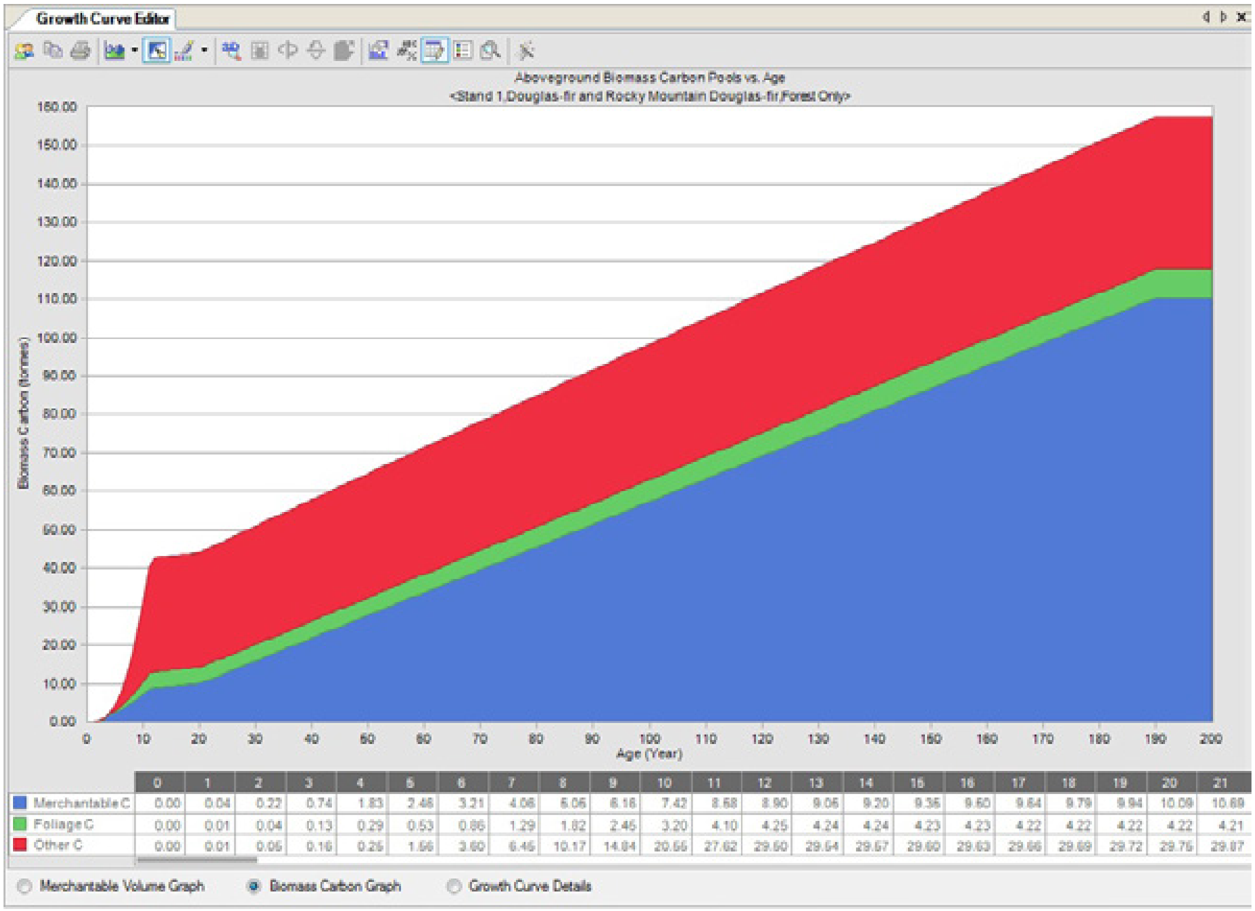


Figure 6-23. The "Growth Curve Editor" window with the "Biomass Carbon Graph" display selected.

2. Click on the "Add a new growth curve for the filters you have selected above by clicking here" link

An "Add Growth Curve" window will pop up, stating that a growth and yield curve has been created.

3. Click on the "OK" button

The "Growth Curve Editor" window (Fig. 6-21) will pop up. The user must begin by identifying the species component of the growth and yield curve that is being created.

4. Click on the "Available Species" box and select a species name from the drop list that appears

5. Click on the "Add" button

The name of the selected species will appear in the "Added Stand Species" box.

6. Click on the species name in the "Added Stand Species" box

Tip: Removing an unwanted species

To remove an unwanted species from the "Added Stand Species" box

Click on the species name in the "Added Stand Species" box and press the "Delete" key on the computer keyboard

In the "Age and Merchantable Volume Information" table

7. **Enter a value for merchantable volume in the "Volume" column corresponding to each age in the "Age" column**
8. **Click on the "Save" button**
9. **Repeat steps 4 to 8 to add more species components to the growth and yield curve**

☞ *Tip: Viewing all age–volume pairs for all species and total volume*

To view all of the age–volume pairs for all species associated with a growth and yield curve and the total volume in the "Age and Merchantable Volume Information" table

Click on the "View All Species Component Merchantable Volumes" check box, so that a check mark appears

To specify which Biomass Conversion Assumption is to be used for the Biomass Carbon Graph

10. **Click on the "Use the Biomass Conversion Assumption selected below when displaying biomass carbon curve" box and select an assumption from the drop list that appears**

The user should associate this curve with a Run Growth Assumption in the Run Growth Assumption Composer (see section 7.10).

6.5 Inventory Editor

The Inventory Editor can be used to view or edit the inventory of a project that has been opened in the CBM-CFS3.

To access the Inventory Editor window

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**
3. **Select "Inventory" from the side drop list that appears**

The "Inventory Editor" window (Fig. 6-24) will pop up. Inventory information in this window can be displayed as a graph of the area by age class with the "Graph" view (Fig. 6-24) or as a summary table of the inventory with the "Summary" view (Fig. 6-25).

6.5.1 Graph View

The "Graph" view (Fig. 6-25) displays a graph and data table of the area by age class based on the inventory that has been opened in the CBM-CFS3. To access the "Graph" view in the "Inventory Editor" window

Click on the "Graph" radio button

The graph and data table of the amount of area by age class will be displayed. Placing the cursor over any point on the graph will highlight the associated value in the table and vice versa. The way in which both the graph and the table is displayed can be modified (see Chapter 9); however, the data represented in each can be modified only by editing or changing the inventory in the "Summary" view.

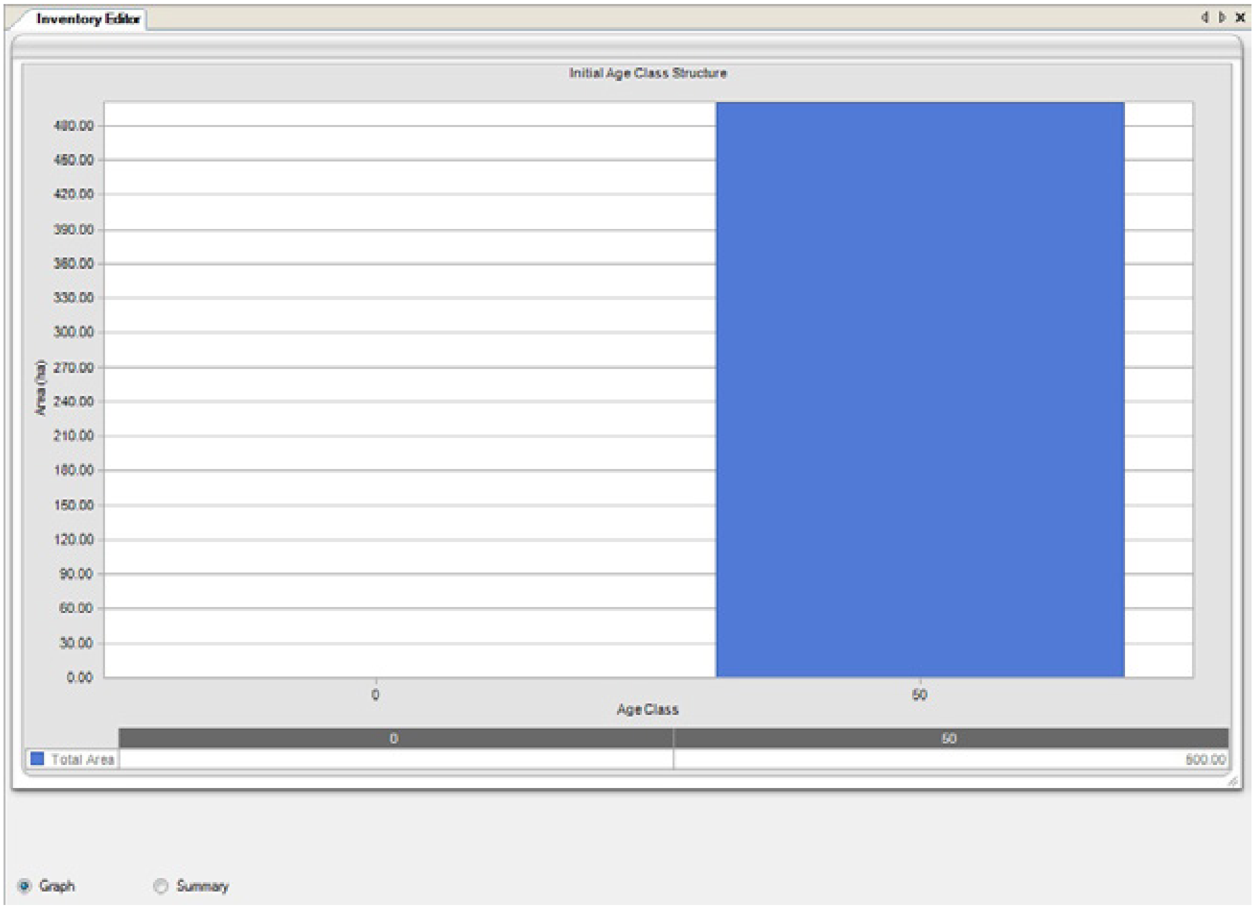


Figure 6-24. The "Inventory Editor" window with the "Graph" view selected.

6.5.2 Summary View

In the "Summary" view, the user can view, edit, or load an inventory. To access the "Summary" view (Figure 6-25) in the "Inventory Editor" window

Click on the "Summary" radio button

Viewing Inventory Data

If the inventory data for a project is linked to only one administrative boundary and one ecological boundary, all of the data will be automatically displayed in the table in the "Summary" view of the "Inventory Editor" window.

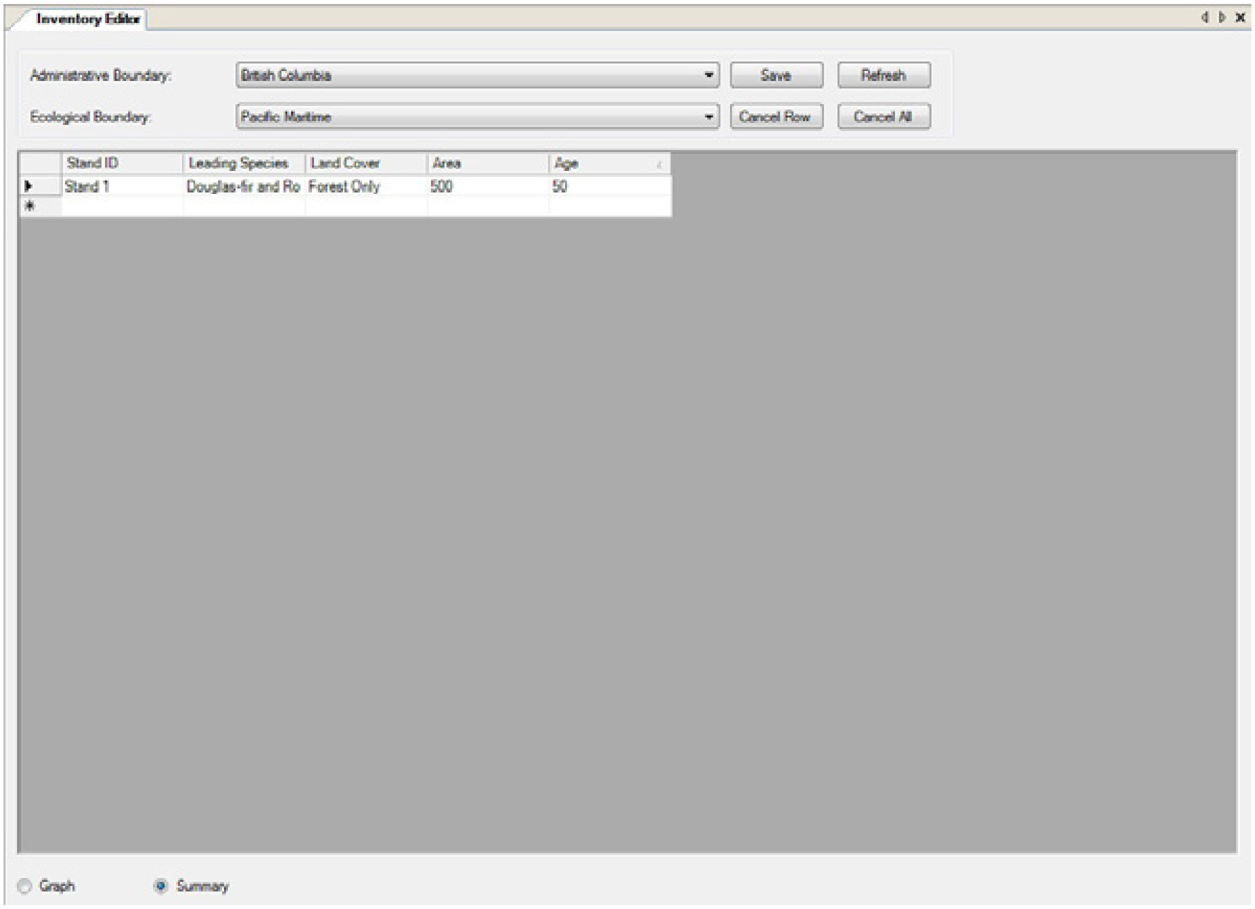


Figure 6-25. The "Inventory Editor" window with the "Summary" view selected.

If the inventory data for the project is linked to multiple administrative and/or ecological boundaries, the user can view the data for each combination. To proceed

1. **Click on the "Administrative Boundary" box and select an administrative boundary name from the drop list that appears**
2. **Click on the "Ecological Boundary" box and select an ecological boundary name from the drop list that appears**

The table will display the project data for the boundaries selected, and the user can edit the inventory data if desired.

Editing Inventory Data

To edit the inventory data for the project currently open in the CBM-CFS3 or data that have been loaded into the editor

1. **Click on the "Refresh" button**
2. **Edit the data in the inventory table**

☞ *Tip: Deleting a row of data*

To remove a row of data

Click on the gray cell next to the row containing the data
Click on the "Cancel Row" button

3. **Click on the "Save" button**
   or
   Click on the "Cancel All" button to undo any edits

If the user clicks on the "Save" button, an "Inventory Editor" window will pop up asking the user to confirm the edits

4. **Click on the "Yes" button to continue**
   or
   Click on the "No" button to cancel the edits

6.6 Transition Rules Editor

The Transition Rules Editor can be used to search for, edit, or add transition rules for any disturbances imported or created for a project. Transition rules describe the forest type(s) to which a particular forest type will convert at a particular age following a particular disturbance event. Transition rules in the Transition Rules Editor can be linked to specific assumptions in the assumption composer for Disturbance and Management (see Fig. 6-26).

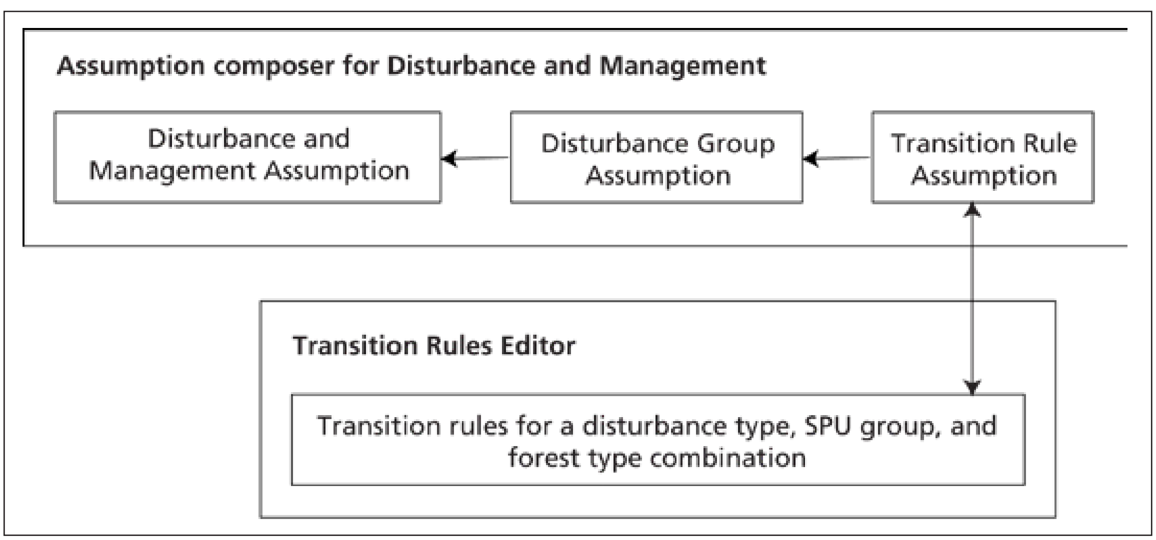


Figure 6-26. Links between the Assumption Composer for Disturbance and Management and the "Transition Rules Editor".

To access the "Transition Rules Editor" window

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**
3. **Select "Transition Rules" from the side drop list that appears**

The "Search for Transition Rule Assumptions" window (Fig. 6-27) will pop up. In this window, the user must search for existing Transition Rule Assumptions in the project database that is open. The user can then edit any transition rules within the Transition Rule Assumptions that are found or can add new transition rules. In addition, a new transition rule can be added through this window if a desired Transition Rule Assumption cannot be found through a search.

6.6.1 Searching for Transition Rule Assumptions

To locate a Transition Rule Assumption, users can filter their search by Location (SPU Group) and/or Disturbance Type. To proceed

1. **Click on the "Location (SPU Group)" check box, click on the associated drop list box, and select an option from the list that appears,**

   and/or

   Click on the "Disturbance Type" check box, click on the associated drop list box, and select an option from the drop list that appears

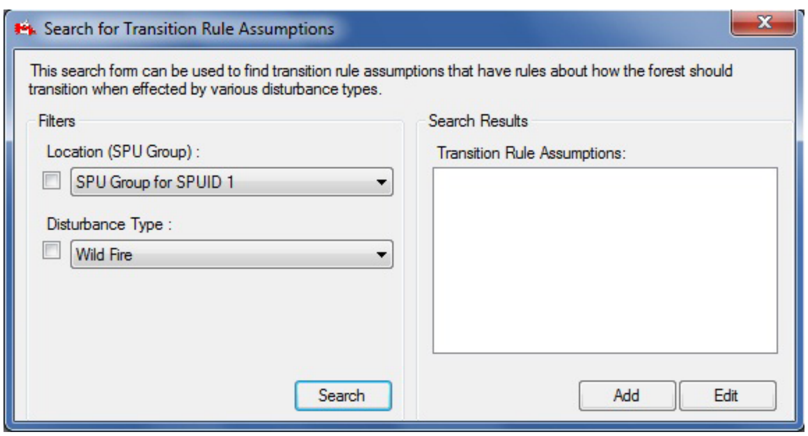


Figure 6-27. The "Search for Transition Rule Assumptions" window.

2. **Click on the "Search" button**

Any Transition Rule Assumptions found will be displayed in the "Transition Rule Assumptions" box. The user has the option of viewing and editing transition rules associated with the Transition Rule Assumption that was found or of adding a new Transition Rule Assumption.

6.6.2 Viewing and Editing Transition Rules

To view or edit an appropriate Transition Rule Assumption that has been found and displayed in the "Transition Rule Assumptions" box in the "Search for Transition Rule Assumptions" window (Fig. 6-27)

1. **Click on the name of the transition rule assumption in the "Transition Rule Assumptions" box**
2. **Click on the "Edit" button**

The "Transition Rules Editor" window (Fig. 6-28) will pop up. This window displays any existing transition rules for the selected Transition Rule Assumption (the name of which is displayed at the top of the window). A transition rule is composed of one or more forest types, each with its own hardwood and/or softwood component age ranges (affected by the disturbance), and the post-disturbance forest type(s) (the forest type[s] to which the original forest type[s] will convert following the disturbance, the age after disturbance, the proportion undergoing transition, and the regeneration delay). Users can add or delete forest types, and add, edit, or delete age ranges and the postdisturbance forest type for each forest type added to the Transition Rule Assumption. To return to the "Search for Transition Rule Assumptions" window, click on the "Return to Search" button.

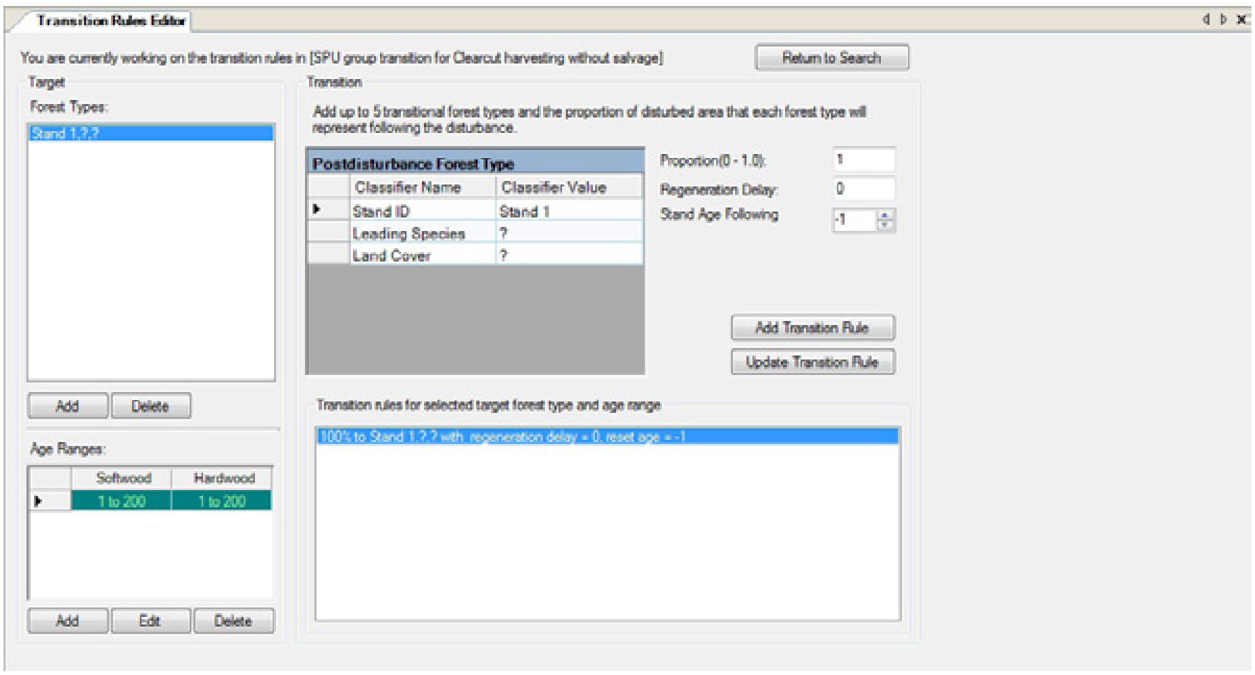


Figure 6-28. The "Transition Rules Editor" window.

Adding Forest Types

The user can add one or more forest types to the "Forest Types" box in the "Transition Rules Editor" window. Forest types that appear in this box should be eligible to be affected by the disturbance type associated with the chosen Transition Rule Assumption (the name of which is displayed at the top of the window). To add forest types to this box

1. **Click on the "Add" button below the "Forest Types" box**

The "Add/Edit Target Transition Information" window will pop up (Fig. 6-29).

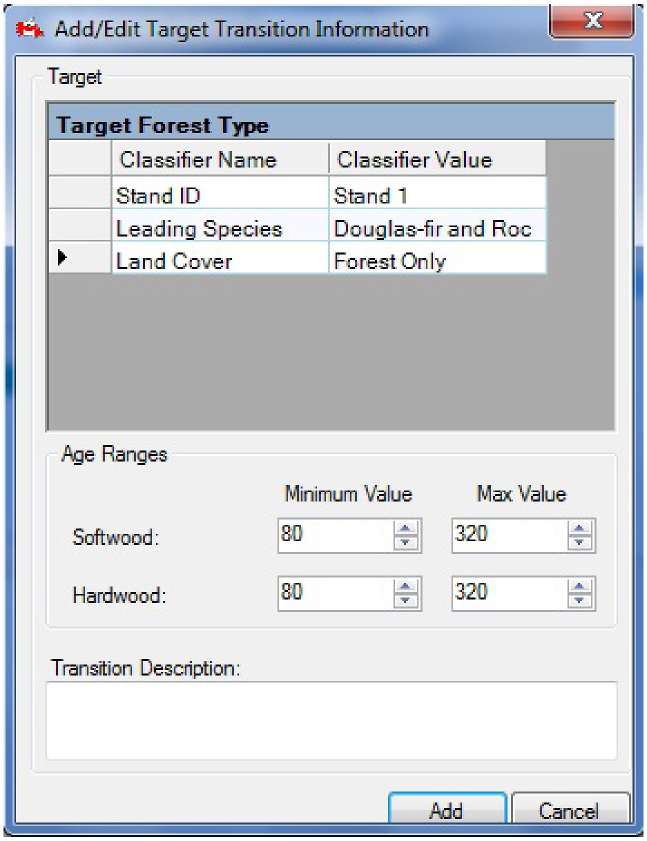


Figure 6-29. The "Add/Edit Target Transition Information" window.

To select the specific forest type

2. **Click on a cell in the "Classifier Value" column and select an option from the drop list that appears for each "Classifier Name" in the "Target Forest Type" table**

Next, the user must define the age range within the selected forest type that can be affected by the disturbance associated with the Transition Rule Assumption. To proceed

3. **Click on the arrows in the "Min Value" and "Max Value" boxes for softwood and hardwood to select minimum and maximum eligible age boundaries (optional). Note that the values entered are themselves not eligible.**
4. **Type a description in the "Description" box (optional)**
5. **Click on the "Add" button to proceed**

   or

   Click on the "Cancel" button to cancel the addition

If the user clicks on the "Add" button, the "Add/Edit Target Transition Information" window will close. The new forest type will appear in the "Forest Types" box, and the age ranges will appear in the "Age Ranges" box in the "Transition Rules Editor" window.

Deleting Forest Types

To delete forest types appearing in the "Forest Types" box in the "Transition Rules Editor" window that are not affected by the disturbance type associated with the chosen Transition Rule Assumption (the name of which is displayed at the top of the window)

1. **Click on the name of a forest type in the "Forest Types" box**
2. **Click on the "Delete" button under the "Forest Types" box**

A "Delete Record" window will pop up asking the user to confirm deletion of the forest type.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

If the user clicks the "Yes" button, the selected forest type, along with its associated age class ranges and transition rules, will be removed from the "Transition Rules Editor" window.

Adding Age Ranges

Each forest type in the "Forest Types" box in the "Transition Rules Editor" window must be associated with an age range representing the period of time that the forest type is eligible for the disturbance type associated with the chosen Transition Rule Assumption (the name of which is displayed at the top of the window) (Fig. 6-28).

To add an age range (if such was not added when the forest type was added or if additional age ranges are required)

1. **Click on a forest type in the "Forest Types" box**
2. **Click on the "Add" button below the "Age Ranges" table**

The "Add/Edit Target Transition Information" window will pop up (Fig. 6-29).

Note: Editing Forest Type

Although forest type and a transition description are displayed along with age range information in the "Add/Edit Target Transition Information" window, these fields cannot be edited until the "Forest Types" table is enabled. To edit a forest type, the user must click on the "Add" button under the "Forest Types" table in the "Transition Rules Editor" window. The "Add/Edit Target Transition Information" window will pop up with forest type enabled.

In the "Age Ranges" box, the user can enter boundary age ranges for both softwood and hardwood components of forest types. "Min Value" is the lowest age boundary of the selected forest type after which it will be eligible for the disturbance associated with the selected Transition Rule Assumption, and "Max Value" is the highest age boundary of the selected forest type before which it will be eligible for the disturbance associated with the selected Transition Rule Assumption. Note that the values entered are themselves not eligible.

3. **Click on the arrows in the "Min Value" and "Max Value" boxes for the softwood component to select an appropriate age range**

   and/or

   Click on the arrows in the "Min Value" and "Max Value" boxes for the hardwood component to select an appropriate age range
4. **Click on the "Add" button to proceed**

   or

   Click on the "Cancel" button to cancel the addition

If the user clicks on the "Add" button, the "Add/Edit Target Transition Information" window will close. The new age range(s) will appear in the "Age Ranges" table and the forest type with which they are associated will be highlighted in the "Forest Types" box.

Editing Age Ranges

To edit an existing age range associated with a forest type in the "Forest Types" box in the "Transition Rules Editor" window

1. **Click on a forest type in the "Forest Types" box**
2. **Click on the gray cell next to the row containing the age range to be edited in the "Age Ranges" table**
3. **Click on the "Edit" button**

The "Add/Edit Target Transition Information" window will pop up (Fig. 6-29).

Note: Editing Forest Type

Although forest type and a transition description are displayed along with age range information in the "Add/Edit Target Transition Information" window, these fields cannot be edited until the "Forest Types" table is enabled. To edit forest type, the user must click on the "Add" button under the "Forest Types" table in the "Transition Rules Editor" window. The "Add/Edit Target Transition Information" window will pop up again with forest type enabled.

4. **Click on the arrows in the "Min Value" and "Max Value" boxes for the softwood component to edit the age ranges**

   and/or

   Click on the arrows in the "Min Value" and "Max Value" boxes for the hardwood component to edit the age ranges
5. **Click on the "Update" button to proceed (the "Update" button replaces the "Add" button in Fig. 6-30)**

   or

   Click on the "Cancel" button to cancel the edits

If the user clicks on the "Update" button, the "Add/Edit Target Transition Information" window will close. The edited age range(s) will appear in the "Age Ranges" table and the forest type with which they are associated will be highlighted in the "Forest Types" box.

Deleting Age Ranges

To delete an age range associated with a forest type appearing in the "Forest Types" box in the "Transition Rules Editor" window

1. **Click on a forest type in the "Forest Types" box**
2. **In the "Age Ranges" table, click on the gray cell beside the age range to be deleted**
3. **Click on the "Delete" button under the "Age Ranges" table**

A "Delete Record" window will pop up asking the user to confirm deletion of the age ranges.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

Adding Transition Rules

A transition rule describes the change in forest type that results from a disturbance or management event. The postdisturbance forest type is the forest type to which the target (original) forest type will convert (if different from the original) after a disturbance event or management activity. To add a Target Forest Type in the "Transition Rules Editor" window (Fig. 6-28)

1. **Click on a forest type in the "Forest Types" box**

Note: Transitions back to the target forest type

It is not necessary to add a postdisturbance forest type if the target forest type converts back to the same forest type following disturbance. In this situation, the same forest type will automatically appear in the "Transition Rules for Selected Target Forest Type and Age Range" box.

To select the forest type that will result following the disturbance

2. **In the "Postdisturbance Forest Type" table, click on each row associated with a classifier name in the "Classifier Value" column, and select an option from the drop list that appears**

Next, the user must enter the proportion (e.g., 0.2 for 20%) of the target forest type that will become the postdisturbance forest type. To proceed

3. **Enter a proportion in the "Proportion" box**

Note: Entering a proportion

If only one postdisturbance forest type is created for the target forest type, the proportion is 100% and the value entered must be 1. If more than one postdisturbance forest type is created for the target forest type, the proportions entered must sum to 1. If the proportions sum to less than 1, then the remainder is assumed to transition back to the predisturbance forest type.

To enter the regeneration delay for the postdisturbance forest following the disturbance

4. **Enter a number of years in the "Regeneration Delay" box (must be a positive value)**

Next, the user must select, on the growth and yield curve for the postdisturbance forest type, the age at which the postdisturbance forest type will begin growing. For example, target forest types burned in a wildfire may convert to postdisturbance forest types at age zero, whereas target forest types that are commercially thinned may convert to postdisturbance forest types at age 25. If the user enters a value of −1, this will indicate no change in age following disturbance; however, if the disturbance type associated with the transition rule is a stand-replacing disturbance type, the −1 value will be ignored by the model, and the age will be set to zero following disturbance. To proceed

5. **Click on the arrows in the "Stand Age following Transition" box to select an age (if required)**
6. **Click on the "Add Transition Rule" button**

The new transition rule will appear in the "Transition Rules for Selected Source Forest Type and Age Range" box.

Editing Transition Rules

Existing transition rules for a target forest type will appear in the "Transition Rules for Selected Source Forest Type and Age Range" box. To edit an existing transition rule for a target forest type in the "Forest Types" box (Fig. 6-28)

1. **Click on a forest type in the "Forest Types" box**
2. **Click on a transition rule in the "Transition Rules for Selected Source Forest Type and Age Range" box**

The user can then proceed through a number of optional steps to edit the transition rule. In the "Postdisturbance Forest Type" table

3. **Click on each row associated with a classifier name in the "Classifier Value" column, and select an option from the drop list that appears**
4. **Enter a new proportion in the "Proportion" box**

Note: Entering a proportion

If only one postdisturbance forest type is created for the target forest type, the proportion is 100% and the value entered must be 1. If more than one postdisturbance forest type exists, the proportions entered must sum to 1.

5. **Enter a new number in the "Regeneration Delay" box**
6. **Click on the arrows in the "Stand Age following Transition" box to select a new age**
7. **Click on the "Update Transition Rule" button**

   or

   Right-click over the transition rule in the "Transition Rules for Selected Source Forest Type and Age Range" box and click "Update" on the menu that appears

Deleting Transition Rules

To delete an existing transition rule

1. **Click on a target forest type in the "Forest Types" box (Fig. 6-28)**
2. **Right-click over a transition rule in the "Transition Rules for Selected Source Forest Type and Age Range" box**
3. **Click "Delete" on the menu that appears**

A "Delete Record" window will pop up asking the user to confirm deletion of the transition rule.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion process

If any transition rules remain in the "Transition Rules for Selected Source Forest Type and Age Range" box, the user will need to update the proportions for each so that 100% of the target forest type is accounted for in transitions to the postdisturbance forest types.

6.6.3 Adding Transition Rule Assumptions

Users who do not find an appropriate Transition Rule Assumption through a search in the "Search for Transition Rule Assumptions" window (Fig. 6-27) have the option of creating a new Transition Rule Assumption. To do this in the "Search for Transition Rule Assumptions" window

Click on the "Add" button

This will cause the "Disturbance & Management" tab (see Fig. 7-15 in Chapter 7) of the "Assumption Composers" window to pop up. On the "Transition Rule Assumption" tab (see Fig. 7-17 in Chapter 7), the user must create a new Transition Rule Assumption (see section 7.9.9). Once the new Transition Rule Assumption has been created, the user can add transition rules to the assumption, either by clicking the "Add/Edit Transition Rules" button on the "Transition Rule Assumption" tab or by returning to the "Search for Transition Rule Assumptions" window, searching for the new assumption, and then editing the rules.

6.7 Default Input Data Editor

The Default Input Data Editor can be used to add, edit, or copy default disturbances or tree species (and their biomass parameters) in the model. In addition, user-created disturbance types can be deleted with this editor. The Default Input Data Editor can be accessed at any time, and when it is accessed, any open project will be closed. Any changes applied while in the editor will apply to all projects created thereafter. To access the "Default Input Data Editor" window (Fig. 6-30)

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Data Editors" from the drop list that appears**
3. **Select "Default Input Data Editor" from the side drop list that appears**

The "Default Input Data Editor" window will pop up. This window can be closed by clicking the "Close" button.

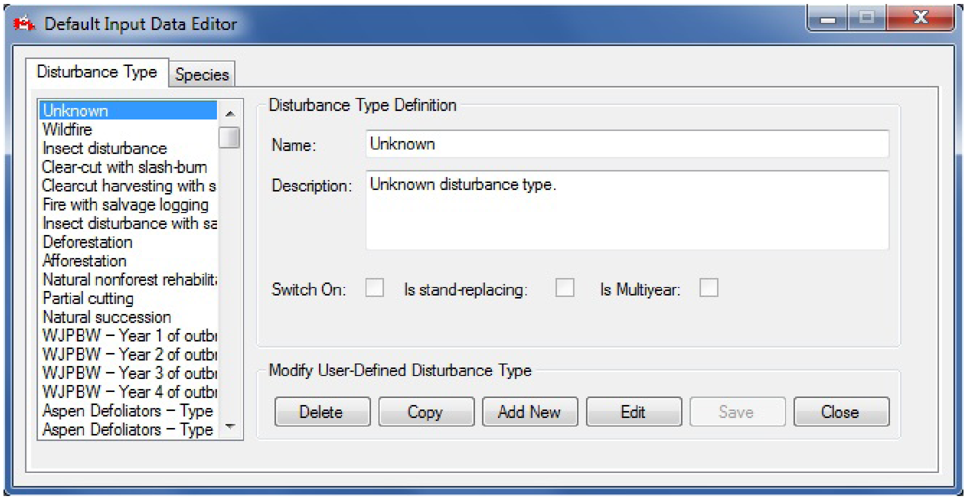


Figure 6-30. The "Default Input Data Editor" window with the "Disturbance Type" tab selected.

6.7.1 Adding a Disturbance Type

To add a default disturbance type

1. **Click on the "Disturbance Type" tab**
2. **Click on the "Add New" button**
3. **Enter a name in the "Name" box**
4. **Enter a description in the "Description" box**
5. **Click on the "Switch On" check box to turn the disturbance on**
6. **Click on the "Is Multi Year" check box to indicate that the disturbance can occur in more than one year (if required)**
7. **Click on the "Is Stand Replacing" check box to indicate that the disturbance completely removes a stand and returns the age class to zero (if required)**
8. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to cancel the addition

If the user clicks on the "Save" button, the new default disturbance type will be added to the box listing default disturbance types, and the "Search for Disturbance Matrices" window (Fig. 6-13) will pop up so that the user can proceed to edit the disturbance matrices associated with this new disturbance type, for each ecozone. To learn how to edit the disturbance matrices for the new disturbance type, see section 6.3.1.

6.7.2 Editing a Disturbance Type

To edit a disturbance type

1. **Click on the "Disturbance Type" tab in the "Default Input Data Editor" window (Fig. 6-30)**
2. **Click on a disturbance type in the box listing all disturbance types**
3. **Click on the "Edit" button**
4. **Make the necessary edits to the "Name" and "Description" boxes and any applicable check boxes**
5. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to cancel the edits

6.7.3 Copying a Disturbance Type

To copy a disturbance type

1. **Click on the "Disturbance Type" tab (Fig. 6-30)**
2. **Click on a disturbance type in the box listing all disturbance types**
3. **Click on the "Copy" button**

The "Search for Disturbance Matrices" window (Fig. 6-13) will pop up. In the "Default Input Data Editor" window, the copied disturbance type will appear in the box listing disturbance types. To change the name or description of the copied disturbance type, the user can edit the disturbance type (see section 6.7.2 and ensure that the "Switch On," the "Is Multi Year," and/or the "Is Stand-Replacing" check boxes are checked, as required). Once all of the edits are completed, the user will need to turn their attention to the "Search for Disturbance Matrices" window. This window will display a copy of the disturbance matrix for each ecozone, and the user has the option of editing any or all of their associated matrices. For more information on how to select and edit a disturbance matrix, see section 6.3.1.

6.7.4 Deleting a Disturbance Type

Any disturbance type that the user has created can also be deleted, but model default disturbance types cannot be deleted. To delete a user-created disturbance type

1. **Click on the name of the disturbance type in the box containing the list of disturbances on the "Disturbance Type" tab of the "Default Input Data Editor" window (Fig. 6-30)**
2. **Click on the "Delete" button**

A "Delete Disturbance Type" window will pop up asking the user to confirm deletion of the selected disturbance type.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

If the user clicks on the "Yes" button, the disturbance type will be deleted and any associated disturbance matrices will also be deleted.

6.7.5 Adding a Default Tree Species

To add a default tree species

1. **Click on the "Species" tab (Fig. 6-31)**

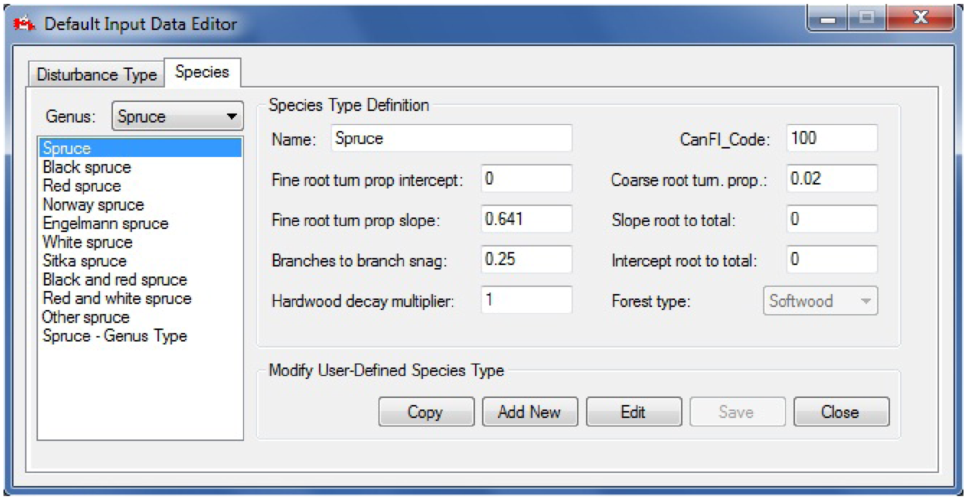


Figure 6-31. The "Default Input Data Editor" window with the "Species" tab selected.

2. **Click on the "Genus" box and select a genus from the drop list that appears**
3. **Click on the "Add New" button**
4. **Enter the tree species name in the "Name" box**

Next, the user must enter the Canadian Forest Inventory (CanFI) code for the species (see Appendix 13, Canadian Forest Inventory Codes for Tree Species).

5. **Enter the CanFI code in the "CanFI_Code" box**

Note: Slope and intercept parameters disabled

Although the "Fine root turn prop intercept," "Fine root turn prop slope," "Slope root to total," and "Intercept root to total" boxes display default values and can be edited, these parameters are currently not applied in model calculations.

To enter the coarse root turnover proportion, representing the proportion (from 0 to 1) of coarse root biomass carbon that transfers to the fast belowground DOM pool annually

6. **Enter a proportion in the "Coarse root turn prop" (coarse root turnover proportion) box**

To enter the branch biomass to branch snags proportion, representing the proportion (from 0 to 1) of branch turnover that transfers to the branch snag pool annually

7. **Enter a proportion in the "Branches to branch snag" box**

To enter the hardwood decay multiplier, a number (from 0 to a maximum defined by the user) that can be used to increase or decrease decay rates of DOM pools for hardwood relative to softwood

8. **Enter a multiplier in the "Hardwood decay multiplier" box**
9. **Click on the "Forest type" box and select a type from the drop list that appears**
10. **Click on the "Save" button to proceed**

    or

Click on the "Cancel" button to cancel the addition

If the user clicks on the "Save" button, the new default species type will appear in the box listing species.

6.7.6 Editing a Default Tree Species

To edit a default tree species

1. **Click on the "Species" tab (Fig. 6-31)**
2. **Click on the "Genus" box and select a genus from the drop list that appears**
3. **Click on a tree species name in the box listing tree species**
4. **Click on the "Edit" button**
5. **Make the required modifications to any of the Species Type Definition options**
6. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to cancel the edits

6.7.7 Copying a Default Tree Species

To copy a default tree species

1. **Click on the "Genus" box and select a genus from the drop list that appears (Fig. 6-31)**
2. **Click on the name of a tree species in the box listing tree species**
3. **Click on the "Copy" button**

The copied tree species will appear in the box listing tree species, where it will be named as a copy (e.g., "Copy of Trembling Aspen"). Users can edit the name, associated data, and parameters of the copy (as described in section 6.7.6).

CHAPTER 7

RUNNING SIMULATIONS AND BUILDING ASSUMPTIONS

The preceding chapters have described how to import data into a project, manage a project, edit the data used to create a project, and run the default simulation created when a project is first generated. This chapter provides additional information about the Simulation Scheduler and its functions and introduces and describes the Assumption Composer Tools.

When the user imports data into a CBM-CFS3 project, the model uses that information to create default assumptions about a variety of parameter sets, including stand initialization (in terms of biomass and dead organic matter [DOM] carbon), biomass turnover, climate, DOM turnover, disturbance matrices, disturbance and management events, growth and yield, and volume-to-biomass conversion. In addition, the model creates assumptions about how the various parameter set assumptions will be combined to form project run- and simulation-level assumptions. When the user schedules a simulation assumption in the Simulation Scheduler, the model uses the parameter sets referenced by the various assumptions associated with the simulation assumption to inform the simulation. Before or after a project simulation, the default assumptions can be viewed and modified in any of the Assumption Composer tools or new assumptions can be created for application to the project data. Several of the Assumption Composer tools, specifically those for disturbance matrices, disturbance and management, growth and yield, and climate, are linked to specific data-editing tools (Fig. 1-4), so that specific assumptions can be created using specific data from specific data editors.

Figure 7-1 displays the assumptions hierarchy. The Simulation Assumption is at the top and dictates the entire assumption selection for a given simulation.

- A ***Simulation Assumption*** is composed of a Stand Initialization Assumption and a CBM Run Assumption.
- A ***Stand Initialization Assumption*** is composed of 10 underlying default and/or user-defined assumptions (Figure 7-1). During a simulation, these assumptions inform the modeling of the forest ecosystem carbon dynamics that generate the initial (time step 0) carbon pools for all stands.
- A ***CBM Run Assumption*** is composed of 9 underlying default and/or user-defined assumptions (Fig. 7-1). During a simulation, these assumptions inform the modeling of the forest ecosystem carbon dynamics that simulate the carbon pools and transfers for all stands for time step 1 and beyond.

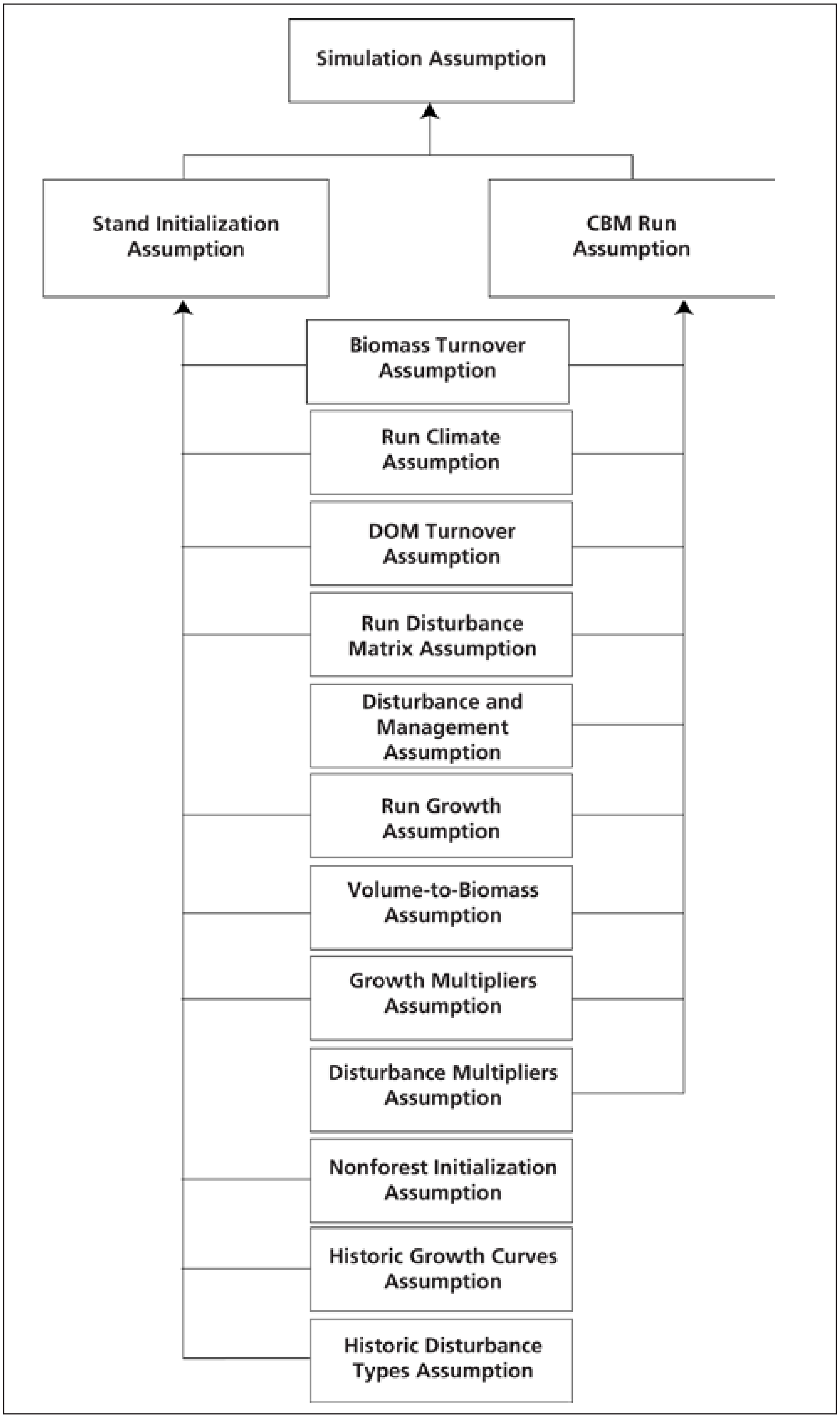


Figure 7-1. The hierarchy of assumptions (default or user-defined) in the CBM-CFS3.

Most of the run-level assumptions that are used to construct a Stand Initialization or CBM Run assumption are composed of one or more regional-level (SPU Group) assumptions.

- A **Biomass Turnover Assumption** contains biomass turnover parameter settings for all tree species.
- A **Run Climate Assumption** (also referred to as an SPU Group Climate Assumption) is linked to the regional mean annual temperature and precipitation data by time step.
- A **DOM Turnover Assumption** contains DOM turnover parameters and decay rates.
- A **Run Disturbance Matrix Assumption** is composed of one or more SPU Group Disturbance Matrix Assumptions, each of which is an association of an SPU Group ID, a disturbance type, and a disturbance matrix.
- A **Disturbance and Management Assumption** is composed of human and natural disturbance events that occur on a land base and their transition rules.
- A **Run Growth Assumption** is composed of one or several SPU Group Growth Assumptions linked to growth–and-yield curves in the Growth Curve Editor (see Figure 6-21).
- A **Volume-to-Biomass Assumption** is composed of both volume-to-biomass parameters and biomass-to-carbon parameters.
- A **Growth Multipliers Assumption** defines the relation between groups of growth curves and growth multipliers. All growth curves used in a simulation must be accounted for in an assumption of this type.
- A **Disturbance Multipliers Assumption** is composed of one or more disturbance groups and a disturbance multiplier.
- A **Nonforest Initialization Assumption** is composed of an inventory group, nonforest DOM carbon pool values, nonforest biomass carbon pool values, and United Nations Framework Convention on Climate Change (UNFCCC) flags.
- **Historic Growth Curves Assumptions** are composed of one or more historic growth curve groups, each linked to a set of historic growth curves and last-pass growth curves.
- **Historic Disturbance Types Assumptions** are composed of one or more historic disturbance type groups, each linked to a set of historic disturbance types and last-pass disturbance types.

When putting together a set of assumptions for a simulation, the user should build from the bottom up, starting by modifying the underlying assumptions of interest, then creating a new Stand Initialization Assumption and CBM Run Assumption to assemble the underlying assumptions, and finally creating a new Simulation Assumption. The user can then proceed to the "Simulation Scheduler" (Fig. 3-41) to run this new simulation through the CBM-CFS3.

The Assumption Composer Tools can be used to create, edit, copy, delete, and view assumptions. In the "Assumption Composers" window, the user can click from one assumption composer tab to another and can use (by clicking) the scroll arrow buttons at the top of the window to view all of the tabs.

7.1 Simulation Scheduler

To run imported data through the model under the default assumptions created by the CBM-CFS3, the user must use the Simulation Scheduler. To proceed

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Simulation Scheduler" from the drop list that appears**

When the "Simulation Scheduler" window (Fig. 3-41) opens, the names of the Simulation Assumption(s) that have been created and/or any default Simulation Assumption(s) should appear in the "Available Simulations" box.

Note: Displaying simulations that have already been processed

By clicking the "Display unqueued simulations" check box, the user can choose to display only Simulation Assumptions that have already been processed by the CBM-CFS3. If the user clicks on a Simulation Assumption name in the "Available Simulations" box, the details about the simulation will appear on the "Simulation Details" tab (Fig. 3-41). Details of the Stand Initialization Assumption (Fig. 7-2) and the CBM Run Assumption (Fig. 7-3) can be viewed by clicking on the appropriate tabs in the "Simulation Scheduler" window.

Several command buttons also appear in the "Simulation Scheduler" window: the "Run" button "Close" button, "Reload" button, "Reset Selected" button, "Reset All" button, and "Show Logs" button. Use of the "Run" button is discussed in Chapter 3, Section 3.5.

To reconnect the "Simulation Scheduler" to the Archive Index Database (to allow verification of whether any new Simulation Assumptions have been added and to add them to the "Available Simulations" box in the "Simulation Scheduler" window)

Click on the "Reload" button

To close the "Simulation Scheduler" window

Click on the "Close" button

To rerun a Simulation Assumption that has been run before

1. **Click on the "Display unqueued simulations" check box**

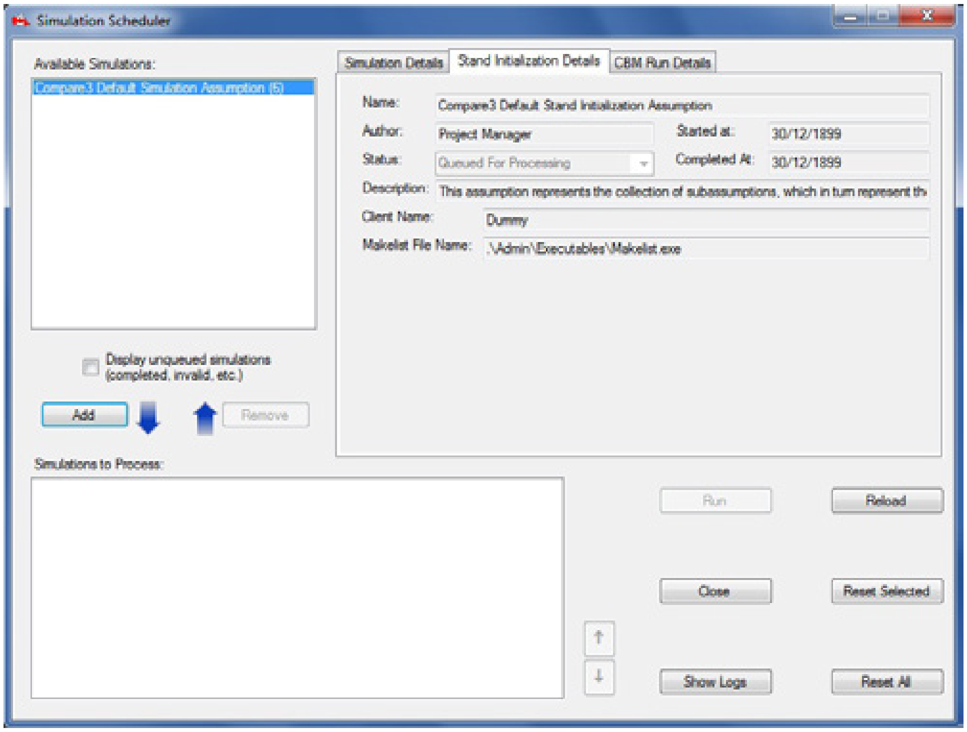


Figure 7-2. The "Simulation Scheduler" window with the "Stand Initialization Details" tab selected.

2. **In the "Available Simulations" box, click on the name of a Simulation Assumption that failed or is to be rerun**
3. **Click on the "Reset Selected" button**

Note: Not using the "Reset Selected" button

If the user does not click on the "Reset Selected" button before the "Add" button, a pop-up window will appear stating, "Warning; you have chosen completed or failed simulations. Clicking 'Run' will replace any previous results." To proceed

Click on the "OK" button

4. **Remove the check mark from the "Display unqueued simulations" check box.**
5. **Click on the "Add" button**

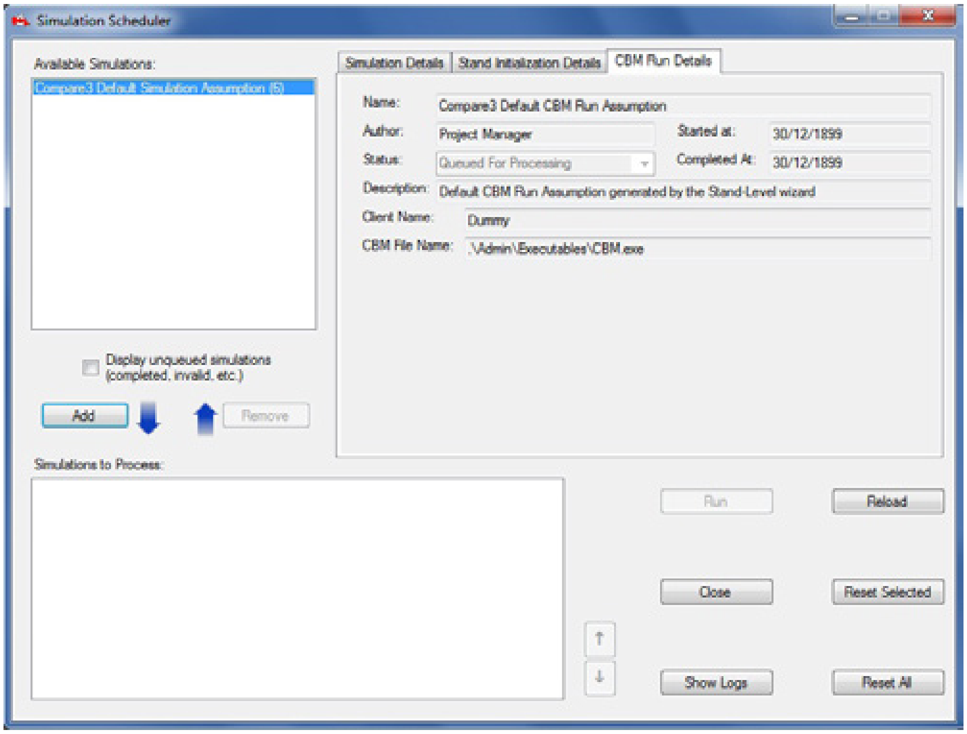


Figure 7-3. The “Simulation Scheduler” window with the “CBM Run Details” tab selected.

6. **Click on the “Run” button**

To reset all Simulation Assumptions for a project as “Queued for Processing”

Click on the “Display unqueued simulations” check box

Click on the “Reset All” button

Remove the check mark from the “Display unqueued simulations” check box

To make the “Message” window (Fig. 5-3) pop up

Click on the “Show Logs” button

7.1.1 Selecting and Running a Simulation

To select a Simulation Assumption and run it through the model

1. **Click on the Simulation Assumption name in the “Available Simulations” box**
2. **Click on the “Add” button**

Note: Adding new simulations with modified default data

If the user modifies the data underlying an assumption within a project that has already been run and wants to rerun the simulation, then the status of the simulation must be changed. When the name of the simulation is added to the list of simulations to be run, a pop-up window will appear, stating, “Warning: you have chosen completed or failed simulations. Clicking ‘Run’ will replace any previous results.” To proceed

Click on the “OK” button

3. **Click on the “Run” button**

The model will begin to process the user's simulation. Whether or not the simulation is successful, a window will pop up stating, "Successfully completed # of # selected simulations," where the numbers displayed will represent the number of simulations that were successfully processed through the model and the number of simulations that the user chose to run at once.

4. **Click on the "OK" button**

If the simulation is successful, the user can analyze results by creating and/or examining views for the processed data (see Chapter 8). If the simulation is unsuccessful, the user should consult the "Message" window (Fig. 5-3) to identify the problem. After the problem is corrected, the user must reset the simulation status before rerunning the simulation.

7.1.2 Removing a Simulation from Processing

If the user mistakenly adds the wrong Simulation Assumption to the "Simulations to Process" box

1. **Click on the Simulation Assumption name in the "Simulations to Process" box**
2. **Click on the "Remove" button**

7.2 Composing Simulation Assumptions

A Simulation Assumption is the top assumption for a project (Fig. 7-1) and dictates the entire assumption selection for a given simulation. It is composed of a Stand Initialization Assumption and a CBM Run Assumption, which in turn are composed of underlying assumptions. If any new assumptions are created that can feed into a Simulation Assumption (Fig. 7-1), the user must also create a new Simulation Assumption that uses these underlying assumptions, so that they can be run in the Simulation Scheduler.

To access the Assumption Composer for Simulations

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Simulation" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-4) will pop up, displaying the "Simulation" tab.

