What is the Watershed Evaluation of Beneficial Management Practices?

A long-term research program initiated by Agriculture and Agri-Food Canada in 2004, the Watershed Evaluation of Beneficial Management Practices (WEBs) evaluates the economic and environmental performance of BMPs at a small watershed scale. To gain a regional perspective, this information is being scaled up to larger watershed areas using hydrologic models.

WEBs findings are helping researchers and agri-environmental policy and programming experts to understand how BMPs perform and interact with land and water. This knowledge will also help producers determine which BMPs are best for their operations and regions.

WEBs studies are conducted at nine watershed sites across Canada. These outdoor living laboratories bring together a wide range of experts from various government, academic, watershed and producer groups. Many valuable findings have emerged and research continues at all sites.

Table 1: Type and description of BMPs studied within WEBs

Type of BMP	BMP description
Riparian	Cattle exclusion fencing and off-stream watering
	Off-stream watering without fencing
	Riparian vegetation management
In-field	Nutrient input / management
	Tillage / crop residue management
	Crop rotation
	Perennial cover
	Reduced herbicide use
	Winter bale-grazing
	Irrigation efficiency
Runoff/ discharge	Diversion terraces and grassed waterways
	Surface runoff control measures
	Buffer strips
	Farmyard runoff management
	Runoff retention pond
	Small reservoirs
	Wetland restoration
	Controlled tile drainage

Insights gained

On-farm costs and benefits

Based on WEBs findings to date, most of the BMPs evaluated appear to require significant investment to implement and/or may increase operational costs through ongoing maintenance. These costs may be offset through some on-farm financial benefits.

Structural BMPs such as fencing, off-stream livestock watering, holding ponds to capture runoff from a cattle containment area or diversion terraces involve potentially large upfront investments. Management BMPs such as nutrient management and crop rotations may also have annual operational costs.

About 75 percent of the BMPs tested in WEBs provide some on-farm benefits, which may partially offset the cost of BMP implementation. For example, cattle exclusion fencing with off-stream watering may increase pasture utilization while providing high