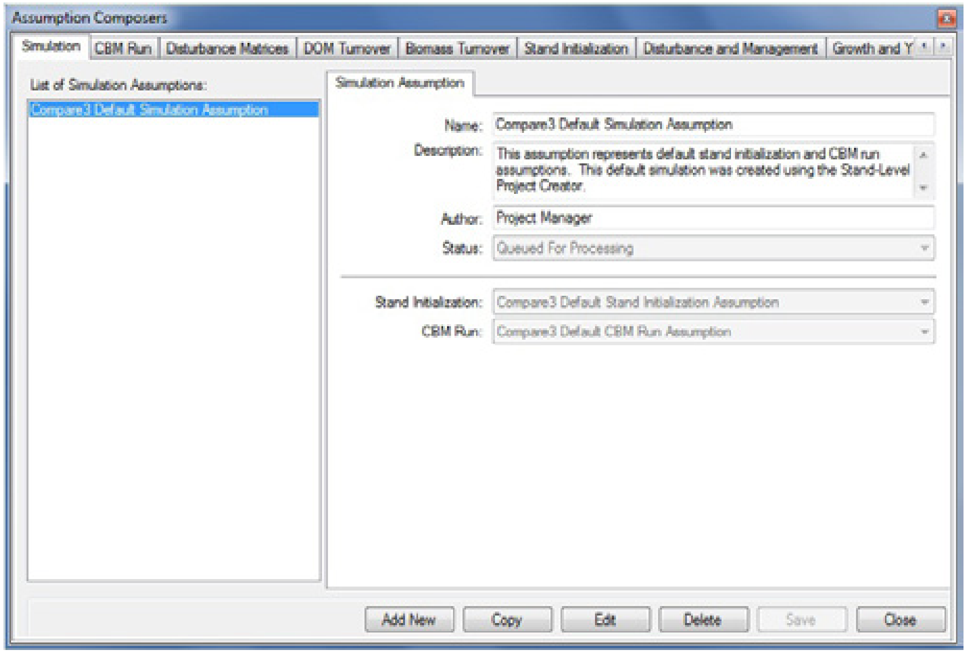


Figure 7-4. The "Assumption Composers" window with the "Simulation" tab selected.

On the "Simulation" tab, the "List of Simulation Assumptions" box displays all existing Simulation Assumptions linked to a project that the user has opened (Fig. 7-4). If the user clicks on a Simulation Assumption name in the "List of Simulation Assumptions" box, the tab will display the assumption name, description, author, status, and the names of the Stand Initialization and CBM Run Assumptions to which it is linked. Simulation Assumptions can be edited, copied, or deleted. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

7.2.1 Adding a Simulation Assumption

To add (create) a new Simulation Assumption using the "Simulation" tab in the "Assumption Composers" window (Fig. 7-4)

1. **Click on the "Add New" button**
2. **Enter a name for the simulation in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date'")**
4. **Enter the author's name in the "Author" box**
5. **Click on the "Status" box and select "Queued for Processing" from the drop list that appears**

By selecting "Queued for Processing," the user indicates to the CBM-CFS3 that the Simulation Assumption selected is available to be run through the Simulation Scheduler. At any time, the user can determine the run status of a Simulation Assumption by clicking on an assumption name in the "List of Simulation Assumptions" box and checking the status in the "Status" box.

6. **Click on the "Stand Initialization" box and select a Stand Initialization Assumption from the drop list that appears**
7. **Click on the "CBM Run" box and select a CBM Run Assumption from the drop list that appears**
8. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the addition

If the user clicks on the "Save" button, the new Simulation Assumption name will appear in the "List of Simulation Assumptions" box. Once the Simulation Assumption has been created, the user can run it through the CBM-CFS3 using the Simulation Scheduler (section 7.1.1).

7.2.2 Copying a Simulation Assumption

To copy an existing Simulation Assumption using the "Simulation" tab in the "Assumption Composers" window (Fig. 7-4)

1. **Click on the name of a Simulation Assumption in the "List of Simulation Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Simulation Assumption, called "Copy of 'original Simulation Assumption name'" will be added to the "List of Simulation Assumptions" box. The user can then edit the copy of the Simulation Assumption.

7.2.3 Editing a Simulation Assumption

To edit an existing Simulation Assumption using the "Simulation" tab in the "Assumption Composers" window (Fig. 7-4)

1. **Click on the name of a Simulation Assumption in the "List of Simulation Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to any of the Simulation Assumption settings (see section 7.2.1)**
4. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to cancel the edits

If the user clicks on the "Save" button, an "Add or Update Simulation Assumption" window will pop up asking the user to confirm modification of the selected simulation record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

7.2.4 Deleting a Simulation Assumption

To delete an existing Simulation Assumption using the "Simulation" tab in the "Assumption Composers" window (Fig. 7-4)

1. **Click on the name of a Simulation Assumption in the "List of Simulation Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Simulation Record Confirmation" window will pop up asking the user to confirm deletion of the selected assumption record.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.3 Composing Stand Initialization Assumptions

A Stand Initialization Assumption combines underlying assumptions (Fig. 7-1) that, when combined with a Simulation Assumption (section 7.2) and run in the Simulation Scheduler (section 7.1.1), will be used to generate the initial (time step 0) carbon dynamics and pools for all stands during a project simulation. A Stand Initialization Assumption is linked to a specific project database. It is composed of assumptions created in the underlying Assumption Composer Tools.

To access the Assumption Composer for Stand Initialization

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Stand Initialization" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-5) will pop up, displaying the "Stand Initialization" tab. The "Stand Initialization" tab displays, in the "List of Stand Initialization Assumptions" box (Fig. 7-5), all existing Stand Initialization Assumptions available to a project that the user has open. If the user clicks on the name of a Stand Initialization Assumption in the "List of Stand Initialization Assumptions" box, the "Stand Initialization" tab (Fig. 7-5) will display the assumption name, description, author, and names of linked underlying assumptions.

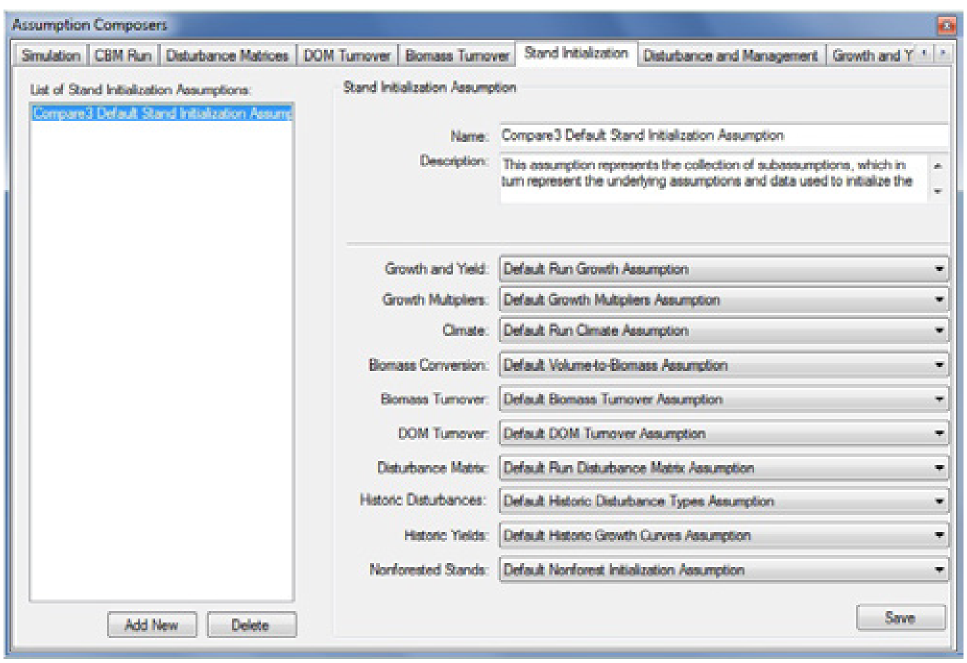


Figure 7-5. The "Assumption Composers" window with the "Stand Initialization" tab selected.

The user can add or delete Stand Initialization Assumptions. To close the window

Click on the "x" button

7.3.1 Adding a Stand Initialization Assumption

To add (create) a new Stand Initialization Assumption using the "Stand Initialization" tab in the "Assumption Composers" window (Fig. 7-5)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "Growth and Yield" box and select a Run Growth Assumption from the drop list that appears**
5. **Click on the "Growth Multipliers" box and select a Growth Multipliers Assumption from the drop list that appears**
6. **Click on the "Climate" box and select a Run Climate Assumption from the drop list that appears**
7. **Click on the "Biomass Conversion" box and select a Volume-to-Biomass Assumption from the drop list that appears**
8. **Click on the "Biomass Turnover" box and select a Biomass Turnover Assumption from the drop list that appears**
9. **Click on the "DOM Turnover" box and select a DOM Turnover Assumption from the drop list that appears**
10. **Click on the "Disturbance Matrix" box and select a Run Disturbance Matrix Assumption from the drop list that appears**
11. **Click on the "Historic Disturbances" box and select a "Historic Disturbance Assumption" from the drop list that appears**
12. **Click on the "Historic Yields" box and select a Historic Growth Curves Assumption from the drop list that appears**
13. **Click on the "Nonforested Stands" box and select a Nonforest Initilization Assumption from the drop list that appears**
14. **Click on the "Save" button**

The new Stand Initialization Assumption will be added to the "List of Stand Initialization Assumptions" box, and the user will be able to select it when creating a Simulation Assumption.

7.3.2 Deleting a Stand Initialization Assumption

To delete an existing Stand Initialization Assumption using the "Stand Initialization" tab in the "Assumption Composers" window (Fig. 7-5)

1. **Click on the name of a Stand Initialization Assumption in the "List of Stand Initialization Assumptions" box**
2. **Click on the "Delete" button**

7.4 Composing CBM Run Assumptions

Like a Stand Initialization Assumption, a CBM Run Assumption combines a set of underlying assumptions that can be applied in a Simulation Assumption (Fig. 7-1). Unlike a Stand Initialization Assumption, a CBM Run Assumption does not include underlying assumptions related to stand initialization, namely, a Historic Growth Curve Assumption, a Historic Disturbance Type Assumption, or a Nonforest Initialization Assumption. However, a CBM Run Assumption does contain a unique underlying assumption, the Disturbance and Management Assumption (see section 7.9), which is used to generate the sequence of natural and anthropogenic activities that cause alterations in the carbon dynamics and pools beginning with time step 1. A CBM Run Assumption also contains a user-specified simulation length.

To access the Assumption Composer for CBM Run Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Model Run" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-6) will pop up, displaying the "CBM Run" tab. The user can add, copy, edit, or delete CBM Run Assumptions. To cancel any of these actions

Click on the "Cancel" button

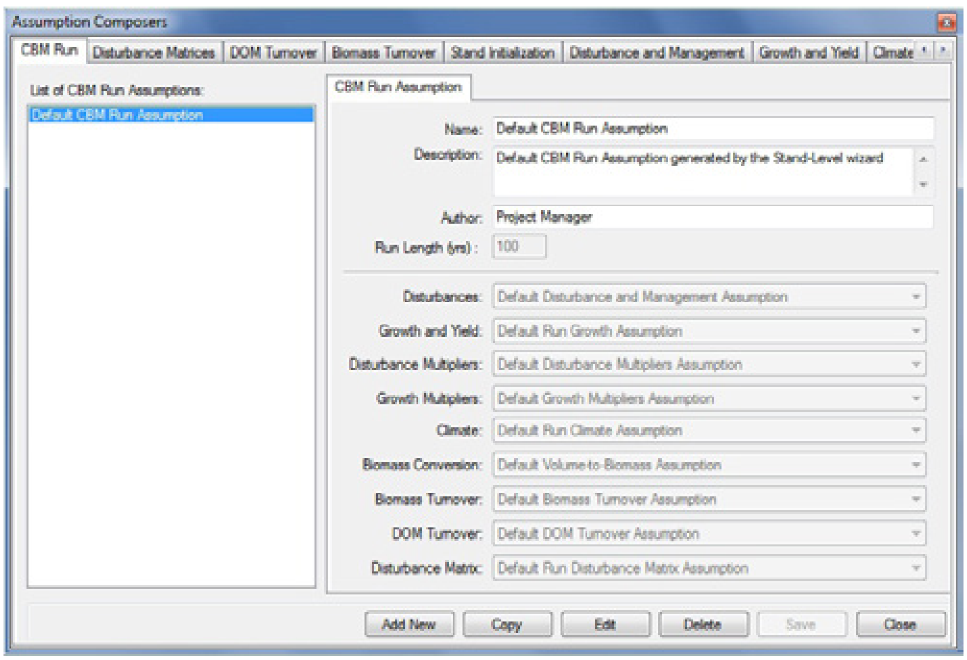


Figure 7-6. The "Assumption Composers" window with the "CBM Run" tab selected.

To close the window

Click on the "Close" button

7.4.1 Adding a CBM Run Assumption

To add (create) a new CBM Run Assumption using the "CBM Run" tab in the "Assumption Composers" window (Fig. 7-6)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Enter the author's name in the "Author" box**
5. **Enter a value (in years) for the length of the simulation run in the "Run Length (yrs)" box**
6. **Click on the "Disturbances" box and select a Disturbance and Management Assumption from the drop list that appears**
7. **Click on the "Growth and Yield" box and select a Run Growth Assumption from the drop list that appears**
8. **Click on the "Disturbance Multipliers" box and select a Disturbance Multipliers Assumption from the drop list that appears**
9. **Click on the "Growth Multipliers" box and select a Growth Multipliers Assumption from the drop list that appears**
10. **Click on the "Climate" box and select a Run Climate Assumption from the drop list that appears**
11. **Click on the "Biomass Conversion" box and select a Volume-to-Biomass Assumption from the drop list that appears**
12. **Click on the "Biomass Turnover" box and select a Biomass Turnover Assumption from the drop list that appears**
13. **Click on the "DOM Turnover" box and select a DOM Turnover Assumption from the drop list that appears**
14. **Click on the "Disturbance Matrix" box and select a Disturbance Matrix Assumption from the drop list that appears**
15. **Click on the "Save" button to proceed**

    or

    Click on the "Cancel" button to terminate the addition

The new CBM Run Assumption will be added to the "List of CBM Run Assumptions" box and the user will be able to select it when creating a Simulation Assumption.

7.4.2 Copying a CBM Run Assumption

To copy an existing CBM Run Assumption using the "CBM Run" tab in the "Assumption Composers" window (Figure 7-6)

1. **Click on the name of the CBM Run Assumption in the "List of CBM Run Assumptions" box**
2. **Click on the "Copy" button**

The copy of the CBM Run Assumption, called 'Copy of 'original CBM Run Assumption name" will be added to the "List of CBM Run Assumptions" box. The user can then edit the copy of the CBM Run Assumption.

7.4.3 Editing a CBM Run Assumption

To edit an existing CBM Run Assumption using the "CBM Run" tab in the "Assumption Composers" window (Fig. 7-6)

1. **Click on the name of the CBM Run Assumption in the "List of CBM Run Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to any of the CBM Run Assumption settings (see section 7.4.1)**
4. **Click on the "Save" button**

   or

   Click on the "Cancel" button to cancel the edits

If the user clicks on the "Save" button, an "Add or Update CBM Run Assumption" window will pop up asking the user to confirm modification of the selected run record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

7.4.4 Deleting a CBM Run Assumption

To delete an existing CBM Run Assumption using the "CBM Run" tab in the "Assumption Composers" window (Fig. 7-6)

1. **Click on the name of the CBM Run Assumption in the "List of CBM Run Assumptions" box**
2. **Click on the "Delete" button**

A "Delete CBM Run Record Confirmation" window will pop up asking the user to confirm deletion of the assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.5 Composing Biomass Turnover Assumptions

A Biomass Turnover Assumption contains biomass turnover parameter settings that can be edited for the softwood and hardwood components of projects. Parameter settings include the proportion of coarse root turnover, hardwood decay as a proportion of the softwood decay multiplier, and the proportion of "Other" biomass that naturally becomes branches of snags. "Other" biomass includes sapling stem wood, merchantable stem bark, branches, tops, and stumps.

To access the Assumption Composer for Biomass Turnover Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Biomass Turnover Parameters" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-7) will pop up displaying the "Biomass Turnover" tab. Existing Biomass Turnover Assumptions are displayed in the "List of Biomass Turnover Assumptions" box. The user can click on the name of a specific assumption in this box to view its associated parameters. The user can add, copy, edit, or delete Biomass Turnover Assumptions. To cancel any of these actions

Click on the "Cancel" button

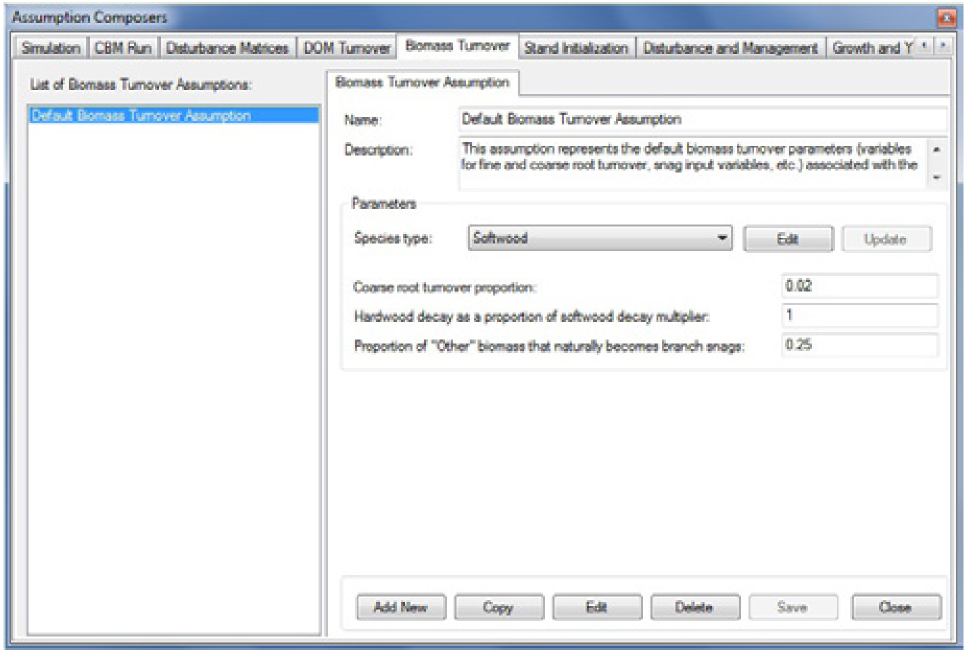


Figure 7-7. The "Assumption Composers" window with the "Biomass Turnover" tab selected.

To close the window

Click on the "Close" button

Note: How to modify root biomass turnover parameters
Users interested in modifying the root turnover aboveground-belowground split for a CBM-CFS3 project must do so in the Microsoft Access database for their project, before executing their project simulation in the Simulation Scheduler. For details on how to modify these parameters, see Appendix 11.

7.5.1 Adding a Biomass Turnover Assumption

To add (create) a new Biomass Turnover Assumption using the "Biomass Turnover" tab in the "Assumption Composers" window (Fig. 7-7)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date'")**
4. **Click on the "Save" button**

The new Biomass Turnover Assumption will be added to the "List of Biomass Turnover Assumptions" box.

The CBM-CFS3 sets default parameters based on the administrative and ecological boundaries selected by the user during the data import process. If satisfied with the default parameters for all species types, proceed to step 12. Alternatively, to edit the default parameters for any species types in the inventory

5. **Click on the "Edit" button**
6. **Click on the "Species type" box and select a species type from the drop list that appears**

Each step involving the change of a parameter is optional. The first parameter that the user can change is the coarse root turnover proportion, which represents the proportion (from 0 to 1) of coarse root biomass carbon that transfers to the belowground fast DOM pool annually. To change this parameter

7. **Enter a new proportion in the "Coarse root turnover proportion" box**

Next, the user can change hardwood decay, as a proportion of the softwood decay multiplier. This multiplier (0 to a maximum defined by the user) is used to increase or decrease decay rates of DOM pools for hardwood relative to softwood. To make a change

8. **Enter a new multiplier in the "Hardwood decay as a proportion of softwood decay multiplier" box**

Next, the user can change the proportion (from 0 to 1) of branch turnover that transfers to the branch snag pool annually. To make a change

9. **Enter a new proportion in the "Proportion of 'Other' biomass that naturally becomes branch snag" box**
10. **Click on the "Update" button**

An "Update Biomass Turnover Parameters" window will pop up asking the user to confirm modification of the biomass turnover parameters.

11. **Click on the "Yes" button to proceed**

    or

    Click on the "No" button to cancel the edits
12. **Repeat steps 4 to 10 to edit parameters for other species**

7.5.2 Copying a Biomass Turnover Assumption

To copy an existing Biomass Turnover Assumption using the "Biomass Turnover" tab in the "Assumption Composers" window (Fig. 7-7)

1. **Click on the name of a Biomass Turnover Assumption in the "List of Biomass Turnover Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Biomass Turnover Assumption, called "Copy of 'original Biomass Turnover Assumption name'" will be added to the "List of Biomass Turnover Assumptions" box. The user can then edit the copy of the Biomass Turnover Assumption.

7.5.3 Editing a Biomass Turnover Assumption

To edit an existing Biomass Turnover Assumption using the "Biomass Turnover" tab in the "Assumption Composers" window (Fig. 7-7)

1. **Click on the name of a Biomass Turnover Assumption in the "List of Biomass Turnover Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the name and/or description**
4. **Click on the "Save" button**

An "Add or Update Biomass Turnover Assumption" window will pop up asking the user to confirm modification of the selected biomass turnover record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits
6. **Make any necessary changes to the parameters (see section 7.5.1 for details)**

7.5.4 Deleting a Biomass Turnover Assumption

To delete an existing Biomass Turnover Assumption using the "Biomass Turnover" tab in the "Assumption Composers" window (Fig. 7-7)

1. **Click on the name of a Biomass Turnover Assumption in the "List of Biomass Turnover Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Biomass Turnover Record Confirmation" window will pop up asking the user to confirm deletion of the selected biomass turnover record.

3. **Click on the "Yes" button to proceed,**

   or

   Click on the "No" button to cancel the deletion

7.6 Composing Run Climate Assumptions

Run Climate Assumptions are composed of one or several SPU Group Climate Assumptions, each linked to its own mean annual temperature and precipitation data by time step in the Climate Data Editor (see Fig. 6-3).

To access the Assumption Composer for Run Climate Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Climate" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-8) will pop up, displaying the "Climate" tab.

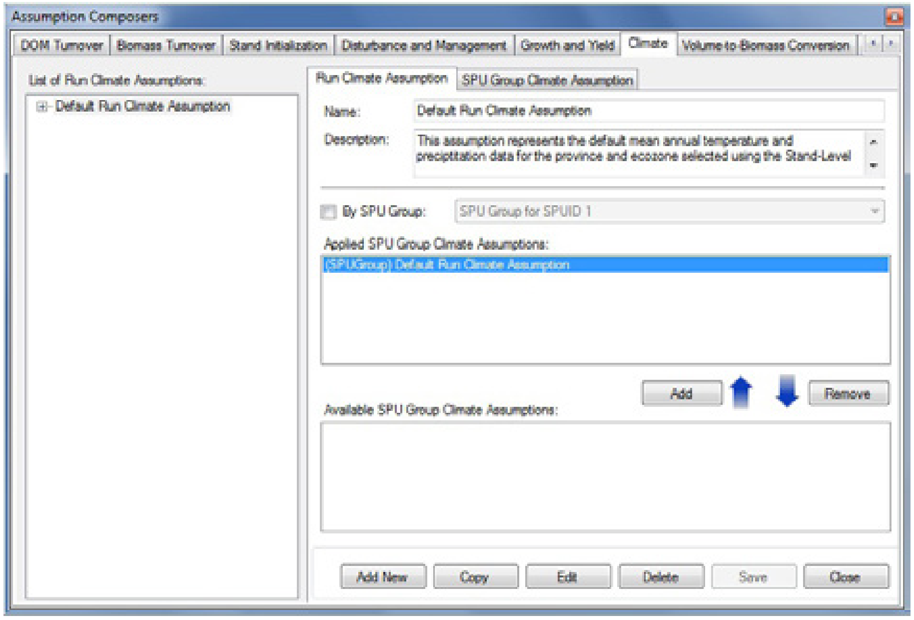


Figure 7-8. The "Assumption Composers" window with the "Climate" and "Run Climate Assumption" tabs selected.

On the "Climate" tab, existing Run Climate Assumptions are displayed in the "List of Run Climate Assumptions" box in a hierarchical directory tree structure. On the directory tree, the user can double-click on a specific Run Climate Assumption or click on the "+" next to the assumption to expand the tree and see the SPU Group Climate Assumption associated with it. Clicking on a "-" in the directory tree will collapse the corresponding assumption section of the directory tree. The user can also right-click in the directory tree box and choose, by selecting the appropriate option from the pop-up menu, to expand or collapse the directory tree. SPU Group Climate Assumptions are also displayed in the "Applied SPU Group Climate Assumptions" box and the "Available SPU Group Climate Assumptions" box.

The user can add, copy, edit, or delete Run Climate Assumptions or SPU Group Climate Assumptions. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

7.6.1 Adding a Run Climate Assumption

To add (create) a new Run Climate Assumption using the "Run Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-8)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "Save" button**

The new Run Climate Assumption will be added to the directory tree in the "List of Run Climate Assumptions" box.

Adding an SPU Group Climate Assumption to a Run Climate Assumption

As previously stated, a Run Climate Assumption is composed of one or more SPU Group Climate Assumptions. To add an existing SPU Group Climate Assumption to a Run Climate Assumption

1. **Click on the name of a Run Climate Assumption in the "List of Run Climate Assumptions" box (Fig. 7-8)**
2. **Click on the name of an SPU Group Climate Assumption in the "Available SPU Group Climate Assumptions" box**

☞ *Tip: Filtering the list of assumptions*

If the list of SPU Group Climate Assumptions is extensive

Click on the "By SPU Group" check box

Select an SPU Group from the drop list to filter the list of assumptions for the selected SPU Group

3. **Click on the "Add" button**

The added SPU Group Climate Assumption will appear in the "Applied SPU Group Climate Assumptions" box and in the "List of Run Climate Assumptions" box (linked to the selected Run Climate Assumption).

Removing an SPU Group Climate Assumption from a Run Climate Assumption

To remove an SPU Group Climate Assumption from a Run Climate Assumption

1. **Click on the name of a Run Climate Assumption in the "List of Run Climate Assumptions" box (Fig. 7-8)**
2. **Click on the name of the SPU Group Climate Assumption in the "Applied SPU Group Climate Assumptions" box**
3. **Click on the "Remove" button**

7.6.2 Copying a Run Climate Assumption

To copy an existing Run Climate Assumption using the "Run Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-8)

1. **Click on the name of a Run Climate Assumption in the "List of Run Climate Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Run Climate Assumption, called "Copy of 'original Run Climate Assumption name' " will be added to the "List of Run Climate Assumptions" box. The user can then edit the copy of the Run Climate Assumption.

7.6.3 Editing a Run Climate Assumption

To edit an existing Run Climate Assumption using the "Run Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-8)

1. **Click on the name of a Run Climate Assumption in the "List of Run Climate Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Run Climate Assumption name and/or description (see section 7.6.1)**
4. **Click on the "Save" button**

An "Add or Update Run Climate Assumption" window will pop up asking the user to confirm modification of the selected climate record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

The user can also modify the SPU Group Climate Assumptions that are associated with a Run Climate Assumption (see section 7.6.1).

7.6.4 Deleting a Run Climate Assumption

To delete an existing Run Climate Assumption using the "Run Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-8)

1. **Click on the name of a Run Climate Assumption in the "List of Run Climate Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Climate Record Confirmation" window will pop up asking the user to confirm deletion of the selected climate record.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.6.5 Adding an SPU Group Climate Assumption

To add (create) a new SPU Group Climate Assumption (to be added to a Run Climate Assumption) using the "SPU Group Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-9)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "SPU Group" box and select an SPU Group from the drop list that appears**
5. **Click on the "Save" button**

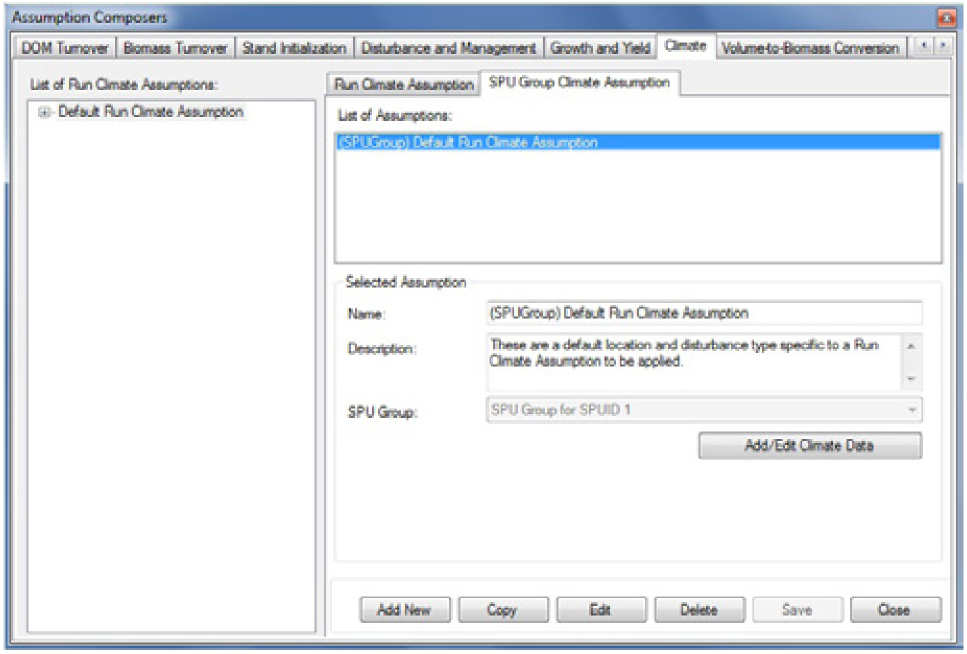


Figure 7-9. The "Assumption Composers" window with the "Climate" and "SPU Group Climate Assumption" tabs selected.

The new assumption will appear in the "List of Assumptions" box and in the "Available SPU Group Climate Assumptions" box on the "Run Climate Assumption" tab. The user must then enter the climate data associated with this new assumption. To proceed

6. **Click on the "Add/Edit Climate Data" button**

This will launch the "Climate Editor" window. To learn how to enter the data for the new SPU Group Climate Assumption in this window, consult section 6.1.

7.6.6 Copying an SPU Group Climate Assumption

To copy an existing SPU Group Climate Assumption using the "SPU Group Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-9)

1. **Click on the name of an SPU Group Climate Assumption in the "List of Assumptions" box**
2. **Click on the "Copy" button**

The copy of the SPU Group Climate Assumption, called "Copy of 'original SPU Group Climate Assumption name'" will be added to the "List of Assumptions" box. The user can then edit the copy of the SPU Group Climate Assumption.

7.6.7 Editing an SPU Group Climate Assumption

To edit an existing SPU Group Climate Assumption using the "SPU Group Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-9)

1. **Click on the name of an SPU Group Climate Assumption in the "List of Assumptions" box**
2. **Click on the "Edit" button**

3. **Make the necessary changes to the SPU Group Climate Assumption name, description, and/or assigned SPU Group (see section 7.6.5)**
4. **Click on the "Save" button**

An "Add or Update SPU Group Climate Assumption" window will pop up, asking the user to confirm modification of the selected SPU Group climate record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

To edit the climate data associated with the assumption

Click on the "Add/Edit Climate Data" button

This will launch the "Climate Editor" window. To learn how to enter the data for the SPU Group Climate Assumption in this window, consult section 6.1.

7.6.8 Deleting an SPU Group Climate Assumption

To delete an existing SPU Group Climate Assumption using the "SPU Group Climate Assumption" tab in the "Assumption Composers" window (Fig. 7-9)

1. **Click on the name of an SPU Group Climate Assumption in the "List of Assumptions" box**
2. **Click on the "Delete" button**

A "Delete SPU Group Climate Record Confirmation" window will pop up, asking the user to confirm deletion of the selected SPU Group Climate Assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.7 Composing DOM Turnover Assumptions

A DOM Turnover Assumption is linked to a particular ecological boundary and all carbon pools. Each assumption is composed of both DOM turnover parameters and DOM parameters.

DOM turnover parameters and DOM parameters are listed and defined in Table 7-1. Default values for DOM turnover parameters are listed in Appendix 3 and for DOM parameters in Appendix 4.

To access the Assumption Composer for DOM Turnover Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "DOM Turnover Parameters" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-10) will pop up displaying the "DOM Turnover" tab. Existing DOM Turnover Assumptions are displayed in the "List of DOM Turnover Assumptions" box. The user can click on a specific assumption and then the various DOM tabs to view its associated parameters. The user can add, copy, edit, or delete DOM Turnover Assumptions. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

Table 7-1. Definitions for dead organic matter (DOM) turnover parameters (Fig. 7-11) and DOM parameters (Fig. 7-12; units in parentheses)

Parameter type	Box name	Parameter name	Definition
DOM Turnover Parameters	Average	Slow DOM Pool (t ha^{-1})	Initial slow DOM pool value for the forest stand used by the stand initialization program (MAKELIST) that is run at the start of a simulation
		Decay Multiplier (0 to maximum defined by user)	Sensitivity analysis multiplier that alters the decay rates of all pools
		Stand Replacing Disturbance Interval (yr)	Average number of years between stand-replacing disturbances, which is used in MAKELIST to grow the stand(s) in an iterative process until equilibrium is reached in the slow DOM pool
	Turnover Rate (0 to 1)	Softwood Other	Proportion of softwood branches that die annually
		Merchantable Annual	Proportion of stems that die annually
		Hardwood Other	Proportion of hardwood branches that die annually
	Snag Fall Rate (0 to 1)	Dead Softwood Merchantable	Proportion of softwood stem snags that transfer to the medium soil pool annually
		Dead Softwood Other	Proportion of softwood branch snags that transfer to the fast aboveground pool
		Dead Hardwood Merchantable	Proportion of hardwood stem snags that transfer to the medium soil pool annually
		Dead Hardwood Other	Proportion of hardwood branch snags that transfer to the fast aboveground pool
	Foliage Fall Rate (0 to 1)	Softwood	Proportion of softwood foliage that transfers to the very fast aboveground pool
		Hardwood	Proportion of hardwood foliage that transfers to the very fast aboveground pool
DOM Parameters	Decay Rate	Decay rate of organic matter at the reference temperature (yr^{-1})	Annual base decay rate of organic matter at the specified reference temperature
		Maximum decay rate multiplier for the soil pool type (softwood)	Maximum decay rate value that can be used for softwood DOM pools
		Maximum decay rate multiplier for the soil pool type (hardwood)	Maximum decay rate value that can be used for hardwood DOM pools
	General	Reference mean annual temperature for decay rate (°C)	Mean annual temperature for the base decay rate used as a reference point for application of q10
		q10 (°C) (>1)	A parameter used to modify organic matter decay rates in response to mean annual temperature (e.g., a q10 value of 2 results in a doubling of the decay rate for every 10°C increase in mean annual temperature relative to the reference temperature)
		Proportion of carbon transferred from soil pools to atmosphere (0 to 1)	Proportion of carbon in the selected soil pool that transfers to the atmosphere; default value is 0.83 for all DOM pools except the slow aboveground and belowground pools, for which the default is 1
	Carbon Flux Rate (peat only)	Rate at which carbon is added to the given soil pool	Rate at which carbon is added to the peat pool
		Rate at which carbon is lost from the given soil pool	Rate at which carbon is lost from the peat pool

Note: How to modify root biomass turnover parameters

Users interested in modifying the root turnover aboveground-belowground split for a CBM-CFS3 project must do so in the Microsoft Access database for their project, before executing their project simulation in the Simulation Scheduler. For details on how to modify these parameters, see Appendix 11.

7.7.1 Adding a Dead Organic Matter Turnover Assumption

To add (create) a new DOM Turnover Assumption using the "DOM Turnover Assumption" tab in the "Assumption Composers" window (Fig. 7-10)

1. **Click on the "Add New" button**

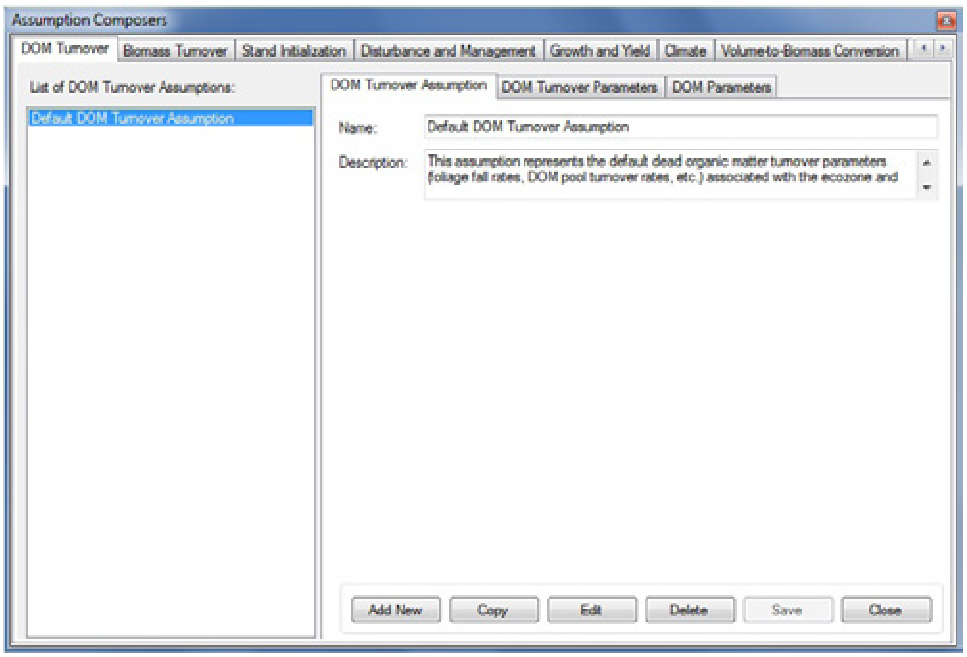


Figure 7-10. The "Assumption Composers" window with the "DOM Turnover" and "DOM Turnover Assumption" tabs selected.

2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "Save" button**

The new DOM Turnover Assumption will be added to the "List of DOM Turnover Assumptions" box. The user can then set up the DOM turnover parameters and DOM parameters for the assumption. To proceed

5. **Click on the name of the new assumption in the "List of DOM Turnover Assumptions" box**
6. **Click on the "DOM Turnover Parameters" tab (Fig. 7-11) to view the default turnover parameters**

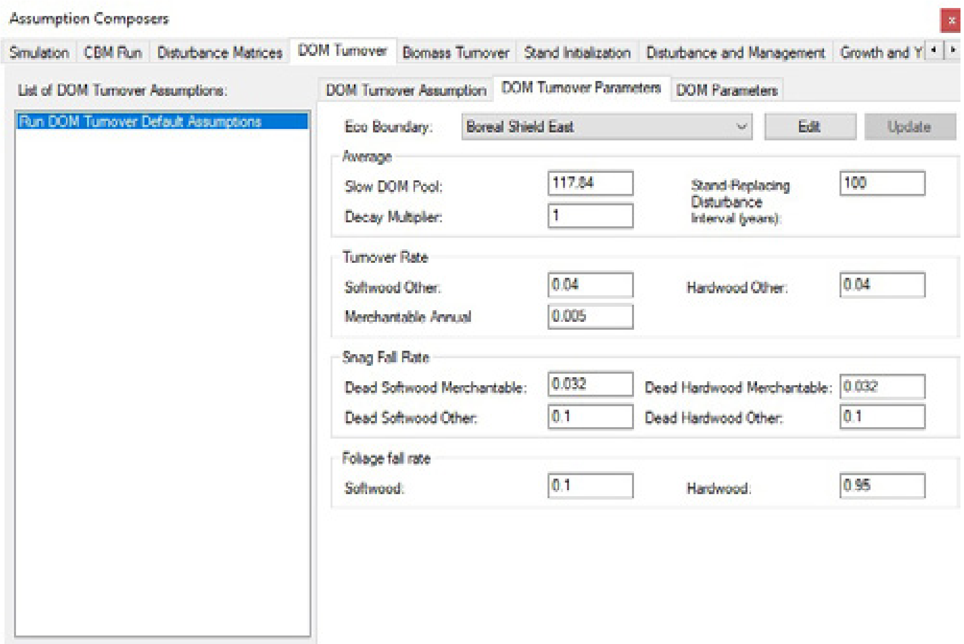


Figure 7-11. The "Assumption Composers" window with the "DOM Turnover" and "DOM Turnover Parameters" tabs selected.

Refer to Table 7-1 for parameter definitions. If satisfied with the default values, proceed to step 13. To edit the parameters

7. **Click on the "Edit" button**
8. **Click on the "Eco Boundary" box and select the name of an ecological boundary from the drop list that appears**
9. **Make the necessary changes to the DOM turnover parameter values**
10. **Click on the "Update" button**

An "Update Parameters" window will pop up, asking the user to confirm modification of the DOM turnover parameters.

11. **Click on the "Yes" button to proceed**

    or

    Click on the "No" button to cancel the edits

If required,

12. **Repeat steps 7 to 11 for any remaining ecological boundaries in the "Ecological Boundaries" box**
13. **Click on the "DOM Parameters" tab (Fig. 7-12) to view the default DOM Parameters**

Refer to Table 7-1 for parameter definitions. If satisfied with the default values, the new DOM Turnover Assumption is complete. To edit the parameters

14. **Click on the "Soil Pool" box and select the name of a soil pool from the drop list that appears**
15. **Click on the "Edit" button**
16. **Make the necessary changes to the DOM parameter values**
17. **Click on the "Update" button**

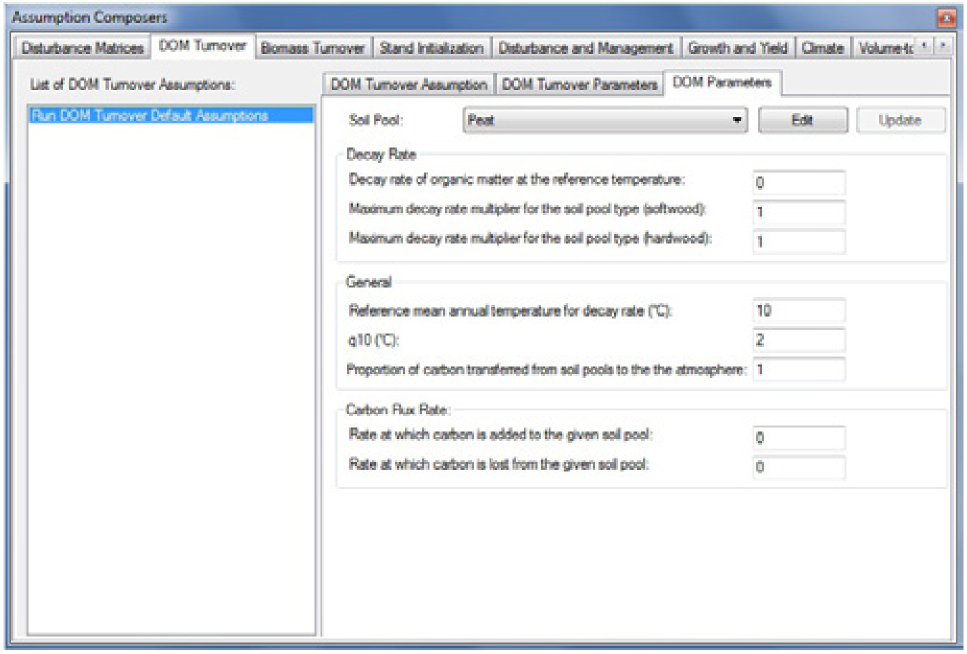


Figure 7-12. The "Assumption Composers" window with the "DOM Turnover" and "DOM Parameters" tabs selected.

An "Update Parameters" window will pop up, asking the user to confirm modification of the DOM and peat parameters.

18. **Click on the "Yes" button to proceed**

    or

    Click on the "No" button cancel the edits
19. **Repeat steps 14 to 18 for the remaining soil types in the "Soil Pool" box**

7.7.2 Copying a Dead Organic Matter Turnover Assumption

To copy an existing DOM Turnover Assumption using the "DOM Turnover Assumption" tab in the "Assumption Composers" window (Fig. 7-10)

1. **Click on the name of a DOM Assumption in the "List of DOM Turnover Assumptions" box**
2. **Click on the "Copy" button**

A copy of the DOM Turnover Assumption, called "Copy of 'original DOM Turnover Assumption name'" will be added to the "List of DOM Turnover Assumptions" box. The user can then edit the copy of the DOM Turnover Assumption.

7.7.3 Editing a Dead Organic Matter Turnover Assumption

Editing the Assumption Name and Description

To edit the name and description of an existing DOM Turnover Assumption using the "DOM Turnover Assumption" tab in the "Assumption Composers" window (Fig. 7-10)

1. **Click on the name of a DOM Assumption in the "List of DOM Turnover Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the name and/or description (see section 7.7.1)**
4. **Click on the "Save" button**

An "Add or Update DOM Turnover Assumption" window will pop up, asking the user to confirm modification of the selected DOM turnover record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

Editing Assumption Parameters

To edit the parameters of an existing DOM Turnover Assumption using the "DOM Turnover Assumption" tab in the "Assumption Composers" window (Fig. 7-10)

1. **Click on the name of a DOM Turnover Assumption in the "List of DOM Turnover Assumptions" box**
2. **Click on either the "DOM Turnover Parameters" tab or the "DOM Parameters" tab**
3. **Click on the "Edit" button**
4. **Make the necessary changes to the parameters (see section 7.7.1)**
5. **Click on the "Update" button**

An "Update Parameters" window will pop up, asking the user to confirm modification of the DOM Parameters or the DOM and peat parameters (depending on which tab was selected).

6. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button cancel the edits

To edit the parameters tab not selected in step 2, repeat steps 2 to 6 for that tab.

7.7.4 Deleting a Dead Organic Matter Turnover Assumption

To delete an existing DOM Turnover Assumption using the "DOM Turnover Assumption" tab in the "Assumption Composers" window (Fig. 7-10)

1. **Click on the name of a DOM Turnover Assumption in the "List of DOM Turnover Assumptions" box**
2. **Click on the "Delete" button**

A "Delete DOM Turnover Record Confirmation" window will pop up, asking the user to confirm deletion of the selected DOM Turnover Assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.8 Composing Run Disturbance Matrix Assumptions

Run Disturbance Matrix Assumptions are composed of one or more SPU Group Disturbance Matrix Assumptions. Each SPU Group Disturbance Matrix Assumption is an association of an SPU Group ID, a disturbance type, and a disturbance matrix.

Run Disturbance Matrix Assumptions are, or can be, linked to disturbance matrices in the Disturbance Matrix Editor (see Fig. 6-13). To learn about disturbance matrices, read section 6.3.

To access the Assumption Composer for Run Disturbance Matrix Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Disturbance Matrices" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-13) will pop up, displaying the "Disturbance Matrices" tab. On the "Disturbance Matrices" tab, existing Run Disturbance Matrix Assumptions are displayed in a hierarchical structure in the box containing the directory tree of assumptions. To view assumptions in the directory for all disturbance types, the user can click on the "Show all disturbance types" radio button. The user can also view assumptions linked to a specific disturbance type in the directory tree by clicking on the "By" radio button and selecting a disturbance type from the drop list that will appear beside it. On the directory tree, the user can then double-click on a specific Run Disturbance Matrix Assumption or click on the "+" next to the assumption to expand the tree and see the SPU and SPU Group Disturbance Matrix Assumptions associated with that assumption. One Run Disturbance Matrix Assumption may contain many combinations of SPUs and SPU Group Disturbance Matrices. Clicking on a "-" in the directory tree will collapse the corresponding assumption section of the directory tree. The user can also right-click in the directory tree box and choose, by selecting the appropriate option from the pop-up menu, to expand or collapse the directory tree.

The user can add, copy, edit, or delete Run Disturbance Matrix Assumptions or SPU Group Disturbance Matrix Assumptions. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

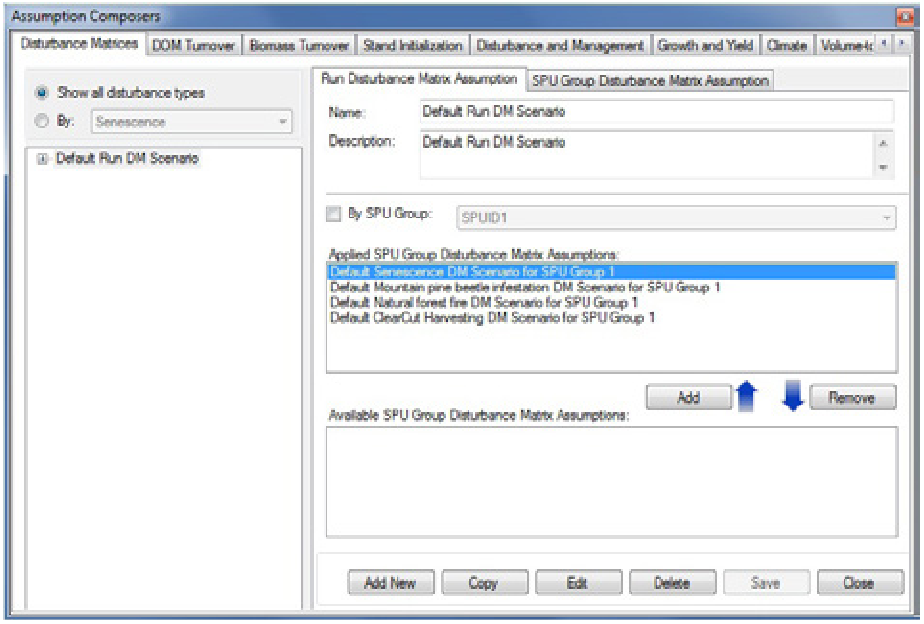


Figure 7-13. The "Assumption Composers" window with the "Disturbance Matrices" and "Run Disturbance Matrix Assumption" tabs selected.

The hierarchical structure for a Run Disturbance Matrix Assumption is as follows:

1. Run Disturbance Matrix Assumption
2. Disturbance Type
3. SPU Group
4. Disturbance Matrix

7.8.1 Adding a Run Disturbance Matrix Assumption

To add (create) a new Run Disturbance Matrix Assumption using the "Run Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-13)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "Save" button**

The new Run Disturbance Matrix Assumption will be added to the directory tree box.

Adding an SPU Group Disturbance Matrix to a Run Disturbance Matrix Assumption

If a Run Disturbance Matrix Assumption is to be used in a model simulation it must be linked to an SPU Group Disturbance Matrix Assumption. To add an SPU Group Disturbance Matrix Assumption appearing in the "Available SPU Group Disturbance Matrix Assumptions" box to a Run Disturbance Matrix Assumption

1. **Click on the name of a Run Disturbance Matrix Assumption in the directory tree box**
2. **Click on the name of an SPU Group Disturbance Matrix Assumption in the "Available SPU Group Disturbance Matrix Assumptions" box**

☞ *Tip: Filtering the list of SPU Group Disturbance Matrix Assumptions*

If the list of SPU Group Disturbance Matrix Assumptions is extensive

Click on the "By SPU Group" check box

Select an SPU Group from the drop list to filter the list of matrices for the selected SPU

3. **Click on the "Add" button**

The SPU Group Disturbance Matrix Assumption will appear in the "Applied SPU Group Disturbance Matrix Assumptions" box and in the directory tree box linked to the selected Run Disturbance Matrix Assumption.

Removing an SPU Group Disturbance Matrix Assumption from a Run Disturbance Matrix Assumption

To remove an SPU Group Disturbance Matrix Assumption from a Run Disturbance Matrix Assumption

1. **Click on the name of a Run Disturbance Matrix Assumption in the directory tree box**
2. **Click on the name of an SPU Group Disturbance Matrix Assumption in the "Applied SPU Group Disturbance Matrix Assumptions" box**
3. **Click on the "Remove" button**

7.8.2 Copying a Run Disturbance Matrix Assumption

To copy an existing Run Disturbance Matrix Assumption using the "Run Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-13)

1. **Click on the name of a Run Disturbance Matrix Assumption in the directory tree box**
2. **Click on the "Copy" button**

The copy of the Run Disturbance Matrix Assumption, called "Copy of 'original Run Disturbance Matrix Assumption name'" will be added to the directory tree box. The assumption will not have any assigned SPU Group Disturbance Matrix Assumptions. To learn how to add SPU Group Disturbance Matrix Assumptions to this assumption, read section 7.8.1. The user can then edit the copy of the Run Disturbance Matrix Assumption.

7.8.3 Editing a Run Disturbance Matrix Assumption

To edit the name and/or description of an existing Run Disturbance Matrix Assumption using the "Run Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-13)

1. **Click on the name of a Run Disturbance Matrix Assumption in the directory tree box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Run Disturbance Matrix Assumption name and/or description**
4. **Click on the "Save" button**

An "Add or Update Assumption" window will pop up asking the user to confirm modification of the selected disturbance matrix record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

To learn how to add or remove SPU Group Disturbance Matrix Assumptions associated with a Run Disturbance Matrix Assumption, see section 7.8.1.

7.8.4 Deleting a Run Disturbance Matrix Assumption

To delete an existing Run Disturbance Matrix Assumption using the "Run Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-13)

1. **Click on the name of a Run Disturbance Matrix Assumption in the directory tree box**
2. **Click on the "Delete" button**

A "Delete Run Disturbance Matrix Record Confirmation" window will pop up, asking the user to confirm deletion of the selected disturbance matrix.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.8.5 Adding an SPU Group Disturbance Matrix Assumption

To add (create) an SPU Group Disturbance Matrix Assumption using the "SPU Group Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-14)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**

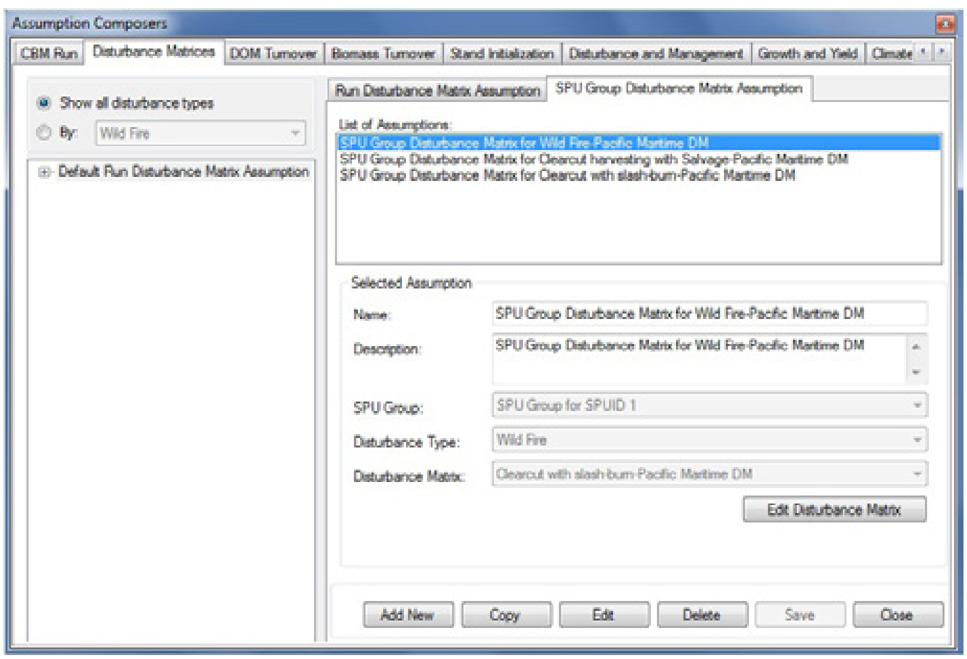


Figure 7-14. The "Assumption Composers" window with the "Disturbance Matrices" and "SPU Group Disturbance Matrix Assumption" tabs selected.

4. **Click on the "SPU Group" box and select an SPU Group name from the drop list that appears**
5. **Click on the "Disturbance Type" box and select a disturbance type name from the drop list that appears**
6. **Click on the "Disturbance Matrix" box and select a disturbance matrix name from the drop list that appears**
7. **Click on the "Save" button**

The new SPU Group Disturbance Matrix Assumption will be added to the "List of Assumptions" box and can be linked to a Run Disturbance Matrix Assumption on the "Run Disturbance Matrix Assumption" tab (Fig. 7-13).

7.8.6 Copying an SPU Group Disturbance Matrix Assumption

To copy an existing SPU Group Disturbance Matrix Assumption using the "SPU Group Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-14)

1. **Click on the name of an SPU Group Disturbance Matrix Assumption in the "List of Assumptions" box**
2. **Click on the "Copy" button**

The copy of the SPU Group Disturbance Matrix Assumption, called "Copy of 'original SPU Group Disturbance Matrix Assumption name'" will be added to the "List of Assumptions" box. The user can then edit the SPU Group Disturbance Matrix Assumption.

7.8.7 Editing an SPU Group Disturbance Matrix Assumption

To edit an existing SPU Group Disturbance Matrix Assumption using the "SPU Group Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-14)

1. **Click on the name of an SPU Group Disturbance Matrix Assumption in the "List of Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the SPU Group Disturbance Matrix Assumption name, description, SPU Group, disturbance type, and/or disturbance matrix (see section 7.8.5)**
4. **Click on the "Save" button**

An "Add or Update SPU Group Disturbance Matrix Assumption" window will pop up asking the user to confirm modification of the selected SPU Group disturbance matrix record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

Editing a Disturbance Matrix

The "Edit Disturbance Matrix" button appears on the "SPU Group Disturbance Matrix Assumption" tab (Fig. 7-14). By clicking on this button, the user can access the "Disturbance Matrix Editor" window to view and/or edit a specific disturbance matrix in the model. To use this feature

1. **Click on the "SPU Group Disturbance Matrix Assumption" tab (Fig. 7-14)**
2. **In the "List of Assumptions" box, click on the name of an SPU Group Disturbance Matrix**

Assumption that is linked to a disturbance matrix of interest (see the "Disturbance Matrix" box)

3. **Click on the "Edit Disturbance Matrix" button**

The "Disturbance Matrix Editor" window (Fig. 6-15) will pop up displaying the selected disturbance matrix. For details on how to edit a disturbance matrix, read section 6.3.

7.8.8 Deleting an SPU Group Disturbance Matrix Assumption

To delete an existing SPU Group Disturbance Matrix Assumption using the "SPU Group Disturbance Matrix Assumption" tab on the "Disturbance Matrices" tab (Fig. 7-14)

1. **Click on the name of an SPU Group Disturbance Matrix Assumption in the "List of Assumptions" box**
2. **Click on the "Delete" button**

A "Delete SPU Group Disturbance Matrix Record Confirmation" window will pop up, asking the user to confirm deletion of the selected SPU Group Disturbance Matrix Assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.9 Composing Disturbance and Management Assumptions

Disturbance and Management Assumptions are assumptions about human and natural disturbance events that occur on a land base. These assumptions can be used to represent historic events or projections of future events. Each is composed of one or more Disturbance Group Assumptions, which aggregate the time series of disturbance events of a specific disturbance type within a given region (see Figure 6-5). Each Disturbance Group assumption is linked to a corresponding regional Transition Rule Assumption, which specifies the default transitions that should be followed by events in this group (see Figure 6-26).

To access the Assumption Composer for Disturbance and Management Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Disturbance Events and Management Activities" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-15) will pop up displaying the "Disturbance and Management" tab.

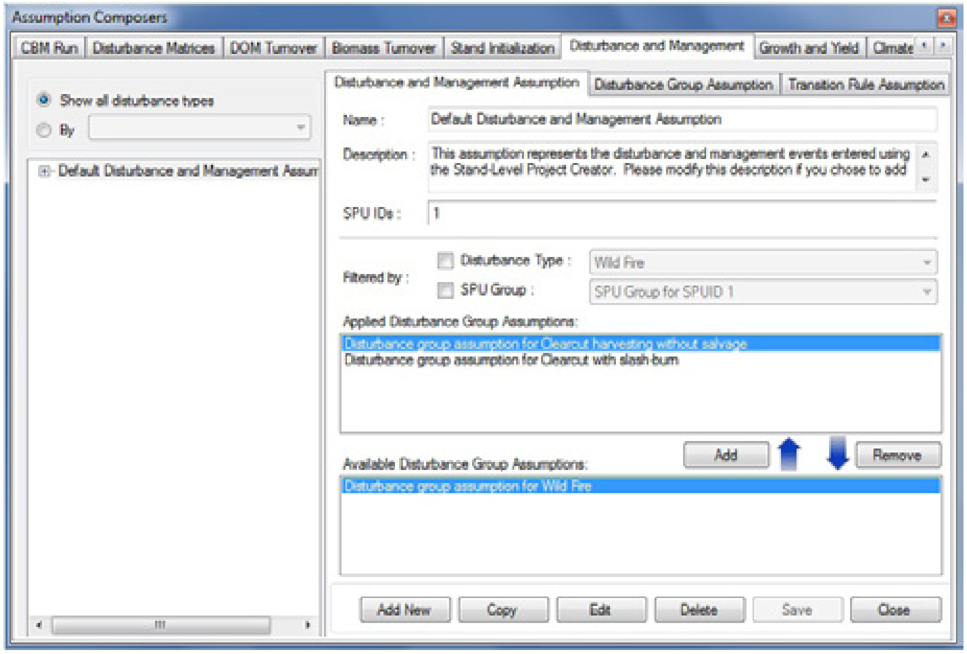


Figure 7-15. The “Assumption Composers” window with the “Disturbance and Management” and “Disturbance and Management Assumption” tabs selected.

Existing Disturbance and Management Assumptions are displayed in this window in a hierarchical structure in the box containing the directory tree of assumptions. To view assumptions in the directory for all disturbance types, the user can click on the “By all disturbance types” radio button. The user can also view assumptions linked to a specific disturbance type in the directory tree by clicking on the “By” radio button and selecting a disturbance type from the drop list beside it.

On the directory tree, the user can then double-click on a specific Disturbance and Management Assumption or click on the “+” next to it to expand the tree and see the management, natural disturbance, land-use change, and/or other disturbance hierarchy. The Disturbance Group Assumptions associated with this Disturbance and Management Assumption will be displayed in the “Applied Disturbance Group Assumptions” box. On the directory tree, the user can double-click on one of the four headings to view the Disturbance Group Assumptions and Transition Rule Assumptions in the tree structure and click on either of these to view the details about them. Clicking on a “-” in the directory tree will collapse the corresponding assumption section of the directory tree. The user can also right-click in the directory tree box and choose, by selecting the appropriate option from the pop-up menu, to expand or collapse the directory tree.

Users can add, copy, edit, or delete Disturbance and Management Assumptions, Disturbance Group Assumptions, or Transition Rule Assumptions. To cancel any of these actions

Click on the “Cancel” button

To close the window

Click on the “Close” button

The hierarchical structure for a Disturbance and Management Assumption is as follows

1. **Disturbance and Management Assumption**
2. **Disturbance Group Assumption**
3. **Transition Rule Assumption**

7.9.1 Adding a Disturbance and Management Assumption

To add (create) a new Disturbance and Management Assumption using the "Disturbance and Management Assumption" tab on the "Disturbance and Management " tab (Fig. 7-15)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Enter the eligible SPU identification (ID) numbers separated by commas, if the project contains more than one**
5. **Click on the "Save" button**

The new Disturbance and Management Assumption will be added to the directory tree box. To be used in a simulation, a Disturbance and Management Assumption must be composed of one or more Disturbance Group Assumptions.

Adding a Disturbance Group Assumption to a Disturbance and Management Assumption

To add a Disturbance Group Assumption to a Disturbance and Management Assumption

1. **Click on the name of a Disturbance and Management Assumption in the directory tree box (Fig. 7-15)**
2. **In the "Available Disturbance Group Assumptions" box, click on the name of the Disturbance Group Assumption to be linked to it**

☞ *Tip: Filtering Disturbance Group Assumptions*

If the list of Disturbance Group Assumptions is extensive, the user can filter the list to show only those Disturbance Group Assumptions associated with a particular disturbance type and/or SPU Group. To do this

Click on the "Disturbance Type" check box and select an item from the drop list

and/or

Click on the "SPU Group" check box and select an item from the drop list

3. **Click on the "Add" button**

The Disturbance Group Assumption will appear in the "Applied Disturbance Groups Assumptions" box.

Removing a Disturbance Group Assumption from a Disturbance and Management Assumption

To remove a Disturbance Group Assumption from a Disturbance and Management Assumption

1. **Click on the name of the Disturbance and Management Assumption in the directory tree box (Fig. 7-15)**
2. **Click on the name of the Disturbance Group Assumption in the "Applied Disturbance Group Assumptions" box**
3. **Click on the "Remove" button**

7.9.2 Copying a Disturbance and Management Assumption

To copy an existing Disturbance and Management Assumption using the "Disturbance and Management Assumption" tab on the "Disturbance and Management" tab (Fig. 7-15)

1. **Click on the name of a Disturbance and Management Assumption in the directory tree box**
2. **Click on the "Copy" button**

The copy of the Disturbance and Management Assumption, called "Copy of 'original Disturbance and Management Assumption name'" will be added to the directory tree box. The user can then edit the copy of the Disturbance and Management Assumption.

7.9.3 Editing a Disturbance and Management Assumption

To edit an existing Disturbance and Management Assumption using the "Disturbance and Management Assumption" tab on the "Disturbance and Management" tab (Fig. 7-15)

1. **Click on the name of a Disturbance and Management Assumption in the directory tree box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Disturbance and Management Assumption name, description, and/or SPU ID(s) (see section 7.9.1)**
4. **Click on the "Save" button**

The Disturbance Group Assumptions linked to a Disturbance and Management Assumption can also be added or removed (see section 7.9.1).

7.9.4 Deleting a Disturbance and Management Assumption

To delete an existing Disturbance and Management Assumption using the "Disturbance and Management Assumption" tab on the "Disturbance and Management" tab (Fig. 7-15)

1. **Click on the name of a Disturbance and Management Assumption in the directory tree box**
2. **Click on the "Delete" button**

A "Delete Disturbance Record Confirmation" window will pop up, asking the user to confirm deletion of the selected disturbance assumption.

3. **Click on the "Yes" button to proceed**
   or
   Click on the "No" button to cancel the deletion

7.9.5 Adding a Disturbance Group Assumption

Disturbance Group Assumptions are composed of a disturbance type, an SPU Group, and a Transition Rule Assumption. Existing Disturbance Group Assumptions appear in the "List of Assumptions" box on the "Disturbance Group Assumption" tab (Fig. 7-16).

To add (create) a new Disturbance Group Assumption using the "Disturbance Group Assumption" tab on the "Disturbance and Management" tab (Fig. 7-16)

1. **Click on the "Add New" button**

2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date'")**
4. **Click on the "Disturbance Type" box and select a disturbance type from the drop list that appears**
5. **Click on the "SPU Group" box and select an SPU Group from the drop list that appears**

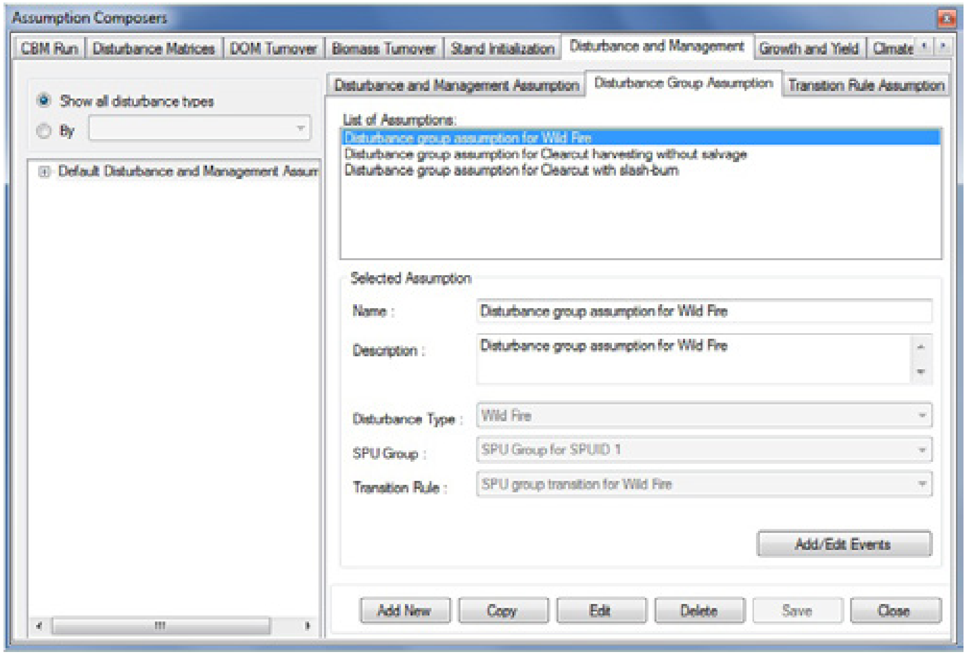


Figure 7-16. The "Assumption Composers" window with the "Disturbance and Management" and "Disturbance Group Assumption" tabs selected.

Next, the user must select a transition rule. A transition rule describes the transition of a specific pre-disturbance forest type to one or more post-disturbance forest types following a specific disturbance event. For example, following clear-cutting, an area with a black spruce forest type may convert to 50% black spruce and 50% trembling aspen forest types. To proceed

6. **Click on the "Transition Rule" box and select a transition rule from the drop list that appears**
7. **Click on the "Save" button**

The new Disturbance Group Assumption will be added to the "List of Assumptions" box and can be linked to a Disturbance and Management Assumption.

Adding Disturbance Events

The "Add/Edit Events" button on the "Disturbance Group Assumption" tab can be used to link new disturbance events to a new Disturbance Group Assumption. To use this feature,

1. **Click on the name of the new Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Add/Edit Events" button**

The "Disturbance Events Editor" window (Fig. 6–7) will pop up where the user can add one event, multiple events, or multiple repeating events—see section 6.2.3 for instructions on how to add disturbance events in this window; however, the user should note that when accessing this window via the "Disturbance Group

Assumption" tab and clicking on the "Add New Event" button as per the instructions, the "Disturbance Rules Generator" window (Fig. 6–11) will pop up, and not the "Individual Disturbance Event Editor" (Fig. 6–9). Instructions for the "Disturbance Rules Generator" window can be found in section 6.2.4.

7.9.6 Copying a Disturbance Group Assumption

To copy an existing Disturbance Group Assumption using the "Disturbance Group Assumption" tab on the "Disturbance and Management" tab (Fig. 7-16)

1. **Click on the name of a Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Disturbance Group Assumption called "Copy of 'original Disturbance Group Assumption name'" will be added to the "List of Assumptions" box. The user can then edit the copy of the Disturbance Group Assumption.

Adding Disturbance Events

The "Add/Edit Events" button on the "Disturbance Group Assumption" tab can be used to link new disturbance events to a copied Disturbance Group Assumption. To use this feature,

1. **Click on the name of the new Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Add/Edit Events" button**

The "Disturbance Events Editor" window (Fig. 6–7) will pop up where the user can add one event, multiple events, or multiple repeating events—see section 6.2.3 for instructions on how to add disturbance events in this window; however, the user should note that when accessing this window via the "Disturbance Group Assumption" tab and clicking on the "Add New Event" button as per the instructions, the "Disturbance Rules Generator" window (Fig. 6–11) will pop up, and not the "Individual Disturbance Event Editor" (Fig. 6–9). Instructions for the "Disturbance Rules Generator" window can be found in section 6.2.4.

7.9.7 Editing a Disturbance Group Assumption

To edit an existing Disturbance Group Assumption using the "Disturbance Group Assumption" tab on the "Disturbance and Management" tab (Fig. 7-16)

1. **Click on the name of a Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Disturbance Group Assumption name, description, disturbance type, SPU Group, and/or transition rule (see section 7.9.5)**
4. **Click on the "Save" button**

Editing a Disturbance Event

The "Add/Edit Events" button on the "Disturbance Group Assumption" tab can be used to edit existing disturbance events or link new disturbance events to an existing Disturbance Group Assumption. To use this feature:

1. **Click on the name of the Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Add/Edit Events" button**

The "Disturbance Events Editor" window (Fig. 6–7) will pop up where the user can edit (see section 6.2.2 for instructions) or add (see section 6.2.3 for instructions) single events via the "Individual Disturbance Event Editor" (Fig. 6–9) window. If the user wants to add multiple repeating disturbance events to an existing Disturbance Group Assumption that already has scheduled disturbance events, they will need to access the "Disturbance Rules Generator" window (Fig. 6–11) instead via the Disturbance Events Editor (see section 6.2).

7.9.8 Deleting a Disturbance Group Assumption

To delete an existing Disturbance Group Assumption using the "Disturbance Group Assumption" tab on the "Disturbance and Management" tab (Fig. 7-16)

1. **Click on the name of a Disturbance Group Assumption in the "List of Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Disturbance Group Record Confirmation" window will pop up, asking the user to confirm deletion of the Disturbance Group Assumption.

3. **Click on the "Yes" button to proceed**
   or
   Click on the "No" button to cancel the deletion

7.9.9 Adding a Transition Rule Assumption

Transition Rule Assumptions are composed of a disturbance type, an SPU Group, and an associated forest type. Each assumption is linked to transition rules in the Transition Rules Editor. If a Transition Rule Assumption is to be used in a simulation run, it must be linked to a Disturbance Group Assumption (which must in turn be linked to a Disturbance and Management Assumption). Existing Transition Rule Assumptions (if any) appear in the "List of Assumptions" box on the "Transition Rule Assumption" tab (Fig. 7-17).

To add (create) a new Transition Rule Assumption using the "Transition Rule Assumption" tab on the "Disturbance and Management" tab (Fig. 7-17)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**

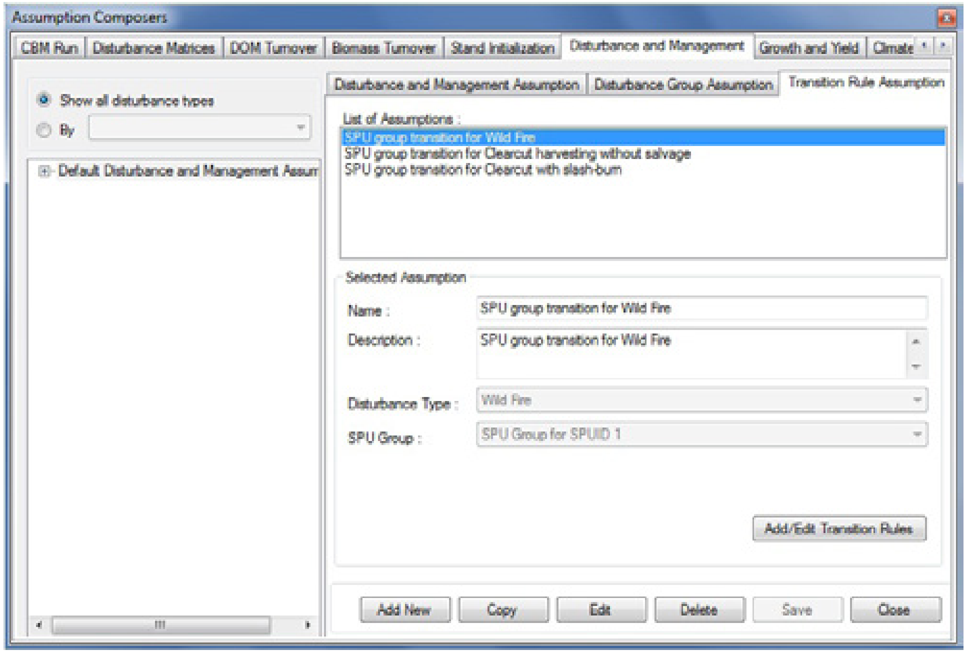


Figure 7-17. The "Assumption Composers" window with the "Disturbance and Management" and "Transition Rules Assumption" tabs selected.

3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date'")**
4. **Click on the "Disturbance Type" box and select the name of a disturbance type from the drop list that appears**
5. **Click on the "SPU Group" box and select the name of an SPU Group from the drop list that appears**
6. **Click on the "Save" button**

The new Transition Rule Assumption will be added to the "List of Assumptions" box and can be linked to a Disturbance Group Assumption. The user can edit the transition rules associated with the Transition Rule Assumption (see section 7.9.11).

7.9.10 Copying a Transition Rule Assumption

To copy an existing Transition Rule Assumption using the "Transition Rule Assumption" tab on the "Disturbance and Management" tab (Fig. 7-17)

1. **Click on the name of a Transition Rule Assumption in the "List of Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Transition Rule Assumption called "Copy of 'original Transition Rule Assumption name'" will be added to the "List of Assumptions" box. The user can then edit the copy of the Transition Rule Assumption.

7.9.11 Editing a Transition Rule Assumption

To edit an existing Transition Rule Assumption using the "Transition Rule Assumption" tab on the "Disturbance and Management" tab (Fig. 7-17)

1. **Click on the name of a Transition Rule Assumption in the "List of Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Transition Rule Assumption name, description, applied disturbance type, and/or SPU Group, (see section 7.9.9)**
4. **Click on the "Save" button**

Editing Transition Rules

To edit the transition rules associated with a disturbance type in a Transition Rule Assumption

1. **Click on the "Transition Rules Assumption" tab (Fig. 7-17)**
2. **Click on the name of a Transition Rule Assumption in the "List of Assumptions" box**
3. **Click on the "Add/Edit Transition Rules" button**

At this point, the "Transition Rules Editor" window (Fig. 6-28) will pop up. For details on how to use the Transition Rules Editor, read section 6.6.

7.9.12 Deleting a Transition Rule Assumption

To delete an existing Transition Rule Assumption using the "Transition Rule Assumption" tab on the "Disturbance and Management" tab (Fig. 7-17)

1. **Click on the name of a Transition Rule Assumption in the "List of Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Transition Rule Record Confirmation" window will pop up, asking the user to confirm deletion of the Transition Rule Assumption.

3. **Click on the "Yes" button to proceed**
   or
   Click on the "No" button to cancel the deletion

7.10 Composing Run Growth Assumptions

Run Growth Assumptions are composed of one or more SPU Group Growth Assumptions. SPU Group Growth Assumptions are, or can be, linked to growth and yield curves in the Growth Curve Editor (see Fig. 6-19).

To access the Assumption Composer for Run Growth Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Growth and Yield" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-18) will pop up displaying the "Growth and Yield" tab.

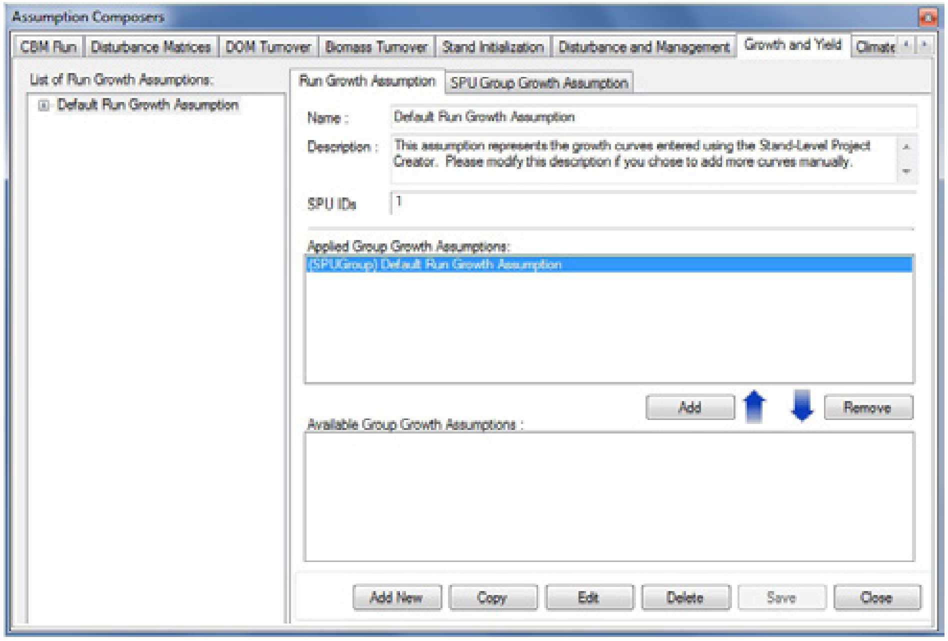


Figure 7-18. The "Assumption Composers" window with the "Growth and Yield" and "Run Growth Assumption" tabs selected.

Existing Run Growth Assumptions are displayed in the "List of Run Growth Assumptions" box in a hierarchical directory tree structure. On the directory tree, the user can double-click on a specific Run Growth Assumption or click on the "+" next to the assumption to view details about it and its associated SPU Group Growth Assumptions, either in the directory tree or in the "Applied Group Growth Assumptions" box. Clicking on a "-" in the directory tree will collapse the corresponding assumption section of the directory tree. The user can click on an associated SPU Group Growth Assumption in the directory tree to view its details on the "SPU Group Growth Assumptions" tab. The user can also right-click in the "List of Run Growth Assumptions" box and choose, by selecting the appropriate option from the pop-up menu, to expand or collapse the directory tree.

The user can add, copy, edit, or delete Run Growth Assumptions or SPU Group Growth Assumptions. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

The hierarchical structure for a Run Growth Assumption is as follows:

1. **Run Growth Assumption**
2. **SPU Group Growth Assumption**

7.10.1 Adding a Run Growth Assumption

To add (create) a new Run Growth Assumption using the "Run Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-18)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**

3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date'")**
4. **Enter the eligible SPU identification (ID) numbers separated by commas, if the project contains more than one**
5. **Click on the "Save" button**

The new Run Growth Assumption will be added to the "List of Run Growth Assumptions" box. To be eligible for use in a model simulation, a Run Growth Assumption should consist of one SPU Group Growth Assumption.

Adding an SPU Group Growth Assumption to a Run Growth Assumption

An SPU Group Growth Assumption is composed of user-specified growth and yield curves linked to specific forest types. To add an SPU Group Growth Assumption to a Run Growth Assumption

1. **Click on the name of a Run Growth Assumption in the "Run Growth Assumptions" box (Fig. 7-18)**
2. **In the "Available Group Growth Assumptions" box, click on the name of the SPU Group Growth Assumption to be added**
3. **Click on the "Add" button**

The new SPU Group Growth Assumption will be added to the "Applied Group Growth Assumptions" box and will be linked to the Run Growth Assumption in the "List of Run Growth Assumptions" box.

Removing an SPU Group Growth Assumption from a Run Growth Assumption

To remove an SPU Group Growth Assumption from a Run Growth Assumption

1. **Click on the name of the Run Growth Assumption in the "List of Run Growth Assumptions" box (Fig. 7-18)**
2. **Click on the name of the SPU Group Growth Assumption in the "Applied Group Growth Assumptions" box**
3. **Click on the "Remove" button**

7.10.2 Copying a Run Growth Assumption

To copy an existing Run Growth Assumption using the "Run Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-18)

1. **Click on the name of a Run Growth Assumption in the "List of Run Growth Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Run Growth Assumption, called "Copy of 'original Run Growth Assumption name'" will be added to the directory tree in the "List of Run Growth Assumptions" box. The user can add SPU Group Growth Assumptions to this copy by following the steps in the "Adding an SPU Group Growth Assumption to a Run Growth Assumption" subsection of section 7.10.1. The user can then edit the copy of the Run Growth Assumption.

7.10.3 Editing a Run Growth Assumption

To edit an existing Run Growth Assumption using the "Run Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-18)

1. **Click on the name of a Run Growth Assumption in the "List of Run Growth Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Run Growth Assumption name, description, and/or SPU ID(s) (see section 7.10.1)**
4. **Click on the "Save" button**

An "Add or Update Assumption" window will pop up, asking the user to confirm modification of the selected growth record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

7.10.4 Deleting a Run Growth Assumption

To delete an existing Run Growth Assumption using the "Run Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-18)

1. **Click on the name of a Run Growth Assumption in the "List of Run Growth Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Growth Record Confirmation" window will pop up, asking the user to confirm deletion of the Growth Assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.10.5 Adding an SPU Group Growth Assumption

SPU Group Growth Assumptions are linked to an SPU Group and one or more user-assigned growth and yield curves. Existing SPU Group Growth Assumptions (if any) appear in the "List of Assumptions" box on the "SPU Group Growth Assumption" tab (Fig. 7-19).

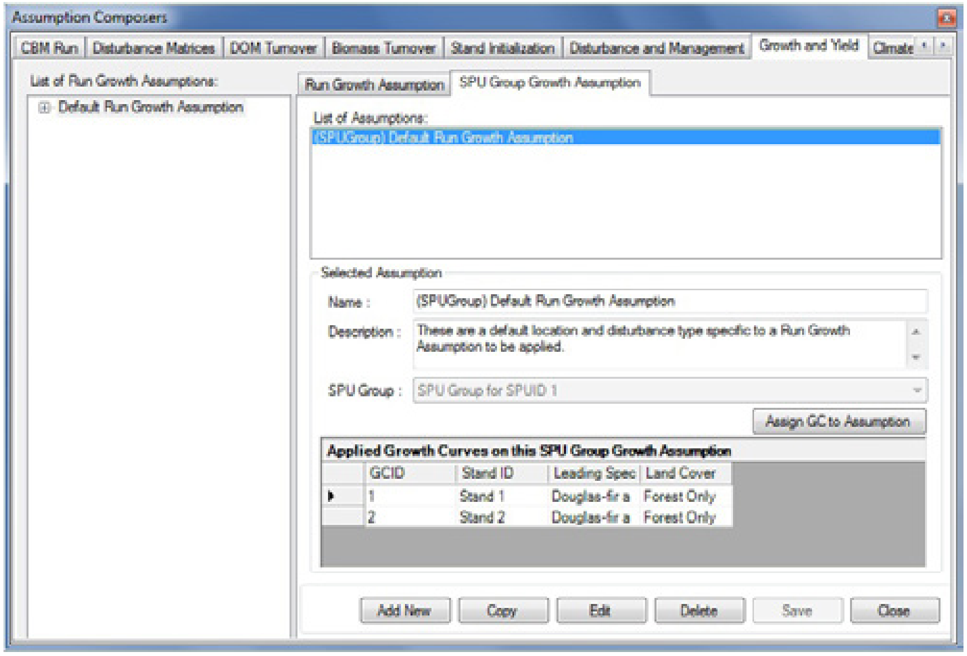


Figure 7-19. The "Assumption Composers" window with the "Growth and Yield" and "SPU Group Growth Assumption" tabs selected.

When the user clicks on an SPU Group Growth Assumption name in this box, the assigned growth and yield curves (if any) will be displayed in the scrollable "Applied Growth Curves on this SPU Group Growth Assumption" table.

To add a new SPU Group Growth Assumption using the "SPU Group Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-19)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank the default is "Created on 'current date' ")**
4. **Click on the "SPU Group" box and select an option from the drop list that appears**
5. **Click on the "Save" button**

The new SPU Group Growth Assumption will be added to the "List of Assumptions" box. Next, the user must assign growth and yield curves and stand types to the new assumption.

6. **Click on the "Assign GC to Assumption" button**
7. **Proceed to the "Assigning Growth and Yield Curves and Stand Types to an SPU Group Growth Assumption" subsection in section 7.10.9**

7.10.6 Copying an SPU Group Growth Assumption

To copy an existing SPU Group Growth Assumption using the "SPU Group Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-19)

1. **Click on the name of an SPU Group Growth Assumption in the "List of Assumptions" box**
2. **Click on the "Copy" button**

The copy of the SPU Group Growth Assumption, called "Copy of 'original SPU Group Growth Assumption name'" will be added to the "Available SPU Group Growth Assumptions" box on the "Run Growth Assumption" tab and will appear in the "List of Assumptions" box on the "SPU Group Growth Assumption" tab. The user can then edit the copy of the SPU Group Growth Assumption.

7.10.7 Editing an SPU Group Growth Assumption

To edit an existing SPU Group Growth Assumption using the "SPU Group Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-19)

1. **Click on the name of an SPU Group Growth Assumption in the "List of Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the SPU Group Growth Assumption name, description, and/or SPU group**
4. **Click on the "Save" button**

An "Add or Update SPU Group Growth Assumption" window will pop up, asking the user to confirm modification of the selected SPU group growth record.

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

The user can also edit the growth and yield curves and stand types associated with an assumption by clicking on the "Assign GC to Assumption" button and following instructions in the "Updating Growth and Yield Curves and Stand Types of an SPU Group Growth Assumption" subsection in section 7.10.9.

7.10.8 Deleting an SPU Group Growth Assumption

To delete an existing SPU Group Growth Assumption using the "SPU Group Growth Assumption" tab on the "Growth and Yield" tab (Fig. 7-19)

1. **Click on the name of an SPU Group Growth Assumption in the "List of Assumptions" box**
2. **Click on the "Delete" button**

A "Delete SPU Group Growth Record Confirmation" window will pop up, asking the user to confirm deletion of the SPU Group Growth Assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.10.9 Viewing, Assigning, Updating, or Removing Associated Growth and Yield Curves and/or Stand Types

If the user clicks on the "Assign GC to Assumption" button on the "SPU Group Growth Assumption" tab (Fig. 7-19), the "Growth Curve Assignment" window will pop up (Fig. 7-20). The "Growth Curve Assignment" window displays the SPU Group Growth Assumption being edited (in the "Name" box), a list of growth and yield curves associated with the project (in the "Defined Growth Curves" box), and a list of stand types associated with the project (in the "Defined Stand (Classifier Sets)" box).

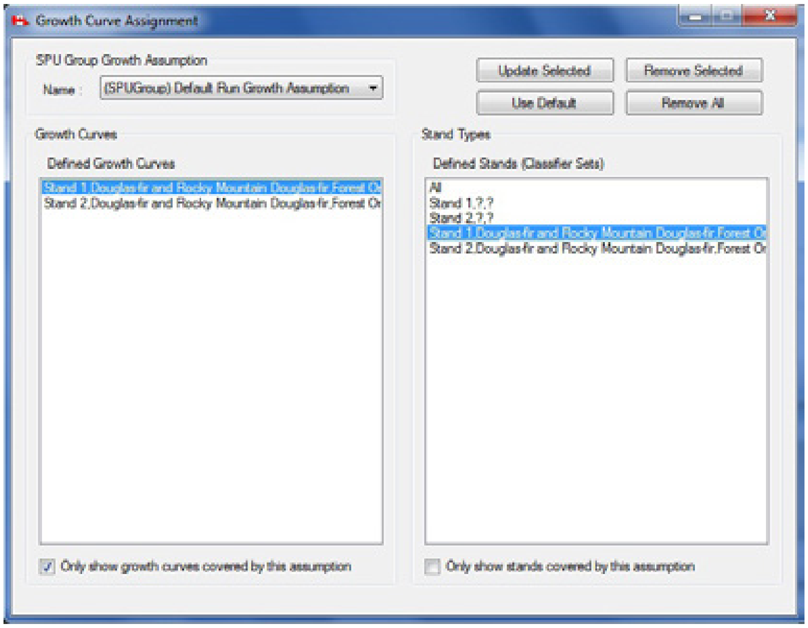


Figure 7-20. The "Growth Curve Assignment" window.

In this window, for any selected SPU Group Growth Assumptions, the user can view associated growth and yield curves and/or stand types, update associated growth and yield curves and stand types, remove some or all of the associated growth and yield curves and/or stand types, or reset all associated growth and yield curve(s) and stand type(s) to their original imported settings.

Viewing Associated Growth and Yield Curves and/or Stand Types

In the "Growth Curve Assignment" window (Fig. 7-20), the "Only show growth curves covered by this assumption" check box and "Only show stands covered by this assumption" check box permit the user to view all available growth and yield curve(s) or stand type(s) associated with a project or only those associated with the SPU Group Growth Assumption selected in the "Name" box. When these check boxes are unchecked, the user will see all available growth and yield curve(s) or stand type(s) associated with a project displayed in the "Defined Growth Curves" box and "Defined Stand (Classifier Sets)" box.

To view only those growth and yield curve(s) or stand type(s) associated with an SPU Group Growth Assumption

1. **Click on the "Name" box and select an SPU Group Growth Assumption from the drop list that appears**
2. **Click on the "Only show growth curves covered by this assumption" check box (so that a check mark is displayed)**

Following this step, only growth and yield curves that are associated with the SPU Group Growth Assumption will be displayed.

3. **Click on the "Only show stands covered by this assumption" check box (so that a check mark is displayed)**

Following this step, only stands that are associated with the SPU Group Growth Assumption will be displayed.

To view the stand types associated with each growth and yield curve

Click on a growth and yield curve name in the "Defined Growth Curves" box

The associated stand type(s) will be highlighted in the "Defined Stand (Classifier Sets)" box.

To exit the "Growth Curve Assignment" window

4. **Click on the "X" button**

Assigning Growth and Yield Curves and Stand Types to an SPU Group Growth Assumption

When the user creates a new SPU Group Growth Assumption, growth and yield curves and stand types must be assigned to it before it can be associated with a Run Growth Assumption. To assign growth and yield curves and stand types to a new SPU Group Growth Assumption using the "Growth Curve Assignment" window (Fig. 7-20)

1. **Click on the "Name" box and select the new SPU Group Growth Assumption from the drop list that appears**

The "Only show growth curves covered by this assumption" check box and "Only show stands covered by this assumption" check box should not be checked. If they are

Click on each check box to remove the check mark

Next, the user must select the growth and yield curves to be linked to the SPU Group Growth Assumption and must associate stand types with these growth and yield curves.

2. **Click on the name of a growth and yield curve in the "Defined Growth Curves" box**
3. **Click on one or more (by holding down the Shift key or Ctrl key on the keyboard) stand types in the "Defined Stand (Classifier Sets)" box**
4. **Click on the "Update Selected" button**

An "Associate Growth Curve and Stand Type(s)" window will pop up, asking the user to confirm the association of the selected growth and yield curves and stand type(s).

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to terminate the process and skip to step 7
6. **Repeat steps 2 to 5 to add more growth and yield curves and stand types**

Should the user link the wrong stand types to a growth and yield curve and click on the "Update Selected" button, steps 2 to 5 can be repeated to overwrite the previous association.

To exit the "Growth Curve Assignment" window

7. **Click on the "X" button**

Updating Growth and Yield Curves and Stand Types of an SPU Group Growth Assumption

To update the growth and yield curves and their associated stand types for an SPU Group Growth Assumption in the "Growth Curve Assignment" window (Fig. 7-20)

1. **Click on the "Name" box and select an SPU Group Growth Assumption from the drop list that appears**

The user should verify which growth and yield curves are linked to the SPU Group Growth Assumption and the stand type(s) with which each growth and yield curve is associated (see "Viewing Associated Growth and Yield Curves and/or Stand Types," above in this section). Neither the "Only show growth curves covered by this assumption" check box or the "Only show stands covered by this assumption" check box should be checked. If either or both of these boxes are checked

Click on each check box to remove the checkmark

Next, users must select the growth and yield curve linked to the SPU Group Growth Assumption and update the stand type(s) associated with it.

2. **Click on the growth and yield curve name in the "Defined Growth Curves" box**
3. **Click on one or more (by holding down the Shift key or Ctrl key on the keyboard) stand types in the "Defined Stand (Classifier Sets)" box**
4. **Click on the "Update Selected" button**

An "Associate Growth Curve and Stand Type(s)" window will pop up asking users if they are sure that they want to associate the selected growth and yield curve and stand type(s).

5. **Click on the "Yes" button to proceed,**

   or

   Click on the "No" button to terminate the process

If users clicked on the "Yes" button, they can (otherwise skip to step 7)

6. **Repeat steps 2 to 5 to update the stand types for another growth and yield curve**

Should users link the wrong stand types to a growth and yield curve and click on the "Update Selected" button, they can repeat steps 2-5 to overwrite the previous association.

To exit the "Growth Curve Assignment" window

7. **Click on the "X" button**

Removing Growth and Yield Curves and Stand Types from an SPU Group Growth Assumption

The user has two options for removing growth and yield curves (and their associated stand types) from an SPU Group Growth Assumption in the "Growth Curve Assignment" window (Figure 7-20): removing all or removing only selected growth and yield curves. To remove all growth and yield curves

1. **Click on the "Name" box and select the name of an SPU Group Growth Assumption from the drop list that appears**
2. **Click on the "Remove All" button**

A "Remove Growth Curve and Stand Type Associations" window will pop up, asking the user to confirm removal of the association between the currently selected growth and yield curves and stand type(s).

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, all growth and yield curves and their associated stand types will no longer be associated with the selected SPU Group Growth Assumption. Although all growth and yield curves and stand types have been removed from the SPU Group Growth Assumption, the entry "Empty growth curve" will be displayed in the "Defined Growth Curves" box and a number of question marks representing the number of classifiers in the project will be displayed in the "Defined Stand (Classifier Sets)" box, separated by commas. Both of these entries are simply placeholders with no value. The "Empty Growth Curve" has volumes of zero assigned to each age class, and the question marks represent all stands associated with the "Empty growth curve."

To remove selected growth and yield curves

1. **Click on the "Name" box and select an SPU Group Growth Assumption name from the drop list that appears**
2. **Click on the "Only show growth curves covered by this assumption" check box (so that a check mark is displayed)**
3. **Click on one or more (by holding down the Shift key or Ctrl key on the keyboard) growth and yield curves in the "Defined Growth Curves" box**
4. **Click on the "Remove Selected" button**

A "Remove Growth Curve and Stand Type Associations" window will pop up, asking the user to confirm removal of the association between the selected growth and yield curve and stand type(s).

5. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, the selected growth and yield curves and their associated stand types will no longer be associated with the selected SPU Group Growth Assumption.

To exit the "Growth Curve Assignment" window

6. **Click on the "X" button**

7.11 Composing Volume-to-Biomass Assumptions

A Volume-to-Biomass Assumption is composed of both volume-to-biomass parameters and biomass-to-carbon parameters. Default or user-defined volume-to-biomass parameters are assigned for all combinations of tree species types (softwood and/or hardwood) and SPUs imported by the user. These parameters include estimates of total stem wood biomass, nonmerchantable expansion factors, sapling expansion factors, proportions of stem bark, proportions of branches, and proportions of foliage. Biomass-to-carbon parameters include softwood and hardwood multipliers for the merchantable biomass component, foliage biomass component, other biomass component, submerchantable biomass component, coarse root biomass component, and fine root biomass component. All of these parameters are parts of equations developed by the Program on Energy Research and Development biomass study. Default parameters that the user encounters in the model are assigned on the basis of the ecological boundary chosen during the data import process.

To access the Assumption Composer for Volume-to-Biomass Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Volume-to-Biomass Parameters" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-21) will pop up, displaying the "Volume-to-Biomass Conversion" tab.

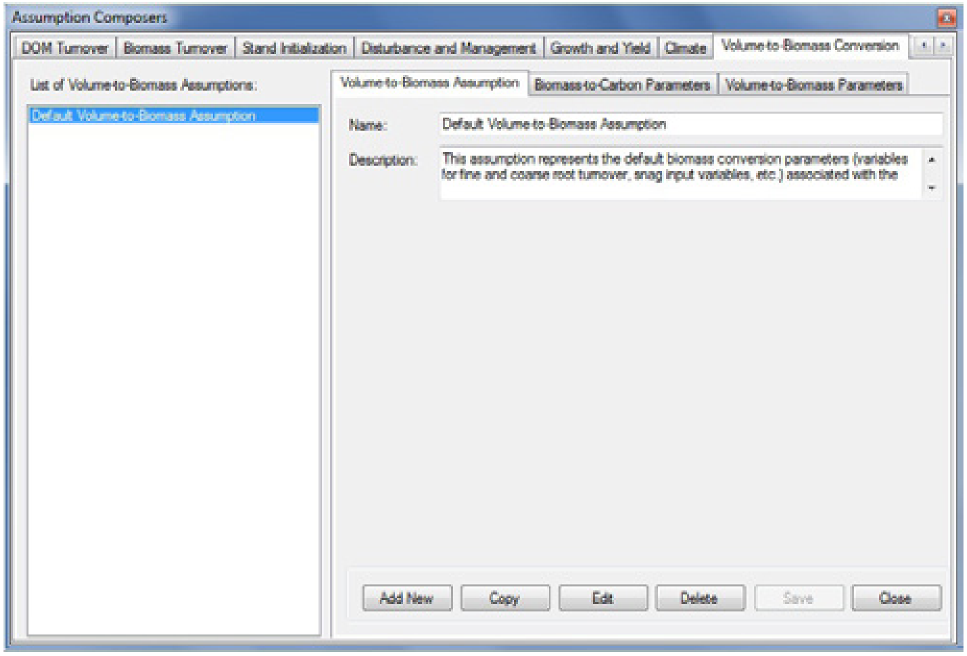


Figure 7-21. The "Assumption Composers" window with the "Volume-to- Biomass Conversion" and "Volume-to-Biomass Assumption" tabs selected.

Existing Volume-to-Biomass Assumptions are displayed in the "List of Volume-to-Biomass Assumptions" box. Users can click on a specific assumption name to view its associated parameters on the "Volume-to-Biomass Parameters" tab or the "Biomass-to-Carbon Parameters" tab. The user can add, copy, edit, or delete Volume-to-Biomass Assumptions and/or edit their assigned volume-to-biomass or biomass-to-carbon parameters. To cancel any of these actions

Click on the "Cancel" button

To close the window

Click on the "Close" button

Note: How to modify root biomass parameters

Users interested in modifying the root biomass parameters for a CBM-CFS3 project must do so in the Microsoft Access database for their project before executing their project simulation in the Simulation Scheduler. For details on how to modify these parameters, see Appendix 11.

7.11.1 Adding a Volume-to-Biomass Assumption

To add (create) a new Volume-to-Biomass Assumption using the "Volume-to-Biomass Assumption" tab on the "Volume-to-Biomass Conversion" tab Fig. 7-21)

1. **Click on the "Add New" button**
2. **Enter a name for the assumption in the "Name" box**
3. **Enter a description for the assumption in the "Description" box (if this box is left blank, the default is "Created on 'current date' ")**
4. **Click on the "Save" button**

The new Volume-to-Biomass Assumption will be added to the "List of Volume-to-Biomass Assumptions" box. The model will automatically assign default parameter values for all of the user's species based on the project's administrative and ecological boundaries.

Next, the user can edit the volume-to-biomass parameters for the assumption on the "Volume-to-Biomass Parameters" tab (Fig. 7-22). Parameters on this tab are displayed according to the selection of spatial unit and species type. The equations for these parameters can be found in Boudewyn et al. (2007), and descriptions can be found in Table 7-2. To make edits on this tab

5. **Click on the "Volume-to-Biomass Parameters " tab**
6. **Click on the "SPU" drop list box and select a spatial unit**
7. **Click on the "Species Type" drop list box and select a species type**
8. **Click on the "Edit" button**

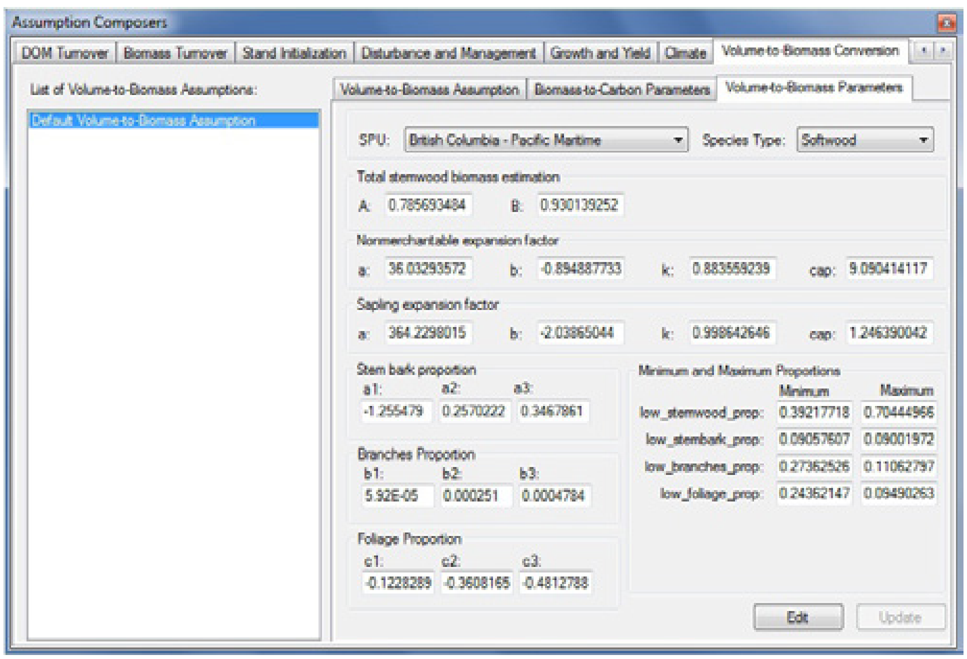


Figure 7-22. The "Assumption Composers" window displaying the "Volume- to-Biomass Conversion" and "Volume-to-Biomass Parameters" tabs.

Note: Editing assumption parameter values associated with simulations that have already been simulated

If a user tries to edit parameters for an assumption that has already been simulated, an "Add or Update Biomass Conversion Assumption" window will pop up, asking the user to confirm that the parameters are to be edited.

Click on the "Yes" button to proceed

or

Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, the edits can be made.

9. **Make the necessary changes to any of the parameter values listed on the tab**

Table 7-2. Names and descriptions of parameter values displayed on the "Volume-to-Biomass Parameters" tab on the "Volume-to-Biomass Conversion" tab in the "Assumption Composers" window

Box name	Parameter name	Description
Total stemwood biomass estimation	A	Nonlinear parameter fit separately by jurisdiction, ecozone, and lead tree species
	B	Nonlinear parameter fit separately by jurisdiction, ecozone, and lead tree species
Nonmerchantable expansion factor	a	Biomass model parameter fit separately by jurisdiction, ecozone, and lead tree species
	b	Biomass model parameter fit separately by jurisdiction, ecozone, and lead tree species
	k	Biomass model parameter fit separately by jurisdiction, ecozone, and lead tree species
	cap	Upper limit on nonmerchfactor
Sapling expansion factor	a	Biomass model parameter fit separately by combinations of jurisdiction, ecozone, and predominant genus
	b	Biomass model parameter fit separately by combinations of jurisdictions, ecozone, and predominant genus
	k	Biomass model parameter fit separately by combinations of jurisdictions, ecozone, and predominant genus
	cap	Upper limit on sapling expansion factor
Stem bark proportion	a1	Stem bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	a2	Stem bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	a3	Stem bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
Branches proportion	b1	Branch bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	b2	Branch bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	b3	Branch bark proportion model parameter fit separately by jurisdiction, ecozone, and lead species
Foliage proportion	c1	Foliage proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	c2	Foliage proportion model parameter fit separately by jurisdiction, ecozone, and lead species
	c3	Foliage proportion model parameter fit separately by jurisdiction, ecozone, and lead species
Minimum and Maximum Proportions	low_stemwood_prop	Upper and lower proportion limits for stem wood, equivalent to expected factors associated with the maximum and minimum volumes
	low_stembark_prop	Upper and lower proportion limits for stem bark, equivalent to expected factors associated with the maximum and minimum volumes

Table 7-2. Concluded

Box name	Parameter name	Description
Minimum and Maximum Proportions	low_branches_prop	Upper and lower proportion limits for branches, equivalent to expected factors associated with the maximum and minimum volumes
	low_foliage_prop	Upper and lower proportion limits for foliage, equivalent to expected factors associated with the maximum and minimum volumes

10. Click on the "Update" button

An "Update Volume-to-Biomass Parameters" window will pop up, asking the user to confirm that the parameters are to be updated.

11. Click on the "Yes" button to proceed

or

Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, the edits will be applied to the associated SPU and species type for the selected Volume-to-Biomass Assumption.

Next, users can edit the default hardwood and softwood biomass-to-carbon conversion multipliers for biomass components linked to a Volume-to-Biomass Assumption (if required). To edit these parameters

12. Click on the "Biomass-to-Carbon Parameters" tab (Fig. 7-23)

13. Click on the "Edit" button

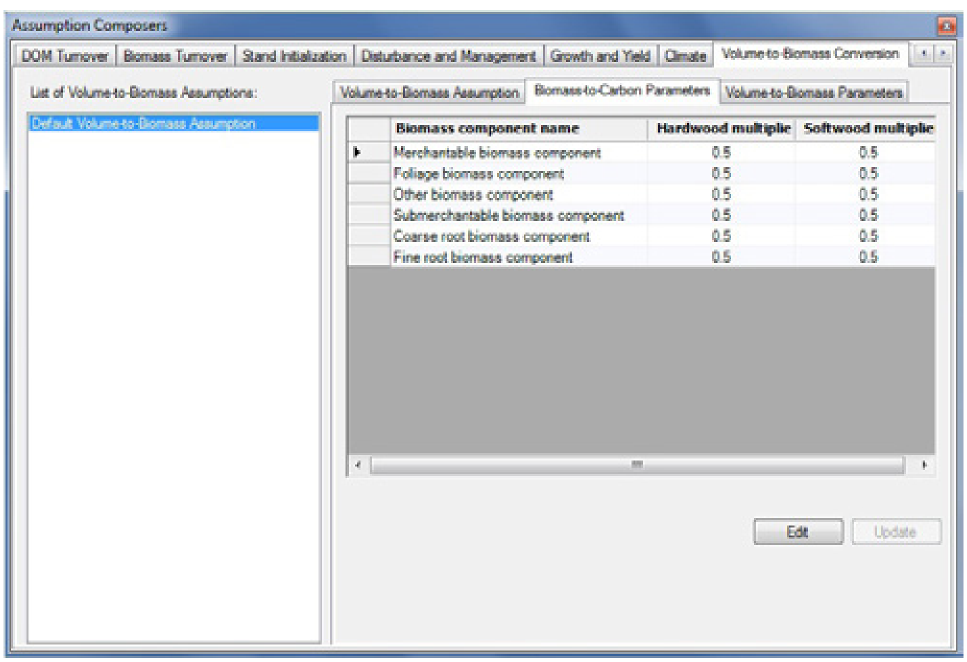


Figure 7-23. The "Assumption Composers" window with the "Volume-to- Biomass Conversion" and "Biomass-to-Carbon Parameters" tabs selected.

Note: Editing assumption parameter values associated with a simulation assumption that has already been run

If the user tries to edit parameters for a volume-to-biomass assumption that is linked to a simulation assumption that has already been run, an "Add or Update Biomass Conversion Assumption" window will pop up, asking the user to confirm that the parameters are to be edited.

Click on the "Yes" button to proceed

or

Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, the edits can be made.

14. **Enter a conversion multiplier in the softwood and/or hardwood column for each biomass component in the "Biomass Component Name" column of the table displayed (as required)**
15. **Click on the "Update" button**

An "Update Parameters" window will pop up, asking the user to confirm modification of the biomass-to-carbon parameters.

16. **Click on the "Yes" button to proceed**

    or

    Click on the "No" button to cancel the edits

7.11.2 Copying a Volume-to-Biomass Assumption

To copy an existing Volume-to-Biomass Assumption using the "Volume-to-Biomass Assumption" tab on the "Volume-to-Biomass Conversion" tab (Fig. 7-21)

1. **Click on the name of a Volume-to-Biomass Assumption in the "List of Volume-to-Biomass Assumptions" box**
2. **Click on the "Copy" button**

The copy of the Volume-to-Biomass Assumption, called "Copy of 'original Volume-to-Biomass Assumption name' " will be added to the "List of Volume-to-Biomass Assumptions" box. The user can then edit the copy of the Volume-to-Biomass Assumption.

7.11.3 Editing a Volume-to-Biomass Assumption

Editing the Assumption Name and Description

To edit the name and description of an existing Volume-to-Biomass Assumption using the "Volume-to-Biomass Assumption" tab on the "Volume-to-Biomass Conversion" tab (Fig. 7-21)

1. **Click on the name of an assumption in the "List of Volume-to-Biomass Assumptions" box**
2. **Click on the "Edit" button**
3. **Make the necessary changes to the Volume-to-Biomass Assumption name and/or description**
4. **Click on the "Save" button**

An "Add or Update Run Biomass Conversion Assumption" window will pop up, asking the user to confirm modification of the selected run biomass conversion record.

5. **Click on the "Yes" button to proceed**

    or

Click on the "No" button to cancel the edits

Editing the Assumption Parameters

To edit parameters of an existing Volume-to-Biomass Assumption using the "Volume-to-Biomass Assumption" tab on the "Volume-to-Biomass Conversion" tab (Fig. 7-21)

1. **Click on the name of an assumption in the "List of Volume-to-Biomass Assumptions" box**
2. **Click on either the "Volume-to-Biomass Parameters" tab or the "Biomass-to-Carbon Parameters" tab**
3. **Click on the "Edit" button**
4. **Make the necessary changes to the parameters (see section 7.11.1)**
5. **Click on the "Update" button**

An "Update Volume-to-Biomass Parameters" window or "Update Parameters" window (depending on which tab is in use) will pop up, asking the user to confirm modification of the parameters.

6. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the edits

To edit the parameters tab not selected in step 2, repeat steps 2 to 6 for that tab.

7.11.4 Deleting a Volume-to-Biomass Assumption

To delete an existing Volume-to-Biomass Assumption using the "Volume-to-Biomass Assumption" tab on the "Volume-to-Biomass Conversion" tab (Fig. 7-21)

1. **Click on the name of an assumption in the "List of Volume-to-Biomass Assumptions" box**
2. **Click on the "Delete" button**

A "Delete Biomass Conversion Record Confirmation" window will pop up, asking the user to confirm deletion of the selected biomass conversion assumption.

3. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

7.12 Composing Growth Multipliers Assumptions

A Growth Multipliers Assumption defines the relation between groups of growth curves and growth increment multipliers (for which the default value = 1). All growth curves used in a simulation must be accounted for in an assumption (even if the multiplier is set to 1). During a simulation, the multiplier is applied to each increment of each growth curve (associated with a growth curve group). A Growth Multipliers Assumption can be linked to one or more Stand Initialization Assumptions and CBM Run Assumptions.

To access the Assumption Composer for Growth Multipliers Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Growth Multipliers" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-24) will pop up, displaying the "Growth Multipliers" tab. Existing Growth Multipliers Assumptions will be displayed in the "List of Growth Multipliers Assumptions" box. The user can click on a specific assumption name to view its associated growth curve groups on the "Growth Curve Groups" tab or its associated growth multipliers on the "Growth Multiplier Values" tab. The user can add or delete Growth Multipliers Assumptions and/or edit the assigned growth curve groups or growth multiplier values. The growth curve groups minimize the duplication of multipliers assigned to yield curves, since all curves with the same multiplier can be added to the same growth curve group.

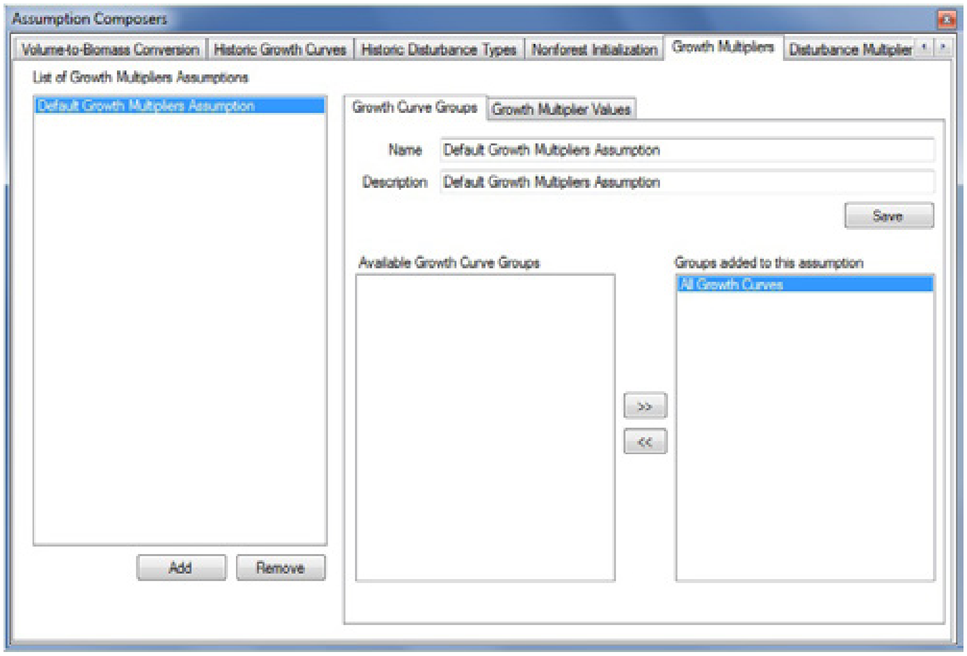


Figure 7-24. The "Assumption Composers" window, displaying the "Growth Multipliers" and "Growth Curve Groups" tabs.

To close the window

Click on the "X" button

7.12.1 Adding a Growth Multipliers Assumption

To add (create) a new Growth Multipliers Assumption using the "Growth Curve Groups" tab on the "Growth Multipliers" tab (Fig. 7-24)

1. **Click on the "Add" button**

A new numbered assumption named "New Run Growth Multipliers Assumption" will appear in the "List of Growth Multipliers Assumptions" box.

2. **Click on the new assumption name in the "List of Growth Multipliers Assumptions" box**
3. **Enter a name for the assumption in the "Name" box (optional)**
4. **Enter a description for the assumption in the "Description" box (optional)**
5. **Click on the "Save" button**

Next, the user must assign one or more growth curve groups to the assumption.

6. **Click on a growth curve group in the "Available Growth Curve Groups" box**
7. **Click on the ">>" button**

The selected growth curve group will move to the "Groups added to this assumption" box.

☞ *Tip: Removing unwanted growth curve groups from an assumption*

If the user has inadvertently added an unwanted growth curve group to a Growth Multipliers Assumption, it can be removed through the following steps:

1. **Click on the name of the Growth Multipliers Assumption in the "List of Growth Multipliers Assumptions" box on the "Growth Curve Groups" tab (Fig. 7-24)**
2. **Click on the name of the growth curve group in the "Groups added to this assumption" box**
3. **Click on the "<<" button**

The growth curve group name will move to the "Available Growth Curve Groups" box.

8. **Repeat steps 6 and 7 until all required group curve groups have been added to the assumption**

Next, the user can modify the default growth multiplier value(s) associated with the growth curve group(s) that have been assigned to the assumption. To do this

9. **Click on the "Growth Multiplier Values" tab (Fig. 7-25)**

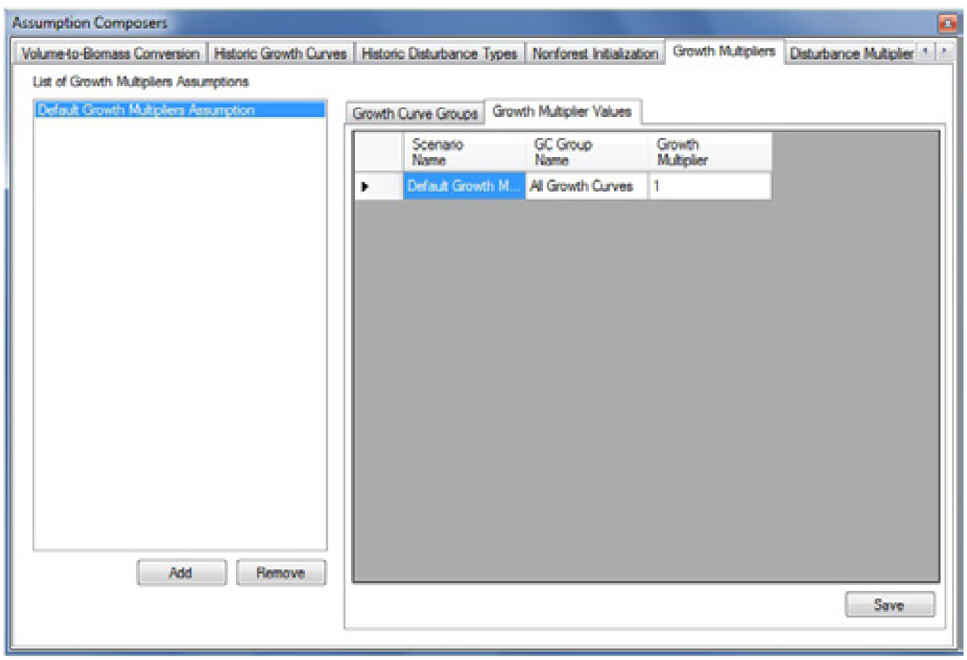


Figure 7-25. The "Assumption Composers" window, displaying the "Growth Multipliers" and "Growth Multiplier Values" tabs.

The table on this tab displays three columns: the "Scenario Name", the "GC (growth curve) Group Name", and the "Growth Multiplier". Each growth curve group assigned to the assumption will appear in this table, and each will have its own distinct growth multiplier.

To make changes to the multiplier value of any record in this table

10. **Click on the "Growth Multiplier" cell and change the value**
11. **Click on the "Save" button**

7.12.2 Editing a Growth Multipliers Assumption

Editing the Assumption Name, Description, and Growth Curve Groups

To edit the name, description, and/or growth curve groups of an existing Growth Multipliers Assumption using the "Growth Curve Groups" tab on the "Growth Multipliers" tab (Fig. 7-24)

1. **Click on the name of an assumption in the "List of Growth Multipliers Assumptions" box**
2. **Make the necessary changes to the Growth Multipliers Assumption name and/or description**
3. **Click on the "Save" button**
4. **Make the necessary changes to the associated growth curve groups**

☞ *Tip: Removing unwanted growth curve groups from an assumption*

If the user has inadvertently added an unwanted growth curve group to a Growth Multipliers Assumption, it can be removed through the following steps:

1. **Click on the name of the Growth Multipliers Assumption in the "List of Growth Multipliers Assumptions" box on the "Growth Curve Groups" tab (Fig. 7-24)**
2. **Click on the name of the growth curve group in the "Groups added to this assumption" box**
3. **Click on the "<<" button**

The growth curve group name will move to the "Available Growth Curve Groups" box.

Editing the Assumption Values

To edit multiplier values of an existing Growth Multipliers Assumption using the "Growth Multiplier Values" tab on the "Growth Multipliers" tab (Fig. 7-25)

1. **Click on the name of an assumption in the "List of Growth Multipliers Assumptions" box**
2. **Make the necessary changes to any of the values in the "Growth Multiplier" cells**
3. **Click on the "Save" button**

7.12.3 Deleting a Growth Multipliers Assumption

To delete an existing Growth Multipliers Assumption on the "Growth Multipliers" tab (Fig. 7-24 or 7-25)

1. **Click on the name of the assumption in the "List of Growth Multipliers Assumptions" box**
2. **Click on the "Remove" button**

7.13 Composing Disturbance Multipliers Assumptions

A Disturbance Multipliers Assumption is composed of one or more disturbance groups, each associated with a default disturbance multiplier (value of 1) or a user-defined disturbance multiplier. The disturbance multiplier is applied to the target type amount (specified in terms of area, carbon, or proportion of record) of the disturbance event during a simulation. A Disturbance Multipliers Assumption can be linked to one or more CBM Run Assumptions.

To access the Assumption Composer for Disturbance Multipliers Assumptions

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Disturbance Multipliers" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-26) will pop up, displaying the "Disturbance Multipliers" tab. Existing Disturbance Multipliers Assumptions will be displayed in the "List of Disturbance Multipliers Assumptions" box. The user can click on a specific assumption name to view its associated disturbance groups on the "Disturbance Groups" tab or its associated disturbance multipliers on the "Disturbance Multiplier Values" tab. The user can add or delete Disturbance Multipliers Assumptions and/or edit the assigned disturbance groups or disturbance multiplier values.

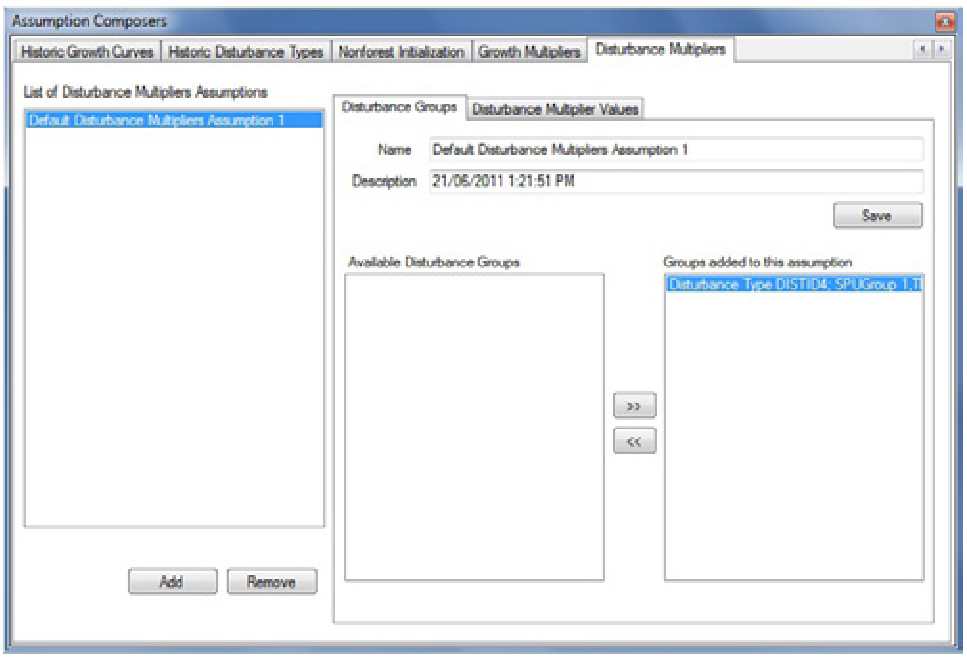


Figure 7-26. The "Assumption Composers" window, displaying the "Disturbance Multipliers" and "Disturbance Groups" tabs.

To close the window

Click on the "X" button

7.13.1 Adding a Disturbance Multipliers Assumption

To add (create) a new Disturbance Multipliers Assumption using the "Disturbance Groups" tab on the "Disturbance Multipliers" tab (Fig. 7-26)

1. **Click on the "Add" button**

A new numbered assumption named "New Disturbance Multipliers Assumption" will appear in the "List of Disturbance Multipliers Assumptions" box.

2. **Click on the new assumption name in the "List of Disturbance Multipliers Assumptions" box**

3. **Enter a name for the assumption in the "Name" box (optional)**
4. **Enter a description for the assumption in the "Description" box (optional)**
5. **Click on the "Save" button**

Next, the user must assign one or more disturbance groups to the assumption.

6. **Click on a disturbance group in the "Available Disturbance Groups" box**
7. **Click on the ">>" button**

The selected disturbance group will move to the "Groups added to this assumption" box.

☞ *Tip: Removing unwanted disturbance groups from an assumption*

If the user has inadvertently added an unwanted disturbance group to a Disturbance Multipliers Assumption, it can be removed through the following steps:

1. **Click on the name of the Disturbance Multipliers Assumption in the "List of Disturbance Multipliers Assumptions" box on the "Disturbance Multipliers" tab (Fig. 7-26)**
2. **Click on the name of the disturbance group in the "Groups added to this assumption" box**
3. **Click on the "<<" button**

The disturbance group name will move to the "Available Disturbance Groups" box.

8. **Repeat steps 6 and 7 until all required disturbance groups have been added to the assumption**

Next, the user can modify the default disturbance multiplier values associated with the Disturbance Group(s) that were assigned to the assumption. To do this

9. **Click on the "Disturbance Multiplier Values" tab (Fig. 7-27)**

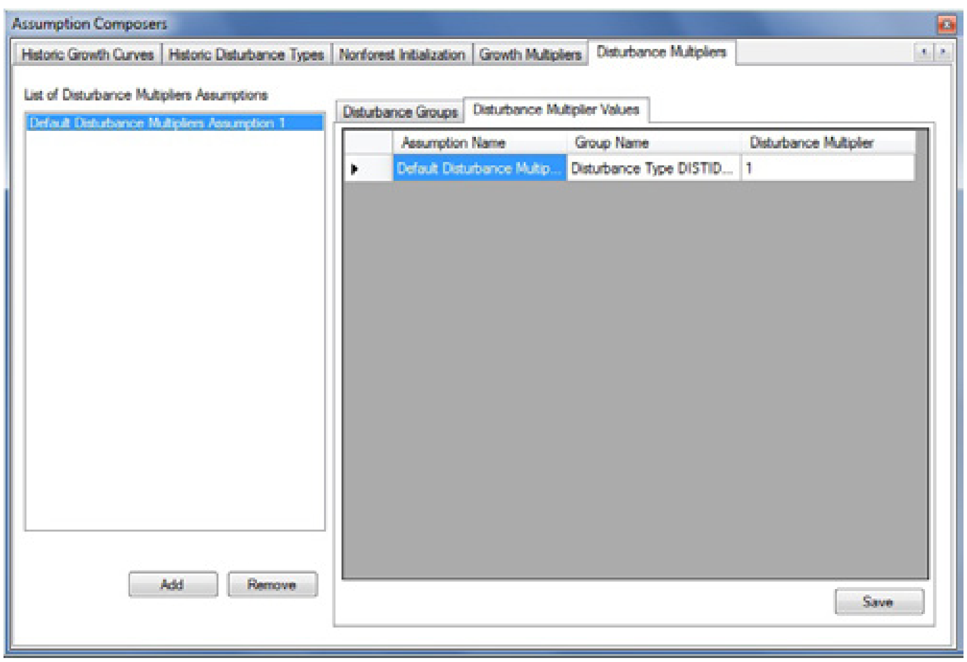


Figure 7-27. The "Assumption Composers" window, displaying the "Disturbance Multipliers" and "Disturbance Multiplier Values" tabs.

The table on this tab displays three columns: the "Assumption Name", the "(Disturbance) Group Name", and the "Disturbance Multiplier". Each disturbance group assigned to the assumption will appear in this table, and each will have its own distinct disturbance multiplier. To make changes to the multiplier value of any record in this table

10. **Click on the "Disturbance Multiplier" cell and change the value**
11. **Click on the "Save" button**

7.13.2 Editing a Disturbance Multipliers Assumption

Editing the Assumption Name, Description, and Disturbance Groups

To edit the name, description, and/or disturbance groups of an existing Disturbance Multipliers Assumption using the "Disturbance Groups" tab on the "Disturbance Multipliers" tab (Fig. 7-26)

1. **Click on the name of the assumption in the "List of Disturbance Multipliers Assumptions" box**
2. **Make the necessary changes to the Disturbance Multipliers Assumption name and/or description**
3. **Click on the "Save" button**
4. **Make the necessary changes to the associated disturbance groups**

☞ *Tip: Removing unwanted disturbance groups from an assumption*

If the user has inadvertently added an unwanted disturbance group to a Disturbance Multipliers Assumption, it can be removed through the following steps:

1. **Click on the name of the Disturbance Multipliers Assumption in the "List of Disturbance Multipliers Assumptions" box on the "Disturbance Multipliers" tab (Fig. 7-26)**
2. **Click on the name of the disturbance group in the "Groups added to this assumption" box**
3. **Click on the "<<" button**

The disturbance group name will move to the "Available Disturbance Groups" box.

Editing the Assumption Values

To edit multiplier values of an existing Disturbance Multipliers Assumption using the "Disturbance Multiplier Values" tab on the "Disturbance Multipliers" tab (Fig. 7-27)

1. **Click on the name of the assumption in the "List of Disturbance Multipliers Assumptions" box**
2. **Make the necessary changes to any of the values in the "Disturbance Multiplier" cells**
3. **Click on the "Save" button**

7.13.3 Deleting a Disturbance Multipliers Assumption

To delete an existing Disturbance Multipliers Assumption on the "Disturbance Multipliers" tab (Fig. 7-26 or 7-27)

1. **Click on the name of the assumption in the "List of Disturbance Multipliers Assumptions" box**
2. **Click on the "Remove" button**

7.14 Composing Nonforest Initialization Assumptions

A Nonforest Initialization Assumption is used only in projects containing areas of nonforest land that will be afforested (although it is necessary to use an empty Nonforest Initialization Assumption when creating a Stand Initialization Assumption). A Nonforest Initialization Assumption is composed of one or more inventory groups, each associated with default or user-defined DOM carbon pool values, biomass carbon pool values, and UNFCCC flags. A Nonforest Initialization Assumption is or can be linked to one or more Stand Initialization Assumptions.

To access the Assumption Composer for Nonforest Initialization

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Nonforest Initialization" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-28) will pop up, displaying the "Nonforest Initialization" tab. Existing Nonforest Initialization Assumptions will be displayed in the "List of Nonforest Initialization Assumptions" box. The user can click on a specific assumption name to view its associated DOM pool values on the "Dead Organic Matter (DOM)" tab, its associated biomass pool values on the "Biomass Carbon" tab, or any associated UNFCCC flags on the "UNFCCC Flags" tab. The user can add or delete Nonforest Initialization Assumptions and/or edit the assigned DOM or biomass carbon pool values or the UNFCCC flags.

To close the window

Click on the "X" button

7.14.1 Adding a Nonforest Initialization Assumption

To add (create) a new Nonforest Initialization Assumption on the "Nonforest Initialization" tab (Fig. 7-28)

1. **Click on the "Add" button**

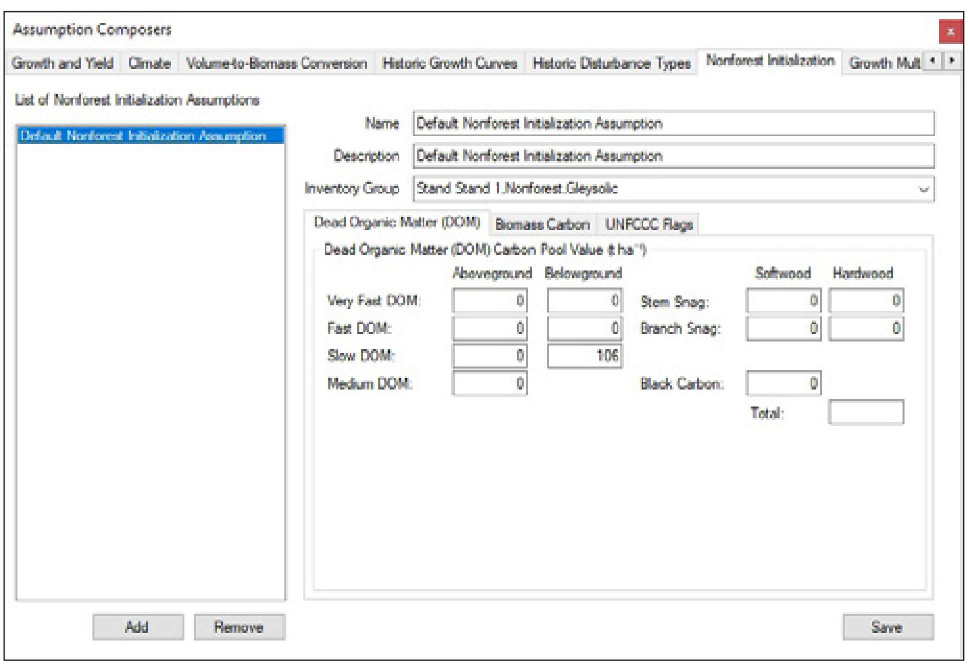


Figure 7-28. The "Assumption Composers" window, displaying the "Nonforest Initialization" and "Dead Organic Matter (DOM)" tabs.

The "Inventory Group Creator" window (Fig. 7-29) will pop up. In this window, the user can create a new assumption containing one or more inventory groups partitioned by age and area ranges and can further partition these groups by UNFCCC land classification (Land Class) or by one or more classifiers. Because this type of assumption can contain only nonforest UNFCCC land classes, land classes 0, 6, 7, 8, 9, 10, 16, and 22 are excluded by default, but the user has the option of excluding others as well. UNFCCC land classes are defined in Table 3-1.

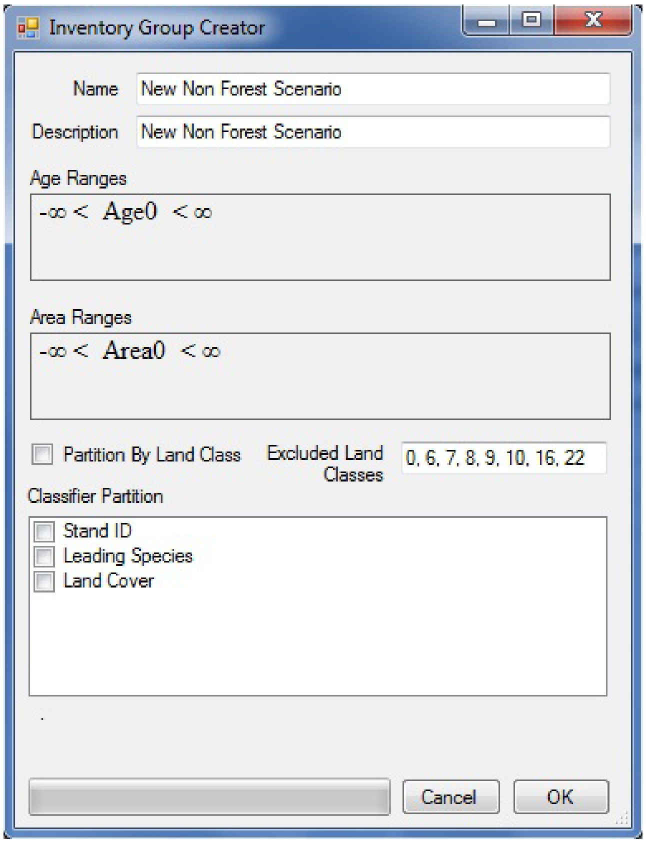


Figure 7-29. The "Inventory Group Creator" window for nonforest assumptions.

1. **Enter a name for the assumption in the "Name" box (optional)**
2. **Enter a description for the assumption in the "Description" box (optional)**

The "Age Ranges" and "Area Ranges" boxes display controls that can be used to create inequality expressions to partition an inventory by age and/or area sets. By default, both of these boxes display a statement equivalent to "no partitioning," i.e., –∞ < Age0 < ∞ and –∞ < Area0 < ∞. These defaults display a constant, followed by an operator, followed by a variable, followed by an operator, followed by a constant. The literal meaning of these statements is that Age0 or Area0 can take any value that is greater than negative infinity and less than positive infinity. If, for example, a user wants to partition the nonforest inventory into two groups by area, one for inventory records with an area less than or equal to 20 ha and one for inventory records with an area greater than 20 ha, the user would write an expression that will display as –∞ < Area0 <= 20 < Area1 < ∞. However, the outer infinity constants and their adjacent operators cannot be typed into the "Age Ranges" and "Area Ranges" boxes; instead, they are added automatically, for display purposes, to a successfully parsed expression. To enter the expression displayed above, the user would type "Area0 <= 20 < Area1".

When entering expressions into the "Age Ranges" and/or "Area Ranges" boxes, follow these rules:

- Each subsequent constant must represent a larger number than the previous one
- The two legal operators are "<=" or "<"; no other operators are allowed
- Given the nature of the operators, any two operators that precede and follow a constant cannot be of the same type
- A constant may be any floating point value
- Each subsequent variable from left to right is numbered starting from 0 with the variable's index
- Because the age for nonforest stands is typically zero, the user should not need to partition the inventory by age.

4. **Click on the "Age Ranges" box and enter an inequality expression (if nonforest records with an age other than zero exist in the inventory being imported)**
5. **Click on the "Area Ranges" box and enter an inequality expression (if required)**
6. **If partitioning by UNFCCC land class is required, click on the "Partition By Land Class" check box so that a check mark appears**

If the user chooses to partition the nonforest inventory groups by land class, the maximum number of groups created as a result of this partitioning will be displayed below the "Classifier Partition" box. By default, land classes 0, 6, 7, 8, 9, 10, 16, and 22 are not associated with nonforest land; they will be displayed in the "Excluded Land Classes" box and will be excluded from the nonforest inventory groups to be created.

7. **Click on the "Excluded Land Classes" box and enter any remaining UNFCCC land classes to be excluded from land-class partitioning (if required)**

Next, the user has the option of partitioning the nonforest inventory groups by inventory classifier. To partition the group by one or more classifiers

8. **Click on the check box for each required classifier listed in the "Classifier Partition" box so that a check mark appears**
9. **Click on the "OK" button to proceed**
   or
   Click on the "Cancel" button to terminate the process

If the user clicks on the "OK" button, an "Info" window will pop up, stating, "You are about to create '#' inventory groups. Proceed?" where "#" represents the number of nonforest inventory groups that will be created.

10. **Click on the "Yes" button to proceed**
    or
    Click on the "No" button to terminate the process

If the user clicks the "Yes" button, the new Nonforest Initilization Assumption will be added to the "List of Nonforest Initialization Assumptions" box on the "Nonforest Initialization" tab (Fig. 7-28).

11. **Click on the name of the new assumption in the "List of Nonforest Initialization Assumptions" box**

The DOM parameters associated with this assumption will appear on the "Dead Organic Matter (DOM)" tab (Fig. 7-28). Descriptions of these carbon pools are given in Table 7-3. To edit the default DOM carbon pool values on this tab

12. **Enter the alternative values in the appropriate carbon pool boxes**

The biomass parameters associated with this assumption will appear on the "Biomass Carbon" tab (Fig. 7-30). Descriptions of these carbon pools are given in Table 7-3. To edit the default biomass carbon pool values on this tab

13. Click on the "Biomass Carbon" tab

14. Enter the alternative values in the appropriate carbon pool boxes

The user should note that any positive value entered in a biomass carbon pool will remain static within the stand, even after afforestation, will not be subject to growth or decay (because it is not linked to a growth curve), and can only be removed through a stand-replacing disturbance event that transfers all biomass carbon to DOM pools, the atmosphere, or to the forest products pool. For this reason, if tree biomass carbon is included in nonforest stands, it is recommended that a modified afforestation disturbance type and matrix be applied to that stand in order to transfer any existing biomass carbon to DOM carbon pools, the atmosphere, or the forest products pool at the time of afforestation. This is not the case for default or modified values used for DOM pools—these values will remain static until the afforestation event is executed, after which they will be subject to annual decay processes as they would be in any forest stand.

The UNFCCC flags associated with this assumption will appear on the "UNFCCC Flags" tab (Fig. 7-31). Descriptions of each of these variables are given in Table 7-4. To edit any of these variables

15. Click on the "UNFCCC Flags" tab

16. Make any necessary changes to the default entries for each variable

17. Click on the "Save" button

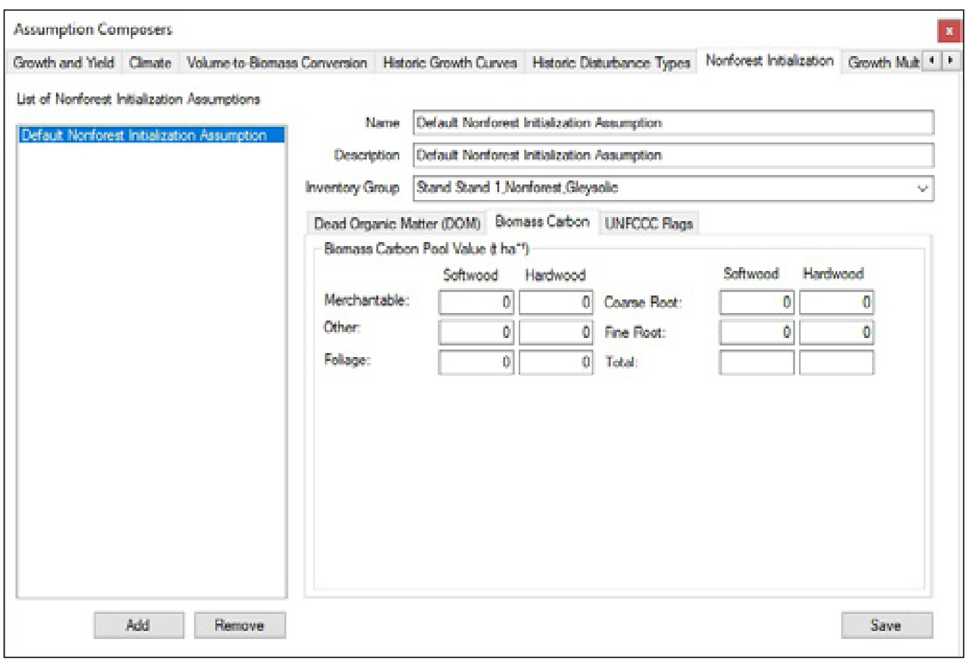


Figure 7-30. The "Assumption Composers" window, displaying the "Nonforest Initialization" and "Biomass Carbon" tabs.

Table 7-3. Names and descriptions of parameter values displayed on the "Dead Organic Matter (DOM)" and "Biomass Carbon" tabs on the "Nonforest Initialization" tab in the "Assumption Composers" window

Tab name	Parameter name	Description
Dead Organic Matter (DOM)	Aboveground Very Fast DOM	Carbon in the L horizon with input from foliage and fine roots approximately <5 mm diameter
	Belowground Very Fast DOM	Carbon in dead fine roots approximately <5 mm diameter in the mineral soil
	Aboveground Fast DOM	Carbon in fine and small woody debris DOM including dead coarse roots in the forest floor, with a portion of inputs from the Other pool, and inputs from snag branches and coarse roots approximately ≥ 5 mm diameter
	Belowground Fast DOM	Carbon in dead coarse roots approximately ≥ 5 mm diameter in the mineral soil
	Aboveground Slow DOM	Carbon in the F, H, and O horizons with input from the Aboveground Very Fast, Fast, Medium, Snag Stem Wood and Snag Branches DOM pools; slow transfer rate
	Belowground Slow DOM	Carbon in humified organic matter in the mineral soil with input from the Belowground Very Fast, Belowground Fast, and Aboveground Slow pools
	Medium DOM	Carbon in coarse woody debris DOM with input from merchantable stem wood and stem snags
	Softwood Stem Snag	Carbon in dead standing softwood stem wood of merchantable size, including bark; snag stem wood transfer rate
	Hardwood Stem Snag	Carbon in dead standing hardwood stem wood of merchantable size, including bark; snag stem wood transfer rate
	Softwood Branch Snag	Carbon in dead softwood branches, and nominally, a portion of input from the Softwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
	Hardwood Branch Snag	Carbon in dead hardwood branches, and nominally, a portion of input from the Hardwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
	Black Carbon	Stable carbon from incomplete combustion after fire
Biomass Carbon	Softwood Merchantable	Carbon in softwood merchantable stem wood
	Hardwood Merchantable	Carbon in hardwood merchantable stem wood
	Softwood Other	Carbon in softwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
	Hardwood Other	Carbon in hardwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
	Softwood Foliage	Carbon in softwood foliage
	Hardwood Foliage	Carbon in hardwood foliage
	Softwood Coarse Root	Carbon in softwood coarse roots
	Hardwood Coarse Root	Carbon in hardwood coarse roots
	Softwood Fine Root	Carbon in softwood fine roots
	Hardwood Fine Root	Carbon in hardwood fine roots
	Softwood Total	Total softwood biomass carbon in the nonforested stand; typically zero
	Hardwood Total	Total hardwood biomass carbon in the nonforested stand; typically zero

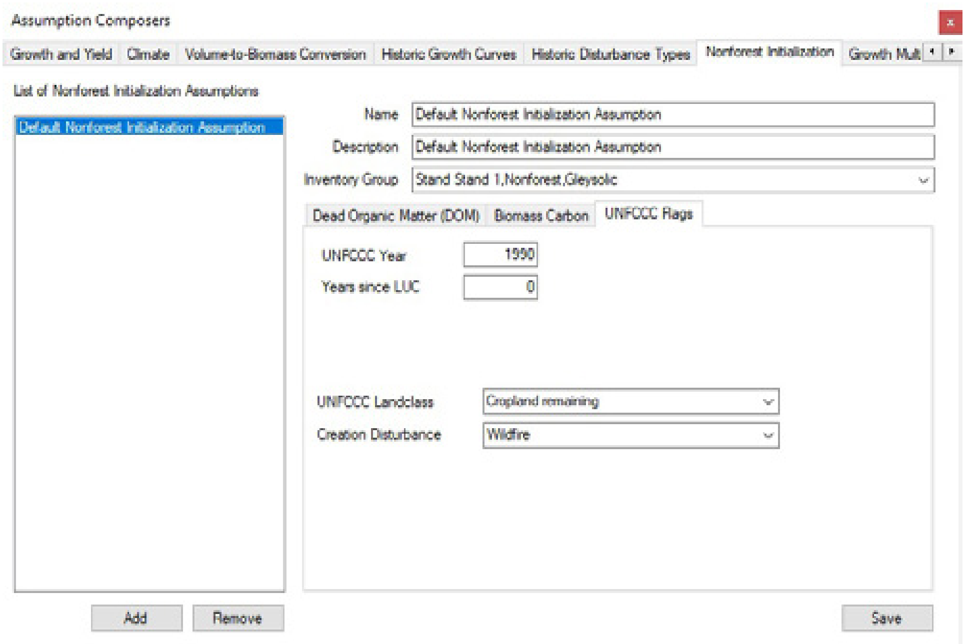


Figure 7-31. The "Assumption Composers" window, displaying the "Nonforest Initialization" and "UNFCCC Flags" tabs.

Table 7-4. Names and descriptions of variables displayed on the "UNFCCC Flags" tab on the "Nonforest Initialization" tab in the "Assumption Composers" window

Variable name	Description
UNFCCC Year	Calendar year when the land-use change occurred for the group of stands
Years since LUC	Number of years since the land-use change occurred
UNFCCC Landclass	Forest converted to agriculture, forest converted to wetland, etc. (see Table 3-1 for full list of acceptable values)
Creation Disturbance	Disturbance type that caused the land-use change; used to initialize the DOM pools where appropriate

7.14.2 Editing a Nonforest Initialization Assumption

Only the name, description, DOM parameter values, biomass parameter values, and UNFCCC flag variables of an existing Nonforest Initialization Assumption on the "Nonforest Initialization" tab can be edited. To edit any of these items associated with an assumption

1. **Click on the name of the assumption in the "List of Nonforest Initialization Assumptions" box**
2. **Make the necessary changes to the name, description, DOM parameter values (on the "Dead Organic Matter (DOM)" tab), biomass parameter values (on the "Biomass Carbon" tab), and/or UNFCCC flag entries (on the "UNFCCC Flags" tab)**

The user should note that any positive value entered in a biomass carbon pool will remain static within the stand, even after afforestation, will not be subject to growth or decay (because it is not linked to a growth curve), and can only be removed through a stand-replacing disturbance event that transfers all biomass carbon to DOM pools, the atmosphere, or to the forest products pool. For this reason, if tree biomass carbon is included in nonforest stands, it is recommended that a modified afforestation disturbance type and matrix be applied to that stand in order to transfer any existing biomass carbon to DOM carbon pools, the atmosphere, or the forest products pool at the time of afforestation. This is not the case for default or modified values used for DOM pools—these values will remain static until the afforestation event is executed, after which they be subject to annual decay processes as they would be in any forest stand.

3. **Click on the "Save" button**

7.14.3 Deleting a Nonforest Initialization Assumption

To delete an existing Nonforest Initialization Assumption on the "Nonforest Initialization" tab (Fig. 7-28)

1. **Click on the name of an assumption in the "List of Nonforest Initialization Assumptions" box**
2. **Click on the "Remove" button**

7.15 Composing Historic Growth Curves Assumptions

The Historic Growth Curves Assumption specifies the growth curves that the model should use during the forest carbon initialization process for forest stands over the past approximately 2000 years (historic) and during the last iteration (last pass) of the initialization process. It is composed of one or more growth curve groups, each associated with default or user-defined historic and "last-pass" growth curves. A Historic Growth Curves Assumption is linked to the Stand Initialization Assumption during construction of a simulation.

To access the Assumption Composer for Historic Growth Curves

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**
2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Historic Growth Curves" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-32) will pop up, displaying the "Historic Growth Curves" tab. Existing Historic Growth Curves Assumptions are displayed in the "List of Historic Growth Curves Assumptions" box. The user can click on a specific assumption name to view its associated growth curve Group Name, Historic Growth Curves, and Last Pass Growth Curves. The user can add or delete Historic Growth Curves Assumptions and/or edit the names, descriptions, and historic and last-pass growth curves linked to each group name included in the assumption.

To close the window

Click on the "X" button

7.15.1 Adding an Historic Growth Curves Assumption

To add (create) a new Historic Growth Curves Assumption on the "Historic Growth Curves" tab (Fig. 7-32)

1. **Click on the "Add" button**

The "Inventory Group Creator" window (Fig. 7-33) will pop up. In this window, the user can create a new assumption containing one or more growth curve groups partitioned by age and area ranges and can further partition these groups by UNFCCC land classification (Land Class) or by one or more classifiers. UNFCCC land classes are defined in Table 3-1.

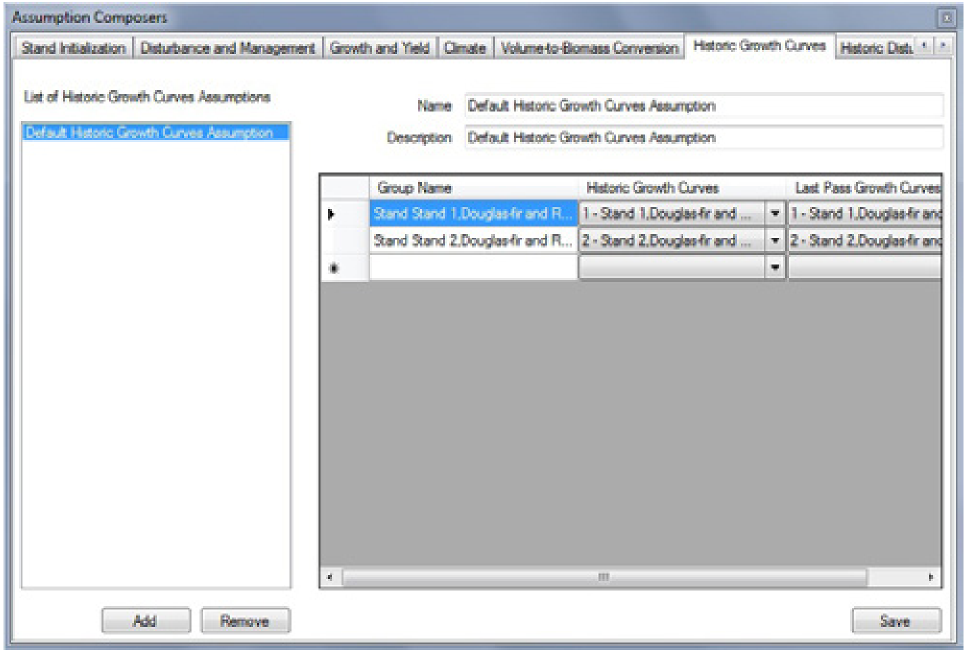


Figure 7-32. The "Assumption Composers" window, displaying the "Historic Growth Curves" tab.

2. **Enter a name for the assumption in the "Name" box (optional)**
3. **Enter a description for the assumption in the "Description" box (optional)**

The "Age Ranges" and "Area Ranges" boxes display controls that can be used to create inequality expressions to partition an inventory by age and/or area sets. By default, both of these boxes display a statement equivalent to "no partitioning," i.e., $-\infty < \text{Age0} < \infty$ and $-\infty < \text{Area0} < \infty$. These defaults display a constant, followed by an operator, followed by a variable, followed by an operator, followed by a constant. The literal meaning of these statements is that Age0 or Area0 can take any value that is greater than negative infinity and less than positive infinity. If, for example, a user wants to partition the inventory into two groups by area, one for inventory records with an area less than or equal to 20 hectares and one for inventory records with an area greater than 20 hectares, the user would write an expression that will display as $-\infty < \text{Area0} <= 20 < \text{Area1} < \infty$. However, the outer infinity constants and their adjacent operators cannot be typed into the "Age Ranges" and "Area Ranges" boxes; instead, they are added automatically, for display purposes, to a successfully parsed expression. To enter the expression displayed above, the user would type "Area0 <= 20 < Area1".

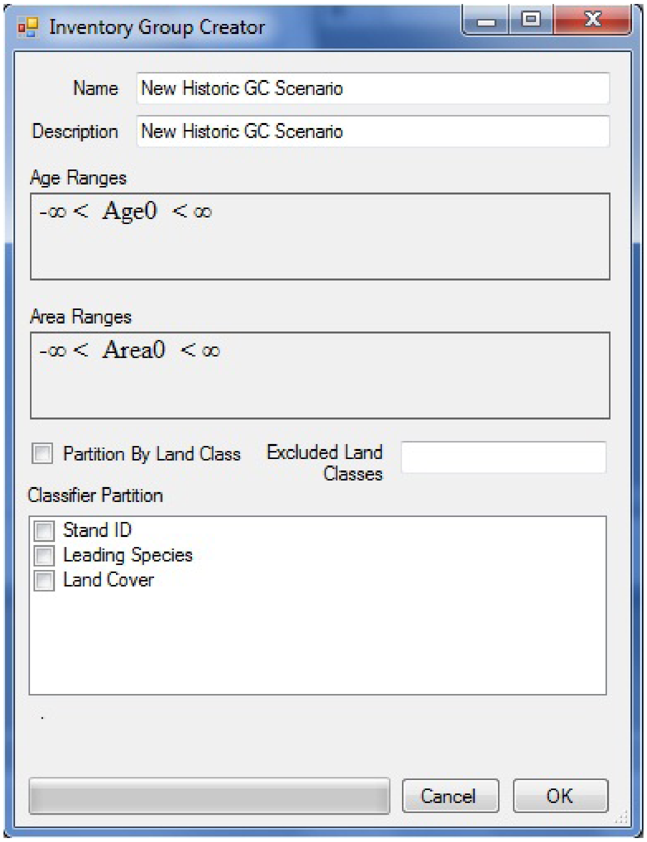


Figure 7-33. The “Inventory Group Creator” window for historic growth curves assumptions.

When entering expressions into the “Age Ranges” and/or “Area Ranges” boxes, follow these rules:

- Each subsequent constant must represent a larger number than the previous one
- The two legal operators are “<=” or “<”; no other operators are allowed
- Given the nature of the operators, any two operators that precede and follow a constant cannot be of the same type
- A constant may be any floating point value
- Each subsequent variable from left to right is numbered starting from 0 with the variable’s index

4. **Click on the “Age Ranges” box and enter an inequality expression (if required)**
5. **Click on the “Area Ranges” box and enter an inequality expression (if required)**
6. **If partitioning by UNFCCC land class is required, click on the “Partition By Land Class” check box so that a check mark appears**

If the user chooses to partition the inventory groups by land class, the maximum number of groups created as a result of this partitioning will be displayed below the “Classifier Partition” box.

7. **Click on the “Excluded Land Classes” box and enter any remaining UNFCCC land classes to be excluded from land-class partitioning (if required)**

Next, the user has the option of partitioning the inventory groups by inventory classifier. To partition the group by one or more classifiers

8. **Click on the check box for each required classifier listed in the "Classifier Partition" box so that a check mark appears**
9. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "OK" button, an "Info" window will pop up, stating, "You are about to create '#' inventory groups. Proceed?" where "#" represents the number of inventory groups that will be created.

10. **Click on the "Yes" button to proceed**

    or

    Click on the "No" button to terminate the process

If the user clicks on the "Yes" button, the new Historic Growth Curves Assumption will be added to the "List of Historic Growth Curves Assumptions" box on the "Historic Growth Curves" tab (Fig. 7-32).

7.15.2 Editing an Historic Growth Curves Assumption

The name and description of an existing Historic Growth Curves Assumption on the "Historic Growth Curves " tab can be edited, along with the historic and last-pass growth curves associated with each group name included in the assumption. To edit any of these items

1. **Click on the name of the assumption in the "List of Historic Growth Curves Assumptions" box (Fig. 7-32)**
2. **Make the necessary changes to the name and description**

For each group name listed in the table displayed

3. **Click on the "Historic Growth Curves" and/or "Last Pass Growth Curves" drop list box and make the necessary changes**
4. **Click on the "Save" button**

7.15.3 Deleting an Historic Growth Curves Assumption

To delete an existing Historic Growth Curves Assumption on the "Historic Growth Curves" tab (Fig. 7-32)

1. **Click on the name of the assumption in the "List of Historic Growth Curves Assumptions" box**
2. **Click on the "Remove" button**

7.16 Composing Historic Disturbance Types Assumptions

A Historic Disturbance Types Assumption specifies the stand-replacing disturbance types that the model should use during the forest carbon initialization process for forest stands over the past approximately 2000 years (historic) and during the last iteration (last pass) of the initialization process. It is composed of one or more disturbance groups, each associated with a default or user-defined historic and "last-pass" disturbance type. A Historic Disturbance Types Assumption can be linked to one or more Stand Initialization Assumptions.

To access the Assumption Composer for Historic Disturbance Types

1. **Click on "Tools" on the menu bar of the main CBM-CFS3 window**

2. **Select "Assumption Composers" from the drop list that appears**
3. **Select "Historic Disturbance Types" from the side drop list that appears**

The "Assumption Composers" window (Fig. 7-34) will pop up, displaying the "Historic Disturbance Types" tab. Existing Historic Disturbance Types Assumptions are displayed in the "List of Historic Disturbance Types Assumptions" box. The user can click on a specific assumption name to view its associated disturbance group names, historic disturbances, and last-pass disturbances. The user can add or delete Historic Disturbance Types Assumptions and/or edit their names, descriptions, and historic and last-pass growth curves linked to each group name included in the assumption.

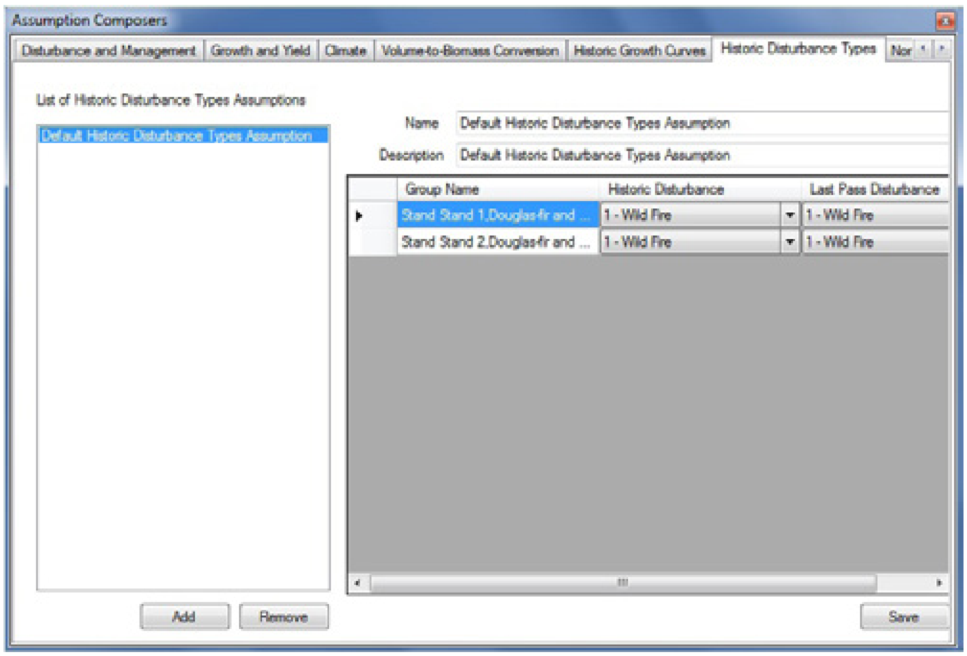


Figure 7-34. The "Assumption Composers" window, displaying the "Historic Disturbance Types" tab.

To close the window

Click on the "X" button

7.16.1 Adding an Historic Disturbance Types Assumption

To add (create) a new Historic Disturbance Types Assumption on the "Historic Disturbance Types" tab (Fig. 7-34)

1. **Click on the "Add" button**

The "Inventory Group Creator" window (Fig. 7-35) will pop up. In this window, the user can create a new assumption containing one or more disturbance groups partitioned by age and area ranges and can further partition these groups by UNFCCC land classification (Land Class) or by one or more classifiers. UNFCCC land classes are defined in Table 3-1.

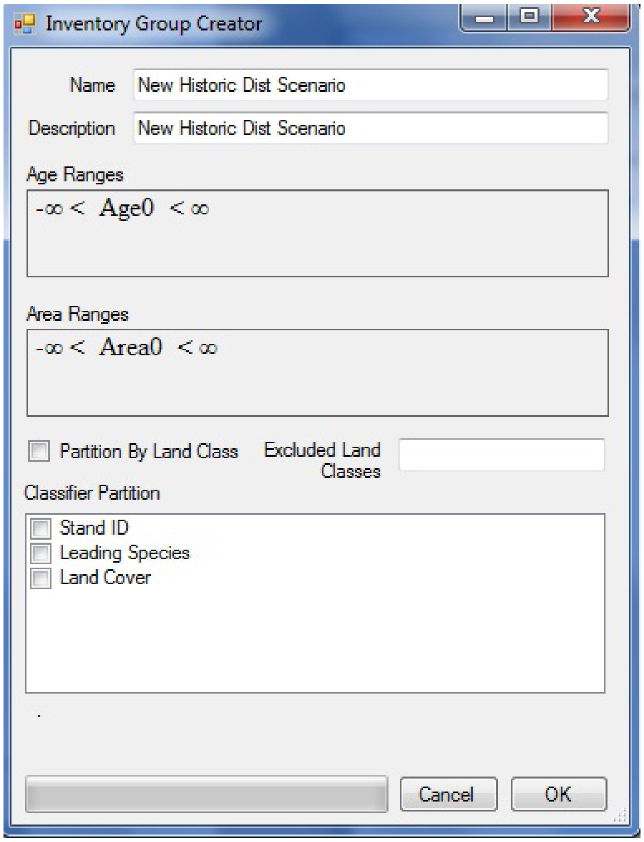


Figure 7-35. The "Inventory Group Creator" window for historic disturbance types assumptions.

1. **Enter a name for the assumption in the "Name" box (optional)**
2. **Enter a description for the assumption in the "Description" box (optional)**

The "Age Ranges" and "Area Ranges" boxes display controls that can be used to create inequality expressions to partition an inventory by age and/or area sets. By default, both of these boxes display a statement equivalent to "no partitioning", i.e., –∞ < Age0 < ∞ and –∞ < Area0 < ∞. These defaults display a constant, followed by an operator, followed by a variable, followed by an operator, followed by a constant. The literal meaning of these statements is that Age0 or Area0 can take any value that is greater than negative infinity and less than positive infinity. If, for example, a user wants to partition the inventory into two groups by area, one for inventory records with an area less than or equal to 20 hectares and one for inventory records with an area greater than 20 hectares, the user would write an expression that will display as –∞ < Area0 <= 20 < Area1 < ∞. However, the outer infinity constants and their adjacent operators cannot be typed into the "Age Ranges" and "Area Ranges" boxes; instead, they are added automatically, for display purposes, to a successfully parsed expression. To enter the expression displayed above, the user would type "Area0 <= 20 < Area1".

When entering expressions into the "Age Ranges" and/or "Area Ranges" boxes, follow these rules:

- Each subsequent constant must represent a larger number than the previous one
- The two legal operators are "<=" or "<"; no other operators are allowed
- Given the nature of the operators, any two operators that precede and follow a constant cannot be of the same type
- A constant may be any floating point value
- Each subsequent variable from left to right is numbered starting from 0 with the variable's index

4. **Click on the "Age Ranges" box and enter an inequality expression (if required)**
5. **Click on the "Area Ranges" box and enter an inequality expression (if required)**
6. **If partitioning by UNFCCC land class is required, click on the "Partition by land class" check box so that a check mark appears**

If the user chooses to partition the inventory groups by land class, the maximum number of groups created as a result of this partitioning will be displayed below the "Classifier Partition" box.

7. **Click on the "Excluded Land Classes" box and enter any remaining UNFCCC land classes to be excluded from land-class partitioning (if required)**

Next, the user has the option of partitioning the inventory groups by inventory classifier. To partition the group by one or more classifiers

8. **Click on the check box for each required classifier listed in the "Classifier Partition" box so that a check mark appears**
9. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "OK" button, an "Info" window will pop up, stating, "You are about to create '#' inventory groups. Proceed?" where "#" represents the number of inventory groups that will be created.

10. **Click on the "Yes" button to proceed or the "No" button to terminate the process**

If the user clicks on the "Yes" button, the new Historic Disturbance Types Assumption will be added to the "List of Historic Disturbance Types Assumptions" box on the "Historic Disturbance Types" tab (Fig. 7-34).

7.16.2 Editing an Historic Disturbance Types Assumption

The name and description of an existing Historic Disturbance Types Assumption on the "Historic Disturbance Types" tab can be edited, along with the historic and last-pass disturbance types associated with each group name included in the assumption. To edit any of these items

1. **Click on the name of the assumption in the "List of Historic Disturbance Types Assumptions" box (Fig. 7-32)**
2. **Make the necessary changes to the name and description**

For each group name listed in the table displayed

3. **Click on the "Historic Disturbance Type" and/or "Last Pass Disturbance Type" drop list box and make the necessary changes**
4. **Click on the "Save" button**

7.16.3 Deleting an Historic Disturbance Types Assumption

To delete an existing Historic Disturbance Types Assumption on the "Historic Disturbance Types" tab (Fig. 7-32)

1. **Click on the name of the assumption in the "List of Historic Disturbance Types Assumptions" box**
2. **Click on the "Remove" button**

CHAPTER 8

USING THE RESULTS EXPLORER

This chapter describes the options for exploring the results of CBM-CFS3 project simulation runs.

At the completion of a project simulation run performed with the Simulation Scheduler (read section 3.5 or 7.1.1), the results are stored in a simulation results database. The Results Explorer (Fig. 8-1) allows the user to query the results and extract relevant information from the database. This information can be used to generate a variety of views (graph, table, and report) summarizing the simulation results, to compare one or more variables from one or more simulation runs, and to export the underlying data in several formats.

To access the "Results Explorer" window (Fig. 8-1)

1. **Click on "View" on the menu bar of the main CBM-CFS3 window**
2. **Select "Results Explorer" from the drop list that appears**

The "Results Explorer" window contains a small library of predefined views in categorized folders labeled "Stocks", "Stock Changes", "Age Classes", and "Advanced Views", to assist users in their initial exploration of model results. These folders are located in a folder labeled "Default Views". The user can modify and expand the initial library of views by creating a view for the variable(s) of interest to be displayed and then saving the view for future use. For example, a user might create a view to display the dynamics of aboveground and belowground biomass carbon over time. The user defines the variables to display, the type of graph desired, the title of the graph, the scale of the *y*-axis, and other graph properties. The user can also define certain filters (e.g., display the carbon stocks only for areas with certain attributes, whose values are defined in the forest inventory and are accessible through the results database). Technically, a view represents a Structured Query Language (SQL) query with additional information on the attributes of the graph. An empty folder in the "Views" box labeled "My Views" can be used to store any new views the user creates.

The Results Explorer can be used to Open, Save, add (New View), Display, Edit, Rename, Copy, Delete, remove all (Blank Explorer), or see a Description of a view, and to add (New Folder), Rename, Copy, or Delete folders. Once a view has been created, it can be applied to the results of one or more project simulations using the same data classifiers. For example, the carbon stocks in two scenarios using the same input data set but with different harvest rates could be displayed and compared, or the carbon stocks in two scenarios using different input data sets could be compared.

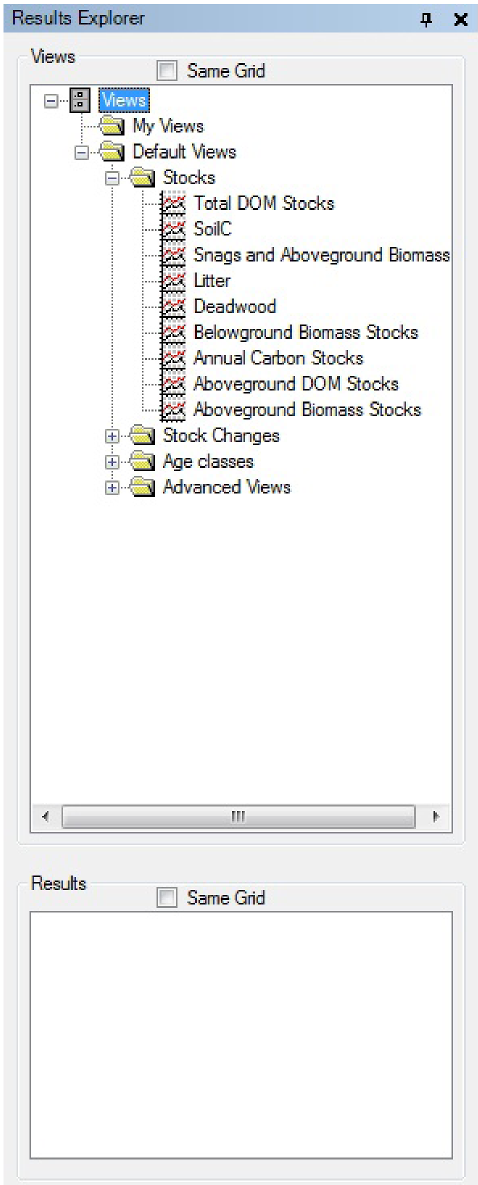


Figure 8-1. The "Results Explorer" window.

The views in the "Results Explorer" window are displayed in the "Views" box in a directory tree that is collapsible (click on a "-") and expandable (click on a "+").

If the user right-clicks over the name of a view or a folder in the "Views" box, a menu will appear with options allowing the user to open a stored directory of views (Open), save a directory of views (Save), create a folder (New Folder), create a view (New View), display a view (Display), edit a view (Edit), rename a view (Rename), copy a view (Copy), delete a view (Delete), remove all views in the directory tree in the "Results Explorer" window (Blank Explorer), refresh the list of simulations in the "Results" box (Refresh), or view the description of a view (Description).

If the user right-clicks over a blank area in the "Views" box, only "Blank Explorer" and "Refresh" will be available on the menu that appears.

A small Results Explorer icon toolbar (Fig. 8-2), normally grayed-out in the main CBM-CFS3 window, will become functional when the "Results Explorer" window is opened.

Figure 8-2. The Results Explorer icon toolbar.

These icons can be used to perform various actions in the Results Explorer (described in more detail in the following sections). The name of the tool with which an icon is associated is displayed when the user positions the cursor over the icon.

8.1 Managing Simulation Results Databases

When the user completes a simulation run for a project using the Simulation Scheduler (see section 7.1) a simulation results database is created. These databases are managed in the "Results Explorer" window (Fig. 8-1). The user can choose which database(s) to make available for viewing and analysis, which to archive, which to delete, and view information to help identify a database, beyond its name.

8.1.1 Making a Simulation Results Database Available for Viewing Results

To make a simulation results database available so that particular views can be applied to it using the "Results Explorer" window (Fig. 8-1)

1. **Right-click over the "Results" box**

On the menu that appears

2. **Click on "Manage Results"**

The "Simulation Results" window (Fig. 8-3) will pop up.

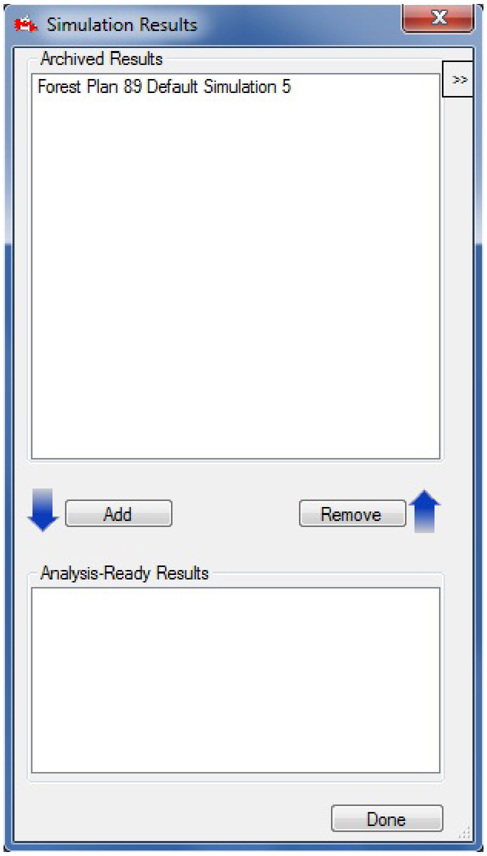


Figure 8-3. The "Simulation Results" window.

3. **Click on the name of a simulation results database in the "Archived Results" box**
4. **Click on the "Add" button**

The name of the selected simulation results database will appear in the "Analysis-Ready Results" box.

5. **Click on the "Done" button**

The selected simulation results database will appear in the "Results" box in the "Results Explorer" window (Fig. 8-1) and will be available for viewing and analysis.

8.1.2 Archiving a Simulation Results Database

When the "Results" box in the "Results Explorer" window (Fig. 8-1) becomes too cluttered with simulation results databases, the user may want to remove and archive some of them. When a simulation results database is archived, it is no longer displayed in the "Results" box and is not available for analysis or viewing, but it can be added back to the window at a later time (as described in section 8.1.1). To archive a simulation results database in the "Results Explorer" window

1. **Click on the name of a simulation results database in the "Results" box (Fig. 8-1) so that a check mark is displayed beside it**
2. **Right-click over the "Results" box**
3. **Select "Manage Results" from the menu that appears**

The "Simulation Results" window (Fig. 8-3) will pop up.

4. **Click on the name of the simulation results database selected in step 1 which is displayed in the "Analysis-Ready Results" box**
5. **Click on the "Remove" button**
6. **Click on the "Done" button**

8.1.3 Deleting a Simulation Results Database

Instead of storing multiple simulation results databases for a project (which will take up space on the hard drive), the user may want to delete a simulation results database after the results have been viewed and analyzed. To delete a simulation results database in the "Results Explorer" window (Fig. 8-1)

1. **Click on the name of the simulation results database in the "Results" box so that a check mark is displayed beside it**
2. **Right-click over the "Results" box**
3. **Select "Delete Checked Results" from the menu that appears**

A "Delete Results Database" window will pop up, asking the user to confirm deletion of the simulation results database

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

The simulation results database name will be removed from the "Results" box and the database will be deleted.

8.1.4 Identifying a Simulation Results Database

Should the user forget the details of a simulation for a simulation results database that is identified only by the simulation name in the "Results" box in the "Results Explorer" window (Fig. 8-1), detailed information about the database, such as the project name, path, description, simulation name, author, completion date, and full location path, can be viewed. To access this information via the "Results Explorer" window (Fig. 8-1)

1. **Click on the name of the simulation results database of interest in the "Results" box so that a check mark is displayed beside it**
2. **Right-click over the "Results" box**
3. **Select "Results Info" from the menu that appears**

The "Simulation Results" window will pop up, displaying a "Results Info" box (Fig. 8-4). The "Results Info" box contains the additional information about the selected simulation results database. To return to the "Results Explorer" window

4. **Click on the "Done" button**

An alternative way to view the "Results Info" box, when only the "Simulation Results" window is displayed, is to click on the ">>" button (Fig. 8-3). To close the display of the "Results Info" box in the "Simulation Results" window, click on the "<<" button.

8.2 Creating a New Folder for Views

Views represent SQL queries with some additional properties that enable users to analyze, visualize (in graphs, tables, or reports), and share simulation results. Any existing user-created and/or predefined views are displayed in the "Views" box in the directory tree and are linked to a particular folder in the directory tree. Before creating new views, the user may want to first create a folder in which to store them. The user can create as many folders and subfolders as desired to store and organize the views created.

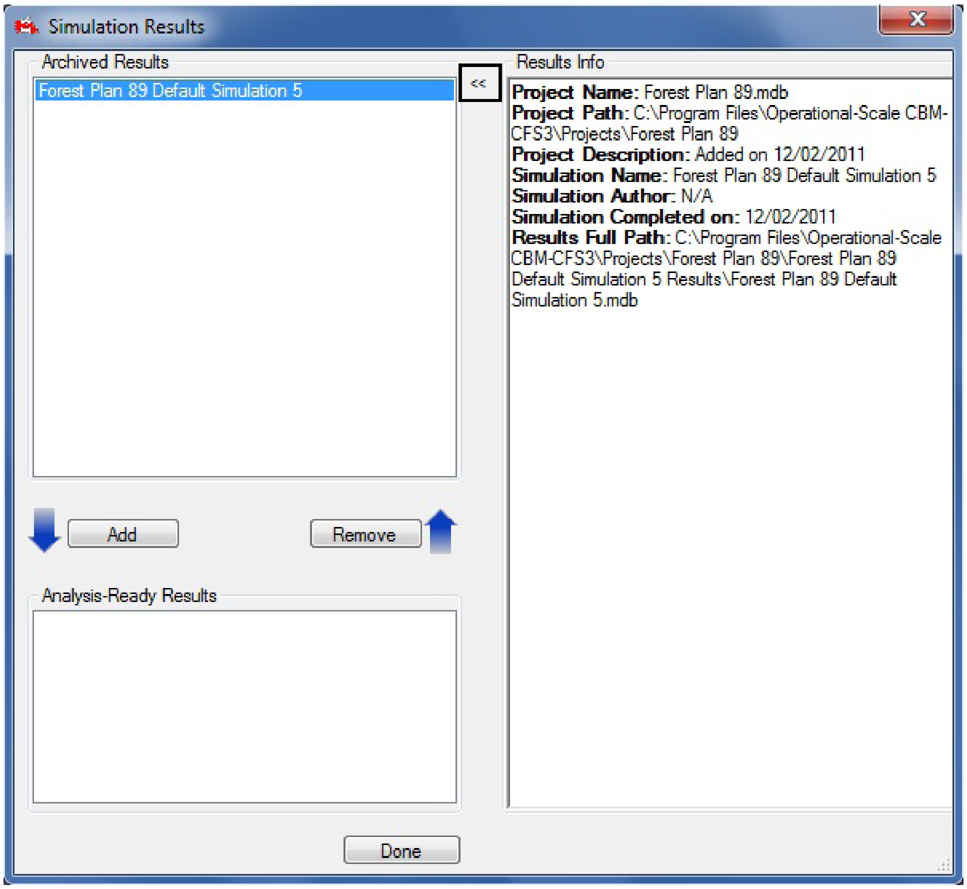


Figure 8-4. The "Simulation Results" window displaying the "Results Info" box.

8.2.1 Making a New Folder in the Directory Tree

To create a folder in the "Views" box in the "Results Explorer" window (Fig. 8–1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on "Views" in the directory tree in the "Views" box**
3. **Click on the "New Folder" icon on the Results Explorer icon toolbar (Fig. 8-2)**

A new folder, named "New Folder," will appear in the directory tree connected to the node selected. The user can then rename the folder (see section 8.3.2).

8.2.2 Making a Subfolder in the Directory Tree

To create a subfolder in an existing folder in the "Views" box in the "Results Explorer" window (Figure 8–1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on the name of an existing folder in the directory tree in the "Views" box**
3. **Right-click and select "New Folder" from the menu that appears**

   or

   Click on the "New Folder" icon on the Results Explorer icon toolbar (Fig. 8-2)

A new subfolder, named "New Folder," will appear in the directory tree connected to the selected folder. The user can then rename the folder (see section 8.3.2).

8.3 Copying, Renaming, Deleting, or Relocating a View or Folder

Views and folders displayed in the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1) can be copied, renamed, deleted, or relocated.

8.3.1 Copying a View or Folder

To make a copy of an existing view or folder in the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on the name of a view or folder in the directory tree in the "Views" box**
3. **Right-click and select "Copy" from the menu that appears**

   or

   Click on the "Duplicate the selected view/folder" icon on the Results Explorer icon toolbar (Fig.8- 2)

The copy of the view or folder named "Copy of 'original folder or view name'" will appear in the directory tree, linked to the same node or folder as the original folder or view in the directory tree in the "Views" box. The user can then rename the copied view or folder (see section 8.3.2).

8.3.2 Renaming a View or Folder

To rename an existing view or folder in the "Results Explorer" window (Fig. 8-1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on the name of a view or folder in the directory tree in the "Views" box**
3. **Right-click and select "Rename" from the menu that appears**

or

Click on the "Rename" icon on the Results Explorer icon toolbar (Fig. 8-2)

The "Rename View" window (Fig. 8-5) will pop up.

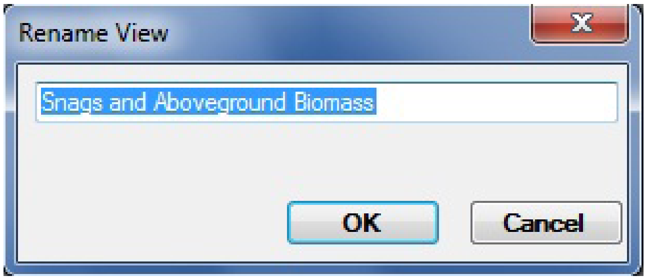


Figure 8-5. The "Rename View" window.

4. **Enter a new name in the text box**
5. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "OK" button, the view or folder will appear in the directory tree in the "Views" box with its new name.

8.3.3 Deleting a View or Folder, or Closing all Views and Folders

The user has the options of deleting a single view or folder or closing all views and folders from the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1).

Deleting a Single View or Folder

To delete a single view or folder from the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on the name of a view or folder in the directory tree in the "Views" box**
3. **Right-click and select "Delete" from the menu that appears**

   or

   Click on the "Remove" icon on the Results Explorer icon toolbar (Fig. 8-2)

A "Confirmation" window will pop up asking the user to confirm deletion of the selected view or folder.

4. **Click on the "Yes" button to proceed**

   or

   Click on the "No" button to cancel the deletion

Closing All Views and Folders

To close all views and folders displayed in the "Views" box in the "Results Explorer" window (Fig. 8-1)

1. **Right-click over the "Views" box**
2. **Select "Blank Explorer" from the menu that appears**

A "Save?" window will pop up asking the user if changes (to views or folders) in the Results Explorer should be saved before they are closed. Any changes not saved will be lost after they are closed. Closed views and folders are stored as .dat files and can be opened at a later time (see section 8.6.7).

3. **Click on the "Yes" button to save the changes**

or

Click on the "No" button to cancel any changes

or

Click on the "Cancel" button to terminate the process

If the user clicks on the "No" button, all views and folders will be removed from the "Views" box. If the user clicks on the "Yes" button, the "Save As" window will pop up (Fig. 8-6). To proceed

4. **Enter a name for the collection of views and folders in the "File Name" box**
5. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "Save" button, a "Success!" window will pop up stating that the views have been successfully saved and providing the location where they were saved. To proceed

6. **Click on the "OK" button**

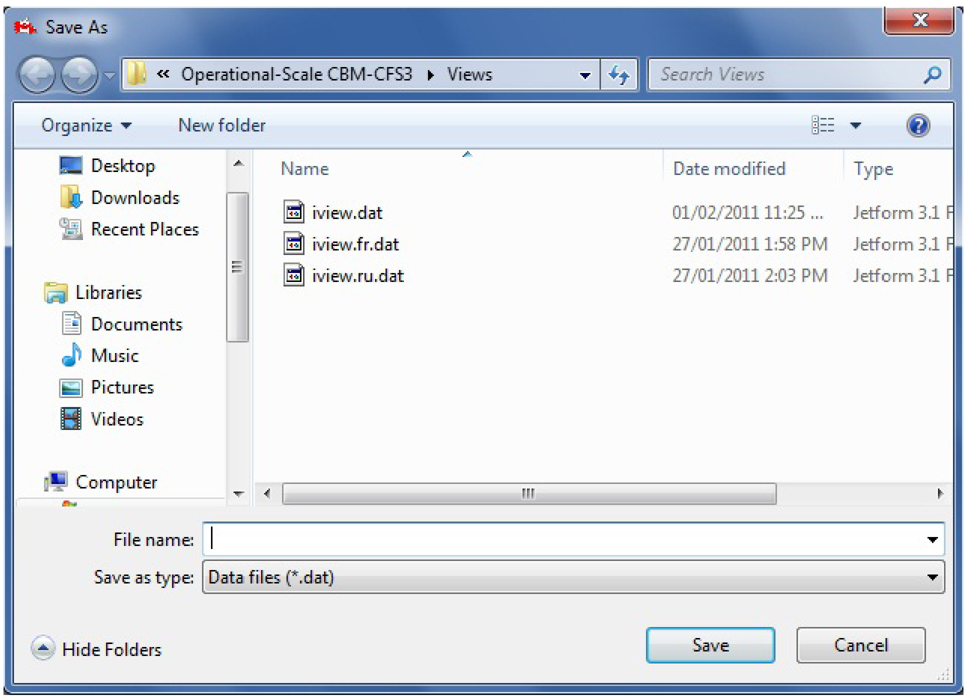


Figure 8-6. The "Save As" window.

8.3.4 Relocating a View or Folder

To relocate any view or folder displayed in the "Views" box of the "Results Explorer" window (Fig. 8-1)

1. **Click on the name of a folder or the icon beside a view in the "Views" box**
2. **Drag (by holding down the left mouse button) the selected folder or view to the desired location in the "Views" box and release the mouse button (for left-handed mouse users, the button designation may need to be reversed)**

8.4 Views

Views represent SQL queries with some additional properties that enable users to analyze, visualize (in graphs, tables, or reports), and share simulation results. The user can create views even if no folder has been created in which to place the new view (see section 8.2.1 for instructions on creating a new folder). Any existing user-created and/or predefined views are displayed in the "Views" box (Fig. 8-1) in the directory tree and are linked to a particular folder in the directory tree.

8.4.1 View Components

Views can be created from a wide variety of output variables, which are grouped into several categories, specifically (carbon) Stocks, (carbon) Stock Changes, Ecosystem Indicators, Ecosystem Transfers, (disturbance) Emissions, Disturbed Area, Age Classes, Age Classes by Time Step, Disturbance Transfers, and Unrealized Disturbance.

The Stocks category of output variables contains information on all biomass and dead organic matter (DOM) stocks. The stock results are reported in tonnes of carbon for each year for the forest area selected by the user. The user can select each stock individually, sum various stocks, select subtotals (such as total aboveground biomass), or select total ecosystem carbon.

Note: Black carbon

The black carbon pool represents stable carbon resulting from incomplete combustion during fire. By default, no allocations are made to the black carbon pool following fire disturbances since research to understand carbon transfers of this nature is in progress. However, the user can make allocations to the black carbon pool in the fire disturbance matrices by means of the Disturbance Matrix Editor (section 6.3).

The Stock Changes category of output variables contains information about changes in carbon stocks, reported in tonnes of carbon for each year, for the area selected by the user. A positive value for annual change in carbon stock indicates a net gain in carbon stocks, a negative value indicates a net loss, and a zero value indicates neither a gain nor a loss. At present, only stock changes in total biomass (Total Delta Biomass), total DOM (Total Delta DOM), and total ecosystem pools (Total Delta Ecosystem) are stored in the database. Queries for each individual pool will be available in a later version of the model. For analyses of Total Delta Ecosystem, annual values greater than zero indicate that the ecosystem is functioning as a carbon sink, annual values below zero indicate that it is functioning as a carbon source, and an annual value of exactly zero indicates that the ecosystem is carbon-neutral (i.e., neither a source nor a sink).

The Ecosystem Indicators category of output variables contains ecological information that is primarily of scientific interest, including measures of ecosystem productivity such as Net Primary Productivity (NPP) and Net Ecosystem Productivity (NEP). Both NPP and NEP are estimated for the entire ecosystem of the area within the administrative and ecological boundaries defined by the user. A positive value indicates an increase in carbon stocks and a negative value, a decrease. All values are expressed in tonnes of carbon for each year for the area selected by the user. NPP is defined as the sum of all biomass production during a year and is calculated as the sum of all biomass increments minus all losses due to litterfall, biomass turnover, disturbances, and harvesting. NEP is defined as NPP minus all decomposition losses.

The Ecosystem Indicators category of output variables includes a number of additional indicators. Net Growth is the net biomass increment before losses from disturbances. Total Litterfall is the sum of all inputs of biomass to DOM pools through litterfall, turnover, and mortality, but does not include transfers resulting from disturbances. Decomposition Releases is the sum of all releases to the atmosphere through decomposition, not counting direct losses because of disturbances. Net Litterfall is Total Litterfall minus Decomposition Releases (again, not counting losses due to disturbances).

More recent variable additions to this category include net CO_2 emissions and removals expressed as CO_2 equivalent (CO_2e), the sums of CO and CH_4 production, N_2O expressed as CO_2e, C transfers to the forest products sector expressed as CO_2e, and the net forest-atmosphere exchange expressed as either CO_2e or C. NetCO2emissions_removalsCO2e results are the CO_2 equivalent of Delta Total Ecosystem and NBP variable results; however, these are displayed from an atmospheric perspective, so positive values indicate net loss and negative values indicate net gain. Those modelling the carbon lifecycle of harvested wood products outside of the CBM-CFS3 should use the Net forest-atmosphere exchange_CO2e view instead, or the Net forest atmosphere exchange_C view, as they do not treat harvested C as an instant emission. The SumofCOProduction_CO2e and SumofCH4Production_CO2e variables portray emissions of each in CO_2e resulting from disturbances, while the N2O_CO2e variable simply displays N_2O in CO_2e. Finally, the ToFps_CO2e variable displays all carbon transfers to the forest products sector in CO_2e.

The Ecosystem Transfers category of output variables contains information on transfers of carbon from the ecosystem to the forest product sector, transfers from the ecosystem to the atmosphere, and transfers from biomass to dead organic matter (DOM). The latter transfers are primarily of scientific interest. The total harvest (in tonnes of carbon for each year) is represented by the variable Total Harvest (Biomass+Snags). Other ecosystem to forest product sector variables include Total Harvest (Biomass), Total Harvest (Snags), Softwood Harvest (Biomass), Softwood Harvest (Snags), Hardwood Harvest (Biomass), and Hardwood Harvest (Snags). The decomposition-related releases from 15 pools to the atmosphere are also accessible to the user. All decomposition losses are assumed to occur as carbon dioxide and are reported in tonnes of carbon for each year. The biomass transfers to dead organic matter are summarized by biomass pool of origin (except for black carbon) and are reported for each biomass pool of origin as annual transfers without the impacts of disturbances.

The Emissions category of output variables contains annual process-related emissions to the atmosphere and emissions related to disturbances or other activities that are summarized in four ways: by source (total, total biomass, and total DOM pools), by gas (carbon dioxide, carbon monoxide, and methane), by gas from biomass, and by gas from DOM pools. All output is reported in tonnes of carbon for each year. This information can be further filtered, for example, by disturbance type, to separate out emissions from slash burning and wildfire.

The Disturbed Area category contains two variables, "Area Disturbed", representing the area affected annually by disturbances, management actions, and annual processes (e.g., natural stand dynamics), and "Area", representing project area. To view "Area Disturbed", the user must select and submit that variable and then filter by the disturbance type. The results will consist of the area disturbed, in hectares, in each year of the simulation. To View "Area", the user must select and submit that variable and then filters can be applied (if required). The results will consist of the area, in hectares, in each year of the simulation.

The Age Classes category of output variables contains information on the area (hectares), the total biomass carbon stocks (tonnes), the total DOM carbon stocks (tonnes), and the average age (years) of each age class range. Graphs are displayed as bar charts. The user must first select the variable of interest and then select a filter for the age class ranges in which the information should be displayed. For example, a graph of area by age class would present the age class information by age class range.

The Age Classes by Time Step category of output variables also contains information on the area (hectares), the total biomass carbon stocks (tonnes), the total DOM carbon stocks (tonnes), and the average age (years) of each age class range. Graphs are displayed as bar charts. The user must first select the variable of interest and then select a filter for the age class ranges in which this information should be displayed. For example, a graph of area by age class in time step zero would show the age class information at the beginning of the simulation.

The Disturbance Transfers category of output variables contains information about carbon (tonnes) as it relates to disturbance losses to the atmosphere, transfers from biomass to the soil, and Net Biome Productivity (NBP). NBP is defined as NEP minus losses from harvesting and disturbances. NBP is equivalent to the annual total ecosystem carbon stock change. Disturbance losses are the losses from biomass and DOM stocks resulting from disturbances. "Bio to Soil from Disturbances" reports the total transfer of biomass to the DOM pools resulting from disturbances.

The Unrealized Disturbance category of output variables contains information about the area (in hectares) that was scheduled to be disturbed during the simulation period but for some reason was not disturbed (for example, lack of eligible area to be disturbed in a designated stand type). Only unrealized disturbances that targeted area (not proportion of records or tonnes of merchantable carbon) are displayed.

Note: Viewing annual processes

A number of view categories can be filtered to display annual processes. These categories are the Stock Changes, Ecosystem Transfers, Emissions, Disturbed Area, Disturbance Transfers, and Unrealized Disturbance categories. If a view is filtered for annual processes, (select "Annual Processes" under the "Disturbance Type" filter category) only those ecosystem carbon stocks or stock changes associated with the natural annual carbon exchanges from growth and decomposition will be displayed, exclusive of natural or anthropogenic disturbance events. For more information on filtering views, see the "Selecting View Filter Options" subsection of section 8.4.2.

After clicking on the name of one of the output variable categories, the user will be able to select from one or more lists of variables to be graphed from that category. The variables, grouped by category, are described in Table 8-1.

Table 8-1. View Editor categories and their associated variable names and descriptions (units in parentheses)

Category name	Variable name	Variable description
Stocks (t C)	Total Ecosystem	Carbon in Biomass and DOM pools
	Biomass	Carbon in the aboveground and belowground biomass pools
	Aboveground Biomass	Carbon in all aboveground biomass pools
	Belowground Biomass	Carbon in all belowground biomass pools (coarse plus fine roots)
	DOM[a]	Carbon in all DOM pools
	Aboveground DOM	Carbon in DOM pools above the mineral soil
	Belowground DOM	Carbon in DOM pools in the mineral soil
	Softwood Merchantable	Carbon in the merchantable portion of softwood stem wood and stem bark (excluding tops and stumps)
	Softwood Submerchantable	Carbon in submerchantable softwood stem wood; currently disabled
	Softwood Other	Carbon in softwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
	Softwood Foliage	Carbon in softwood foliage
	Softwood Fine Roots	Carbon in live softwood fine roots, approximately <5 mm diameter
	Softwood Coarse Roots	Carbon in live softwood coarse roots, approximately ≥ 5 mm diameter
	Hardwood Merchantable	Carbon in the merchantable portion of hardwood stem wood and stem bark (excluding tops and stumps)
	Hardwood Submerchantable	Carbon in submerchantable hardwood stem wood; currently disabled
	Hardwood Other	Carbon in hardwood nonmerchantable stem wood and bark, and both merchantable and nonmerchantable branches, tops, stumps, and their bark
	Hardwood Foliage	Carbon in hardwood foliage
	Hardwood Fine Roots	Carbon in live hardwood fine roots, approximately <5 mm diameter
	Hardwood Coarse Roots	Carbon in live hardwood coarse roots, approximately ≥ 5 mm diameter
	Deadwood	Carbon in belowground fast, medium, softwood, and hardwood stem snag, and softwood and hardwood branch snag DOM pools
	Litter	Carbon in very fast aboveground, fast aboveground, and slow aboveground DOM pools
	Soil C	Carbon in very fast belowground, slow belowground, and black carbon DOM pools

Table 8-1. Continued

Category name	Variable name	Variable description
Stocks (t C)	Aboveground Very Fast DOM	Carbon in the L horizon with input from foliage and fine roots approximately <5 mm diameter
	Belowground Very Fast DOM	Carbon in dead fine roots approximately <5 mm diameter in the mineral soil
	Aboveground Fast DOM	Carbon in fine and small woody debris DOM including dead coarse roots in the forest floor, with a portion of inputs from the Other pool, and inputs from snag branches and coarse roots approximately ≥ 5 mm diameter
	Belowground Fast DOM	Carbon in dead coarse roots approximately ≥ 5 mm diameter in the mineral soil
	Medium DOM	Carbon in coarse woody debris DOM with input from merchantable stem wood and stem snags
	Aboveground Slow DOM	Carbon in the F, H, and O horizons with input from the Aboveground Very Fast, Fast, Medium, Snag Stem Wood and Snag Branches DOM pools; slow transfer rate
	Belowground Slow DOM	Carbon in humified organic matter in the mineral soil with input from the Belowground Very Fast, Belowground Fast, and Aboveground Slow pools
	Softwood Stem Snag	Carbon in dead standing softwood stem wood of merchantable size, including bark; snag stem wood transfer rate
	Softwood Branch Snag	Carbon in dead softwood branches, and nominally, a portion of input from the Softwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
	Hardwood Stem Snag	Carbon in dead standing hardwood stem wood of merchantable size, including bark; snag stem wood transfer rate
	Hardwood Branch Snag	Carbon in dead hardwood branches, and nominally, a portion of input from the Hardwood Other pool including dead stumps and nonmerchantable trees; snag branch transfer rate
	Black Carbon	Stable carbon from incomplete combustion after fire
	Peat	Carbon in peat; currently not included in calculations
Stock Changes (t yr^{-1})	Delta Total Ecosystem	Change in Total Ecosystem carbon stocks
	Delta Total Biomass	Change in Biomass carbon stocks
	Delta Total DOM	Change in DOM carbon stocks
Ecosystem Indicators (t yr^{-1})	Net Primary Productivity (NPP)	Sum of all biomass carbon production during a year

Table 8-1. Continued

Category name	Variable name	Variable description
Ecosystem Indicators ($t\ yr^{-1}$)	Net Ecosystem Productivity (NEP)	NPP minus all losses of carbon due to decomposition
	Net Growth	Net biomass increment before losses from disturbances
	Net Litterfall	Total litterfall minus loss of litter carbon due to decomposition
	Total Litterfall	Sum of litterfall and litter decomposition inputs to DOM pools
	Decomposition Releases	Sum of all carbon released to the atmosphere due to decomposition and excluding direct losses from disturbance
	Net CO2 emissions_ removals_CO2e	Net CO_2 emissions and removals in tonnes of CO_2 equivalent
	Sum of CO Production_ CO2e	CO emitted as a results of disturbances in tonnes of CO_2 equivalent
	Sum of CH4 Production_ CO2e	CH_4 emitted as a result of disturbances in tonnes of CO_2 equivalent
	N2O_CO2e	N_2O in tonnes of CO_2 equivalent
	ToFps_CO2e	Carbon in tonnes of CO_2 equivalent transferred to the forest products sector
	Net forest-atmosphere exchange_CO2e	Identical to the "NetCO_2emissions_removals_CO_2e" variable, with the exception that transfers of carbon to the forest products pool resulting from harvest are not treated as an immediate emission. This variable should be used as an alternate to the "NetCO_2emissions_removals_CO_2e" parameter by those modeling emissions from harvested wood products outside of the CBM-CFS3.
	Net forest-atmosphere exchange_C	Identical to the "Net forest-atmosphere exchange_ CO_2e" variable, with the exception that values are expressed in terms of C. It should also be noted that for scenarios involving fire, results between the "Net forest-atmosphere exchange_CO_2e" and "Net forest-atmosphere exchange_C" parameters will not be directly proportional due to differences in how CH_4 and CO convert to CO_2 and to C, and because the "Net forest-atmosphere exchange_CO_2e" parameter additionally calculates N_2O. This variable should be used as an alternate to the "NetCO_2emissions_ removals_CO_2e" parameter by those modeling emissions from harvested wood products outside of the CBM-CFS3
Ecosystem transfers ($t\ ha^{-1}$)	Total Harvest (Biomass+ Snags)	Total transfer of carbon from the ecosystem pools to the forest product sector

Table 8-1. Continued

Category name	Variable name	Variable description
Ecosystem Transfers ($t\ yr^{-1}$)	Total Harvest (Biomass)	Total transfer of carbon from the biomass pools to the forest product sector
	Softwood Harvest (Biomass)	Transfer of carbon from the softwood biomass pools to the forest product sector
	Hardwood Harvest (Biomass)	Transfer of carbon from the hardwood biomass pools to the forest product sector
	Deadwood	Transfer of carbon from the deadwood stocks pools to the atmosphere
	Litter	Transfer of carbon from the litter stocks pools to the atmosphere
	Soil C	Transfer of carbon from the soil carbon stocks pools to the atmosphere
	Belowground Very Fast DOM	Transfer of carbon from the Belowground Very Fast DOM pool to the atmosphere
	Aboveground Very Fast DOM	Transfer of carbon from the Aboveground Very Fast DOM pool to the atmosphere
	Belowground Fast DOM	Transfer of carbon from the Belowground Fast DOM pool to the atmosphere
	Aboveground Fast DOM	Transfer of carbon from the Aboveground Fast DOM pool to the atmosphere
	Medium DOM	Transfer of carbon from the Medium DOM pool to the atmosphere
	Belowground Slow DOM	Transfer of carbon from the Belowground Slow DOM pool to the atmosphere
	Aboveground Slow DOM	Carbon in the F, H, and O horizons with input from the Aboveground Very Fast, Fast, Medium, Snag Stem Wood and Snag Branches DOM pools; slow transfer rate
	Softwood Stem Snag	Transfer of carbon from the softwood stem pool to the to the atmosphere
	Softwood Branch Snag	Transfer of carbon from the softwood branch pool to the atmosphere
	Hardwood Stem Snag	Transfer of carbon from the hardwood stem pool to the atmosphere
	Hardwood Branch Snag	Transfer of carbon from the hardwood branch pool to the atmosphere
	Black Carbon	Transfer of carbon from various pools to the black carbon pool associated with disturbances
	Peat	Transfer of carbon from the peat pool to the atmosphere; currently disabled
	Biomass	Total transfer of carbon from all biomass pools to all DOM pools due to disturbances

Table 8-1. Continued

Category name	Variable name	Variable description
Ecosystem Transfers ($t\ yr^{-1}$)	Merchantable	Transfer of carbon from Softwood Merchantable and Hardwood Merchantable pools to DOM pools
	Submerchantable	Transfer of carbon from Softwood Submerchantable and Hardwood Submerchantable pools to DOM pools; currently disabled
	Other	Transfer of carbon from the Softwood Other and Hardwood Other pools to DOM pools
	Foliage	Transfer of carbon from the Softwood Foliage and Hardwood Foliage pools to DOM pools
	Fine Root	Transfer of carbon from Softwood Fine Roots and Hardwood Fine Roots to DOM pools
	Coarse Root	Transfer of carbon from Softwood Coarse Roots and Hardwood Coarse Roots pools to DOM pools
Emissions ($t\ yr^{-1}$)	Total	Total emissions from all ecosystem components (DOM + Biomass) resulting from annual decay processes and fire disturbance
	Total Biomass	Total emissions from all biomass components resulting from fire disturbance
	Total DOM	Total emissions from all DOM pools resulting from annual decay processes and fire disturbance
	Total CO2	Total carbon dioxide emissions resulting from annual decay processes and fire disbufbance
	Total CO	Total carbon monoxide emissions resulting from fire disturbance
	Total CH4	Total methane emissions resulting from fire disturbance
	Bio CO2	Carbon dioxide emissions from all biomass pools resulting from fire disturbance
	Bio CO	Carbon monoxide emissions from all biomass pools resulting from fire disturbance
	Bio CH4	Methane emissions from all biomass pools resulting from fire disturbance
	DOM CO2	Carbon dioxide emissions from all DOM pools resulting from annual decay processes and fire disturbance
	DOM CO	Carbon monoxide emissions from all DOM pools resulting from fire disturbance
	DOM CH4	Methane emissions from all DOM pools resulting from fire disturbance
Disturbed Area ($ha\ yr^{-1}$)	Area Disturbed	Area disturbed annually by fire, insects, or management activities

Table 8-1. Concluded

Category name	Variable name	Variable description
Disturbed Area (ha yr^{-1})	Area (ha)	Area of the forest
Age Classes	Area (ha)	Area of the forest in a particular age class
	Biomass (t)	Total biomass carbon by 20-year age classes
	DOM (t)	DOM carbon by age class
	Average Age (years)	Average age of each age class
Age Classes by Timestep	Area (ha)	Area by age-class reported by time step
	Biomass (t)	Total biomass carbon by age-class for each time step
	DOM (t)	Total DOM carbon by age-class for each time step
	Average Age (years)	Average age of an age-class
Disturbance Transfers (t yr^{-1})	Disturbance Losses	Carbon losses from biomass and DOM stocks due to disturbance
	Bio to Soil from Disturbances	Total transfer of biomass to DOM pools due to disturbance
	Net Biome Productivity (NBP)	NEP minus losses of carbon due to harvesting and disturbances
Unrealized Disturbance (ha)	Unrealized Disturbed Area	Area allocated for disturbances that could not be disturbed in the model run because of insufficient eligible area

[a]DOM = dead organic matter.

8.4.2 Creating a View

To create a view in the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Click on the name of a folder in the directory tree in the "Views" box**
3. **Right-click and select "New View" from the menu that appears**

   or

   Click on the "New View" icon on the Results Explorer icon toolbar (Fig. 8-2)

The "View Editor" window (Fig. 8-7) will pop up. Using this editor, the user can create a desired view based on any of a wide range of output variables. To select a view category and begin creating a view

4. **Click on a category name in the "Categories" box of the "View Editor" window**

A box with the name of the selected category ("Age Classes" in Fig. 8-8) will pop up, with the "Queries" tab selected. Next, the user can choose (optional) a simulation results database containing the filter values to be selected while creating the view.

Different simulation results databases may have different filter values depending on the project in which they originate. For example, one project might have fire and insects as disturbance filter values, whereas another project might have harvesting as its only disturbance.

Above the box named for the user-selected category ("Age Classes" in Fig. 8-8), a link, with the path and name of a simulation results database, will appear (provided that a database was opened in the "Results" box of the "Result Explorer" window; Fig. 8-1), as well as a "DB" button.

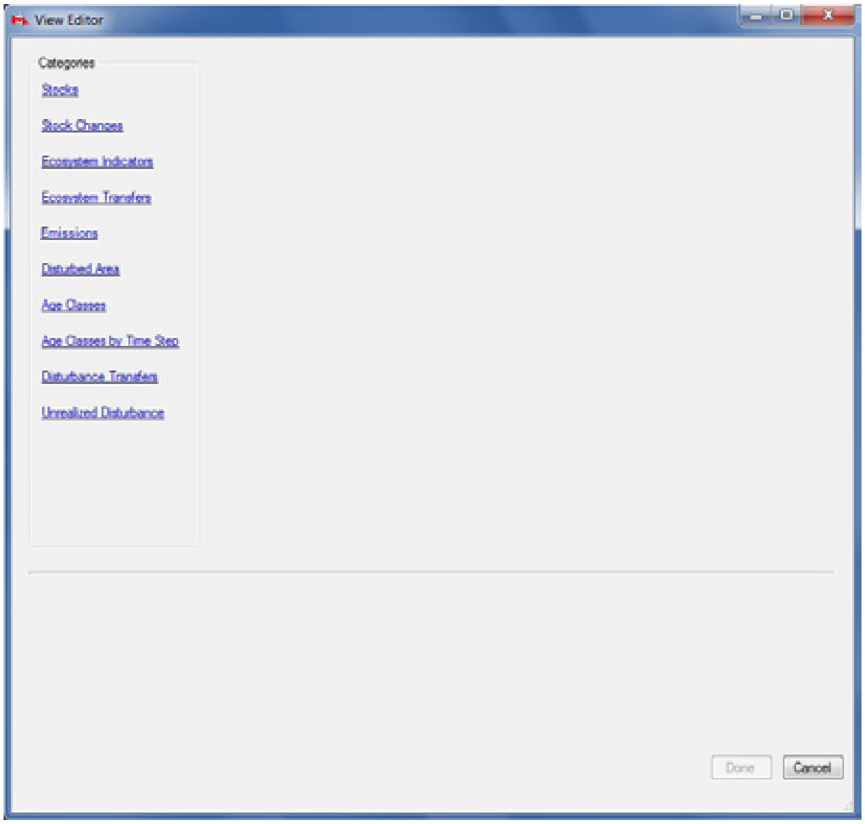


Figure 8-7. The "View Editor" window.

To create new views using the simulation results database (path) displayed, proceed to the next section, "Selecting View Query Variables." To change or select a simulation results database

5. **Click on the link or the "DB" button**

The "Results for Filter Values" window (Fig. 8-9) will pop up. This window allows the user to select a simulation results database to be used for creating new views. To cancel any task and exit this window, click on the "Cancel" button. To select a simulation results database to create new views

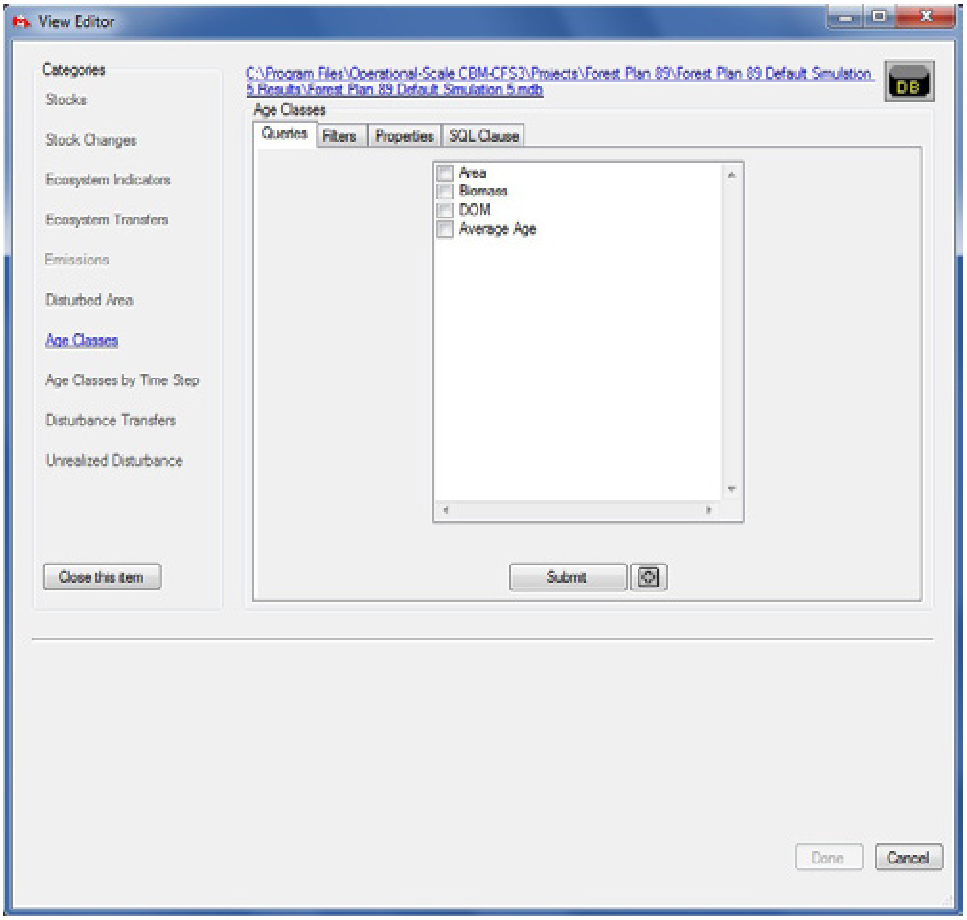


Figure 8-8. **The "View Editor" window displaying the "Age Classes" box with the "Queries" tab selected.**

6. Click on the name of a simulation results database in the "Unarchived Results" box
7. Click on the "Use Selected Results Database" button to proceed

   or

   Click on the "Cancel" button to terminate the process

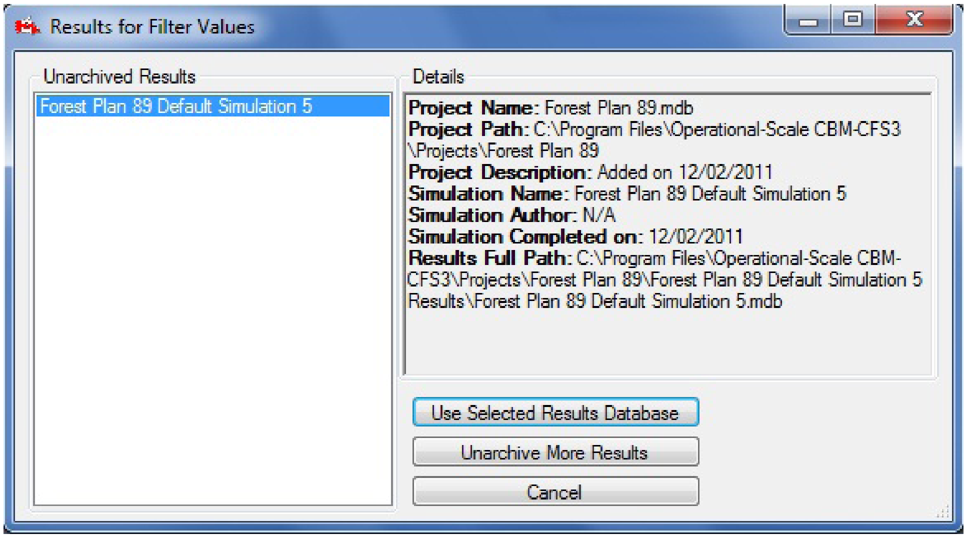


Figure 8-9. The "Results for Filter Values" window.

If the user clicks on the "Use Selected Results-Database" button, the link will be made and the "Results for Filter Values" window will close.

Note: Using the "Results for Filter Values" window to unarchive databases

To unarchive other simulation results databases while in the "Results for Filter Values" window (optional)

Click on the "Unarchive More Results" button

The "Simulation Results" window (Fig. 8-3) will pop up. To learn how to use this window, consult section 8.1.1. Once the user has added a simulation results database through the "Simulation Results" window and has clicked on the "Done" button, the window will close and the user will again have access to the "Results for Filter Values" window and will be able to select the newly unarchived simulation results database.

To continue creating a new view, the user must select view query variables.

Selecting View Query Variables

Although no knowledge of SQL is required to create a view, the "SQL Clause" tab (Fig. 8-10) allows the user to display the SQL programming behind the views created with the other tabs; the user can thus learn how view scripts are written, if so desired. No instructions for writing SQL scripts for views are provided in this guide.

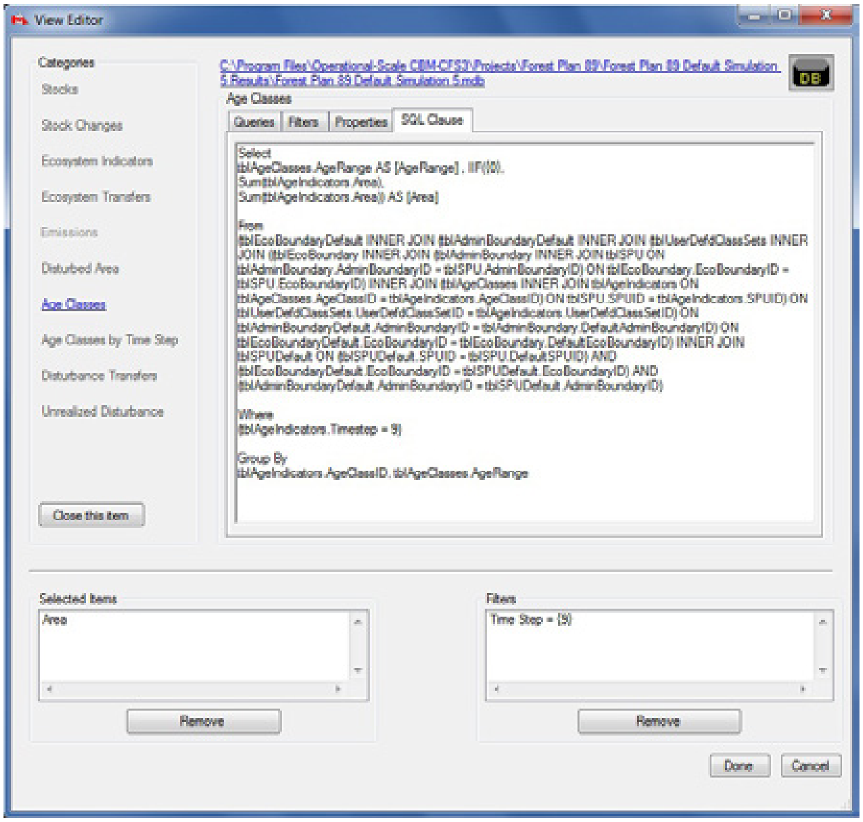


Figure 8-10. The "View Editor" window displaying the "Age Classes" box with the "SQL Clause" tab selected. SQL = Structured Query Language.

To create a view

1. **On the "Queries" tab, click on the check box next to each variable to be graphed (Fig. 8-8)**
2. **Click on the "Submit" button**

☞ *Tip: Scrolling for variable options*

If the desired variable is not automatically displayed in the box on the "Queries" tab, the user can use the scroll bar at the side of the box to view any undisplayed variables.

☞ *Tip: Adding multiple query variables*

The user has another option for adding multiple query variables to a view. To see the sum of two variables graphed in a view (as opposed to displaying the data for each separately in a single view) click on the "+" button instead of the "Submit" button after selecting the variables to be graphed. Note that only variables measured in the same units can be summed in this way. If it is not possible to sum the selected variables, a "Post Processor Visualization" window will pop up, stating that the selected queries will generate a unit conflict. If this window pops up

Click on the "OK" button

Reselect the query variables for the view

The selected query items will appear in a "Selected Items" box in the "View Editor" window (see example in Fig. 8-11). If the user submits a query for any variable in the Age Classes category, the "Instruction" window (Fig. 8-12) will pop up, with instructions on creating a proper view for this category. The user should read the contents of the window and then

3. Click on the "OK" button to close the "Instruction" window

To remove a variable that has been added to the "Selected Items" box of the "View Editor" window (Fig. 8-11)

Click on the variable in the "Selected Items" box

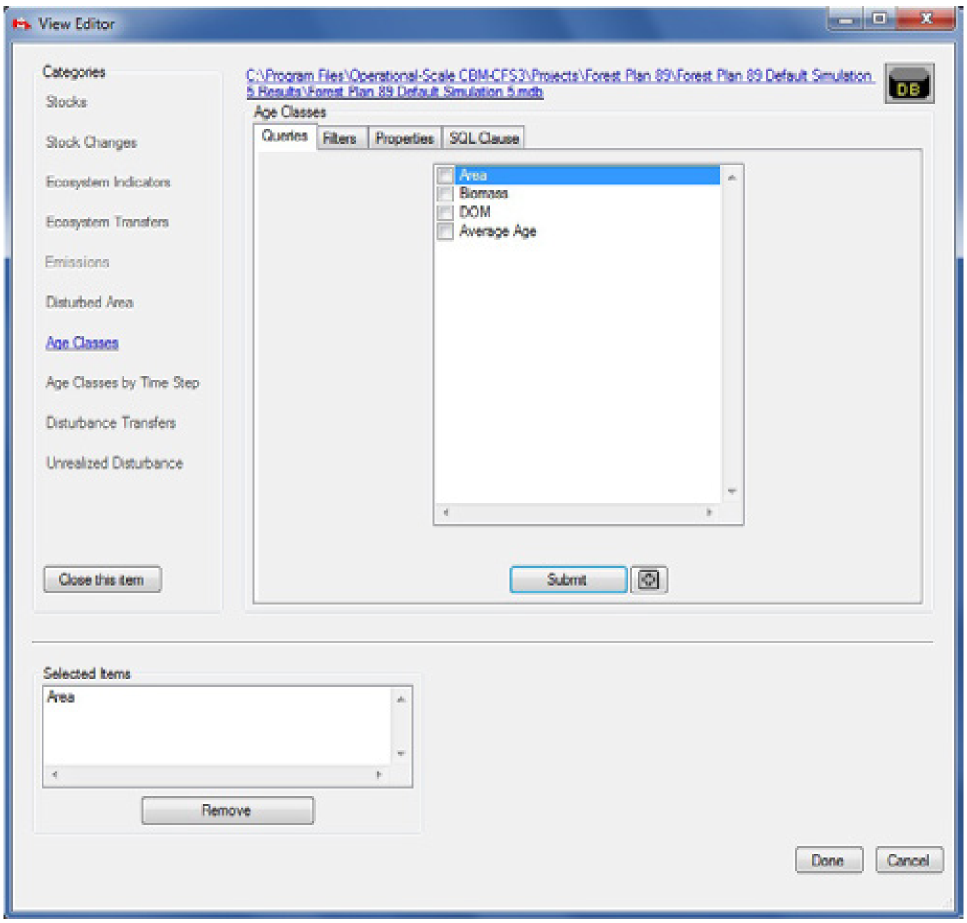


Figure 8-11. The "View Editor" window displaying the "Age Classes" box with the "Queries" tab selected and the "Selected Items" box displayed.

Click on the "Remove" button

Before clicking on the "Done" button, the user can make further modifications to the new view, including selecting filters and setting properties. The application of filters to views is sometimes optional and sometimes required, depending on the view category and variables chosen for display. If application of filters is required, the "Instruction" window (Fig. 8-12) will pop up after variables for a view have been submitted.

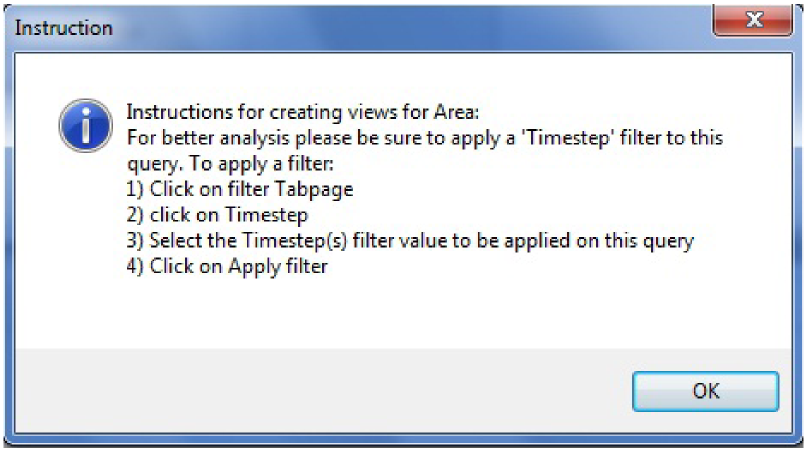


Figure 8-12. The “Instruction” window displaying instructions to create a view for the “Area” variable.

The user must follow the instructions provided in the “Instruction” window to create proper views for that category. If the “Instruction” window does not pop up, the application of filters (discussed later in this section) is optional. Setting properties for views is always optional; the CBM-CFS3 will apply defaults and make the view available to all simulation results databases. If no filters are selected and no properties are set

4. **Click on the “Done” button**

If the user clicks on the “Done” button, the “View Editor” window will close and the name of the new view will be displayed in the “Results Explorer” window (Fig. 8-1), in the directory tree linked to the folder originally selected in the “Views” box.

Selecting View Filter Options

Once the query variables to be viewed have been selected on the “Query” tab, the user can select filters for the view. To apply filters

1. **Click on the “Filters” tab (Fig. 8-13)**

Each view category will display different filter options.

2. **Click on the “Filter Categories” box and select a category name from the drop list that appears**

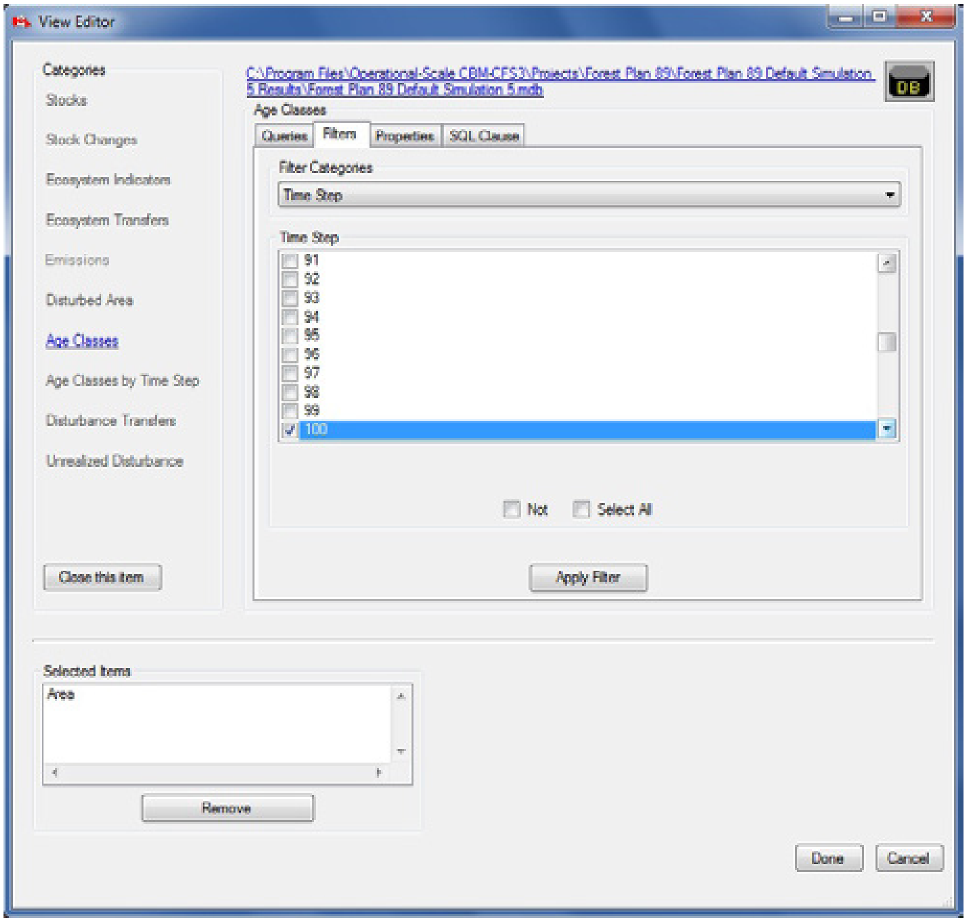


Figure 8-13. The "View Editor" window displaying the "Age Classes" box with the "Filters" tab selected and the category options for the "Time Step" filter displayed.

3. **Click on the check boxes in the filter box to select the category filters to be used**

☞ *Tip: "Select All" and "Not" check boxes*

The "Select All" and "Not" check boxes can also be used to select the appropriate filter variables in a filter category. Clicking on the "Select All" check box allows all of the filter variable check boxes to be checked or unchecked at once. To exclude a few of the filter variables for a filter category, click on the check boxes of the filter variables to be excluded and then click on the "Not" check box. Filters will be applied to all of the filter variables except the ones that have been checked.

Note: Creating an "Emissions" category view

When creating an "Emissions" category view, the user must select filters appropriately to either display emissions from disturbances and other activities or display emissions resulting from annual processes (uptake from growth and decomposition).

To display only emissions from disturbances and other activities

1. **Select "Disturbance Type" from the "Filter Categories" drop list box**
2. **Click on the "Annual Processes" check box in the "Disturbance Type" box**

Note (continued): Creating an "Emissions" category view

3. **Click on the "Not" check box**

To display only emissions from annual processes

1. **Select "Disturbance Type" from the "Filter Categories" drop list box**
2. **Click on the "Annual Processes" check box in the "Disturbance Type" box**

When creating an "Age Classes" category view, the user should filter by a specific time step; otherwise, the view will display the sum of all areas in every time step for the simulation, by age class.

4. **Click on the "Apply Filter" button**

The "Filters" box (Fig. 8-14) will appear, displaying the SQL for the filters used to create the new view.

To remove a filter, the user can simply click on the SQL for the filter in the "Filters" box and click on the "Remove" button.

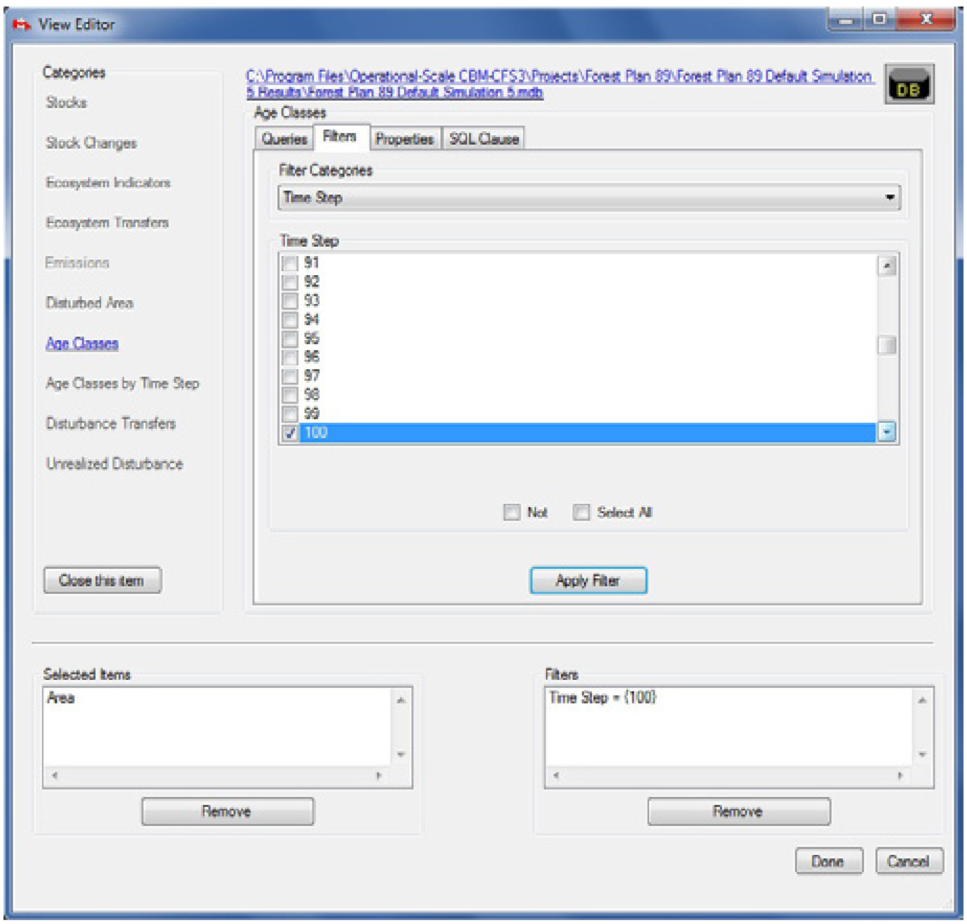


Figure 8-14. The "View Editor" window displaying the "Age Classes" box with the "Filters" tab selected and the "Filters" box displayed.

Note: Applying the same filter to different projects

Use caution with regard to filters. When filters are applied to a view, the values stored in the queries are the pointers to the classifiers used in the database for which the views were developed. Applying a view template from one analysis or project to another region can create problems if the values of the classifiers in the forest inventories of the two regions differ. For example, in Forest X, the classifier for site class has six possible values, with 1 being the poorest site class and 6 the best. A view can be created to filter the results for areas with site class 6 only. If this view is later applied to another analysis area, for example, Forest Y, in which the inventory contains three possible values for site class (good, medium and poor) an error will occur because site class 6 does not exist for Forest Y. Perhaps of greater concern are situations in which no error occurs but the model compiles data for the wrong strata. Therefore, before using views containing filters developed for one analysis area in another area, the user must ensure that the classifier structure and definitions are the same for both areas. Views without filters can be applied to other projects.

Next, the user has the option of setting view properties for the view that is being created. Setting view properties is optional, as the CBM-CFS3 will apply defaults and make the view available to all simulation results databases. To skip setting properties

5. **Click on the "Done" button**

If the user clicks on the "Done" button, the "View Editor" window will close and the name of the new view will be displayed in the "Results Explorer" window (Fig. 8-1), in the directory tree linked to the folder originally selected in the "Views" box.

Selecting View Properties

View properties are the graph title, graph type, *x*-axis title, *y*-axis title, and description. The user can also choose whether to make the view applicable to one simulation results database only or to all simulation results databases that will be created. To set view properties

1. **Click on the "Properties" tab (Fig. 8-15)**
2. **Click on the "Graph Title" box and enter a title for the graph**
3. **Click on the "Graph Type" box and select an option from the drop list that appears**
4. **Click on the "x Axis Title" box and enter a title for the *x*-axis**
5. **Click on the "y Axis Title" box and enter a title for the *y*-axis**

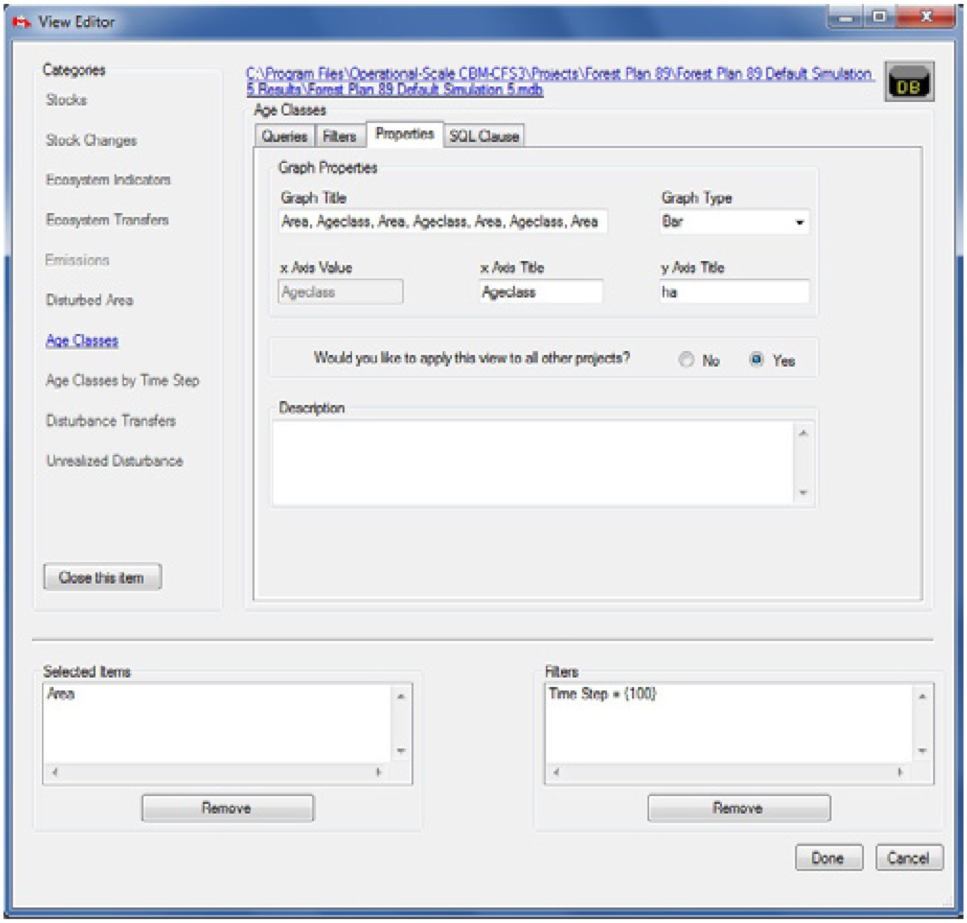


Figure 8-15. The "View Editor" window displaying the "Age Classes" box with the "Properties" tab selected.

In the "Would you like to apply this view on all other projects too?" box

6. **Click on the "No" radio button to make the view applicable only to the current project**

   or

   Click on the "Yes" radio button to make the view applicable to all projects

Note: Use of filters in views and their application to different projects

If the user applies filters during creation of a view, it is not possible to make that view applicable to all simulation results databases, unless all of the databases contain the same classifiers and variables.

7. **Enter a description in the "Description" box**

Once the view properties are acceptable

8. **Click on the "Done" button to complete the view creation process**

   or

   Click on the "Cancel" button to terminate the view creation process

If the user clicks on the "Done" button, the "View Editor" window will close and the name of the new view will be displayed in the "Views" box in the "Results Explorer" window (Fig. 8-1), in the directory tree linked to the folder originally selected.

8.5 Editing a View

To edit an existing view displayed in the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1)

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **In the directory tree in the "Views" box, click on the name of the view to be edited**
3. **Right-click and select "Edit" from the menu that appears**

   or

   Click on the "Edit" icon on the Results Explorer icon toolbar (Fig. 8-2)

The "View Editor" (Fig. 8-14) will pop up with the view-related category open and ready to edit.

4. **Make the necessary changes to the view (see section 8.4)**
5. **Click on the "Done" button to save the edits**

   or

   Click on the "Cancel" button to cancel the edits

8.6 Displaying, Exporting, Saving, and Opening Views

In the "Results Explorer" window (Fig. 8-1), simulation results can be displayed in a variety of ways: as one view for one simulation results database, as one view combining results from multiple simulation results databases, as multiple views in one for one simulation results database, or as multiple views in one for multiple simulation results databases.

Once a view is displayed in the "Results" window, the user can view the display in a combined graph and table (Fig. 8-16) by clicking on the "Graph" radio button, in a table (Fig. 8-17) by clicking on the "Table" radio button, or in a report (Fig. 8-18) by clicking on the "Report" radio button.

The combined graph and table format displays the graph view of the results along with a scrollable table of the data displayed in the graph. If the user places the cursor over a data point in the graph, an information box will appear displaying the name of the data type and the x and y values of that data point. At the same time, the data for the point will be highlighted in the table below the graph. If the user holds the cursor over a variable in the legend, the data for that variable will be highlighted in the graph and in the table.

☞ ***Tip: Viewing results per hectare***

To view y-axis results on a per-hectare basis in a graph, table, or report, click on the "Divide by Area" check box in the appropriate "Results" window.

The user can modify the combined graph and table view display and properties directly using graph tool icons, indirectly by right-clicking over the graph and table display and clicking on any of the menu options that appear, or by selecting "Tools" on the graph and table menu bar displayed (see Chapter 9). The user can load, save, copy, or print graphs (see Chapter 9). A graph, table, or report can be exported as a text file or a Microsoft Excel file. A directory of views in the "Views" box in the "Results Explorer" window (Fig. 8-1) can be saved, and a saved view directory can be opened.

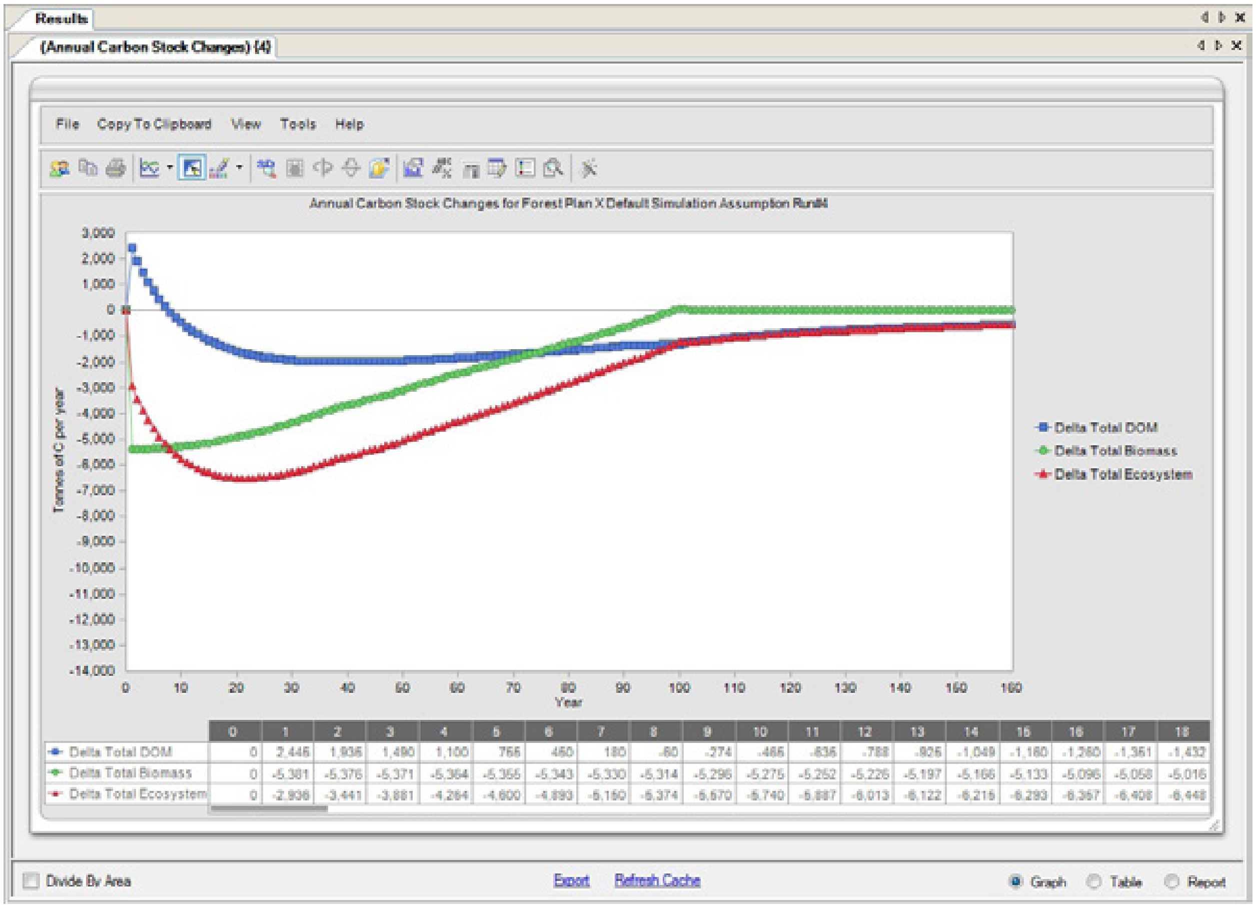


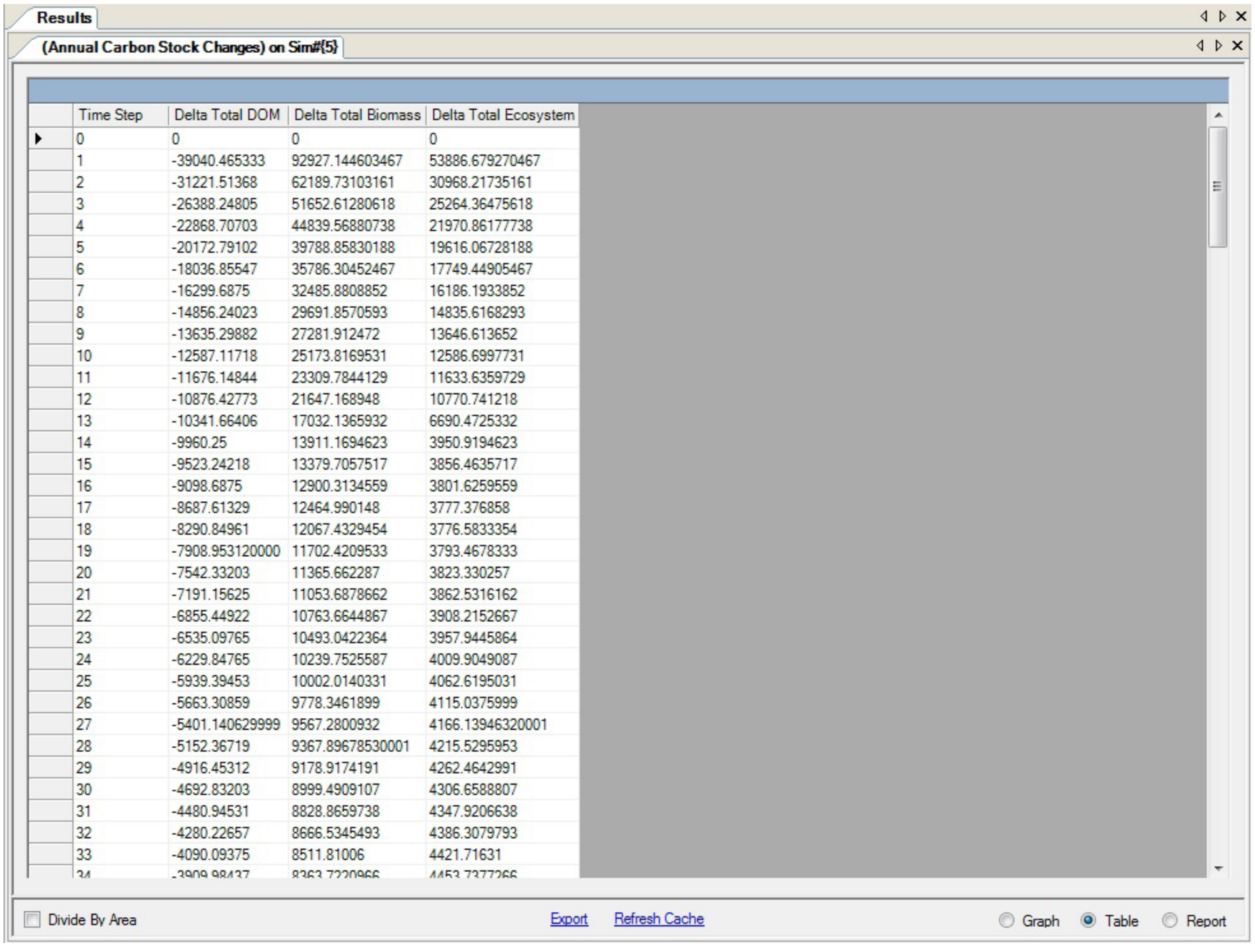
Figure 8-16. The “Results” window with a “Graph” display selected for the “Annual Carbon Stock Changes” view.

8.6.1 Displaying One View for One Simulation Results Database

To display one view for one simulation results database

1. **Click on the name of the simulation results database of interest in the “Results” box (Fig. 8-1) so that a check mark appears beside it**

Should the user forget the details of the simulation that produced the simulation results database, holding the cursor over the name of the simulation results database will cause an information box to appear, displaying the simulation identification number, the simulation name, the project author, the date when the simulation was performed, and the description of the simulation.



Time Step	Delta Total DOM	Delta Total Biomass	Delta Total Ecosystem
0	0	0	0
1	-39040.465333	92927.144603467	53886.679270467
2	-31221.51368	62189.73103161	30968.21735161
3	-26388.24805	51652.61280618	25264.36475618
4	-22868.70703	44839.56880738	21970.86177738
5	-20172.79102	39788.85830188	19616.06728188
6	-18036.85547	35786.30452467	17749.44905467
7	-16299.6875	32485.8808852	16186.1933852
8	-14856.24023	29691.8570593	14835.6168293
9	-13635.29882	27281.912472	13646.613652
10	-12587.11718	25173.8169531	12586.6997731
11	-11676.14844	23309.7844129	11633.6359729
12	-10876.42773	21647.168948	10770.741218
13	-10341.66406	17032.1365932	6690.4725332
14	-9960.25	13911.1694623	3950.9194623
15	-9523.24218	13379.7057517	3856.4635717
16	-9098.6875	12900.3134559	3801.6259559
17	-8687.61329	12464.990148	3777.376858
18	-8290.84961	12067.4329454	3776.5833354
19	-7908.953120000	11702.4209533	3793.4678333
20	-7542.33203	11365.662287	3823.330257
21	-7191.15625	11053.6878662	3862.5316162
22	-6855.44922	10763.6644867	3908.2152667
23	-6535.09765	10493.0422364	3957.9445864
24	-6229.84765	10239.7525587	4009.9049087
25	-5939.39453	10002.0140331	4062.6195031
26	-5663.30859	9778.3461899	4115.0375999
27	-5401.140629999	9567.2800932	4166.13946320001
28	-5152.36719	9367.89678530001	4215.5295953
29	-4916.45312	9178.9174191	4262.4642991
30	-4692.83203	8999.4909107	4306.6588807
31	-4480.94531	8828.8659738	4347.9206638
32	-4280.22657	8666.5345493	4386.3079793
33	-4090.09375	8511.81006	4421.71631
34	-3909.98437	8363.7220966	4453.7377266

Figure 8-17. The "Results" window with the "Table" display selected for the "Annual Carbon Stock Changes" view.

2. **Click on the name of a view in the directory tree in the "Views" box and click on the "Graph" icon on the Results Explorer icon toolbar (Fig. 8-2)**

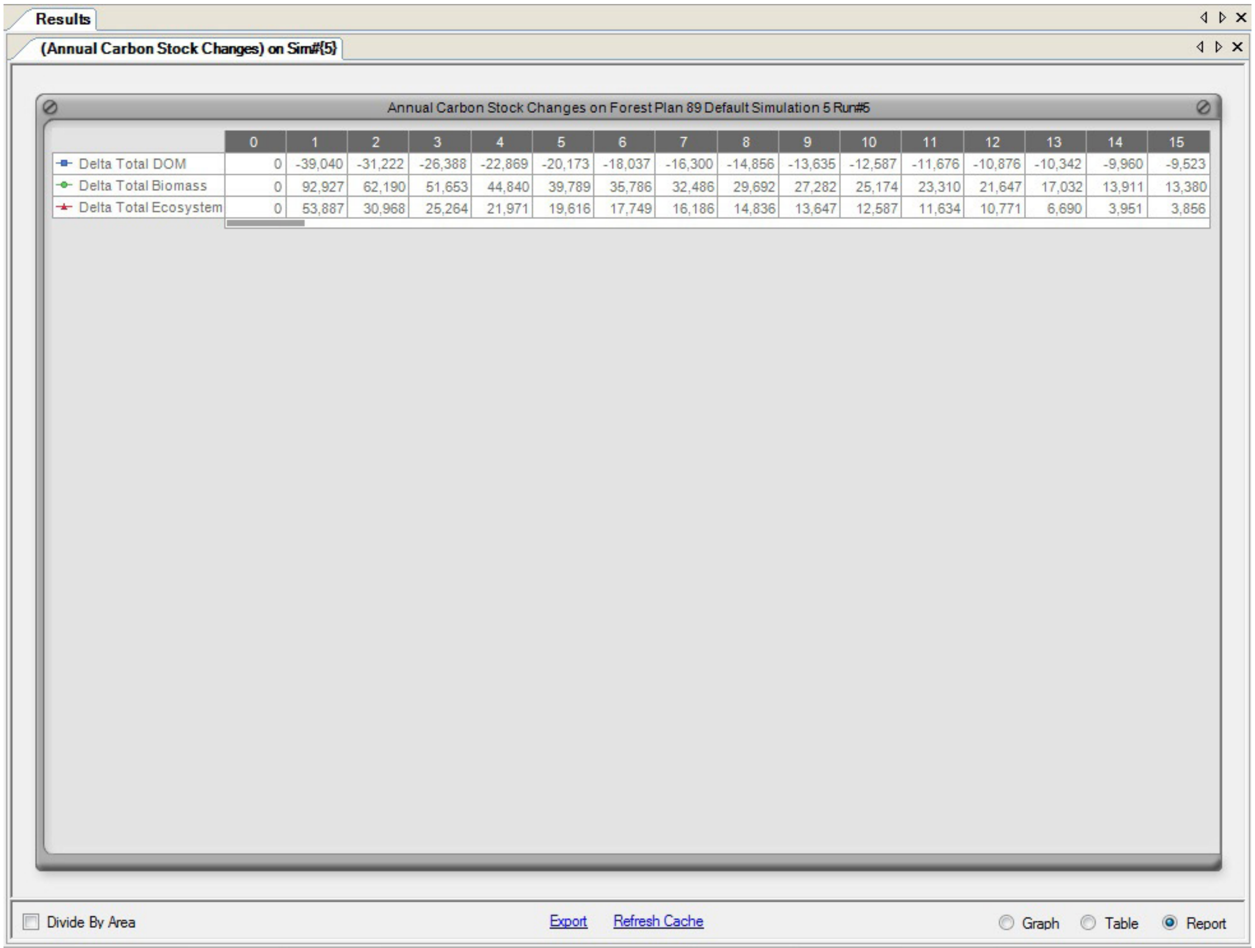
   or

   Click on the name of a view in the directory tree in the "Views" box, right-click, and select "Display" from the menu that appears

   or

   Double-click on the name of a view in the directory tree in the "Views" box

A "Results" window (Fig. 8-16) will open, displaying a combined graph and table of the view using data from the selected simulation results database.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Delta Total DOM	0	-39,040	-31,222	-26,388	-22,869	-20,173	-18,037	-16,300	-14,856	-13,635	-12,587	-11,676	-10,876	-10,342	-9,960	-9,523
Delta Total Biomass	0	92,927	62,190	51,653	44,840	39,789	35,786	32,486	29,692	27,282	25,174	23,310	21,647	17,032	13,911	13,380
Delta Total Ecosystem	0	53,887	30,968	25,264	21,971	19,616	17,749	16,186	14,836	13,647	12,587	11,634	10,771	6,690	3,951	3,856

Figure 8-18. The "Results" window with the "Report" display selected for the "Annual Carbon Stock Changes" view.

Note: Refreshing cached views

When the user pairs a view with a simulation results database for display, the CBM-CFS3 caches this link in local memory to allow quick access when it is selected for display again. However, if the user edits the view after displaying it and then tries to view it again with the same project database, the old cached view will be displayed, not the updated view. In this circumstance, to update the cache

Click on the "Refresh Cache" link in the "Results" window (Fig. 8-16)

8.6.2 Displaying One View for Multiple Simulation Results Databases

To compare the results for two or more simulation results databases in one view

1. **Click on the "Same Grid" check box in the "Results" box (Fig. 8-1)**
2. **Click on the names of two or more simulation results databases in the "Results" box so that a check mark appears beside each database of interest**

Should the user forget the details of the simulation that produced a simulation results database, holding the cursor over the name of the simulation results database will cause an information box to appear, displaying the simulation identification number, the simulation name, the project author, the date when the simulation was performed, and the description of the simulation.

3. **Click on the name of a view in the directory tree in the "Views" box and click on the "Graph" icon on the Results Explorer icon toolbar (Fig. 8-2)**

   or

   Click on the name of a view in the directory tree in the "Views" box, right-click, and select "Display" from the menu that appears

   or

   Double-click on the name of a view in the directory tree in the "Views" box

A "Results" window (Fig. 8-16) will open, displaying a combined graph and table of the view using data from the selected simulation results databases.

Note: Refreshing cached views

When the user pairs a view with a simulation results database for display, the CBM-CFS3 caches this link in local memory to allow quick access when it is selected for display again. However, if the user edits the view after displaying it and then tries to view it again with the same project database, the old cached view will be displayed, not the updated view. In this circumstance, to update the cache

Click on the "Refresh Cache" link in the "Results" window (Fig. 8-16)

8.6.3 Displaying Multiple Views in One for One Simulation Results Database

To see the results of two or more views in one display for one simulation results database

1. **Click on the name of the simulation results database of interest in the "Results" box (Fig. 8-1) so that a check mark appears beside it**

Should the user forget the details of the simulation that produced the simulation results database, holding the cursor over the name of the simulation results database will cause an information box to appear, displaying the simulation identification number, the simulation name, the project author, the date when the simulation was performed, and the description of the simulation.

2. **Click on the "Same Grid" check box in the "Views" box**
3. **Click on the names of multiple views in the directory tree in the "Views" box and click on the "Graph" icon on the Results Explorer icon toolbar (Fig. 8-2)**

   or

   Click on the names of multiple views in the directory tree in the "Views" box, right-click, and select "Display" from the menu that appears

   or

   Double-click on the names of multiple views in the directory tree in the "Views" box

A "Results" window (Fig. 8-16) will open displaying a combined graph and table of the view using data from the selected simulation results database.

Note: Refreshing cached views

When the user pairs a view with a simulation results database for display, the CBM-CFS3 caches this link in local memory to allow quick access when it is selected for display again. However, if the user edits the view after displaying it and then tries to view it again with the same project database, the old cached view will be displayed, not the updated view. In this circumstance, to update the cache

Click on the "Refresh Cache" link in the "Results" window (Fig. 8-16)

8.6.4 Displaying Multiple Views in One for Multiple Simulation Results Databases

To display multiple views in one for multiple simulation results databases

1. **Click on the "Same Grid" check box in the "Results" box (Fig. 8-1)**
2. **Click on the names of multiple simulation results databases in the "Results" box (Fig. 8-1) so that a check mark appears beside each database of interest**

Should the user forget the details of the simulation that produced the simulation results database, holding the cursor over the name of the simulation results database will cause an information box to appear, displaying the simulation identification number, the simulation name, the project author, the date when the simulation was performed, and the description of the simulation.

3. **Click on the "Same Grid" check box in the "View" box**
4. **Click on the names of multiple views in the directory tree in the "Views" box and click on the "Graph" icon on the Results Explorer icon toolbar (Fig. 8-2)**

   or

   Click on the names of multiple views in the directory tree in the "Views" box, right-click, and select "Display" from the menu that appears

   or

   Double-click on the names of multiple views in the directory tree in the "Views" box

A "Results" window (Fig. 8-16) will open displaying a combined graph and table of the view using data from the selected simulation results databases.

Note: Refreshing cached views

When the user pairs a view with a simulation results database for display, the CBM-CFS3 caches this link in local memory to allow quick access when it is selected for display again. However, if the user edits the view after displaying it and then tries to view it again with the same project database, the old cached view will be displayed, not the updated view. In this circumstance, to update the cache

Click on the "Refresh Cache" link in the "Results" window (Fig. 8-16)

8.6.5 Exporting a Graph, Table, or Report

To export a graph, table, or report for a view displayed in the "Results" window (Fig. 8-16)

1. **Click on the "Export" link**

The "Export" window (Fig. 8-19) will pop up.

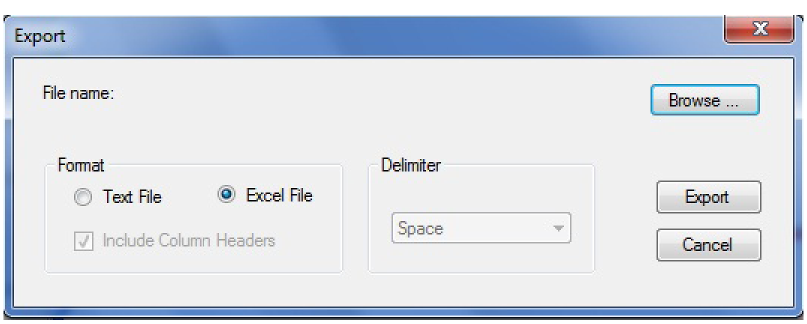


Figure 8-19. The "Export" window.

2. **Click on either the "Text File" radio button or the "Excel File" radio button, depending on the desired file format**

Note: Exporting Results to Microsoft Excel

At this time, the maximum number of results columns that can be exported to a Microsoft Excel file is 256. Should the user try to export more than 256 results columns to a Microsoft Excel file, an error message will pop up.

3. **If the "Text File" option has been selected, click on the "Include Column Headers" check box to either include (checked) or exclude (unchecked) column headers**
4. **If the "Text File" option has been selected, select a data delimiter option (space, colon, semicolon, other) from the drop list in the "Delimiter" box**
5. **Click on the "Browse" button**

A "Save As" window will pop up.

6. **Select a directory and enter a file name in the "File Name" box**
7. **Click on the "Save" button**
8. **Click on the "Export" button in the "Export" window to complete the exporting process**

   or

   Click on the "Cancel" button to cancel the process

8.6.6 Saving Views

The user has the option of saving all folders and views appearing in the directory tree in the "Views" box in the "Results Explorer" window (Fig. 8-1) as a .dat file in any accessible drive directory. Should the user try to close the "Results Explorer" window after creating or editing views, a prompt to save the directory of views will appear. Users who create numerous groups of views can store them when not in use and reopen them when required. To save a directory tree and its folder and view contents to a storage file

1. **Make sure the "Same Grid" check box in the "Views" box is not checked**
2. **Right-click over a view or folder in the "Views" box and click on "Save" on the menu that appears**

   or

   Click on the "Save this set of views" icon on the Results Explorer icon toolbar (Fig. 8-2)

A "Save As" window (Fig. 8-6) will pop up.

3. **Point to the appropriate folder or drive where the data should be stored**
4. **Enter a name for the file in the "File name" box**
5. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

If the user clicks on the "Save" button, the "Success!" window will pop up, notifying the user that the views were successfully saved to the selected directory.

6. **Click on the "OK" button**

8.6.7 Opening Saved Views

To use the “Results Explorer” window (Fig. 8-1) to open a directory tree containing views and folders previously saved and stored as a .dat file

1. **Make sure the “Same Grid” check box in the “Views” box is not checked**

Note: Opening saved views

Opening a directory tree containing views that were previously saved as a .dat file will cause the current directory tree and views displayed in the “Views” box to be replaced by those in the saved .dat file that is being opened.

2. **Right-click over a view or folder in the “Views” box and select “Open” from the menu that appears**

   or

   Click on the “Open another set of views” icon on the Results Explorer icon toolbar (Fig. 8-2)

A “Confirm” window will pop up warning the user that the current views will be replaced by those in the .dat file that is being opened.

3. **Click on the “Yes” button to proceed**

   or

   Click on the “No” button to cancel the process

If the user clicks on the “Yes” button, the “Locating a ‘View’ file” window (Fig. 8-20) will pop up.

4. **Browse to the directory containing the previously saved .dat file**
5. **Click on the name of the file to be opened**
6. **Click on the “Open” button to proceed**

   or

   Click on the “Cancel” button to terminate the process

If the user clicks on the “Open” button, the chosen directory tree, views, and folders will appear in the “Views” box in the “Results Explorer” window.

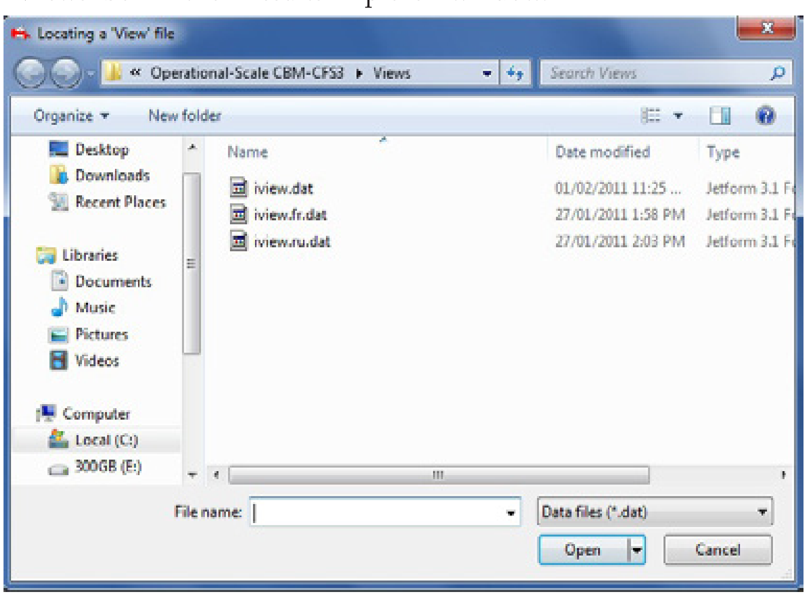


Figure 8-20. The “Locating a ‘View’ file” window.

CHAPTER 9

MANAGING GRAPHS

This chapter introduces the user to the various options for managing graphic displays in the CBM-CFS3. These include options for editing, saving, loading, copying, and printing. Graphs in the Stand-Level Project Creator (Fig. 3-34), Disturbance Events Editor (Fig. 6-7), Growth Curve Editor (Fig. 6-22 and 6-23), Inventory Editor (Fig. 6-24), and Results Explorer (Fig. 8-16) can be managed with these options.

9.1 Editing a Graph

The user can edit a number of graph display features including the title, data table, data points, graph properties, and axes.

9.1.1 Editing a Graph Title

To edit the main title or the title of one of the axes (if any) in a graph

1. **Right-click over the title**
2. **Click on "Edit Title" to change the wording of the title**

   or

   Click on "Text Color" to change the text color of the title

   or

   Click on "Font" to change the text fonts in the title

If "Edit Title" is selected, the user must

1. **Click in the title box and enter a new title**
2. **Click anywhere on the graph outside of the title box to exit the title box**

If the user clicks on "Text Color," a color palette will appear. To change text color

Click on a color for the text

If the user clicks on "Font," the "Font" window (Fig. 9-1) will appear. In this window

Select the desired font, font style, size, effects, or script

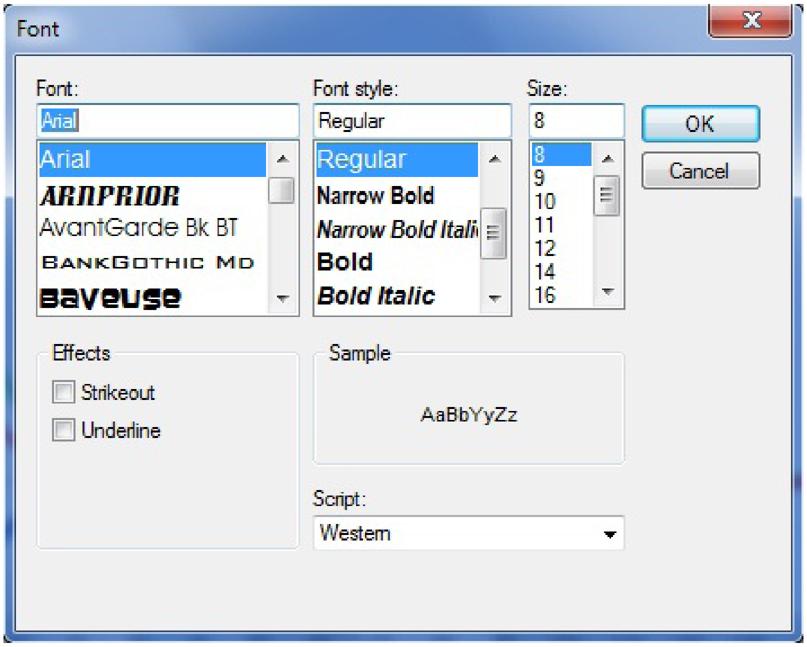


Figure 9-1. The "Font" window.

Once modifications are complete

Click on the "OK" button to save the changes

or

Click on the "Cancel" button to cancel the changes

9.1.2 Editing a Graph Data Table

To edit the data table

1. **Right-click over the data table**
2. **Select one of the location options (Left, Top, Right, Bottom) to relocate the table**

   or

   Select "Font" to change the font used in the table

If the user selects one of the location options, the data table will move to that position in the graph display. If the user selects "Font", the "Font" window (Fig. 9-1) will pop up. In this window

Select the desired font, font style, size, effects or script

Once modifications are complete

Click on the "OK" button to save the changes

or

Click on the "Cancel" button to cancel the changes

9.1.3 Editing Graph Data Points

To edit the display of the data points

1. **Right-click over a data point in the graph**
2. **Select "Gallery" to change the graph type**

   or

   Select "Color" to change the color of the data points

   or

   Select "Point Labels" to add or remove data labels on the points

   or

   Select "Properties" to change the properties of the graph display

If "Gallery" is selected, the user must then select one of the graph type options that will be displayed. If the user selects "Color," a color palette will appear and the user must select a color for the data points. If the user selects "Properties," the "Properties" window (Fig. 9-2) will pop up.

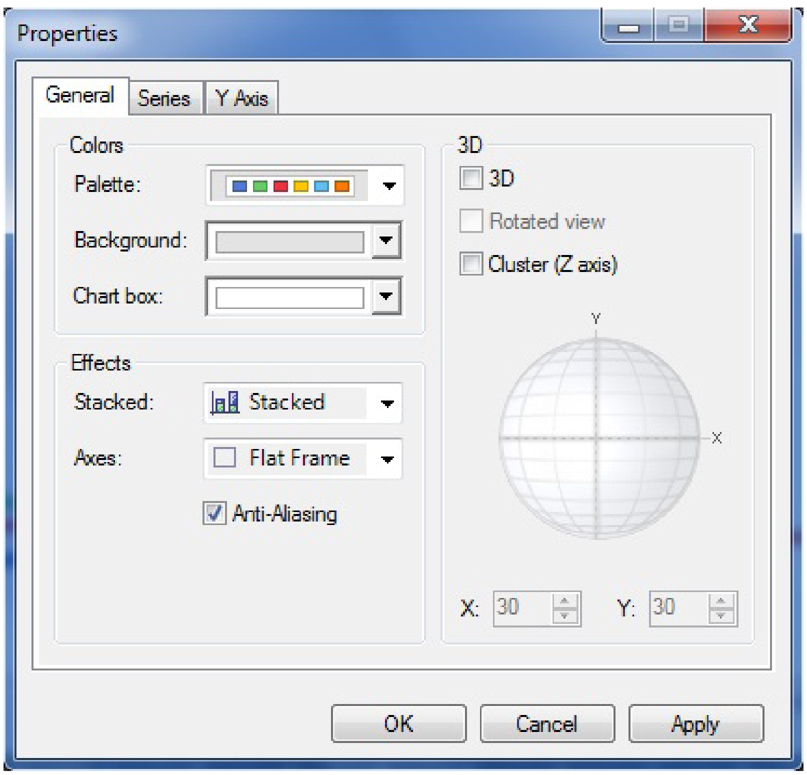


Figure 9-2. The "Properties" window with the "General" tab selected.

In this window

3. **Click on the "General" tab to modify colors, effects, and 3D presentation**

   or

   Click on the "Series" tab to modify the gallery, marker, fill, or border

   or

   Click on the "Y Axis" tab to modify the scale, labels, gridlines, or tickmarks

4. **Click on the "OK" button to save the changes**

or

Click on the "Cancel" button to cancel the changes

or

Click on the "Apply" button to apply the changes without closing the "Properties" window so that other changes can be made

9.1.4 Editing Graph Properties

The user has three options for accessing tools for editing graph properties: by displaying and using the Graph icon toolbar (Fig. 9-3), which has icons for various graph tools; indirectly by right-clicking over the graph (not on a data point, axis, title box, or in the data table); or by displaying and using the Graph menu bar (Fig. 9-4).

Figure 9-3. The Graph icon toolbar.

Figure 9-4. The Graph menu bar.

Editing with the Graph Icon Toolbar

The user can modify the physical appearance of a graph or table view using the icons in the Graph icon toolbar (Fig. 9-3). To add or remove the toolbar of graph tool icons

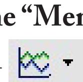
Right-click over an open space (not on a data point, axis, title box, or in the data table) in the graph display area

Select "Toolbar" from the drop list that appears

When the Graph icon toolbar is displayed, the user can determine the tool that a particular icon represents by placing the cursor over the icon. An information box stating the tool represented by the icon will pop up.

The "Menu" icon  is used to display or hide the Graph menu bar (Fig. 9-4). To use this icon

Click on the "Menu" icon

The "Gallery" icon  is used to select the type of graph displayed (line graph, histogram, pie chart, etc.).

To use this tool

Click on the "Gallery" icon

Select a graph type from the image menu that appears

The "Anti-Aliasing" icon  is used to smooth jagged distortions in curves and diagonal lines. To use this tool

Click on the "Anti-Aliasing" icon

The "Palette Selector" icon is used to select general color schemes to be applied to the entire graph.

To use this tool

Click on the "Palette Selector" tool icon

Select a color palette from the image menu that appears

The "3D/2D" icon is used to display a graph in two or three dimensions. To use this tool

Click on the "3D/2D" icon

The "Rotated View" icon is used to rotate the graph along the x-axis or y-axis in a 3D display. To use this tool

Click on the "Rotated View" icon

Click on the "Rotate Around X Axis" icon

or

Click on the "Rotate Around Y Axis" icon

The "Clustered (Z-Axis)" icon is used to display z-axis data in the third dimension. To use this tool

Click on the "Clustered (Z-Axis)" icon

The "Axis Settings" icon is used to modify x-axis and y-axis display properties. To use this tool

Click on the "Axis Settings" icon

On the menu of options that appears

Select "Grid" (for gridlines) or "Interlaced" (for interlaced lines) for the y-axis

or

Select "Grid" (for gridlines) or "Vertical Labels" (to turn labels on their sides) or "Staggered" (to display each successive label higher or lower than the preceeding label) or "Show Labels" (to display or remove labels) for the x-axis

or

Select "Options"

If the user selects "Options," the "Properties" window (Fig. 9-2) will pop up (this can also be accessed by clicking the "Properties" icon on the Graph icon toolbar). For details on options and functions of the "Properties" window, see section 9.1.3, "Editing Graph Data Points."

The "Point Labels" icon is used to add point labels to a graph. To use this tool

Click on the "Point Labels" icon

The "Data Grid" icon is used to add or remove the data table at the bottom of a displayed graph. To use this tool

Click on the "Data Grid" icon

The "Legend Box" icon is used to add or remove the legend displayed with a graph. To use this tool

Click on the "Legend Box" icon

The "Zoom" icon  is used to zoom in on a portion of the graph displayed. To use this tool

Click on the "Zoom" icon

Click and drag a box that will appear over the area of the graph to zoom in on the area of interest

The "Properties" icon  is used to modify graph properties. To do this

Click on the "Properties" icon

The "Properties" window (Fig. 9-2) will pop up. For details on the options and functions of the "Properties" window, see section 9.1.3, "Editing Graph Data Points."

Indirect Editing

The user can make modifications similar to those available with the tool icons (described in the previous section) through other, indirect means. To use the indirect method

Right-click over an open space (not on a data point, axis, title box, or in the data table) in the graph display area

A drop list menu will appear. The drop list menu options are adding or removing the menu bar (Menu), adding or removing the toolbar (Toolbar), adding or removing the table displayed (Data Grid), adding or removing the legend (Legend Box), changing the graph type (Gallery), changing the graph color (Color), changing the graph title (Edit Title), adding or removing point labels (Point Labels), or changing the graph properties (Properties). The use of each of these tools is discussed in the preceding subsections of section 9.1, "Editing a Graph".

Editing Using the Menu Bar

Users who want to edit a graph displayed in the "Results" window (Fig. 8-16) can use tool features available under the "View" and "Tools" options on the Graph menu bar (Fig. 9-4) displayed at the top of a graph or table.

To use the tools available under "View" on the Graph menu bar

Click on "View" on the Graph menu bar

On the menu that appears

Select "3D/2D"

or

Select "Clustered (Z-Axis)"

or

Select "Properties"

All of these menu options and their functions are described in section 9.1.4, "Editing Graph Properties."

To use the tools available under "Tools" on the Graph menu bar

Click on "Tools" on the Graph menu bar

On the menu that appears

Select "Series Legend" to add or remove the graph legend

or

Select "Data Grid" to add or remove the data table portion of the graph display

or

Select "Toolbar" to add or remove the toolbar in the "Results" window (Fig. 8-16)

or

Select "Menu" to add or remove the menu bar in the "Results" window (Fig. 8-16)

9.1.5 Editing Graph Axes

To edit the axes of a graph

1. **Right-click over an axis**

On the drop list that appears

2. **Select "Text Color" to change the axis text color**

   or

   Select "Font" to change the text font on the axis

   or

   Select "Edit Title" to change the axis title

   or

   Select "Staggered" to stagger the axis display

   or

   Select "Vertical Labels" to make the graph labels display vertically or horizontally

   or

   Select "Grid" to add or remove grid lines in the graph

   or

   Select "Interlaced" to add or remove interlaced bars in the graph

   or

   Select "Properties" to change the graph display properties

Clicking on "Text Color" allows the user to select a text color. To proceed

Click on a color in the palette that appears

If the user clicks on "Font," the "Font" window (Fig. 9-1) will pop up. Features and functions for this window are described in section 9.1.1, "Editing a Graph Title."

If the user clicks on "Edit Title" the title box will open for editing.

Enter a new axis title in the title box

Click outside the title box to save the changes

If the user clicks on "Properties," the "Properties" window (Fig. 9-2) will pop up. In this window

Click on the "General" tab and modify colors, effects, and 3D

or

Click on the "Series" tab and modify the gallery, marker, fill, and border

or

Click on the "Y Axis" tab and modify the scale, labels, gridlines, or tickmarks

The user can then

Click on the "OK" button to save the changes

or

Click on the "Cancel" button to cancel the changes

or

Click on the "Apply" button to apply the changes without closing the "Properties" window so that other changes can be made

9.2 Saving a Graph

To save a graph the user can

1. **Click on the "Personalized Charts" icon**  **on the Graph icon toolbar (Fig. 9-3)**
2. **Click on "Save My Chart" on the menu that appears (currently disabled)**

Alternatively, the user can

1. **Click on "File" on the Graph menu bar (Fig. 9-4)**
2. **Click on "Save Chart" on the menu that appears**

The "Save As" window (Fig. 8-6) will pop up. In this window

3. **Point to the appropriate folder in which to save the graph**
4. **Enter a name for the graph, table, or report in the "File name" box**
5. **Click on the "Save" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

9.3 Loading a Graph

To load a graph that was previously created and saved, the user can

1. **Click on the "Personalized Charts" icon**  **on the Graph icon toolbar (Fig. 9-3)**
2. **Click on "Load My Chart" on the menu that appears (currently disabled)**

Alternatively, the user can

1. **Click on "File" on the Graph menu bar (Fig. 9-4)**
2. **Click on "Open Chart" on the menu that appears**

The "Open" window (Fig. 8-20) will pop up. In this window

3. **Point to the appropriate folder in which the graph was saved**
4. **Click on the graph, table, or report name**
5. **Click on the "Open" button to proceed**

   or

   Click on the "Cancel" button to terminate the process

9.4 Copying a Graph to a Clipboard

Users have the option of copying a graph to a clipboard in various formats. To do this

1. **Click on the "Copy to Clipboard" icon on the Graph icon toolbar (Fig. 9-3)**
2. **Click on the desired file format on the menu that appears ("As a Bitmap," "As a Metafile," or "As Text (data only)")**

Alternatively, the user can

1. **Click on "Copy to Clipboard" on the Graph menu bar (Fig. 9-4)**
2. **Click on the desired file format on the menu that appears ("As a Bitmap," "As a Metafile," or "As Text (data only)")**

9.5 Printing a Graph

To print a graph

1. **Click on the "Print" icon on the Graph icon toolbar (Fig. 9-3)**

The "Print" window (Fig. 9-5) will pop up.

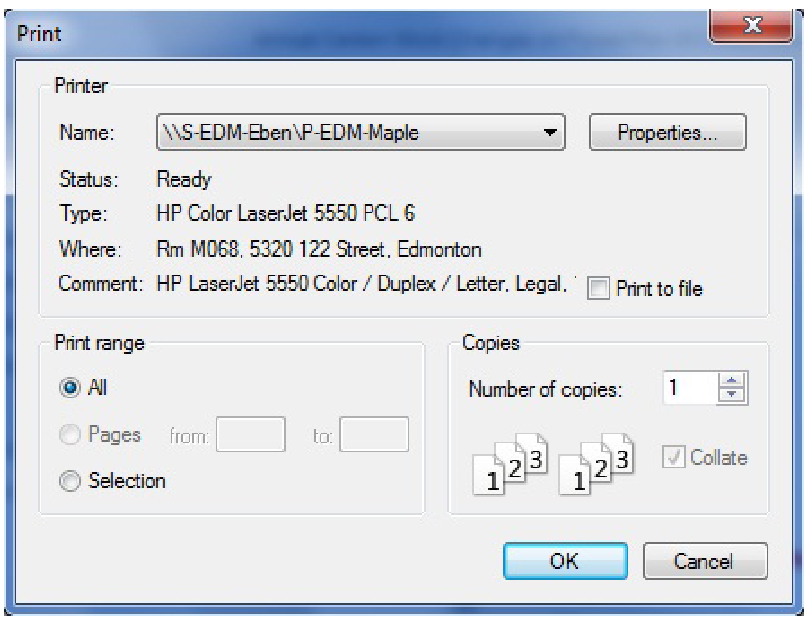


Figure 9-5. The "Print" window.

2. **Select the appropriate printer, print range, and number of copies**
3. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to cancel the print process

Alternatively, the user can

1. **Click on "File" on the Graph menu bar (Fig. 9-4)**
2. **Click on "Print" on the menu that appears**

The "Print" window will pop up.

3. **Select the appropriate printer, print range, and number of copies**
4. **Click on the "OK" button to proceed**

   or

   Click on the "Cancel" button to cancel the print process

☞ ***Tip: Page Setup and Access to Print Preview***

The user can also access setup options for printing (Page Setup) and preview before printing (Print Preview) by clicking on "File" on the Graph menu bar (Fig. 9-4).

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APPENDIX 1

Abbreviations

AG – Aboveground

BG – Belowground

CanFI – Canadian Forest Inventory

CBM-CFS2 – Carbon Budget Model of the Canadian Forest Sector (research version)

CBM-CFS3 – Carbon Budget Model of the Canadian Forest Sector (operational-scale version)

CFS – Canadian Forest Service

CFS-CAT – the carbon accounting team of Natural Resources Canada's Canadian Forest Service

DM – disturbance matrix

DOM – dead organic matter

HW – hardwood

NFCMARS – National Forest Carbon Monitoring, Accounting and Reporting System

NFIS – National Forest Information System

SPU – spatial unit

SQL – structured query language

SW – softwood

UNFCCC – United Nations Framework Convention on Climate Change

APPENDIX 2

Merchantable softwood and hardwood proportions (by province and territory) used in the CBM-CFS3

Appendix 2. Merchantable softwood and hardwood proportions (by province and territory) used in the CBM-CFS3

	CanFI[a]			Softwood				Hardwood		
Province or territory[b]	Stump height (cm)	Top Diameter (cm)	Minimum DBH[c] (cm)	% tops	% stumps	% merchantable stem	Average DBH at harvest (cm)	% tops	% stumps	% merchantable stem
Newfoundland and Labrador	15.0	7.6	9.0	2.851	2.807	94.342	15.0	4.453	2.875	92.673
Nova Scotia	15.0	7.0	9.0	2.132	2.807	95.061	15.0	3.477	2.875	93.649
Prince Edward Island	15.0	8.0	9.0	3.418	2.807	93.776	15.0	5.196	2.875	91.929
New Brunswick	15.0	8.0	9.1	3.418	2.807	93.776	15.0	5.196	2.875	91.929
Quebec	15.0	9.0	9.0	5.183	2.807	92.011	15.0	7.406	2.875	89.719
Ontario	30.0	7.0	9.0	2.132	5.390	92.478	30.0	3.477	5.520	91.003
Manitoba	30.0	7.6	9.1	2.851	5.390	91.759	30.0	4.453	5.520	90.027
Saskatchewan	30.0	7.0	7.0	2.132	5.390	92.478	30.0	3.477	5.520	91.003
Alberta	30.0	7.0	13.0	2.132	5.390	92.478	30.0	3.477	5.520	91.003
British Columbia (pines and hardwoods)	30.0	10.0	12.5	1.794	5.390	92.816	30.0	3.002	5.520	91.478
British Columbia (other species)	30.0	10.0	17.5	1.794	5.390	92.816	30.0	3.002	5.520	91.478
Yukon Territory	30.0	10.0	15.0	7.521	5.390	87.089	30.0	10.169	5.520	84.311
Northwest Territories	30.0	10.2	10.2	8.067	5.390	86.543	30.0	10.169	5.520	83.687

[a]CanFI = Canadian Forest Inventory.
[b]Values for Nunavut have not been included because a forest inventory for this territory is presently not available.
[c]DBH = diameter at breast height.

APPENDIX 3

CBM-CFS3 default dead organic matter (DOM) turnover parameters and values by ecozone

Appendix 3. CBM-CFS3 default DOM turnover parameters and values by ecozone[a]

Ecozone	Parameter	Default value
Atlantic Maritime	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	125
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.0067
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.15
	Foliage Fall Rate; Hardwood	0.95
Boreal Cordillera	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	175
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.0045
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Boreal Plains	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	125
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.005
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Boreal Shield East	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	125
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.005

Appendix 3. Continued

Ecozone	Parameter	Default value
Boreal Shield East	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Boreal Shield West	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	75
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.005
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Hudson Plains	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	75
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.005
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Mixedwood Plains	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	125
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.0067
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.15
	Foliage Fall Rate; Hardwood	0.95

Appendix 3. Continued

Ecozone	Parameter	Default value
Montane Cordillera	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	150
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.0045
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Pacific Maritime	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	300
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.15
	Foliage Fall Rate; Hardwood	0.95
Semiarid Prairies	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	75
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.15
	Foliage Fall Rate; Hardwood	0.95
Subhumid Prairies	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	75
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.006

Appendix 3. Continued

Ecozone	Parameter	Default value
Subhumid Prairies	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.15
	Foliage Fall Rate; Hardwood	0.95
Taiga Cordillera	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	83
	Turnover Rate; Softwood Branch	0.04
	Turnover Rate; Hardwood Branch	0.04
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.1
	Foliage Fall Rate; Hardwood	0.95
Taiga Plains	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	125
	Turnover Rate; Softwood Branch	0.03
	Turnover Rate; Hardwood Branch	0.03
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.05
	Foliage Fall Rate; Hardwood	0.95
Taiga Shield East	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	100
	Turnover Rate; Softwood Branch	0.03
	Turnover Rate; Hardwood Branch	0.03
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.05
	Foliage Fall Rate; Hardwood	0.95

Appendix 3. Concluded

Ecozone	Parameter	Default value
Taiga Shield West	Average; Slow DOM Pool	0
	Average; Decay Multiplier	1
	Average; Stand-Replacing Disturbance Interval (years)	100
	Turnover Rate; Softwood Branch	0.03
	Turnover Rate; Hardwood Branch	0.03
	Turnover Rate; Stem Annual	0.006
	Snag Fall Rate; Softwood Stem	0.032
	Snag Fall Rate; Softwood Branch	0.1
	Snag Fall Rate; Hardwood Stem	0.032
	Snag Fall Rate; Hardwood Branch	0.1
	Foliage Fall Rate; Softwood	0.05
	Foliage Fall Rate; Hardwood	0.95

[a]These parameters can be viewed and modified on the "DOM Turnover Parameters" tabs in the "Modify Regional Default Parameters" window (Figure 3-37) in the Stand-Level Project Creator or in the "Assumption Composers" window for DOM Turnover (Figure 7-11).

APPENDIX 4

CBM-CFS3 default dead organic matter (DOM) parameters and their values by soil pool

Appendix 4. CBM-CFS3 default DOM parameters and their values by soil pool[a]

Soil pool	Parameter	Default value
Aboveground Very Fast		
	Decay rate of organic matter at the reference temperature	0.355
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2.65
	Proportion of carbon transferred from soil pools to atmosphere	0.815
Belowground Very Fast		
	Decay rate of organic matter at the reference temperature	0.5
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Aboveground Fast		
	Decay rate of organic matter at the reference temperature	0.1435
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Belowground Fast		
	Decay rate of organic matter at the reference temperature	0.1435
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Medium		
	Decay rate of organic matter at the reference temperature	0.0374
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Aboveground Slow		
	Decay rate of organic matter at the reference temperature	0.015
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2.65
	Proportion of carbon transferred from soil pools to atmosphere	1

Appendix 4. Continued

Soil pool	Parameter	Default value
Belowground Slow		
	Decay rate of organic matter at the reference temperature	0.0033
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	1
	Proportion of carbon transferred from soil pools to atmosphere	1
Softwood Stem Snag		
	Decay rate of organic matter at the reference temperature	0.0187
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Softwood Branch Snag		
	Decay rate of organic matter at the reference temperature	0.07175
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Hardwood Stem Snag		
	Decay rate of organic matter at the reference temperature	0.0187
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Hardwood Branch Snag		
	Decay rate of organic matter at the reference temperature	0.07175
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	0.83
Black Carbon		
	Decay rate of organic matter at the reference temperature	0.001
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	1

Appendix 4. Concluded

Soil pool	Parameter	Default value
Peat		
	Decay rate of organic matter at the reference temperature	0
	Maximum decay rate multiplier for the soil pool types (softwood)	1
	Maximum decay rate multiplier for the soil pool types (hardwood)	1
	Reference mean annual temperature for decay rate (°C)	10
	q10 (°C)	2
	Proportion of carbon transferred from soil pools to atmosphere	1
	Carbon flux rate – Rate at which carbon is added to the given soil pool	0
	Carbon flux rate – Rate at which carbon is lost from the given soil pool	0

[a]These parameters can be viewed and modified on the "Other DOM Parameters" tab in the "Modify Regional Default Parameters" window (Figure 3-38) in the Stand-Level Project Creator or on the "DOM Parameters" tab in the "Assumption Composers" window for DOM Turnover (Figure 7-12).

APPENDIX 5

CBM-CFS3 default belowground slow dead organic matter (DOM) carbon pool values (based on Canadian cultivated soils) by nonforest soil type, used as the default initial soil carbon pool values for nonforest stands during simulations

Appendix 5. CBM-CFS3 default belowground slow DOM carbon pool values (based on Canadian cultivated soils) by nonforest soil type, used as the default initial soil carbon pool values for nonforest stands during simulations[a]

Nonforest Soil Type	Belowground slow DOM carbon pool ($t\ ha^{-1}$)
Average[b]	81
Brunisolic	83[c]
Chernozemic: Black	114[d]
Chernozemic: Brown	76[d]
Chernozemic: Dark Brown	68[d]
Chernozemic: Dark Gray	97[c]
Gleysolic	106[c]
Luvisolic (E. [Eastern] Canada)	40[c]
Luvisolic (W. [Western] Canada)	66[c]
Podzolic	74[c]

[a]These values can be viewed and edited on the “Nonforest Initial Conditions” tab in the “Modify Regional Default Parameters” window (Figure 3-39) in the Stand-Level Project Creator, and those values included in a project can be viewed and edited on the “Dead Organic Matter (DOM)” tab on the “Nonforest Initialization” tab in the “Assumption Composers” window (Figure 7-28).
[b]Average of all DOM carbon initialization values listed below.
[c]Source: Janzen et al. (1997). Cultivated soil carbon.
[d]Average cultivated soil carbon based on two different source values in Janzen et al. (1997).

APPENDIX 6

Default disturbance types in the CBM-CFS3 and their characteristics

Appendix 6. Default disturbance types in the CBM-CFS3 and their characteristics[a]

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Afforestation	8	The conversion to forested land, through tree-planting, of land that has been nonforested for a minimum of 50 years.			Inventory must contain nonforest areas, mapped to CBM-CFS3 nonforest soil types during project creation.	Developed by the CFS and Environment Canada.
Aspen Defoliators —Type A	16	Moderate defoliation of the hardwood component, causing 45% of the carbon in hardwood foliage to be transferred to the Aboveground Very Fast DOM[b] pool and 5% to be emitted as CO_2.			Can be used to model effects of large aspen tortrix[c] and forest tent caterpillar[d].	Developed by the CFS-CAT[e] in collaboration with CFS entomologists using aerial overview surveys.
Aspen Defoliators —Type B	17	Same impact as Aspen Defoliators — Type A.			Used in the NFCMARS[f] to model effects of large aspen tortrix and forest tent caterpillar.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Aspen Defoliators —Type C	18	Very severe, repeated defoliation of the hardwood component causing 25% mortality of hardwood trees.			Should be applied to stands affected by moderate or severe defoliation in the previous year.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Aspen Defoliators —Type D	19	A defoliation disturbance causing 30% mortality of hardwood trees.			Not recommended for modeling effects of large aspen tortrix or forest tent caterpillar.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Aspen Defoliators —Type E	20	Severe defoliation of the hardwood component causing 5% mortality and 45% defoliation.			Used in the NFCMARS to model effects of large aspen tortrix and forest tent caterpillar.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Aspen Defoliators —Type F	21	A defoliation disturbance causing 40% mortality of hardwood trees.			Not recommended for modeling effects of large aspen tortrix or forest tent caterpillar.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Balsam bark beetle[g] in BC, Very Severe	268	British Columbia-specific balsam bark beetle disturbance causing 50% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. MacLauchlan 2016.
		British Columbia-specific balsam bark beetle disturbance causing 30% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. MacLauchlan 2016.
Balsam bark beetle in BC, Severe	269	British Columbia-specific balsam bark beetle disturbance causing 30% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. MacLauchlan 2016.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Balsam bark beetle in BC, Moderate	270	British Columbia-specific balsam bark beetle disturbance causing 11% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. MacLauchlan 2016.
Balsam bark beetle in BC, Light	271	British Columbia-specific balsam bark beetle disturbance causing 5% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. MacLauchlan 2016.
97% clear-cut	196	A Quebec government harvest method known as Cutting with Protection of Regeneration and Soils (CPRS), as defined in the Sylva II timber supply software (Ministère des ressources naturelles du Québec 1997), removing 97% of the merchantable volume.	√		No specific rule.	Ministère des Ressources naturelles et de la faune (Québec)
Clear-cut harvesting with salvage	4	The harvesting of 85% of merchantable trees and 50% of dead stem snags from a stand, for use in the forest products sector.	√		No specific rule.	Reviewed by Canadian provincial and territorial foresters.
Clear-cut harvesting without salvage	204	The harvesting of 85% of merchantable trees from a stand and the transfer of all snags to the Medium DOM carbon pool.	√		No specific rule.	Developed by the CFS-CAT.
Clear-cut with slash-burn	3	The harvesting of 85% of merchantable trees from a stand, followed by the burning of post-harvest organic residue (slash), in the same year. Burning assumes a mix of burn piles and broadcast burns.	√		No specific rule.	Developed by the CFS-CAT.
10%–75% commercial thinning	201-203, 184-194	Commercial thinning of merchantable trees resulting in a 10%–75% (amount chosen by the user) reduction in both softwood and hardwood biomass carbon and transfer of the merchantable carbon to the forest products sector. The remaining carbon removed from the biomass pools is transferred to the respective DOM pools.			A transition rule can be used to switch growth curve and/or modify stand age following disturbance.	Developed by the CFS-CAT.
Deforestation	7	The conversion of forest land to nonforest land, for example, forest to city.	√		Once the matrix is applied, the simulation represents decay of the remaining forest carbon. This should not be considered complete for crops, pasture, or other biological uses, because postdisturbance growth is not simulated.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and Agriculture and Agri-Food Canada (AAFC).

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Deforestation—Agriculture—Salvage, uprooting, and burn	206	A deforestation event for agricultural development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Agriculture—Salvage, uprooting, and decay	205	A deforestation event for agricultural development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Forestry—Salvage, uprooting, and burn	208	A deforestation event for forestry development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Forestry—Salvage, uprooting, and decay	207	A deforestation event for forestry development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Hydro reservoir—No salvage or burn	152	A deforestation event for hydroelectric reservoir development, involving forest clearing only.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Hydro reservoir—Burn	209	A deforestation event for hydroelectric reservoir development, involving forest clearing, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Hydro reservoir—Salvage and decay	151	A deforestation event for hydroelectric reservoir development, involving forest clearing, salvage of merchantable volume, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Hydro reservoir—Salvage and burn	235	A deforestation event for hydroelectric reservoir development, involving forest clearing, salvage of merchantable volume, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Hydro—Right-of-way—Salvage and burn	149	A deforestation event for hydroelectric right-of-way development, involving forest clearing, salvage of merchantable volume, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Deforestation—Hydro—Right-of-way—Salvage and decay	150	A deforestation event for hydroelectric right-of-way development, involving forest clearing, salvage of merchantable volume, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Industry—Salvage, uprooting, and burn	211	A deforestation event for industrial development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Industry—Salvage, uprooting, and decay	210	A deforestation event for industrial development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Mining—Salvage, uprooting, and burn	224	A deforestation event for mining development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Mining—Salvage, uprooting, and decay	223	A deforestation event for mining development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Municipal—Salvage, uprooting, and burn	226	A deforestation event for municipal development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Municipal—Salvage, uprooting, and decay	225	A deforestation event for municipal development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Oil and gas—Salvage and burn	155	A deforestation event for oil and gas development, involving forest clearing, salvage of merchantable volume, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Deforestation—Oil and gas—Salvage and decay	156	A deforestation event for oil and gas development, involving forest clearing, salvage of merchantable volume, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation — Oil and gas — Salvage, uprooting, and burn	213	A deforestation event for oil and gas development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Oil and gas—Salvage, uprooting, and decay	212	A deforestation event for oil and gas development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Peat mining—Uprooting and burn	228	A deforestation event for peat mining, involving forest clearing, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Peat mining—Uprooting and decay	227	A deforestation event for peat mining, involving forest clearing, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Recreation—Salvage and burn	229	A deforestation event for recreation development, involving forest clearing, salvage of merchantable volume, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Recreation—Salvage and decay	230	A deforestation event for recreation development, involving forest clearing, salvage of merchantable volume, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Recreation—Salvage, uprooting, and burn	232	A deforestation event for recreation development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Recreation—Salvage, uprooting, and decay	231	A deforestation event for recreation development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Deforestation—Transportation—Salvage, uprooting, and burn	234	A deforestation event for transportation development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and burning of the site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Deforestation—Transportation—Salvage, uprooting, and decay	233	A deforestation event for transportation development, involving forest clearing, salvage of merchantable volume, uprooting of tree roots, and decay of organic matter left on site.	√		No specific rule.	Developed by the CFS-CAT, the CFS Digital Remote Sensing Group, and AAFC.
Douglas Fir Beetle[h] in BC, Very Severe	272	British Columbia-specific Douglas fir beetle disturbance causing 50% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Humphreys 1995.
Douglas Fir Beetle in BC, Severe	273	British Columbia-specific Douglas fir beetle disturbance causing 30% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Humphreys 1995.
Douglas Fir Beetle in BC, Moderate	274	British Columbia-specific Douglas fir beetle disturbance causing 11% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Humphreys 1995.
Douglas Fir Beetle in BC, Light	275	British Columbia-specific Douglas fir beetle disturbance causing 5% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Humphreys 1995.
Eastern hemlock looper[i]—Light defoliation	132	4% softwood mortality caused by the eastern hemlock looper.			No specific rule.	Developed by the CFS-CAT in collaboration with CFS entomologists
Eastern hemlock looper—Moderate defoliation	133	32% softwood mortality caused by the eastern hemlock looper.			No specific rule.	Developed by the CFS-CAT in collaboration with CFS entomologists
Eastern hemlock looper—Severe defoliation	134	32% softwood mortality caused by the eastern hemlock looper.			Should be applied to stands with moderate to light defoliation. Used to identify stands with repeated defoliation, eligible for severe cumulative defoliation.	Developed by the CFS-CAT in collaboration with CFS entomologists
Eastern hemlock looper—Severe cumulative defoliation	135	70% softwood mortality caused by the eastern hemlock looper.			Should be applied to stands with severe defoliation in the previous year.	Developed by the CFS-CAT in collaboration with CFS entomologists
Fire with salvage logging	5	A non–stand-replacing forest fire followed by salvage logging in the same year.	√		No specific rule.	Developed by the CFS-CAT.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Firewood collection —SW[j]	236	Collection of live softwood biomass for firewood from small private woodlots including a 30% transfer of softwood merchantable carbon and 20% transfer of other carbon to the forest products pool			No specific rule.	Developed by the CFS-CAT in collaboration with Environment and Climate Change Canada
Firewood collection —HW[k]	237	Collection of live hardwood biomass for firewood from small private woodlots including a 30% transfer of softwood merchantable carbon and 20% transfer of other carbon to the forest products pool			No specific rule.	Developed by the CFS-CAT in collaboration with Environment and Climate Change Canada
Firewood collection —post logging	238	Collection of dead biomass for firewood after a harvesting disturbance involving 50% transfer of carbon from the medium, softwood stem snag, softwood branch snag, hardwood stem snag, and hardwood branch snag pools to the forest products pool			No specific rule.	Developed by the CFS-CAT in collaboration with Environment and Climate Change Canada
Firewood collection —post natural disturbance	239	Collection of dead biomass for firewood after a natural disturbance involving 50% transfer of carbon from the medium, softwood stem snag, softwood branch snag, hardwood stem snag, and hardwood branch snag pools to the forest products pool			No specific rule.	Developed by the CFS-CAT in collaboration with Environment and Climate Change Canada
Generic 5%–95% mortality	165-183	A generic disturbance causing a 5%–95% reduction in biomass carbon (amount chosen by the user), which is transferred from the biomass pool to respective DOM pools.			A transition rule can be used to switch growth curve and/or modify stand age following disturbance.	Developed by the CFS-CAT.
Insect disturbance	2	A generic insect infestation causing stand mortality.	√		No specific rule.	Developed by the CFS-CAT.
Insect disturbance with salvage logging	6	A stand-replacing insect infestation followed by salvage logging in the same year.	√		No specific rule.	Developed by the CFS-CAT.
Mountain pine beetle[l]—Low impact	136	5% mortality of softwood trees caused by a mountain pine beetle disturbance.			No specific rule.	Kurz et al. 2008a, 2008b
Mountain pine beetle—Moderate impact	137	10% mortality of softwood trees caused by a mountain pine beetle disturbance.			No specific rule.	Kurz et al. 2008a, 2008b

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Mountain pine beetle—Severe impact	139	30% mortality of softwood trees caused by a mountain pine beetle disturbance.			Should be applied only to stands disturbed by mountain pine beetle in the previous year.	Kurz et al. 2008a, 2008b
Mountain pine beetle—Very severe impact	138	50% mortality of softwood trees caused by a mountain pine beetle disturbance.			Should be applied only to stands disturbed by mountain pine beetle in the previous year.	Kurz et al. 2008a, 2008b
Natural succession	11	The natural ecological process of biotic communities replacing one another. This disturbance should be used by those who explicitly model natural succession in stands as events. No changes in carbon stocks are associated with this disturbance type.			Can be used to transition stands from one growth curve to another, assuming different merchantable volumes as a result of succession.	Developed by the CFS-CAT.
Old default fire	195	A stand-replacing forest fire disturbance associated with the default fire disturbance matrix from version 1.0 of the CBM-CFS3.	√		No specific rule.	Developed by the CFS-CAT.
Partial cutting	10	The harvesting of 50% of the merchantable biomass in a stand.			No specific rule.	Developed by the CFS-CAT.
Planting	199	Forest management-related tree planting (i.e., not afforestation).			Can be used to transition stands from one growth curve to another, assuming different merchantable volumes as a result of the planting of improved stock or different species.	Developed by the CFS-CAT.
85% precommercial thinning	197	A Quebec government precommercial thinning process as defined in the Sylva II timber supply software, which removes 85% of the nonmerchantable stand biomass.			A transition rule can be used to switch growth curve and/or modify stand age following disturbance.	Ministère des Ressources naturelles et de la faune (Québec)
Roads and landings	198	Temporary stand removal for the construction of roads and landings.	√		Not for use when deforestation is permanent.	Developed by the CFS-CAT.
Salvage logging after fire	130	Salvage logging on areas burned by fire.	√		Apply in a time step following a fire disturbance.	Developed by the CFS-CAT.
Salvage logging after insects	131	Salvage logging on areas with significant insect mortality. Note that this salvage includes the clear-cutting of green wood as part of the salvage operation.	√		Apply in a time step following an insect disturbance.	Developed by the CFS-CAT.

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce beetle[m]—5% mortality	142	5% softwood mortality.	√		No specific rule.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Spruce beetle—20% mortality	141	20% softwood mortality.	√		No specific rule.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Spruce beetle—30% mortality	140	30% softwood mortality.	√		No specific rule.	Developed by the CFS-CAT in collaboration with CFS entomologists using aerial overview surveys.
Spruce Beetle[m] in BC, Very Severe	276	British Columbia-specific spruce beetle disturbance causing 50% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Safranyik et al. 1990.
Spruce Beetle in BC, Severe	277	Description: British Columbia-specific spruce beetle disturbance causing 30% softwood biomass mortality.			No specific rule.	Developed by the CFS-CAT. Safranyik et al. 1990.
Spruce Beetle in BC, Moderate	278	British Columbia-specific spruce beetle disturbance causing 11% softwood biomass mortality			No specific rule.	Developed by the CFS-CAT. Safranyik et al. 1990.
Spruce Beetle in BC, Light	279	British Columbia-specific spruce beetle disturbance causing 5% softwood biomass mortality			No specific rule.	Developed by the CFS-CAT. Safranyik et al. 1990.
Spruce Budworm[n] in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation > 85%	280	Prairie and NWT-specific spruce budworm disturbance causing 13.5% softwood stem, other, and root mortality, and 87% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 76-85%	281	Prairie and NWT-specific spruce budworm disturbance causing 7% softwood stem, other, and root mortality, and 86% foliage mortality			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 66-75%	282	Prairie and NWT-specific spruce budworm disturbance causing 3% softwood stem, other, and root mortality, and 85% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 56-65%	283	Prairie and NWT-specific spruce budworm disturbance causing 1.5% softwood stem, other, and root mortality, and 85% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 46-55%	284	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 85% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 36-45%	285	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 85% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 26-35%	286	Prairie and NWT-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 16-25%	287	Prairie and NWT-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation < 16%	288	Prairie and NWT-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation > 85%	289	Prairie and NWT-specific spruce budworm disturbance causing 13% softwood stem, other, and root mortality, and 58.5% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 76-85%	290	Prairie and NWT-specific spruce budworm disturbance causing 7% softwood stem, other, and root mortality, and 55% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 66-75%	291	Prairie and NWT-specific spruce budworm disturbance causing 3% softwood stem, other, and root mortality, and 53% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 56-65%	292	Prairie and NWT-specific spruce budworm disturbance causing 1.5% softwood stem, other, and root mortality, and 53% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 46-55%	293	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 52% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 36-45%	294	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 52% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 26-35%	295	Prairie and NWT-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 16-25%	296	Prairie and NWT-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation < 16%	297	Prairie and NWT-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation > 85%	298	Prairie and NWT-specific spruce budworm disturbance causing 13% softwood stem, other, and root mortality, and 29% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 76-85%	299	Prairie and NWT-specific spruce budworm disturbance causing 7% softwood stem, other, and root mortality, and 23% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 66-75%	300	Prairie and NWT-specific spruce budworm disturbance causing 3% softwood stem, other, and root mortality, and 20% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 56-65%	301	Prairie and NWT-specific spruce budworm disturbance causing 1.5% softwood stem, other, and root mortality, and 19% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 46-55%	302	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 18% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 36-45%	303	Prairie and NWT-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 18% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 26-35%	304	Prairie and NWT-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 16-25%	305	Prairie and NWT-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation < 16%	306	Prairie and NWT-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6 yr cumulative defoliation >85%	240	Quebec-specific spruce budworm disturbance causing 15% softwood stem, other, and root mortality, and 88% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 76-85%	241	Quebec-specific spruce budworm disturbance causing 8% softwood stem, other, and root mortality, and 86% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 66-75%	242	Quebec-specific spruce budworm disturbance causing 4% softwood stem, other, and root mortality, and 86% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 56-65%	243	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 86% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 46-55%	244	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 86% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 36-45%	245	Quebec-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 86% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 26-35%	246	Quebec-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 16-25%	247	Quebec-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation < 16%	248	Quebec-specific spruce budworm disturbance causing 85% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation > 85%	249	Quebec-specific spruce budworm disturbance causing 15% softwood stem, other, and root mortality, and 60% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 76-85%	250	Quebec-specific spruce budworm disturbance causing 8% softwood stem, other, and root mortality, and 56% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 66-75%	251	Quebec-specific spruce budworm disturbance causing 4% softwood stem, other, and root mortality, and 54% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 56-65%	252	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 53% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 46-55%	253	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 53% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 36-45%	254	Quebec-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 53% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 26-35%	255	Quebec-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 16-25%	256	Quebec-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation < 16%	257	Quebec-specific spruce budworm disturbance causing 52% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation > 85%	258	Quebec-specific spruce budworm disturbance causing 15% softwood stem, other, and root mortality, and 30% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 76-85%	259	Quebec-specific spruce budworm disturbance causing 8% softwood stem, other, and root mortality, and 24% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Continued

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 66-75%	260	Quebec-specific spruce budworm disturbance causing 4% softwood stem, other, and root mortality, and 21% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 56-65%	261	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 19% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 46-55%	262	Quebec-specific spruce budworm disturbance causing 2% softwood stem, other, and root mortality, and 18% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 36-45%	263	Quebec-specific spruce budworm disturbance causing 1% softwood stem, other, and root mortality, and 18% foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 26-35%	264	Quebec-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 16-25%	265	Quebec-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001
Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation <16%	266	Quebec-specific spruce budworm disturbance causing 17.5% softwood foliage mortality.			Consult Appendix 14	Developed by the CFS-CAT. Erdle et al. 1999, and MacLean et al. 2001

Appendix 6. Concluded

Disturbance type	ID	Description	Stand-replacing	Multiyear	Application	Source
Stand-replacing natural succession	200	The natural ecological process of biotic communities replacing one another; with this disturbance, the stand is replaced. This disturbance should be used by those who explicitly model natural succession in stands as events. Changes in carbon stocks are associated with this disturbance type.	√		No specific rule.	Developed by the CFS-CAT.
Wildfire	1	A forest fire causing stand mortality. Impact varies with selection of administrative and ecological boundaries.	√		No specific rule.	de Groot et al. 2007; Kasischke and Bruhwiler 2003; and Cofer et al. 1998
WJPBW[o]—Year 1 of outbreak	12	First-year stand disturbance impacts of a WJPBW outbreak, with 45% defoliation of softwood trees.			No specific rule.	Developed by the CFS-CAT.
WJPBW—Year 2 of outbreak	13	Second-year stand disturbance impacts of a WJPBW outbreak, with 13% mortality of merchantable softwood trees and 45% defoliation of softwood trees.			No specific rule.	Developed by the CFS-CAT.
WJPBW—Year 3 of outbreak	14	Third-year stand disturbance impacts of a WJPBW outbreak, with 23% mortality of merchantable softwood trees and 45% defoliation of softwood trees.			No specific rule.	Developed by the CFS-CAT.
WJPBW—Year 4 of outbreak	15	Fourth-year stand disturbance impacts of a WJPBW outbreak, with 50% mortality of merchantable softwood trees and 45% defoliation of softwood trees.			No specific rule.	Developed by the CFS-CAT.
Unknown	0	A disturbance type that can be selected when no other default disturbance types are appropriate for mapping a disturbance.			The user will need to edit the disturbance matrix for this disturbance type in the Disturbance Matrix Editor.	User defined.

[a]For the application of any disturbance type, the user can set up a transition rule that switches the target stand or forest type to a new growth curve or can leave it on the same growth curve.
[b]DOM = dead organic matter.
[c]Large aspen tortix (*Choristoneura conflictana* Walker).
[d]Forest tent caterpillar (*Malacosoma disstria* Hübner).
[e]CFS-CAT = Canadian Forest Service Carbon Accounting Team.
[f]NFCMARS = National Forest Carbon Monitoring, Accounting and Reporting System.
[g]Western balsam bark beetle (*Dryocoetes confusus Sw.*).
[h]Douglas fir beetle (*Dendroctonus pseudotsugae* Hopkin)
[i]Eastern hemlock looper (*Lambdina fiscellaria fiscellaria* Guen.).
[j]SW = softwood.
[k]HW = hardwood.
[l]Mountain pine beetle (*Dendroctonus ponderosae* Hopkins).
[m]Spruce beetle (*Dendroctonus rufipennis* Kirby).
[n]Spruce Budworm (*Choristoneura fumiferana* Clemens).
[o]WJPBW = Western (Canada) jack pine budworm (*Choristoneura pinus pinus* Freeman).

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APPENDIX 7

Instructions for using the Carbon Curve Project Creator plug-in

The CBM-CFS3 is commonly used to generate curves representing tons of total ecosystem, biomass, or dead organic matter carbon over the length of a forest management period. These curves are then included by a user in their timber supply optimization model. To facilitate the generation of carbon curves, the Carbon Curve Project Creator plug-in was created.

Basically, the Carbon Curve Project Creator takes a CBM-CFS3 project, as directed by the user, and creates a new project with all of the same default assumptions, but with the number of hectares of each forest type (as defined by the classifiers associated with all growth curves) reduced to one hectare. The name given to the new project is the same as the original with the exception that "_cc" is added at the end of the project name. The Simulation Assumption associated with the new project can then be run in the Simulation Scheduler and the required carbon curve results obtained in the Results Explorer.

To use the Carbon Curve Project Creator

1. **Create a project using the Stand-Level Project Creator or the CBM Standard Import Tool**

   On the menu bar of the main CBM-CFS3 window

2. **Select "Tools", "Plug-ins", and "Carbon Curve Project Creator" (Fig.A7-1)**

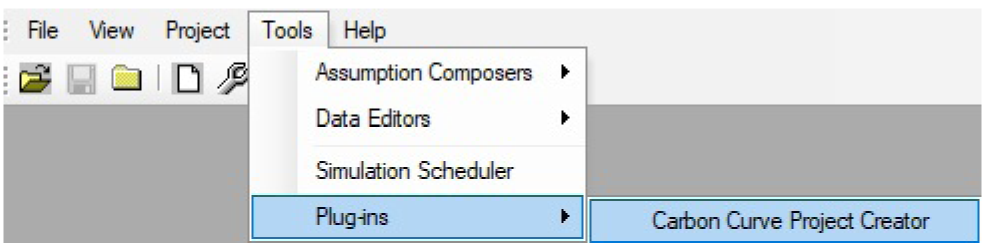


Figure A7-1. The menu bar of the main CBM-CFS3 window displaying how to access the Carbon Curve Project Creator.

The Carbon Curve Project Creator will begin to create the new carbon curve project and close the original project. Once it has completed, a window will pop up stating, "Creation of carbon curve project is complete".

3. **Click on the "OK" button (Fig.A7-2)**

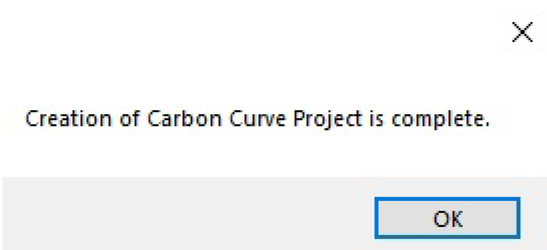


Figure A7-2. The "Creation of Carbon Curve Project is complete" window.

The new project (named the same as the original project, but with "_cc" added to the end of the project name) will be opened. The user can then proceed to the Simulation Scheduler to run the Simulation Assumption for the project, and then create views and export carbon curve results in the Results Explorer. The user should note that in order to view and export carbon curves for a specific stand or forest type (if there is more than one in the project inventory), they will need to create views using the View Editor, and use the "Filters" tab to filter one specific stand or forest type for the view, and then repeat this process for each type for which they need a carbon curve.

APPENDIX 8

Instructions for implementing multiple last disturbance types for stands in the MAKELIST initialization process

For the MAKELIST stand initialization process, the CBM-CFS3 now supports multiple last pass rotation disturbance types at customizable stand-replacing disturbance intervals. Previous versions of the model only had the ability to support a single "last disturbance" event per stand in the MAKELIST initialization routine, at a single stand-replacing disturbance interval (defined by default based on the ecozone identified for the stand), in order to initialize stand conditions at the start of a CBM-CFS3 project simulation.

This new functionality will better support the simulation of stands that have been subject to multiple harvest rotations or other stand-replacing disturbances (in addition to the default historic disturbance and last pass disturbance portions of the MAKELIST initialization process) prior to the first time step in a CBM-CFS3 simulation. Any additional disturbances added by the user, aside from the default last disturbance type, take effect after the initialization routine applies the last disturbance type. As with other disturbance events that occur during the MAKELIST initialization process, detailed fluxes and stocks during this process are not specifically tracked or reported in results. Included below are instructions on how to implement multiple disturbances following the historic and last pass disturbance during the MAKELIST initialization process, followed by an example.

Implementation instructions

Whether CBM-CFS3 users employ the Stand-Level Project Creator or the CBM Standard Import Tool to create a project, the process to set up and create any import files or a project remains the same. The steps to implement the new functionality to assign more than one last disturbance event to any stand in the user's inventory during the MAKELIST initialization process comes after a CBM-CFS3 project has been created.

Once a project has been created,

1.Open the Microsoft Access project database file (by default, located in the user-named folder for the project, in the "Project" folder, in the directory where the user installed the CBM-CFS3)

2. **Open the tblLastPassRotations table**
3. **Populate the table as required for each stand requiring more than one last pass disturbance**
4. **Save the changes and close the database file**
5. **Execute the project simulation in the Simulation Scheduler in the CBM-CFS3**

Table A8-1 displays and describes each field in the tblLastPassRotations table. Together, the values entered in the StandInitDistAssumptionID, InventoryID, and RotationNum columns compose the primary key of the tblLastPassRotations table. Only those stands whose Inventory ID values are entered into this table will engage the extra MAKELIST initialization disturbance and growth rotations entered by the user; all other Inventory ID values will use the default single last pass disturbance value assigned during project creation.

Table A8-1. Names and descriptions of fields in the tblLastPassRotations table in a CBM-CFS3 project database.

Field name	Description
StandInitDistAssumptionID	Enables the table to be used within the CBM-CFS3's assumption system. If multiple assumptions are defined in the database, multiple sets of last pass disturbances may be defined.
InventoryID	A foreign key to the tblInventory table where each InventoryID entered in each row in this table corresponds to a single inventory record in the tblInventory table.

Table A8-1. Concluded

Field name	Description
RotationNum	Defines the sort order by which rotations are applied to a given inventory record when multiple rotations are present for a single inventory record.
RotationLength	Defines the number of growth time steps that will be simulated prior to applying the disturbance corresponding to a row's rotation.
DisturbanceTypeID	A foreign key to the DistTypeID in the tblDisturbanceType table, which defines the disturbance type applied for the rotation.

Example implementation

In the example tblLastPassRotations table (Table A8-2) below, the user's stand represented by InventoryID 1 will be disturbed twice following the MAKELIST last pass disturbance that they entered for the stand when creating their project. The first disturbance (DisturbanceTypeID 1) will occur after 250 years of re-growth (RotationLength 250) following their default last pass disturbance. The second disturbance (DisturbanceTypeID 3) will occur next (because it has a RotationNum value of 2), following 100 years of re-growth (RotationLength 100). The stand represented by InventoryID 2 will only be disturbed once following the MAKELIST last pass disturbance that they entered for the stand when creating their project. DisturbanceTypeID 5 will be applied following 213 years of re-growth. In the case of both stands, once all the disturbances have been executed in the MAKELIST initialization process, they will be grown to their respective inventory ages that were defined by the user when they created the project.

Table A8-2. An example of the tblLastPassRotations table in a user's CBM-CFS3 project database, displaying two stands, one of which (InventoryID 1) incurs 2 additional disturbances following the user's last disturbance identified for the stand.

StandInitDistAssumptionID	InventoryID	RotationNum	RotationLength	DisturbanceTypeID
1	1	1	250	1
1	1	2	100	3
1	2	1	213	5

APPENDIX 9

Instructions for preparing spatially explicit import files.

In order to employ the spatially explicit capabilities of the CBM-CFS3, users will need to prepare their project import files as they usually would for import files using the CBM Standard Import Tool (see section 3.1.1); however, additional columns and data are required in the Inventory, Disturbance Events, and Transition Rules import files.

Inventory import file

Usually, the format of the Inventory import file will appear as it does in the example displayed in Table A9-1 (with or without classifier columns, as the number of these are at the discretion of users, with the exception of a maximum of 10 classifier columns, and a minimum of one — a species classifier).

For a spatially explicit project, a minimum of two inventory records are required, and each inventory record (i.e., row) in the table requires a unique identifier, an integer to be placed in a column (e.g., SVO_map_ID) at the end of the table (see Table A9-2). This identifier explicitly links each inventory record to specific disturbance events.

Table A9-1. An example of an import table for inventory data using Microsoft Access for the CBM Standard Import Tool of the CBM-CFS3 (with three classifiers: AU, LandType, and Species).

AU	LandType	Species	UsingID	Age	Area	Delay	UNFCCCC_LandClass
1007	natural	Pine	0	181	0.5	0	0
1007	natural	Pine	0	181	7	0	0
1005	natural	Spruce	0	139	200	0	0

Note: An import worksheet using Microsoft Excel will have a similar appearance.

Table A9-2. An example of a spatially explicit import table for inventory data (with three classifiers: AU, LandType, and Species) using Microsoft Access for the CBM Stand Import Tool of the CBM-CFS3.

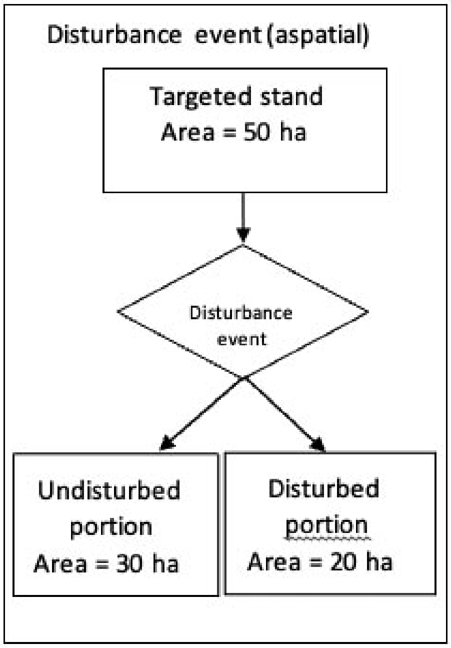
AU	LandType	Species	UsingID	Age	Area	Delay	UNFCCC_ LandClass	SVO_MAP_ ID
1007	natural	Pine	0	181	0.5	0	0	1
1007	natural	Pine	0	181	7	0	0	2
1005	natural	Spruce	0	139	200	0	0	3

Note: An import worksheet using Microsoft Excel will have a similar appearance.

If duplicate SVO map ID numbers are entered for a pair of inventory records, an error will result when the user attempts to create a project with the import files in the CBM Standard Import Tool, and the CBM-CFS3 project will not be created. Each inventory record should also use an actual age and not an age class.

Disturbance events import file

For CBM-CFS3 projects that are not spatially explicit, each disturbance event can target one or more stands, or portions of one or more stands, resulting in the loss of spatial information. A disturbance event in a spatially explicit project always targets one specific stand in its entirety, and the spatial information about this stand is preserved. These differences between disturbance events modeled under spatial and aspatial circumstances are illustrated in Figure A9-1.



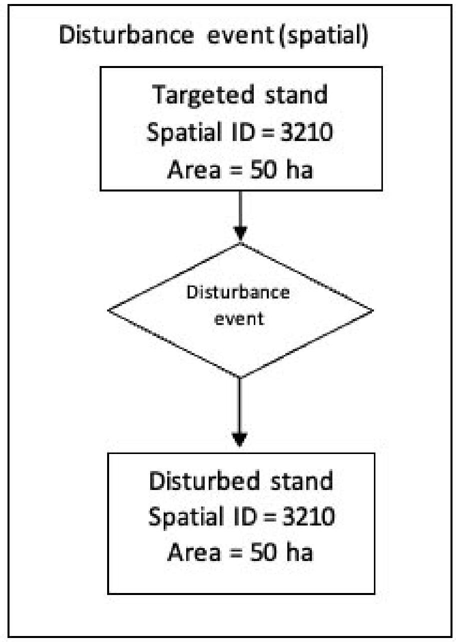


Figure A9-1. A diagram depicting a difference between disturbance events targeting a stand, when modeled aspatially and spatially, where stands modeled aspatially can be split by disturbances, and stands modeled spatially, cannot.

Usually, the format of the Disturbance Events import file will appear as it does in the example Microsoft Access table displayed in Table A9-3.

Table A9-3. An example of an import table for data on disturbance events using Microsoft Access for the CBM Standard Import Tool of the CBM-CFS3. (For display purposes, one or more classifier columns are also required, but they have been omitted here.)

UsingID	SW Start	SW End	HW Start	HW End	Efficiency	Sort Type	Measurement Type	Amount	DistType ID	Year
0	0	999	0	999	1	6	A	1000	DISTID4	4
0	0	999	0	999	1	6	A	500	DISTID4	3

Note: An import worksheet using Microsoft Excel will have a similar appearance.

For a spatially explicit project, each record of a disturbance event (i.e., row) in this table will require a unique identifier, an integer to be placed in a column (e.g., SVO_map_ID) at the end of the table (see Table A9-4). This identifier explicitly links each disturbance event to an inventory record. Each disturbance event record should use actual ages and not age classes.

Table A9-4. An example of a spatially explicit import table for data on disturbance events using Microsoft Access for the CBM Standard Import Tool of the CBM-CFS3. (For display purposes, one or more classifier columns are also required, but they have been omitted here.)

UsingID	SW Start	SW End	HW Start	HW End	Efficiency	Sort Type	Measurement Type	Amount	DistType ID	Year	SVO_ map_ID
0	0	999	0	999	1	6	A	1000	DISTID4	4	1
0	0	999	0	999	1	6	A	500	DISTID4	3	2

Note: An import worksheet using Microsoft Excel will have a similar appearance.

In the example in Table A9-4, each value in the SVO_map_ID field is used to target a specific record in the Inventory import file, and as such, each value for each record must also be included in the users' spatially explicit Inventory import file. The user should note that in any given time step (Year), a specific inventory record can only be targeted once with a disturbance event. In addition, each spatially explicit record of a disturbance event must meet the following criteria:

- The Efficiency value entered must be 1 (i.e., 100%)
- The Sort Type value entered must be 5 (i.e., Sort by SVO ID)
- The Measurement Type entered must be "P" (i.e., proportion of eligible records)
- The Amount entered must be 1 (i.e., 100% when associated Measurement Type is "P")

By entering these values, the CBM-CFS3 will process the events as spatially explicit events, and eligible stands will be completely disturbed.

Transition rules import file

Usually, the format of the Transition Rules import file will appear as it does in the example Microsoft Access table displayed in Table A9-5.

Table A9-5. An example of an import table for transition rules data using Microsoft Access for the CBM Standard Import Tool of the CBM-CFS3. (For display purposes, three classifier columns have been omitted at the beginning of the table in this example, but they appear later in the table (as required) as the "C1", "C2", and "C3" columns. The number and type of classifiers is at the user's discretion; however, they must use at least one (leading species) and no more than a maximum of ten classifiers.)

Using ID	SW Start	SW End	HW Start	HW End	Disturbance	C1	C2	C3	Regen Delay	Reset Age	Percent
0	0	999	0	999	DISTID8	1107	Managed	Pine	0	0	100
0	0	999	0	999	DISTID4	0	Not stocked	Not stocked	0	0	100

Note: An import worksheet using Microsoft Excel will have a similar appearance.

For a spatially explicit project, each transition rule record (i.e., row) in this table will require a unique identifier, an integer to be placed in a column (e.g., SVO_map_ID) at the end of the table (see Table A9-6). This identifier explicitly links each transition rule to a set of disturbance events with a matching disturbance type and spatial reference identifier. The percent transitioned under all spatially explicit transition rules must be 100 percent, because a disturbed stand cannot be split into multiple stands. Each transition rule record should use actual ages and not age classes.

Table A9-6. An example of a spatially explicit import table for the transition rules data using Microsoft Access for the CBM Standard Import Tool of the CBM-CFS3. (For display purposes, three classifier columns have been omitted at the beginning of the table in this example, but they appear later in the table (as required) as the "C1", "C2", and "C3" columns. The number and type of classifiers is at the user's discretion; however, they must use at least one (leading species) and no more than a maximum of ten classifiers.)

Using ID	SW Start	SW End	HW Start	HW End	Disturbance	C1	C2	C3	Regen Delay	Reset Age	Percent	SVO_map_ID
0	0	999	0	999	DISTID8	1107	Managed	Pine	0	0	100	2
0	0	999	0	999	DISTID4	0	Not stocked	Not stocked	0	0	100	2

Note: An import worksheet using Microsoft Excel will have a similar appearance.

Spatial results output

Once the user has successfully run a spatially explicit project through the Simulation Scheduler in the CBM-CFS3, the data output (beyond the simulation results database) will include two additional text files, SpatialFluxInd.out and SpatialPool.out. These files will be created in C:\Program Files\Operational-Scale CBM-CFS3\Temp\CBMRun\output on 32-bit operating systems, in C:\Program Files (x86)\Operational-Scale CBM-CFS3\Temp\CBMRun\output on 64-bit operating systems, or in C:\Users\'users name'\AppData\Local\Programs\Operational-Scale CBMCFS3\Temp\CBMRun\output. These files track each spatially explicit stand for

every time step of a simulation, and thus, can be very large. Currently, the CBMCFS3 graphic user interface has no way to use the data in these files, but the user can write a script to parse them. The column format of the SpatialFluxInd.out file is displayed in Table A9-7, and the column format of the SpatialPool.out file is displayed in Table A9-8.

Table A9-7. The column format, number, and variable names in a space delimited SpatialFluxInd.out file

Column number	Variable name
1	SVOID (the spatial ID for the stand)
2	TimeStep
3	SPUID
4	DistTypeID (0 for an annual process, otherwise the value represents the disturbance type responsible for the flux)
5	ClassifierValueID1
6	ClassifierValueID2
7	ClassifierValueID3
8	ClassifierValueID4
9	ClassifierValueID5
10	ClassifierValueID6
11	ClassifierValueID7

Table A9-7. Continued

Column number	Variable name
12	ClassifierValueID8
13	ClassifierValueID9
14	ClassifierValueID10
15	UNFCCC_ForestType
16	KP33_34
17	UNFCCC_Year
18	KF33_Year
19	KFProjectType
20	KFProjectID
21	CO2Production
22	CH4Production
23	COProduction
24	BioCO2Emission
25	BioCH4Emission
26	BioCOEmission
27	DOMCO2Emission
28	DOMCH4Emssion
29	DOMCOEmission
30	SoftProduction
31	HardProduction
32	DOMProduction
33	DeltaBiomass_AG
34	DeltaBiomass_BG
35	DeltaDOM
36	BiomassToSoil
37	LitterFlux[MERCHANTABLE]
38	LitterFlux[FOLIAGE]
39	LitterFlux[OTHER]
40	LitterFlux[SUBMERCHANTABLE]
41	LitterFlux[COARSEROOT]
42	LitterFlux[FINEROOT]
43	SoilToAir[VERYFASTAG]
44	SoilToAir[VERYFASTBG]
45	SoilToAir[FASTAG]
46	SoilToAir[FASTBG]
47	SoilToAir[MEDIUM]
48	SoilToAir[SLOWAG]

Table A9-7. Concluded

Column number	Variable name
49	SoilToAir[SLOWBG]
50	SoilToAir[SSTEMSNAG]
51	SoilToAir[SBRANCHSNAG]
52	SoilToAir[SBRANCHSNAG]
53	SoilToAir[HSTEMSNAG]
54	SoilToAir[HBRANCHSNAG]
55	SoilToAir[BLACKCARBON]
56	SoilToAir[PEAT]
57	BioToAir[MERCHANTABLE]
58	BioToAir[FOLIAGE]
59	BioToAir[OTHER]
60	BioToAir[SUBMERCHANTABLE]
61	BioToAir[COARSEROOT]
62	BioToAir[FINEROOT]

Table A9-8. The column format, number, and variable names in a space delimited SpatialPool.out file

Column number	Variable name
1	RunID
2	SvoID (the unique ID for the stand)
3	Age (the age of the stand)
4	TimeStepNum
5	SPUID
6	ClassifierValueID1
7	ClassifierValueID2
8	ClassifierValueID3
9	ClassifierValueID4
10	ClassifierValueID5
11	ClassifierValueID6
12	ClassifierValueID7
13	ClassifierValueID8
14	ClassifierValueID9
15	ClassifierValueID10
16	UNFCCC_ForestType
17	KP33_34
18	UNFCCC_Year
19	KF33_Year

Table A9-8. Concluded

Column number	Variable name
20	KFProjectType
21	KFProjectID
22	HWMerchC
23	HWFoliageC
24	HWOtherC
25	HWSubmerchC
26	HWCoarseRootC
27	HWFineRootC
28	SWMerchC
29	SWFoliageC
30	SWOtherC
31	SWSubmerchC
32	SWCoarseRootC
33	SWFineRootC
34	VeryFastCAG
35	VeryFastCBG
36	FastCAG
37	FastCBG
38	MediumC
39	SlowCAG
40	SlowCBG
41	SWSSnagC
42	SWBSnagC
43	HWSSnagC
44	HWBSnagC
45	BlackC
46	PeatC

APPENDIX 10

Instructions for Exporting Data for the CBM-CFS3 with the CBM-CFS3 Carbon budget model tool in the Woodstock Optimization Studio

Introduction

The Woodstock Optimization Studio program (Remsoft Inc. 2025) allows users to export project files for use in the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3). In this situation, the following project files must be exported: actions, themes, areas, transitions, schedule, and yields. Users have the option of exporting all files at once or of exporting specific files individually.

Exporting data

To begin exporting Woodstock Optimization Studio project files for use in the CBM-CFS3, the project must be open and active in the Woodstock Optimization Studio. To proceed,

1. Click on "File" in the menu bar of the main Woodstock Optimization Studio window (Fig. A10-1)

2. Click on "CBM-CFS3 Carbon budget model" on the menu that appears

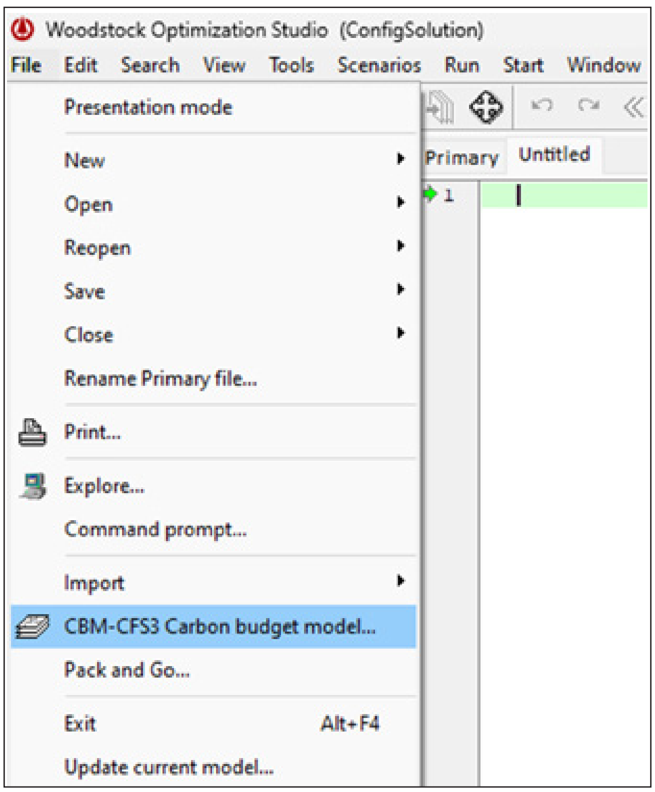


Figure A10-1. Part of the menu bar in the main Woodstock Optimization Studio window, displaying the "File" menu with "CBM-CFS3 Carbon budget model" selected.

The "Export" window (Fig. A10-2) will pop up.

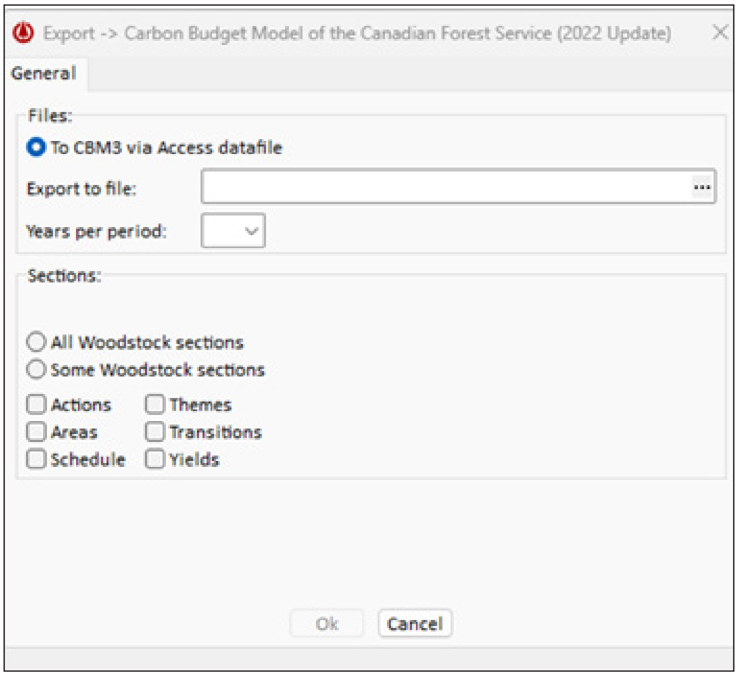


Figure A10-2. The “Export” window.

3. Click on “…” in the “Export to file:” box

The “Save to Datamart” window (Fig. A10-3) will pop up.

4. Browse to the appropriate folder and enter a name in the “File name:” box

5. Click on the “Save” button to proceed or the “Cancel” button to terminate the process

If the user clicks on the “Save” button, the system will return to the “Export” window (Fig. A10-2) and display the location in the “Export to file:” box. To export all of the required files for the CBM-CFS3,

6. Click on the “All Woodstock sections” radio button to export all of the required files and skip to step 11

or

Click on the “Some Woodstock sections” radio button to select particular files, and then click on a file check box so that a check mark appears

If the user chooses “Some Woodstock sections” and selects the “Yields” file for export, a “Yields” tab (Fig. A10-4) will become available in the “Export” window. To proceed,

7. Click on the “Yields” tab

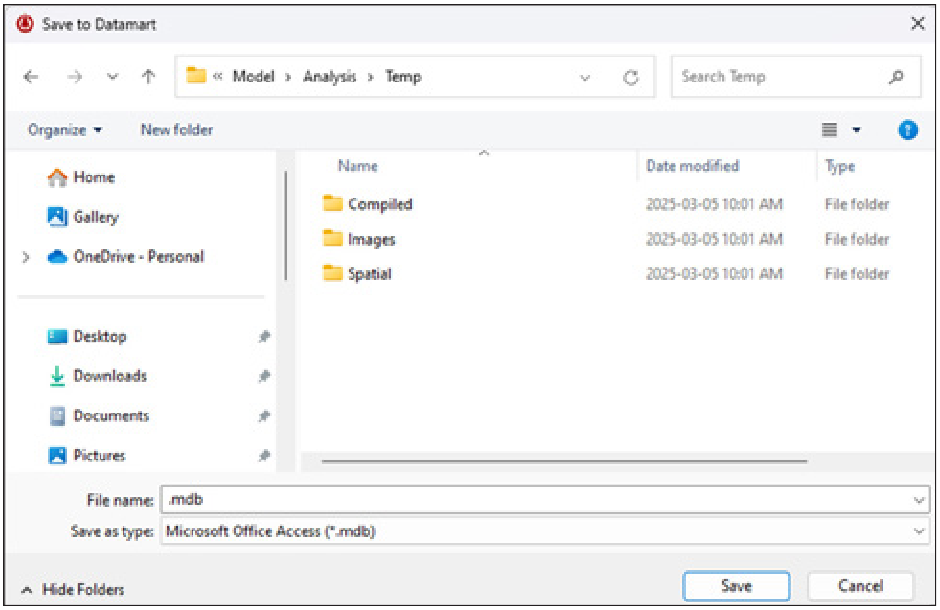


Figure A10-3. The Save to Datamart" window.

8. Click on the "Add" button

The Woodstock Optimization Studio will compile the model and display all available growth and yield curves in the "Yields" section of the user's project file. The "Add" drop down menu will only include yields that have been created in the Yields section of the Woodstock model. It is not necessary to export all of the yield data components: instead, only total volume or total softwood volume and total hardwood volume should be exported. To export a subset of growth and yield curves using the "Yields" tab (Fig. A10-4),

9. On the drop-down list that appears, click on the name(s) of the growth and yield curve(s) to be exported (Fig. A10-5)

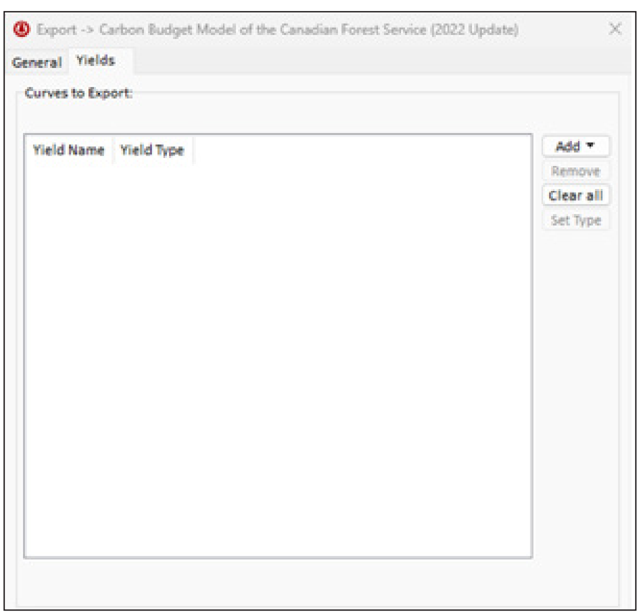


Figure A10-4. The "Yields" tab in the "Export" window of the Woodstock Optimization Studio.

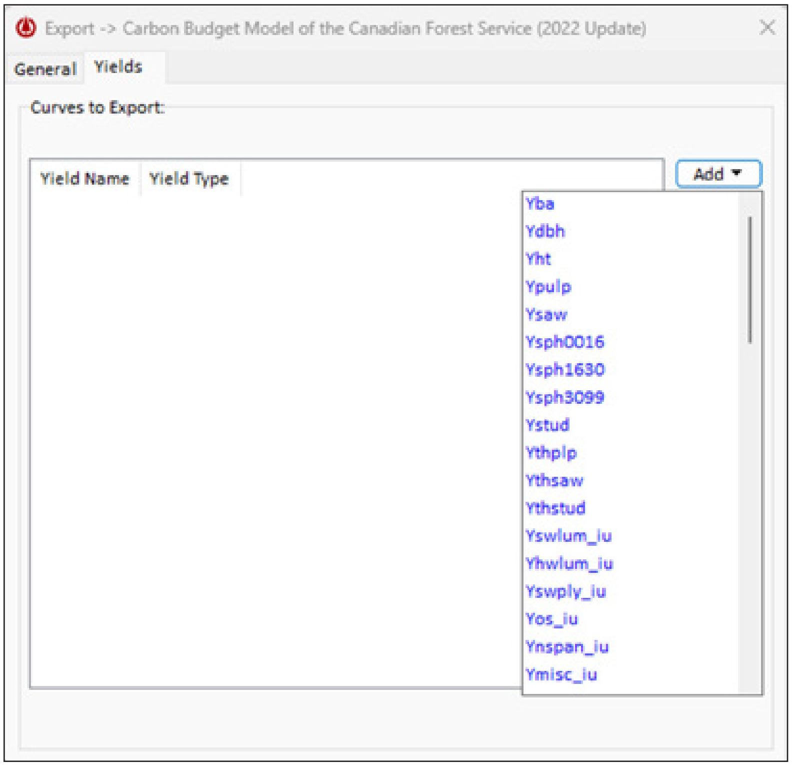


Figure A10-5. The "Yields" tab in the "Export" window of the Woodstock Optimization Studio displaying example names of yield curves on the "Add" button drop-down list.

The Woodstock Optimization Studio will add the selected growth and yield curve(s) to the "Curves to Export" box (Fig. A10-6). Figure A10-6 displays an example where the user selected three yield curves to export, the total softwood (Ysv), total hardwood (Yhv), and total volume (Ytv). The choice of which yield curves to export is entirely the users, with the exception that they must either export the total hardwood and total softwood volume yields OR the total volume yield. If a user wants to include a softwood and hardwood component, the total hardwood volume and softwood volume yield curves must be created in Woodstock first, then selected from the "Add" button drop-down menu in Fig. A10-6.

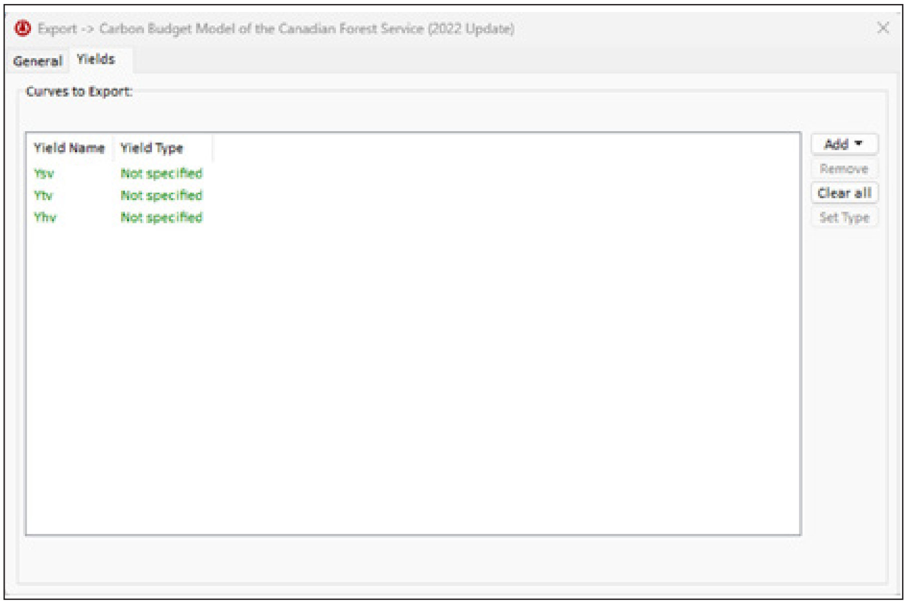


Figure A10-6. The "Yields" tab in the "Export" window of the Woodstock Optimization Studio displaying an example of yield curves selected for export, In this example, total softwood (Ysv), total hardwood (Yhv) and total volume (Ytv) have been selected. The user should note the yield names displayed in this figure are from an example dataset, and it will be up to the user to know the proper yield names representing total softwood volume and total hardwood volume, or total volume in their project.

10. Click on the "General" tab

11. Click on the "OK" button

12. Exit the Woodstock Optimization Studio

Next, the user must import the exported Woodstock Optimization Studio files into a single Microsoft Access database file. The user should note that if a file name is greater than 8 characters in length, Microsoft Access may have difficulty importing the file. For example, the "Transitions.dbf" file must be renamed with fewer than 8 characters. In Microsoft Access,

13. Create a new database

14. Import the exported Woodstock Optimization Studio files as tables

The CBM-CFS3 cannot import a Microsoft Access database file with tables containing more than 10 themes to describe each forest type, so the user must delete any excess classifiers. Users with data for more than one province or terrestrial ecozone of Canada should keep a classifier containing values for each. The Microsoft Access database file can then be imported into the CBM-CFS3 using the CBM Standard Import Tool.

Additional information

For further information about Woodstock Optimization Studio import files for the CBM-CFS3 and the CBM Standard Import Tool, consult sections 3.1.3 and 3.2 of this guide.

LITERATURE CITED

Remsoft Inc. 2025. Woodstock Optimization Studio [computer program]. Version 2025.x. Fredericton, NB.

APPENDIX 11

Instructions for modifying root parameters

Introduction

This appendix outlines the steps required to modify the root turnover aboveground–belowground split and the root parameters within the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3). This new parameter accessibility and functionality is available only in version 1.2.4569.176 and newer of the model.

Modifying the Root Turnover Aboveground-Belowground Split

This section describes how to modify the root turnover aboveground–belowground split for a CBM-CFS3 project. To begin, the user opens the input(project) database for the project, located in the project folder, which is typically found in (depending on where the model was installed):

- **C:\Program Files\Operational-Scale CBM-CFS3\Projects, or**
- **C:\Program Files (x86)\Operational-Scale CBM-CFS3\Projects, or**
- **C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Projects**

The project database will contain a table named "tblRootTurnoverAGSplit," where the required modifications can be made. If this table is left blank, the CBM-CFS3 will apply the default split (0.5 for each).

Table "tblRootTurnoverAGSplit" defines the split between aboveground and belowground coarse and fine root turnover for both softwoods and hardwoods. Figure A11-1 displays the parameters found in table "tblRootTurnoverAGSplit" and the parameter link to table "tblRunBiomassTurnoverScenario," which represents the biomass turnover assumptions for a project. Table A11-1 lists the parameters found in table "tblRootTurnoverAGSplit" and their definitions.

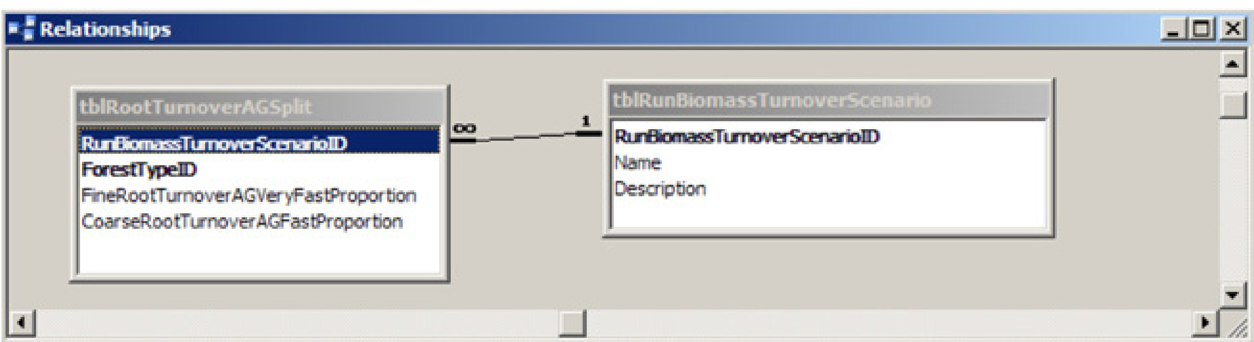


Figure A11-1. Parameters in the table "tblRootTurnoverAGSplit" and linkage with table "tblRunBiomassTurnoverScenario," as displayed in a Microsoft Access database for a Carbon Budget Model of the Canadian Forest Sector project.

Table A11-1. Names and descriptions of parameters in table "tblRootTurnoverAGSplit" in a Microsoft Access database for a Carbon Budget Model of the Canadian Forest Sector project.

Parameter	Description
RunBiomassTurnoverScenarioID	A foreign key to the biomass turnover assumption that permits the user to add multiple simulation assumptions with differing proportions for the root turnover split; the user may apply an assumption to MAKELIST (preprocessing program) only, to the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) only, or to both.
ForestTypeID	A forest-type identifier that should be set to 1 for softwoods and 3 for hardwoods. If the project contains both softwood and hardwood components, then two rows will be needed.
FineRootTurnoverAGVeryFastProportion	The proportion of fine root turnover that will be transferred to the Aboveground Very Fast pool. The remaining proportion will be transferred to the belowground very fast pool. The minimum value for this field is 0, and the maximum value is 1.
CoarseRootTurnoverAGFastProportion	The proportion of coarse root turnover that will be transferred to the aboveground fast pool. The remaining proportion will be transferred to the belowground fast pool. The minimum value for this field is 0, and the maximum value is 1.

Example of Parameter Changes and Impacts on Carbon Stocks

This section provides example input for the table "tblRootTurnoverAGSplit" and estimates of the impacts of the various scenarios on carbon stocks. Below are six possible scenarios for the split in root turnover. Table A11-2 displays the input for these scenarios as it would appear in "tblRootTurnoverAGSplit."

Scenario 1 (the default scenario)

- **Half of the fine root turnover is transferred to the Aboveground Very Fast pool, and the other half is transferred to the Belowground Very Fast pool.**
- **Half of the coarse root turnover is transferred to the Aboveground Fast pool, and the other half is transferred to the Belowground Fast pool.**

Scenario 2

- **All of the fine root turnover is transferred to the Belowground Very Fast pool.**
- **All of the coarse root turnover is transferred to the Belowground Fast pool.**

Scenario 3

- **One quarter of the fine root turnover is transferred to the Aboveground Very Fast pool, and three quarters is transferred to the Belowground Very Fast pool.**
- **One quarter of the coarse root turnover is transferred to the Aboveground Fast pool, and three quarters is transferred to the Belowground Fast pool.**

Scenario 4

- **Identical to Scenario 1 (implemented to demonstrate that no difference will be observed in results when compared to Scenario 1).**

Scenario 5

- **Three quarters of the fine root turnover is transferred to the Aboveground Very Fast pool, and one quarter is sent to the Belowground Very Fast pool.**
- **Three quarters of the coarse root turnover is transferred to the Aboveground Fast pool, and one quarter is transferred to the Belowground Fast pool.**

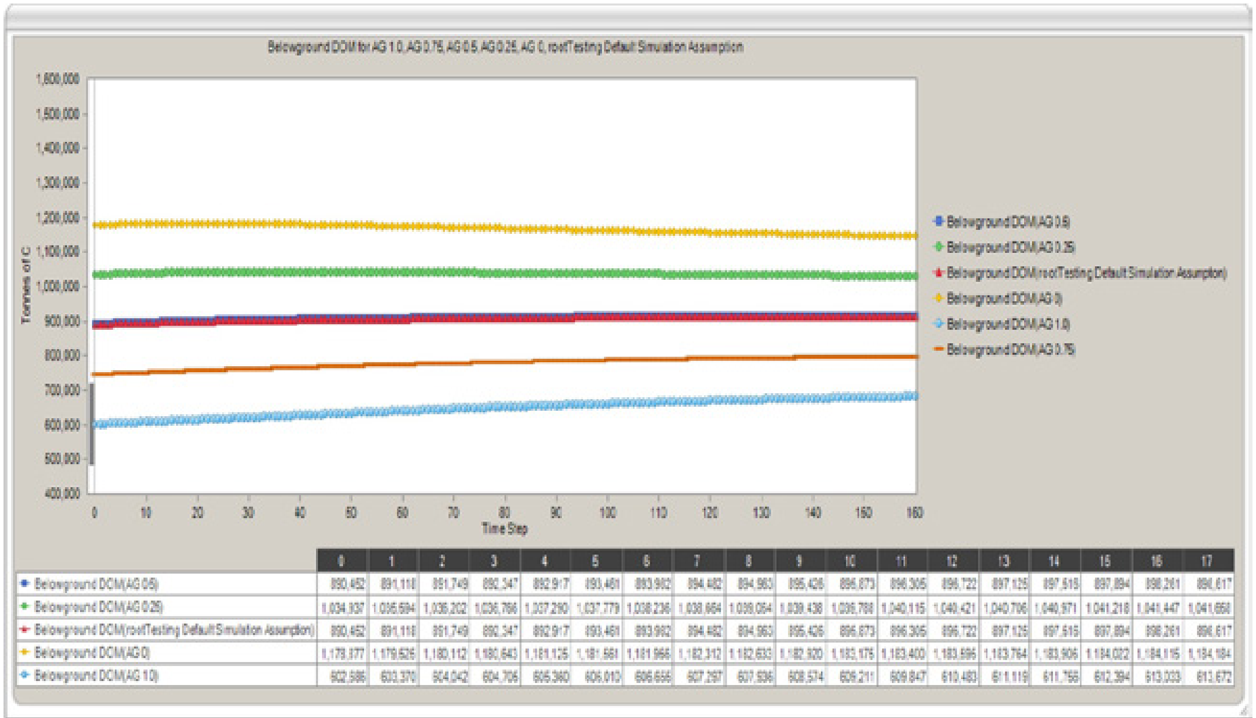
Scenario 6

- **All of the fine root turnover is transferred to the Aboveground Very Fast pool.**
- **All of the coarse root turnover is transferred to the Aboveground Fast pool.**

Once the modifications for all six scenarios were made in table "tblRootTurnoverAGSplit," the project was simulated in the CBM-CFS3, and results were generated. Figure A11-2 displays the belowground dead organic matter (DOM) results for the six scenarios. Figure A11-3 displays the aboveground DOM for the same six scenarios.

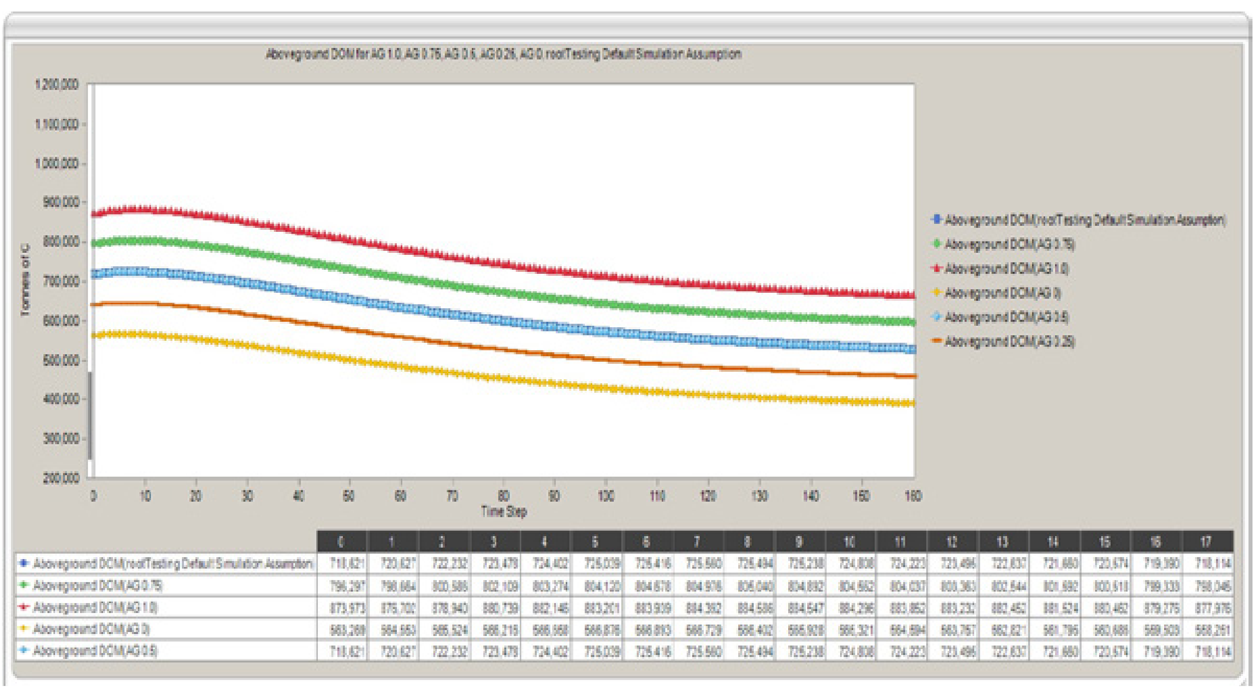
Table A11-2. Table "tblRootTurnoverAGSplit" as it would appear if it contained the six scenarios described in subsection "Example of Parameter Changes and Impacts on Carbon Stocks"

RunBiomass Turnover	ForestTypeID	FineRootTurnoverAG VeryFastProportion	CoarseRootTurnoverAG FastProportion
1	1	0.5	0.5
1	3	0.5	0.5
2	1	0	0
2	3	0.25	0
3	1	0.25	0.25
3	3	0.5	0.25
4	1	0.5	0.5
4	3	0.5	0.5
5	1	0.75	0.75
5	3	0.75	0.75
6	1	1	1
6	3	1	1



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Belowground DOM(AG 0.5)	890,452	891,118	891,749	892,347	892,917	893,461	893,982	894,482	894,963	895,426	895,873	896,305	896,722	897,125	897,515	897,894	898,261	898,617
Belowground DOM(AG 0.25)	1,034,937	1,035,594	1,036,202	1,036,766	1,037,290	1,037,779	1,038,236	1,038,664	1,039,064	1,039,438	1,039,788	1,040,115	1,040,421	1,040,706	1,040,971	1,041,218	1,041,447	1,041,658
Belowground DOM(rootTesting Default Simulation Assumption)	890,452	891,118	891,749	892,347	892,917	893,461	893,982	894,482	894,963	895,426	895,873	896,305	896,722	897,125	897,515	897,894	898,261	898,617
Belowground DOM(AG 0)	1,178,877	1,179,526	1,180,112	1,180,643	1,181,125	1,181,561	1,181,956	1,182,312	1,182,633	1,182,920	1,183,176	1,183,400	1,183,596	1,183,764	1,183,906	1,184,022	1,184,115	1,184,184
Belowground DOM(AG 1.0)	602,586	603,370	604,042	604,706	605,360	606,010	606,656	607,297	607,936	608,574	609,211	609,847	610,483	611,119	611,756	612,394	613,033	613,672

Figure A11-2. Simulation results for belowground dead organic matter (DOM) for the six scenarios described in the subsection "Example of Parameter Changes and Impacts on Carbon Stocks." AG = aboveground, C = carbon.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Aboveground DOM(rootTesting Default Simulation Assumption)	718,621	720,627	722,232	723,478	724,402	725,039	725,416	725,560	725,494	725,238	724,808	724,223	723,496	722,637	721,680	720,674	719,390	718,114
Aboveground DOM(AG 0.75)	796,297	798,664	800,586	802,109	803,274	804,120	804,678	804,976	805,040	804,892	804,562	804,037	803,363	802,544	801,592	800,518	799,333	798,046
Aboveground DOM(AG 1.0)	873,973	875,702	878,940	880,739	882,146	883,201	883,939	884,392	884,586	884,547	884,296	883,852	883,232	882,452	881,524	880,462	879,275	877,976
Aboveground DOM(AG 0)	563,268	564,553	565,524	566,215	566,658	566,876	566,893	566,729	566,402	565,928	565,321	564,594	563,757	562,821	561,796	560,688	559,503	558,251
Aboveground DOM(AG 0.5)	718,621	720,627	722,232	723,478	724,402	725,039	725,416	725,560	725,494	725,238	724,808	724,223	723,496	722,637	721,680	720,674	719,390	718,114

Figure A11-3. Simulation results for aboveground (AG) dead organic matter (DOM), for the six scenarios described in the subsection "Example of Parameter Changes and Impacts on Carbon Stocks". C = carbon.

Modifying Root Parameters

This section describes how to modify the root parameters for stand initialization in the CBM-CFS3 simulation. Default root parameters are documented in Li et al. (2003; see Table 3 on page 132) and are used in the following equations to predict root biomass and fine root proportion.

$$RB_{SW} = 0.222AB_{SW}$$

$$RB_{HW} = 1.576AB_{HW}^{0.615}$$

$$P_f = 0.072 + 0.354\ \exp(-RB/16.608)$$

where RB represents root biomass, AB represents aboveground biomass, SW represents the softwood species groups, HW represents the hardwood species groups, and Pf represents the fine root proportion of total root biomass.

To begin, the user should open the project in the CBM-CFS3, open the Assumption Composer for volume-to-biomass assumptions, and create new volume-to-biomass conversion assumptions (the same number as the number of root parameter scenarios to be simulated). Each of these new volume-to-biomass conversion assumptions should be added to a new Stand Initialization Assumption and a new CBM Run Assumption. Then, each of the new Stand Initialization Assumptions and CBM Run Assumptions should be added to a new Simulation Assumption. Once this process is complete, the user opens the input (project) database for the project, located in the project folder, which is typically found in (depending on where the model was installed):

- **C:\Program Files\Operational-Scale CBM-CFS3\Projects, or**
- **C:\Program Files (x86)\Operational-Scale CBM-CFS3\Projects, or**
- **C:\Users\'user's name'\AppData\Local\Programs\Operational-Scale CBM-CFS3\Projects**

In the project database, the user will find the table "tblRootRatio," where modifications can be made. If this table is left blank, the CBM-CFS3 will apply default root parameter values. In the table, a pair of rows, one for softwood and one for hardwood, can be used by a Stand Initialization Assumption, a CBM Run Assumption, or both.

Example of Modifying the Root Proportion of Total Biomass

This section provides an example of the setup for a CBM-CFS3 project to accommodate three modified root parameter scenarios, in addition to the default scenario. In this example, the project contains a softwood stand, a hardwood stand, and a mixedwood stand. To begin, the CBM-CFS3 project was opened, and three assumptions for volume-to-biomass (in addition to the existing default assumption) were created in the Assumption Composer. Each of these new assumptions was then linked to its own new Stand Initialization Assumption in the Assumption Composer for stand initialization and to its own new CBM Run Assumption in the Assumption Composer for CBM runs. The three new Stand Initialization Assumptions and CBM Run Assumptions were then linked to their own new Simulation Assumptions in the Assumption Composer for simulations.

Table "tblRootRatio" was then opened in the project database. The user then entered root parameter data into the table (see Fig. A11-4) to exercise the following four root parameter scenarios:

1. **Default parameters from Li et al. (2003) (first and second rows in Fig. A11-4)**
2. **0.17 softwood root biomass (third and fourth rows in Fig. A11-4)**
3. **0.17 hardwood root biomass (fifth and sixth rows in Fig. A11-4)**
4. **0.17 softwood and 0.17 hardwood root biomass (seventh and eighth rows in Fig. A11-4)**

The relevant equations used in the CBM-CFS3 are as follows:

$RB_{SW} = aAB_{SW} + b$ for the softwood component

and

$RB_{HW} = aAB_{HW}^{b}$ for the hardwood component,

where a and b are constants defined by the user.

tblRootRatio : Table

RunBiomassConversionScenarioID	SPUID	ForestTypeID	FineRootProportion_a	FineRootProportion_b	FineRootProportion_c	RootBiomass_a	RootBiomass_b
1	1	1	0.072	0.354	16.608	0.222	0
1	1	2	0.072	0.354	16.608	1.576	0.615
2	1	1	0.072	0.354	16.608	0.17	0
2	1	2	0.072	0.354	16.608	1.576	0.615
3	1	1	0.072	0.354	16.608	0.222	0
3	1	2	0.072	0.354	16.608	0.17	1
4	1	1	0.072	0.354	16.608	0.17	0
4	1	2	0.072	0.354	16.608	0.17	1
0	0	0	0	0	0	0	0

Record: 1 of 8

Figure A11-4. Table "tblRootRatio" as it would appear if it contained the four scenarios described in the subsection "Example of Modifying the Root Proportion of Total Biomass."

To change the softwood root proportion to 0.17, the default "RootBiomass_a" value of 0.222 was changed to 0.17, and b was kept at 0. To change the hardwood root proportion to 0.17, the default "RootBiomass_a" value of 1.576 was changed to 0.17, and b was changed to 1.

With these changes implemented, the user returned to the CBM-CFS3 and used the Simulation Scheduler to simulate the four Simulation Assumptions for the project.

Simulation results for scenario 2 (softwood scenario) showed that the root proportion of 0.17 was implemented properly and had the intended effect. Table A11-3 and Fig. A11-5 compare this scenario with scenario 1 (the default scenario).

Table A11-3. Comparison of root biomass carbon and root proportion values for time steps 1 to 91 (in 10-year intervals) for the softwood stand, between scenario 2 (softwood scenario) and scenario 1 (default scenario)

		Scenario 2 (softwood)		Scenario 1 (default)	
Time step	Softwood aboveground biomass (tC)	Root biomass C (t)	Root proportion	Root biomass C (t)	Root proportion
1	0.24	0.04	0.17	0.05	0.222
11	7.18	1.22	0.17	1.59	0.222
21	16.24	2.76	0.17	3.61	0.222
31	24.76	4.21	0.17	5.50	0.222
41	31.55	5.36	0.17	7.00	0.222
51	35.83	6.09	0.17	7.95	0.222
61	40.45	6.88	0.17	8.98	0.222
71	44.27	7.53	0.17	9.83	0.222
81	48.12	8.18	0.17	10.68	0.222
91	51.76	8.80	0.17	11.49	0.222

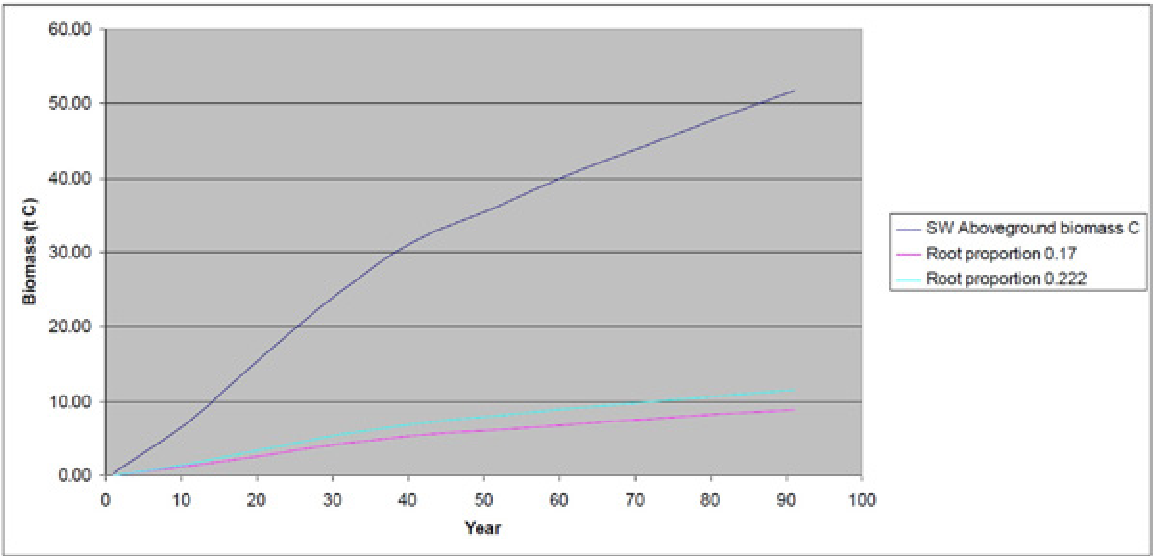


Figure A11-5. Comparison of root biomass carbon for the softwood (SW) stand, between scenario 1 (the default scenario; root proportion = 0.222) and scenario 2 (the softwood scenario; root proportion = 0.17). C = carbon.

Simulation results for scenario 3 (hardwood scenario) showed that the root proportion of 0.17 was implemented properly and had the intended effect. Table A11-4 and Fig. A11-6 compare this scenario with scenario 1 (the default scenario).

Table A11-4. Comparison of root biomass carbon and root proportion values for time steps 1 to 91 (in 10-year intervals) for the hardwood stand, between scenario 3 (hardwood scenario) and scenario 1 (default scenario).

		Scenario 3 (hardwood)		Scenario 1 (default)	
Time step	Hardwood aboveground biomass (tC)	Root biomass C (t)	Root proportion	Root biomass C (t)	Root proportion
1	1.07	0.18	0.17	1.26	1.17
11	25.40	4.32	0.17	8.82	0.35
21	47.28	8.04	0.17	12.93	0.27
31	60.24	10.24	0.17	15.01	0.25
41	66.53	11.31	0.17	15.95	0.23
51	69.19	11.76	0.17	16.34	0.24
61	70.19	11.93	0.17	16.49	0.23
71	70.60	12.00	0.17	16.55	0.23
81	70.71	12.02	0.17	16.56	0.23
91	70.59	12.00	0.17	16.54	0.23

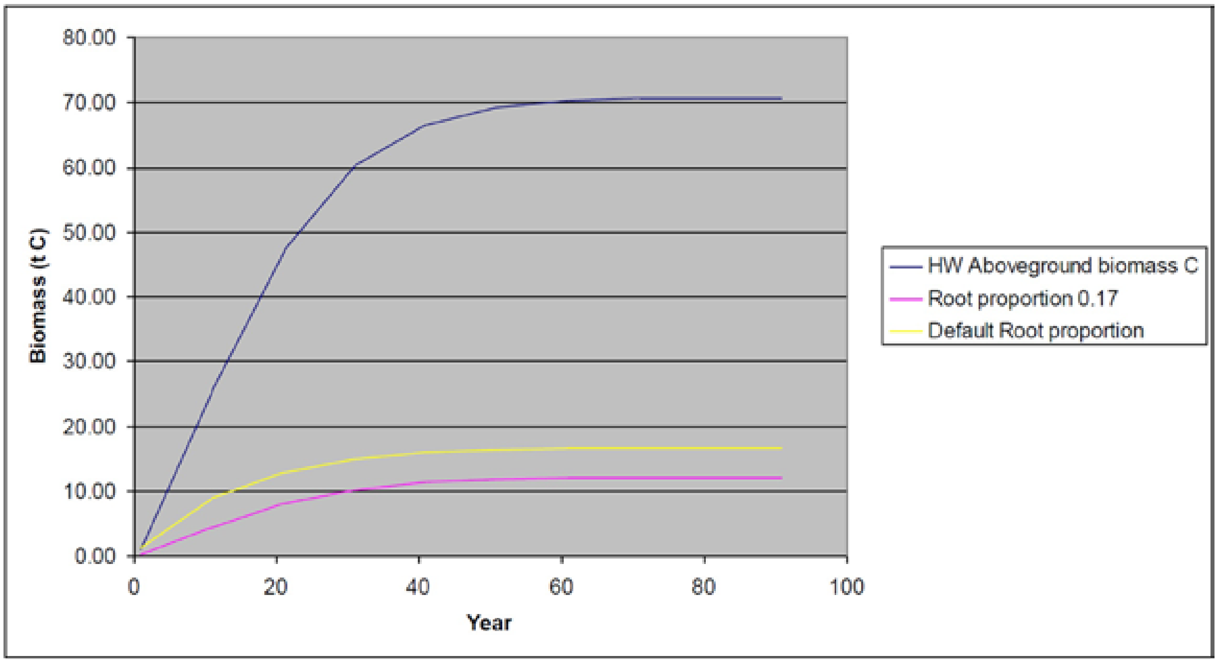


Figure A11-6. Comparison of root biomass carbon for the hardwood (HW) stand, between scenario 1 (the default scenario) and scenario 3 (the hardwood scenario; root proportion = 0.17). C = carbon.

Simulation results for scenario 4 (mixedwood scenario) showed that the root proportion of 0.17 was implemented properly and had the intended effects. Table A11-5 and Fig. A11-7 compare this scenario with scenario 1 (the default scenario).

Table A11-5. Comparison of root biomass carbon and root proportion values for time steps 1 to 91 (in 10-year intervals) for the mixedwood stand, between scenario 4 (softwood 0.17 and hardwood 0.17) and scenario 1 (the default scenario)

		Scenario 4 (mixedwood)		Scenario 1 (default)	
Time step	Mixedwood aboveground biomass (tC)	Root biomass C (t)	Root proportion	Root biomass C (t)	Root proportion
1	0.20	0.03	0.17	0.13	0.65
11	7.60	1.29	0.17	3.70	0.49
21	23.69	4.03	0.17	8.39	0.35
31	41.48	7.05	0.17	12.26	0.30
41	53.38	9.07	0.17	14.53	0.27
51	58.11	9.88	0.17	15.39	0.26
61	60.45	10.28	0.17	15.86	0.26
71	61.82	10.51	0.17	16.17	0.26
81	63.18	10.74	0.17	16.47	0.26
91	64.32	10.93	0.17	16.72	0.26

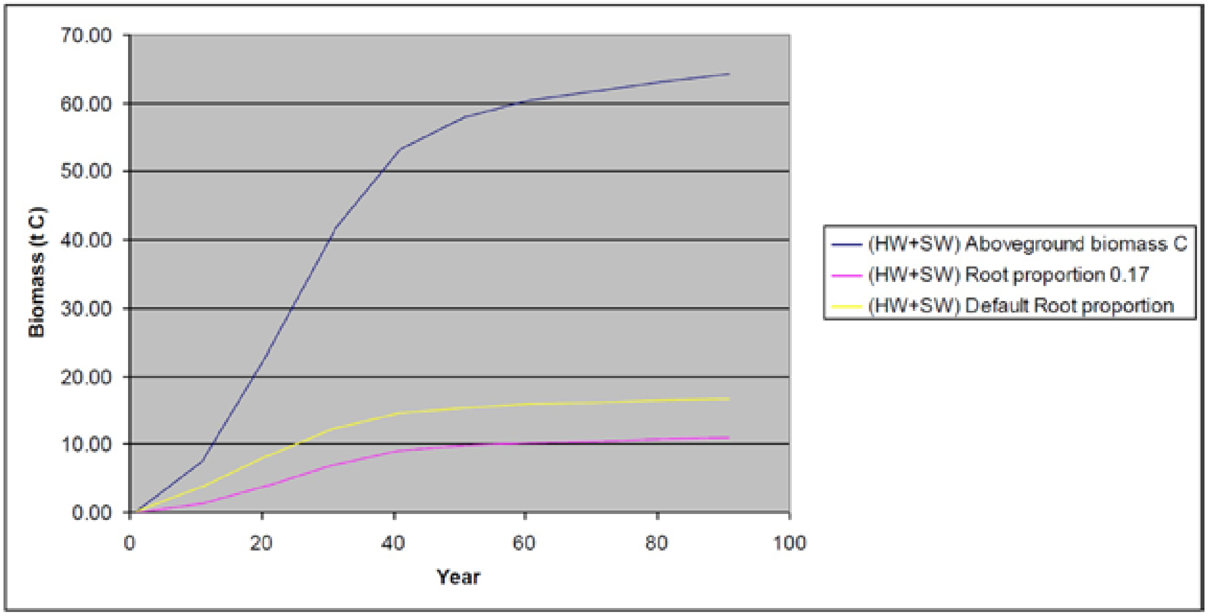


Figure A11-7. Comparison of root biomass carbon for the mixedwood stand, between scenario 1 (default scenario) and scenario 4 (hardwood [HW] and softwood [SW], root proportion = 0.17). C = carbon.

Example of Modifying the Fine Root Proportion of Total Root Parameters

This section provides an example of the setup for a CBM-CFS3 project that includes two modified fine root proportion parameter scenarios, in addition to the default scenario. The modified scenarios represent an increase and a decrease, respectively, in the fine root proportion (relative to the default scenario). In the "Increased scenario," the "FineRootProportion_a" parameter was changed from 0.072 to 0.09, and the "FineRootProportion_b" parameter was changed from 0.354 to 0.4. In the "Decreased scenario," the FineRootProportion_a" parameter was changed from 0.072 to 0.05, and the "FineRootProportion_b" parameter was changed from 0.354 to 0.3. Figure A11-8 displays these values as they would appear in the "tblRootRatio" table (9th through 12th rows; the first eight rows remain from the previous example). Table A11-6 and Fig. A11-9 display the fine root proportions for a range of total root biomass from 0 to 100 tonnes, estimated using the equations in Li et al. (2003). Figure A11-10 compares the simulated fine root proportions as a function of root biomass carbon by softwood and hardwood relative to the proportions calculated manually for each of the scenarios. Figure A11-11 displays the fine root and coarse root results for all stands in the simulation, for all three scenarios.

tblRootRatio : Table

RunBiomassConversionScenarioID	SPUID	ForestTypeID	FineRootProportion_a	FineRootProportion_b	FineRootProportion_c	RootBiomass_a	RootBiomass_b
1	1	1	0.072	0.354	16.608	0.222	0
1	1	2	0.072	0.354	16.608	1.576	0.615
2	1	1	0.072	0.354	16.608	0.17	0
2	1	2	0.072	0.354	16.608	1.576	0.615
3	1	1	0.072	0.354	16.608	0.222	0
3	1	2	0.072	0.354	16.608	0.17	1
4	1	1	0.072	0.354	16.608	0.17	0
4	1	2	0.072	0.354	16.608	0.17	1
5	1	1	0.09	0.4	16.608	0.222	0
5	1	2	0.09	0.4	16.608	1.576	0.615
6	1	1	0.05	0.3	16.608	0.222	0
6	1	2	0.05	0.3	16.608	1.576	0.615
0	0	0	0	0	0	0	0

Record: 10 of 12

Figure A11-8. Table "tblRootRatio" with fine root proportion parameters added in the 9th through 12th rows.

Table A11-6. Proportion of fine roots for the "Default," "Increased," and "Decreased" scenarios relative to total root biomass

	Proportion of fine roots[a] by scenario		
Root biomass (tC)	Default scenario	Increased scenario	Decreased scenario
0	0.4260	0.4900	0.3500
10	0.2659	0.3091	0.2143
20	0.1782	0.2100	0.1400
30	0.1301	0.1557	0.0993
40	0.1038	0.1260	0.0770
50	0.0894	0.1097	0.0648
60	0.0816	0.1008	0.0581
70	0.0772	0.0959	0.0544
80	0.0749	0.0932	0.0524
90	0.0736	0.0918	0.0513
100	0.0729	0.0910	0.0507

[a]Estimated from the equations in Li et al. (2003).

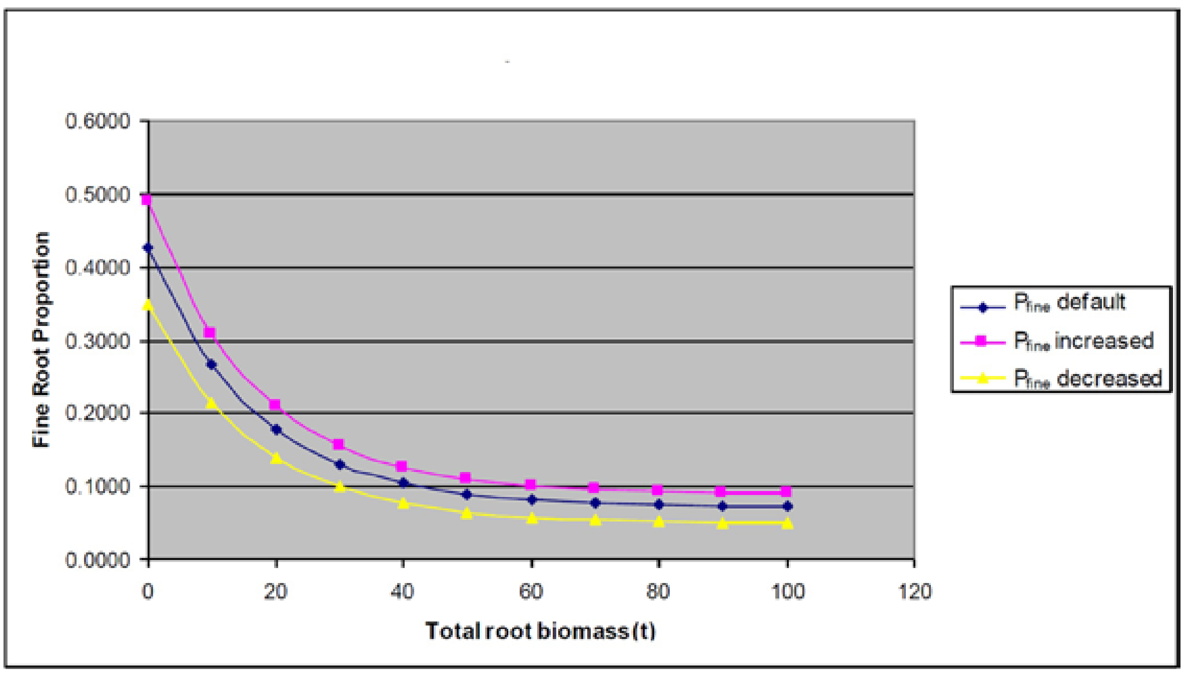


Figure A11-9. Fine root proportion (Pfine) as a function of total root biomass for three scenarios: "Default" (Pfine default), "Increased" (Pfine increased), and "Decreased" (Pfine decreased).

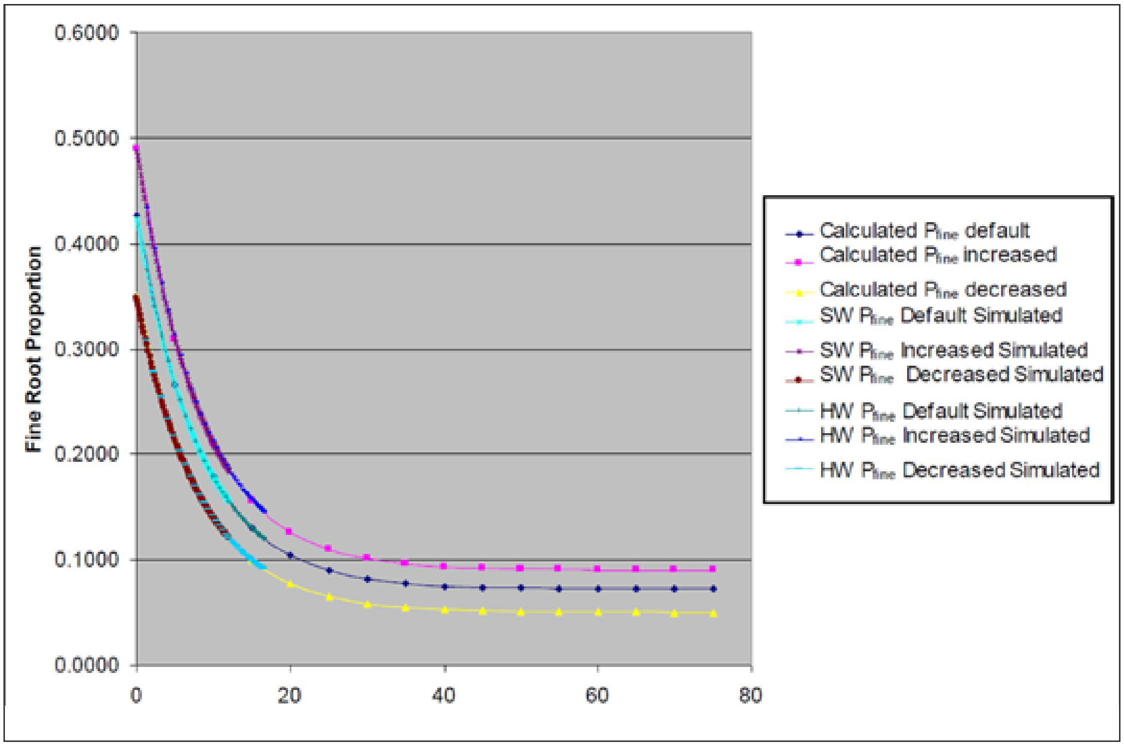


Figure A11-10. Proportion of fine roots (Pfine) as a function of root biomass, calculated for the "Default," "Increased," and "Decreased" scenarios and simulated for the softwood (SW) and hardwood (HW) components of the "Default," "Increased," and "Decreased" scenarios.

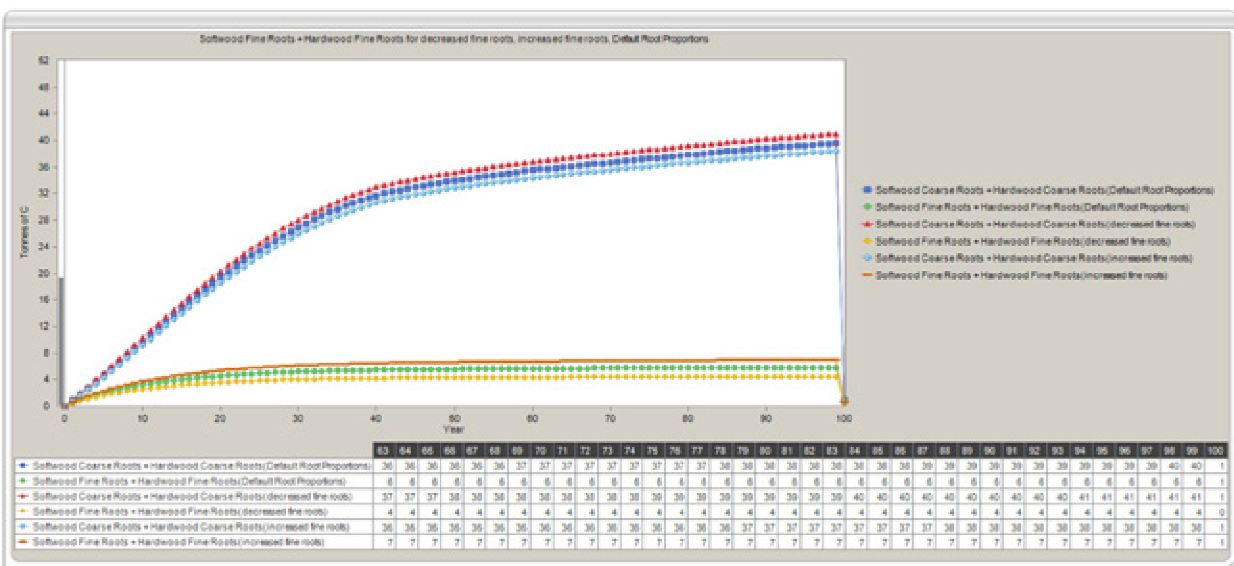


Figure A11-11. Comparison of carbon (C) in coarse and fine roots for the "Default," "Increased," and "Decreased" scenarios.

LITERATURE CITED

Li, Z.; Kurz, W.A.; Apps, M.J.; Beukema, S.J. 2003. Belowground biomass dynamics in the Carbon Budget Model of the Canadian Forest Sector: recent improvements and implications for the estimation of NPP and NEP. Can. J. For. Res. 33:126–136.

APPENDIX 12

The CBM-CFS3 default mean annual temperature (MAT) and mean annual precipitation (MAP) values by administrative (province or territory) and ecological boundary

Appendix 12. The CBM-CFS3 default mean annual temperature (MAT) and mean annual precipitation (MAP) values by administrative (province or territory) and ecological boundary[a]

Administrative boundary	Ecological boundary	MAT (°Celsius)	MAP (mm)
Alberta	Boreal Plains	0.25	487.90
	Boreal Shield West	-1.55	414.80
	Montane Cordillera	-0.19	750.29
	Semiarid Prairies	3.47	526.01
	Subhumid Prairies	2.46	487.06
	Taiga Plains	-2.41	425.58
	Taiga Shield West	-2.97	371.48
British Columbia	Boreal Cordillera	-2.31	535.18
	Boreal Plains	0.58	514.00
	Montane Cordillera	1.69	728.52
	Pacific Maritime	5.21	1995.12
	Taiga Plains	-1.09	485.72
Labrador[b]	Boreal Shield East	-1.10	1044.05
	Taiga Shield East	-1.86	1082.24
Manitoba	Boreal Plains	0.31	502.67
	Boreal Shield West	-1.05	521.38
	Hudson Plains[c]	-5.00	456.09
	Subhumid Prairies	2.04	499.44
	Taiga Shield West[c]	-6.10	445.25
New Brunswick	Atlantic Maritime	3.91	1134.25
Newfoundland[b]	Boreal Shield East	3.37	1292.01
Northwest Territories	Boreal Cordillera	-4.52	555.43
	Boreal Plains	-3.33	326.58
	Taiga Cordillera	-6.43	516.50
	Taiga Plains	-5.82	348.61
	Taiga Shield West	-6.80	284.14
Nova Scotia	Atlantic Maritime	5.86	1386.66
Nunavut	Hudson Plains[c]	-2.24	630.63
	Taiga Shield West[c]	-8.91	344.35
Ontario	Boreal Shield East	2.05	873.00
	Boreal Shield West	0.47	714.29
	Hudson Plains	-0.07	733.14
	Mixedwood Plains	6.32	916.06
Prince Edward Island	Atlantic Maritime	5.36	1122.47
Quebec	Atlantic Maritime	2.55	1120.47
	Boreal Shield East	0.36	995.29
	Hudson Plains[c]	-1.66	738.25
	Mixedwood Plains	5.08	1102.98
	Taiga Shield East[c]	-4.88	729.97
Saskatchewan	Boreal Plains	-0.13	462.48
	Boreal Shield West	-1.65	499.00
	Semiarid Prairies	2.55	386.54
	Subhumid Prairies	1.62	421.77
	Taiga Shield West[c]	-5.27	414.70
Yukon Territory	Boreal Cordillera	-4.46	419.31
	Pacific Maritime[c]	-9.17	724.06
	Taiga Cordillera	-6.70	488.43
	Taiga Plains	-2.37	503.34

[a]Values can be viewed or modified in the “Climate Editor” window (Figure 6-3) when a project is open. Unless otherwise indicated, MAT values represent 1961-1990 normals for managed forest areas within Canada. At this time, MAP values are not used in model calculations, and therefore will not have an impact on carbon results. All values are derived from McKenney et al. (2001).
[b]Split for programming reasons related to fire disturbance matrices.
[c]MAT and MAP values represent normals for the unmanaged forest.

APPENDIX 13

Canadian Forest Inventory (CanFI) codes for tree species

Appendix 13. Canadian Forest Inventory (CanFI) codes for tree species

Common name	Scientific name	CanFI code
Spruce	*Picea* spp.	100
Black spruce	*Picea mariana* (Mill.) BSP	101
Red spruce	*Picea rubens* Sarg.	102
Norway spruce	*Picea abies* (L.) Karst.	103
Engelmann spruce	*Picea engelmannii* Parry ex Engelm.	104
White spruce	*Picea glauca* (Moench) Voss	105
Sitka spruce	*Picea sitchensis* (Bong.) Carrière	106
Black and red spruce	*Picea mariana* (Mill.) BSP and *Picea rubens* Sarg.	107
Red and white spruce	*Picea rubens* Sarg. and *Picea glauca* (Moench) Voss	108
Other spruce	*Picea* spp.	109
Pine	*Pinus* spp.	200
Western white pine	*Pinus monticola* Dougl. ex D. Don	201
Eastern white pine	*Pinus strobus* L.	202
Jack pine	*Pinus banksiana* Lamb.	203
Lodgepole pine	*Pinus contorta* Dougl. ex Loud. var. *latifolia* Engelm.	204
Shore pine	*Pinus contorta* Dougl. ex Loud. var. *contorta*	205
Whitebark pine	*Pinus albicaulis* Engelm.	206
Austrian pine	*Pinus nigra* Arnold	207
Ponderosa pine	*Pinus ponderosa* Dougl. ex P. & C. Laws.	208
Red pine	*Pinus resinosa* Ait.	209
Pitch pine	*Pinus rigida* Mill.	210
Scots pine	*Pinus sylvestris* L.	211
Mugho pine	*Pinus mugo* Turra	212
Limber pine	*Pinus flexilis* James	213
Jack, lodgepole, and shore pine	*Pinus banksiana* Lamb., *Pinus contorta* Dougl. ex Loud. var. *latifolia* Engelm., and *Pinus contorta* Dougl. ex Loud. var. *contorta*	214
Other pine	*Pinus* spp.	215
Jack and lodgepole pine hybrid		216
Whitebark and limber pine		217
Fir	*Abies* spp.	300
Amabilis fir	*Abies amabilis* (Dougl. ex Loud.) Dougl. ex J. Forbes	301
Balsam fir	*Abies balsamea* (L.) Mill.	302
Grand fir	*Abies grandis* (Dougl. ex D. Don) Lindl.	303
Subalpine fir (or alpine fir)	*Abies lasiocarpa* (Hook.) Nutt.	304
Balsam and subalpine fir	*Abies balsamea* (L.) Mill. and *Abies lasiocarpa* (Hook.) Nutt.	305
Alpine, amabilis and grand fir	*Abies lasiocarpa*, *Abies amabilis,* and *Abies grandis*	306
Spruce and balsam fir	*Picea* spp. and *Abies balsamea* (L.) Mill.	320
Balsam fir and spruce	*Abies balsamea* (L.) Mill. and *Picea* spp.	321
Hemlock	*Tsuga* spp.	400
Eastern hemlock	*Tsuga canadensis* (L.) Carrière	401
Western hemlock	*Tsuga heterophylla* (Raf.) Sarg.	402
Mountain hemlock	*Tsuga mertensiana* (Bong.) Carrière	403

Appendix 13. Continued

Common name	Scientific name	CanFI code
Western and mountain hemlock	*Tsuga heterophylla* (Raf.) Sarg. and *Tsuga mertensiana* (Bong.) Carrière	404
Douglas-fir and Rocky Mountain Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii* and *Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco	500
Tamarack/larch	*Larix laricina* (Du Roi) K. Koch	600
European larch	*Larix decidua* Mill.	601
Tamarack	*Larix laricina* (Du Roi) K. Koch	602
Western larch	*Larix occidentalis* Nutt.	603
Subalpine larch	*Larix lyallii* Parl.	604
Japanese larch	*Larix kaempferi* (Lamb.) Carrière	605
Cedar	*Thuja* spp.	700
Eastern white-cedar	*Thuja occidentalis* L.	701
Western redcedar	*Thuja plicata* Donn ex D. Don	702
Cedar and other conifers	*Thuja* spp. (and other conifers)	703
Juniper	*Juniperus* spp.	800
Eastern redcedar	*Juniperus virginiana* L.	801
Rocky Mountain juniper	*Juniperus scopulorum* Sarg.	802
Yew	*Taxus* spp.	900
Western Yew	*Taxus brevifolia* Nutt.	901
Cypress	*Chamaecyparis* spp.	1000
Yellow-cypress	*Chamaecyparis nootkatensis* (D. Don) Spach	1001
Other softwoods		1100
Tamarack and cedar	*Larix* spp. and *Thuja* spp.	1110
Unspecified softwood species		1150
Poplar/aspen	*Populus* spp.	1200
Trembling aspen	*Populus tremuloides* Michx.	1201
European white poplar	*Populus alba* L.	1202
Balsam poplar	*Populus balsamifera* L.	1203
Black cottonwood	*Populus trichocarpa* Torr. & A. Gray	1204
Eastern cottonwood	*Populus deltoides* Bartr. ex. Marsh. ssp. *deltoides*	1205
Largetooth aspen	*Populus grandidentata* Michx.	1206
Carolina poplar	*Populus* x *canadensis* Moench cv. Eugenei	1207
Lombardy poplar	*Populus nigra* L. cv. Italica	1208
Hybrid poplar	*Populus* spp.	1209
Other poplar	*Populus* spp.	1210
Balsam poplar, largetooth aspen, and cottonwood		1211
Balsam poplar and black cottonwood		1212
Birch	*Betula* spp.	1300
Yellow birch	*Betula alleghaniensis* Britt.	1301
Cherry birch	*Betula lenta* L.	1302
White birch	*Betula papyrifera* Marsh.	1303
Gray birch	*Betula populifolia* Marsh.	1304

Appendix 13. Continued

Common name	Scientific name	CanFI code
Alaska paper birch	*Betula neoalaskana* Sarg.	1305
Mountain paper birch	*Betula cordifolia* Regel.	1306
Other birch	*Betula* spp.	1307
White birch and Alaskan white birch		1308
Maple	*Acer* spp.	1400
Sugar maple	*Acer saccharum* Marsh.	1401
Black maple	*Acer nigrum* Michx.	1402
Bigleaf maple	*Acer macrophyllum* Pursh	1403
Manitoba maple	*Acer negundo* L.	1404
Red maple	*Acer rubrum* L.	1405
Silver maple	*Acer saccharinum* L.	1406
Norway maple	*Acer platanoides* L.	1407
Sugar and black maple	*Acer saccharum* Marsh. and *Acer nigrum* Michx.	1408
Other maple	*Acer* spp.	1409
Striped maple	*Acer pensylvanicum* L.	1410
Mountain maple	*Acer spicatum* Lamb.	1411
Other hardwoods		1500
Unspecified hardwood species		1550
Hickory	*Carya* spp.	1600
Bitternut hickory	*Carya cordiformis* (Wangenh.) K. Koch	1601
Red hickory	*Carya glabra* (Mill.) Sweet var. *odorata* (Marsh.) Little	1602
Shagbark hickory	*Carya ovata* (Mill.) K. Koch	1603
Shellbark hickory	*Carya laciniosa* Michx. f.	1604
Walnut	*Juglans* spp.	1700
Butternut	*Juglans cinerea* L.	1701
Black walnut	*Juglans nigra* L.	1702
Alder	*Alnus* spp.	1800
Sitka alder	*Alnus viridis* ssp. *sinuata* (Regel) Á. Löve & D. Löve	1801
Red alder	*Alnus rubra* Bong.	1802
Ironwood	*Ostrya virginiana* (Mill.) K. Koch	1900
Blue-beech	*Carpinus caroliniana* Walt.	1950
Beech	*Fagus grandifolia*	2000
Oak	*Quercus* spp.	2100
White oak	*Quercus alba* L.	2101
Swamp white oak	*Quercus bicolor* Willd.	2102
Garry oak	*Quercus garryana* Dougl.	2103
Bur oak	*Quercus macrocarpa* Michx.	2104
Pin oak	*Quercus palustris* Muenchh.	2105
Chinquapin oak	*Quercus muehlenbergii* Engelm.	2106
Chestnut oak	*Quercus montana* Willd.	2107
Red oak	*Quercus rubra* L.	2108

Appendix 13. Continued

Common name	Scientific name	CanFI code
Black oak	*Quercus velutina* Lam.	2109
Northern pin oak	*Quercus ellipsoidalis* E.J. Hill	2110
Shumard oak	*Quercus shumardii* Buckl.	2111
Elm	*Ulmus* spp.	2200
White elm	*Ulmus americana* L.	2201
Slippery elm	*Ulmus rubra* Muhl.	2202
Rock elm	*Ulmus thomasii* Sarg.	2203
Mulberry	*Morus* spp.	2300
Tulip-tree	*Liriodendron tulipifera* L.	2400
Cucumber-tree	*Magnolia acuminata* L.	2500
Sassafras	*Sassafras albidum* (Nutt.) Nees	2600
Sycamore	*Platanus occidentalis* L.	2700
Cherry	*Prunus* spp.	2800
Black cherry	*Prunus serotina* Ehrh.	2801
Pin cherry	*Prunus pensylvanica* L. f.	2802
Bitter cherry	*Prunus emarginata* Dougl.	2803
Choke cherry	*Prunus virginiana* L. var. *virginiana*	2804
Honey-locust	*Gleditsia triacanthos* L.	2900
Basswood	*Tilia americana* L.	3000
Black-gum	*Nyssa sylvatica* Marsh.	3100
Flowering dogwood	*Cornus* spp.	3200
Eastern flowering dogwood	*Cornus florida* L.	3201
Western flowering dogwood	*Cornus nuttallii* Audub.	3202
Alternate-leaf dogwood	*Cornus alternifolia* L. f.	3203
Arbutus	*Arbutus menziesii* Pursh	3300
Ash	*Fraxinus* spp.	3400
White ash	*Fraxinus americana* L.	3401
Black ash	*Fraxinus nigra* Marsh.	3402
Red ash	*Fraxinus pennsylvanica* Marsh.	3403
Northern red ash	*Fraxinus pennsylvanica* var. *austini* Fern.	3404
Green ash	*Fraxinus pennsylvanica* var. *subintegerrima* (Vahl) Fern.	3405
Blue ash	*Fraxinus quadrangulata* Michx.	3406
Oregon ash	*Fraxinus latifolia* Benth.	3407
Pumpkin ash	*Fraxinus profunda* (Bush) Bush	3408
Willow	*Salix* spp.	3500
Black willow	*Salix nigra* Marsh.	3501
Peachleaf willow	*Salix amygdaloides* Andersson	3502
Pacific willow	*Salix lucida* ssp. *Lasiandra* (Benth.) E. Murr.	3503
Crack willow	*Salix fragilis* L.	3504
Shining willow	*Salix lucida* Muhl. ssp. *lucida*	3505
Kentucky coffee tree	*Gymnocladus dioicus* (L.) K. Koch	3600
Hackberry	*Celtis occidentalis* L.	3700
Serviceberry	*Amelachier* spp.	3800

Appendix 13. Concluded

Common name	Scientific name	CanFI code
Beaked hazel	*Corylus cornuta* Marsh.	3900
Hawthorn	*Crataegus* spp.	3910
Common winterberry	*Ilex verticillata* (L.) A. Gray	3920
Apple	*Malus* spp.	3930
Mountain-holly	*Nemopanthus mucronatus* (L.) Trel.	3940
Staghorn sumac	*Rhus typhina* L.	3950
Mountain ash	*Sorbus* spp.	3960
Tolerant hardwoods		4000
Upland hardwoods other than sugar maple		4500
Intolerant hardwoods		5000
Other broadleaved species		5500
Spruce - Genus type		5500
Pine - Genus type		5500
Fir - Genus type		5500
Hemlock - Genus type		5500
Douglas-fir - Genus type		5500
Larch - Genus type		5500
Cedars and other conifers - Genus		5500
Unspecified conifers		5500
Poplar - Genus type		5500
Birch - Genus type		5500
Maple - Genus type		5500
Lowland hardwoods (silver and red maple, white elm)		5500
Unspecified broadleaved species - Genus type		5500
Softwood forest type		5500
Hardwood forest type		5500

APPENDIX 14

Guidance for application of CBM-CFS3 eastern spruce budworm disturbance types and matrices in Quebec, Alberta, the Northwest Territories, Saskatchewan, and Manitoba

Introduction

Between 2005 and 2018, the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) contained disturbance types and associated disturbance matrices that had been developed for specific Canadian Forest Service research projects to represent different impacts of eastern spruce budworm (*Choristoneura fumiferana* (Clem.)). These disturbance types and disturbance matrices were removed from the model in 2018, with a plan to replace them with new versions developed for Canada's National Inventory Reporting. The need to represent eastern spruce budworm (SBW) in the CBM-CFS3 for national inventory reporting work spurred the development of the new SBW disturbance types and matrices now in the model, for application not only in Quebec (QC) but also in Alberta (AB), Saskatchewan (SK), Manitoba (MB), and the Northwest Territories (NT). A time series of SBW disturbance polygon data (classified by percent annual defoliation) for the years and area(s) of interest is a prerequisite for applying the new disturbance types.

Background

Eastern spruce budworm is a native defoliator of North American conifer forests that targets balsam fir (*Abies balsamea* (L.) Mill.), white spruce (*Picea glauca* (Moench) Voss.), red spruce (*Picea rubens* Sarg.), and black spruce (*Picea mariana* (Mill.) BSP). Its impacts include defoliation, reduced tree growth, and tree mortality (Gray and MacKinnon 2006; Gray et al. 2000). Erdle et al. (1999) provided a quantitative characterization of the impacts of spruce budworm defoliation on forests in eastern Canada that is the basis for all new SBW disturbance types. They reported that the percent reduction in growth rates is equal to the percent cumulative defoliation over several years (CDt) independent of the host tree species, and that tree survival is dependent on CDt, species, and age class.

The new SBW disturbance types in the CBM-CFS3 capture the defoliation, mortality, and growth reduction impacts of SBW. To identify the population of inventory records that contain the appropriate host species for a given disturbance event, CBM-CFS3 users create classifier sets that select records with the appropriate species and then associate those classifier sets with each disturbance event. Defoliation and tree mortality impacts are represented by the transfer parameters of the disturbance matrix associated with each disturbance type for an event, while growth reduction impacts are represented by associating appropriate growth reduction multipliers with each disturbance event.

Application

To apply the new SBW disturbance types, CBM-CFS3 users need to first calculate a cumulative defoliation index CDt for all affected areas in their SBW disturbances dataset. Cumulative defoliation is defined by the following equation (MacLean et al. 2001):

$$CD_t = 0.28D_t + 0.26D_{t-1} + 0.22D_{t-2} + 0..13D_{t-3} + 0.08D_{t-4} + 0.03D_{t-5}$$

where CD_t is cumulative defoliation percentage in year t and D_{t-x} is annual defoliation percentage in year t-x.

Provincial and territorial aerial forest health surveys typically provide spatially explicit polygons delineating areas of SBW defoliation, each assigned to an annual defoliation rate class (e.g., Table A14-1 for QC and Table A14-2 for the NT, AB, SK, and MB). The mid-point of the defoliation rate class provides a Dt value for each polygon that can be used to develop CDt values. The annual disturbance polygons are then stacked and intersected over a backward-looking 5-year period to enable calculation of CDt for each resultant polygon. The resultant "cumulative defoliation" polygons for each year in the time series are then overlaid with planning unit polygons to create a time series of annual disturbance events for CBM-CFS3. The values of Dt and CDt associated with each disturbance event are used to assign the appropriate disturbance type from Table A14- 3 (for QC) or Table A14-4 (for AB, SK, MB, or the NT) for the appropriate simulation time steps in the user's CBM-CFS3 project import files.

Table A14-1. Eastern spruce budworm defoliation classes by estimated percent range of defoliation and percent annual defoliation from the Government of Quebec's aerial survey program.

Defoliation class	Range of defoliation (%)	Annual defoliation (Dt) (%)
L (light)	1-34	17.5
M (moderate)	35-69	52
S (severe)	70-100	85

Table A14-2. Eastern spruce budworm defoliation classes by estimated percent range of defoliation and percent annual defoliation based on mapping systems for the Northwest Territories (NT) and for Alberta (AB), Saskatchewan (SK), and Manitoba (MB)

Defoliation class	NT		AB, SK, MB	
	Range of defoliation (%)	Annual defoliation (Dt) (%)	Range of defoliation (%)	Annual defoliation (Dt) (%)
L (light)	1-29	15	1-34	17.5
M (moderate)	30-49	39.5	35-69	52
S (severe)	50-100	75	70-100	85

The fundamental difference between the SBW disturbance types in Table A14-3 and Table A14-4 is the relative proportions of fir and spruce host species that were used to calculate the mortality impacts captured in the associated disturbance matrices. The SBW disturbance types and associated matrices listed in Table A14-3 assume 30% fir and 70% spruce, whereas the disturbance types and associated matrices in Table A14-4 assume 100% spruce (see Tables A14-5 and A14-6 for more background information on 5-year survival and mortality rates for each province and territory).

If a CBM-CFS3 user wants to use different region-specific tree mortality rates as a function of age class, species mix, and cumulative defoliation, they will need to modify the default SBW disturbance matrices in the CBM-CFS3 or create their own.

Methods to apply CBM-CFS3 eastern spruce budworm disturbance types

A CBM-CFS3 user who wants to model past SBW disturbances must obtain aerial survey polygon data for the year(s) of interest from the province or territory of interest (QC data are available here: https://www.donneesquebec.ca/recherche/fr/dataset/donnees-sur-les-perturbations-naturelles-insecte-tordeuse-des-bourgeons-de-lepinette). These data should be overlain with planning unit polygons or stands, then stacked and intersected over a backward-looking 5-year period to enable calculation of CDt for each resultant stand or polygon. With this, a proper SBW disturbance type from Table A14-3 (for QC) or Table A14-4 (for AB, SK, MB, or the NT) can be assigned to the related SBW disturbance event records for the appropriate simulation time steps, in the user's CBM-CFS3 project import files.

A CBM-CFS3 user who wants to model future SBW disturbances will need to develop their own time series of future SBW disturbance polygons and then, as previously described, estimate a value of CDt for each polygon or stand that they expect will be affected. After this, they will need to assign a disturbance type to each polygon or stand according to Table A14-3 (QC) or Table A14-4 (AB, SK, MB, or the NT). Once this work is complete, the user can set up SBW disturbance events in their CBM-CFS3 import files targeting the appropriate polygons or stands with the appropriate SBW disturbance types in the appropriate time step(s) of their planned projected simulation period.

Table A14-3. CBM-CFS3 eastern spruce budworm disturbance type assignment for Quebec, based on the percentage of annual and cumulative defoliation.

Annual defoliation (Dt)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Severe (85% defoliation)	> 85	240	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation >85%	0.935	427	0.150808
	76-85	241	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 76–85%	0.8	428	0.076917
	66-75	242	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 66–75%	0.7	429	0.038024
	56-65	243	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 56–65%	0.6	430	0.019247
	46-55	244	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 46–55%	0.5	431	0.012593

Table A14-3. Continued

Annual defoliation (Dt)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Severe (85% defoliation)	36-45	245	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 36–45%	0.4	432	0.007306
	26-35	246	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 26–35%	0.3	433	0
	16-25	247	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation 16–25%	0.2	433	0
	< 16	248	Spruce Budworm in QC, Severe annual defoliation, 6yr cumulative defoliation <16%	0.075	433	0
Moderate (52% defoliation)	> 85	249	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation >85%	0.935	434	0.150808
	76-85	250	Spruce Budworm in C, Moderate annual defoliation, 6yr cumulative defoliation 76–85%	0.8	435	0.076917

Table A14-3. Continued

Annual defoliation (Dt)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Moderate (52% defoliation)	66-75	251	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 66–75%	0.7	436	0.038024
	56-65	252	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 56–65%	0.6	437	0.019247
	46-55	253	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 46–55%	0.5	438	0.012593
	36-45	254	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 36–45%	0.4	439	0.007306
	26-35	255	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 26–35%	0.3	440	0
	16-25	256	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation 16–25%	0.2	440	0

Table A14-3. Continued

Annual defoliation (Dt)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Moderate (52% defoliation)	< 16	257	Spruce Budworm in QC, Moderate annual defoliation, 6yr cumulative defoliation <16%	0.075	440	0
Light (17.5% defoliation)	> 85	258	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation >85%	0.935	441	0.150808
	76-85	259	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 76–85%	0.8	442	0.076917
	66-75	260	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 66–75%	0.7	443	0.038024
	56-65	261	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 56–65%	0.6	444	0.019247
	46-55	262	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 46–55%	0.5	445	0.012593

Table A14-3. Concluded

Annual defoliation (Dt)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Light (17.5% defoliation)	36-45	263	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 36–45%	0.4	446	0.007306
	26-35	264	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 26–35%	0.3	447	0
	16-25	265	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation 16–25%	0.2	447	0
	< 16	266	Spruce Budworm in QC, Light annual defoliation, 6yr cumulative defoliation <16%	0.075	447	0

Table A14-4. CBM-CFS3 eastern spruce budworm disturbance type assignment for Alberta (AB), Saskatchewan (SK), Manitoba (MB), and the Northwest Territories (NT), based on the percentage of annual and cumulative defoliation

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Severe (75% defoliation for NT, 85% defoliation for AB, SK, and MB)	> 85	280	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation >85%	0.935	460	0.13438
	76-85	281	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 76–85%	0.8	461	0.06992
	66-75	282	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 66–75%	0.7	462	0.03017
	56-65	283	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 56–65%	0.6	463	0.01526
	46-55	284	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 46–55%	0.5	464	0.01021

Table A14-4. Continued

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Severe (75% defoliation for NT, 85% defoliation for AB, SK, and MB)	36-45	285	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 36–45%	0.4	465	0.00607
	25-36	286	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 26–35%	0.3	466	0
	16-25	287	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation 16–25%	0.2	466	0
	< 16	288	Spruce Budworm in AB, SK, MB, NWT, Severe annual defoliation, 6yr cumulative defoliation <16%	0.075	466	0
Moderate (39.5% defoliation for NT, 52% defoliation for AB, SK, and MB)	> 85	289	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation >85%	0.935	467	0.13438

Table A14-4. Continued

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Moderate (39.5% defoliation for NT, 52% defoliation for AB, SK, and MB)	76-85	290	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 76–85%	0.8	468	0.06992
	66-75	291	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 66–75%	0.7	469	0.03017
	56-65	292	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 56–65%	0.6	470	0.01526
	46-55	293	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 46–55%	0.5	471	0.01021
	36-45	294	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 36–45%	0.4	472	0.00607

Table A14-4. Continued

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Moderate (39.5% defoliation for NT, 52% defoliation for AB, SK, and MB)	26-35	295	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 26–35%	0.3	473	0
	16-25	296	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation 16–25%	0.2	473	0
	< 16	297	Spruce Budworm in AB, SK, MB, NWT, Moderate annual defoliation, 6yr cumulative defoliation <16%	0.075	473	0
Light (15% defoliation for NT, 17.5% defoliation for AB, MB, and SK)	> 85	298	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation >85%	0.935	474	0.13438
	76-85	299	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 76–85%	0.8	475	0.06992

Table A14-4. Continued

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Light (15% defoliation for NT, 17.5% defoliation for AB, MB, and SK)	66-75	300	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 66–75%	0.7	476	0.03017
	56-65	301	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 56–65%	0.6	477	0.01526
	46-55	302	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 46–55%	0.5	478	0.01021
	36-45	303	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 36–45%	0.4	479	0.00607
	26-35	304	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 26–35%	0.3	480	0

Table A14-4. Concluded

Annual defoliation (D_t)	Cumulative defoliation (CD_t) (%)	CBM-CFS3 disturbance type ID	CBM-CFS3 disturbance name	Growth reduction (fraction)	CBM-CFS3 disturbance matrix ID	Mortality (fraction)
Light (15% defoliation for NT, 17.5% defoliation for AB, MB, and SK)	16-25	305	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation 16–25%	0.2	481	0
	< 16	306	Spruce Budworm in AB, SK, MB, NWT, Light annual defoliation, 6yr cumulative defoliation <16%	0.075	480	0

Background on 5-year survival and mortality rates for provinces and a territory

The mortality impacts reported by Erdle et al. (1999) require simplification because provincial forest health monitoring data do not provide information on host species or age class of the affected trees. As such, for each province and territory, a species-weighted average of their 5-year survival rates across all age classes was calculated using the average species mix of managed forests (30% balsam fir, 70% spruce in QC; 100% spruce in AB, SK, MB, and the NT), and the resulting 5-year survival rates were converted to annual mortality rates using the following relationship (since the CBM-CFS3 works with annual time steps and mortality rates):

$$\text{Annual mortality fraction} = 1 - (\text{5-yr survival fraction})^{1/5}$$

The resulting annual mortality rates are summarized in Table A14-5 for QC and in Table A14-6 for AB, SK, MB, and the NT. The potential combinations of three annual defoliation rate classes and nine cumulative defoliation rate classes result in 27 potential disturbance types and 21 potential disturbance matrices for QC (Table A14-3), and for AB, SK, MB, and the NT (Table A14-4).

Table A14-5. Five-year survival and annual mortality rates by cumulative defoliation class range and cumulative defoliation class for eastern spruce budworm.

Measure	Cumulative defoliation class range (%)								
	<16	16-25	26-35	36-45	46-55	56-65	66-75	76-85	>85
	Cumulative defoliation class (midpoint %)								
	10	20	30	40	50	60	70	80	90
Species – weighted avg. 5-yr survival (%)	100	100	100	96.4	93.86	90.74	82.38	67.02	44.16
Species – weighted avg. 1-yr mortality (%)	0.000	0.000	0.000	0.731	1.259	1.925	3.802	7.692	15.081

Table A14-6. Five-year survival and annual mortality rates by cumulative defoliation class range for eastern spruce budworm in Alberta (AB), Saskatchewan (SK), Manitoba (MB), and the Northwest Territories (NT).

Region	Measure	Cumulative defoliation class range (%)								
		<16	16-25	26-35	36-45	46-55	56-65	66-75	76-85	>85
AB, SK, MB, and NT	Species-weighted average 5-year survival (%)	100	100	100	97	95	92.6	85.8	69.6	48.6
	Annual mortality (%)	0	0	0	0.6	1.0	1.5	3.0	7.0	13.4

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APPENDIX 15

Glossary

Administrative boundary – A Canadian provincial or territorial boundary.

Afforestation – The conversion of land that has not been forested for a certain period of time (50 years in the Kyoto Protocol) to forested land through human activities such as planting and seeding.

Archive Index Database – A CBM-CFS3 database that tracks the relations between model input and the simulation results databases (i.e., projects and their results) that the user has created.

Assumption composers – CBM-CFS3 tools that allow the user to view, edit, copy, delete, or create assumptions for simulations, stand initialization, model runs, disturbance and management activities, growth and yield, climate, biomass turnover, DOM turnover, disturbance matrices, or volume-to-biomass parameters.

Biomass – The mass of living forest vegetation represented in the CBM-CFS3. Forest vegetation includes trees of merchantable size, and below merchantable size, broken down by components: merchantable stemwood, foliage, coarse and fine roots, and other (treetops, stumps, and trees of submerchantable size).

Biomass-to-carbon parameters – Editable parameters in the CBM-CFS3 for the conversion of biomass to carbon, linked to a Volume-to-Biomass Assumption in the Volume-to-Biomass Assumption Composer.

Biomass Turnover Assumption – A CBM-CFS3 model assumption containing specific biomass turnover parameters for softwood and hardwood species that can be linked to one or more Stand Initialization or CBM Run Assumptions.

Biomass turnover parameters – Editable parameters in the CBM-CFS3 for biomass turnover by tree species, linked to a Biomass Turnover Assumption in the Biomass Turnover Assumption Composer.

CanFI 2001 – The 2001 version of the Canadian Forest Inventory.

Carbon cycle – The term used to describe the flow of carbon through a system. The forest carbon cycle refers to the flow of carbon through a forest ecosystem. The global carbon cycle refers to the flow of carbon through the earth's atmosphere, oceans, forests, and other terrestrial ecosystems.

Carbon dioxide (CO_2) – A naturally occurring gas that is also a by-product of burning fossil fuels, burning biomass, changes in land use, and other industrial processes. It is the principal greenhouse gas emitted as a result of human activities.

Carbon flux – The transfer of carbon from one carbon pool to another.

Carbon pool – A system component with the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and the atmosphere.

Carbon sequestration – The process of removing carbon from the atmosphere.

Carbon sink – A carbon pool that is increasing in size. A carbon pool can be a sink for atmospheric carbon if, during a given time interval, more carbon is flowing into it than out of it.

Carbon source – A carbon pool that is decreasing in size. A carbon pool can be a source for atmospheric carbon if, during a given time interval, more carbon is flowing out of it than into it.

Carbon stock – The absolute quantity of carbon held within a pool at a specified time.

CBM-CFS2 – The research version of the Carbon Budget Model of the Canadian Forest Sector.

CBM-CFS3 – The operational-scale version of the Carbon Budget Model of the Canadian Forest Sector.

CBM Run Assumption – A CBM-CFS3 model assumption that combines Disturbance and Management, Run Growth, Disturbance Multipliers, Growth Multipliers, Climate, Volume-to-Biomass, Biomass

Turnover, DOM Turnover, and Run Disturbance Matrix Assumptions to define modeled forest ecosystem carbon dynamics that generate carbon pools.

CBM Standard Import Tool – A CBM-CFS3 data import tool used to import seven text or Microsoft Excel data files with specialized formats as outlined in the CBM-CFS3 User's Guide.

Climate – The prevailing environmental conditions resulting from the interactions of wind, water, and temperature.

Climate change – A statistically significant variation in either the average state of the climate or its variability, persisting for an extended period of time (decades or longer).

Climate Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or add climate data for a project.

Connected project – A CBM-CFS3 project that has been connected to the Archive Index Database.

Data editors – CBM-CFS3 tools that allow the user to view, edit, or create data for climate, disturbance and management activities, disturbance matrices, growth and yield, inventory, and transition rules.

Dead organic matter (DOM) – A generic term for all dead organic compounds in the ecosystem, including standing dead trees, downed trees, coarse and fine woody debris, litter, soil carbon, and peat.

Default Input Data Editor – A CBM-CFS3 data editor that allows the user to view, edit, copy, or add default data about species or disturbance types to a project.

Deforestation – The conversion of forested land to nonforested land as a direct result of human activities.

Disconnected project – A CBM-CFS3 project not created with and thus not connected to the Archive Index Database of a particular running copy of the CBM-CFS3.

Disturbance and Management Assumption – A CBM-CFS3 model assumption containing one or more Disturbance Group Assumptions that can be linked to one or more CBM Run Assumptions.

Disturbance event – A managed or natural event resulting in the alteration of an existing forest type, which establishes a pattern for the future development of the forest type.

Disturbance Events Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or add data for a single disturbance event in a project.

Disturbance Group Assumption – An assumption component of a Disturbance and Management Assumption linking a Transition Rule Assumption, spatial unit, and disturbance type.

Disturbance matrix – A matrix defining the proportion of each biomass and DOM pool that is transferred to other pools, the atmosphere, and the forest product sector at the time of a disturbance, according to disturbance type and terrestrial ecozone.

Disturbance Matrix Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or add data to a specific disturbance matrix for a project.

Disturbance Multipliers Assumption – A CBM-CFS3 model assumption containing one or more disturbance groups, each associated with a default multiplier (value of 1) or a user-defined disturbance multiplier, which can be linked to one or more CBM Run Assumptions.

Disturbance Rules Generator – Part of the Disturbance Events Editor that allows the user to add multiple disturbance events of the same type to a sequence of time steps.

DOM Assumption – A CBM-CFS3 model assumption containing specific DOM turnover parameters and DOM parameters that can be linked to one or more Stand Initialization or CBM Run Assumptions.

DOM parameters – Editable parameters for DOM by soil pool, linked to a DOM Assumption in the DOM Assumption Composer.

DOM turnover parameters – Editable parameters for DOM turnover by ecological boundary, linked to a DOM Assumption in the DOM Assumption Composer.

Ecological boundary – A Canadian terrestrial ecozone.

Forest – A vegetation type dominated by trees. Many definitions of the term "forest" are used throughout the world, but for the purposes of the Kyoto Protocol, a nation must define a forest as any land area covering at least 0.05–1.0 ha that has at least 10–30% tree crown cover and trees with the potential to reach 2–5 m height at maturity.

Forest stand – A community of trees, including aboveground and belowground biomass and soils, uniform in species composition, age, and management type.

Forest Inventory Definitions – A CBM-CFS3 tool that allows the user to view and edit imported data for their forest types, classifiers, disturbance types, spatial units and boundaries, and age classes.

Geographic information system – A computer-based system that allows the user to input, store, retrieve, manipulate, analyze, and output georeferenced data.

Greenhouse gases – Those gaseous constituents, both natural and anthropogenic, of the earth's atmosphere that absorb infrared radiation emitted from the earth's surface, the atmosphere, and clouds. By absorbing infrared radiation, these gases trap energy in the earth's atmosphere and cause the greenhouse effect, the trapping of heat in the lower atmosphere, and influence the global climate. Water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are the primary greenhouse gases in the earth's atmosphere.

Growth Curve Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or create growth and yield data for a project.

Growth Multipliers Assumption – A CBM-CFS3 model assumption defining the relation between groups of growth curves and growth increment multipliers (for which the default value = 1), which can be linked to one or more Stand Initialization or CBM Run Assumptions.

Historic Disturbance Types Assumption – A CBM-CFS3 model assumption containing one or more disturbance groups, each associated with a default or user-defined historic and "last-pass" disturbance type, which can be linked to one or more Stand Initialization Assumptions.

Historic Growth Curves Assumption – A CBM-CFS3 model assumption containing one or more growth curve groups, each associated with default or user-defined historic and "last-pass" growth curves, which can be linked to one or more Stand Initialization Assumptions.

Indicator – An ecological or socioeconomic criterion related to forests and forest management planning that can be identified, measured, and managed.

Individual Disturbance Events Editor – Part of the Disturbance Events Editor, which allows the user to view, edit, delete, or add data for a single disturbance event in a project.

Input Database – A CBM-CFS3 database where imported data are stored.

Invalid project – A CBM-CFS3 project that has become disconnected from the Archive Index Database because of an error in the project file.

Inventory Definition Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or create age class, species type, classifier, disturbance type, forest type, spatial unit, and boundary data for imported project data.

Inventory Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or create inventory data for a project.

Land cover – The observed physical and biological cover of the land as vegetation or man-made features.

Land-use change – A change in the use or management of land by humans, which may lead to a change in land cover.

Mitigation – A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Nonforest Initialization Assumption – A CBM-CFS3 model assumption containing one or more nonforest inventory groups, each associated with default or user-defined DOM carbon pool values, biomass carbon pool values, and UNFCCC flags, which can be linked to one or more Stand Initialization Assumptions.

Postdisturbance Forest Type – The forest type created as a result of a specific disturbance type disturbing a Target Forest Type, as defined in a transition rule.

Project Manager – A CBM-CFS3 tool used to create, open, copy, delete, validate, locate, connect, or disconnect projects.

Reforestation – The conversion of nonforested land to forested land through human activities, on land that was previously forested but was converted to nonforested land at some point.

Results Explorer – A CBM-CFS3 tool used to view and export results for one or more processed simulation assumptions attached to a project.

Run Climate Assumption – A CBM-CFS3 model assumption containing an SPU Group Climate Assumption linked to specific climate data, which can be linked to one or more Stand Initialization or CBM Run Assumptions.

Run Disturbance Matrix Assumption – A CBM-CFS3 model assumption containing one or more SPU Group Disturbance Matrix Assumptions, each linked to a specific disturbance matrix, which can be linked to one or more Stand Initialization or CBM Run Assumptions.

Run Growth Assumption – A CBM-CFS3 model assumption containing an SPU Group Growth Assumption linked to one or more growth curves, which can be linked to one or more Stand Initialization or CBM Run Assumptions.

Simulation Assumption – A CBM-CFS3 model assumption that can be run in the Simulation Scheduler, which combines a Stand Initialization Assumption and a CBM Run Assumption to define modeled forest ecosystem carbon dynamics, which generate carbon pools.

Simulation Results Database – A CBM-CFS3 database named after a processed simulation assumption, where results are stored.

Simulation Scheduler – A CBM-CFS3 tool used to select and run one or more simulation assumptions.

Soil carbon – Carbon in soil, including various forms of organic and inorganic soil carbon and charcoal but excluding soil biomass, such as roots and living organisms.

Spatial unit – A forest management area defined by an administrative and an ecological boundary.

SPU Group – A spatial unit with an applied administrative and ecological boundary defined by the user.

SPU Group Climate Assumption – A CBM-CFS3 model assumption linked to specific climate data, which can be linked to one or more Run Climate Assumptions in the Climate Assumption Composer.

SPU Group Disturbance Matrix Assumption – A component assumption of a Run Disturbance Matrix Assumption in the Disturbance Matrix Assumption Composer, which links a specific disturbance matrix, SPU group, and disturbance type.

SPU Group Growth Assumption – A component assumption of a Run Growth Assumption linking an SPU group and growth and yield curves.

Stand Initialization Assumption – A CBM-CFS3 model assumption that combines Run Growth, Growth Multipliers, Climate, Volume-to-Biomass, Biomass Turnover, DOM Turnover, Run Disturbance Matrix, Historic Disturbances Types, Historic Growth Curves, and Nonforest Initialization Assumptions to define how the model should generate initial soil carbon pools.

Stand-Level Project Creator – A CBM-CFS3 project creation tool used to create a project with one or more stands from manual user input.

Target Forest Type – The initial forest type as defined in a transition rule or disturbance event.

Transition age range – The age classes between and including a beginning and ending age class in which a forest type is eligible to be affected by a specific disturbance type.

Transition rule – A rule defining what the resulting forest type(s), reset age class, regeneration delay, management type, and proportion will be for a specific forest type following a specific disturbance event.

Transition Rule Assumption – An assumption component of a Disturbance Group Assumption linking a transition rule to a spatial unit, disturbance type, and forest type.

Transition Rules Editor – A CBM-CFS3 data editor that allows the user to view, edit, delete, or create transition rules for a particular combination of disturbance event and forest type.

Template – Created by a CBM-CFS3 user during import of data with an import tool, it stores predefined rules about importing, parsing, and converting the user's data, and can be used again to import more data into the same project.

View Editor – A CBM-CFS3 tool used for creating and editing results views in the Results Explorer.

Volume-to-Biomass Assumption – A CBM-CFS3 model assumption containing specific volume-to-biomass parameters and biomass-to-carbon parameters that can be linked to one or more Stand Initialization or CBM Run Assumptions.

Volume-to-biomass parameters – Editable parameters in the CBM-CFS3 for the conversion of volume to biomass by spatial unit and soil pool, linked to a Volume-to-Biomass Assumption in the Volume-to-Biomass Assumption Composer.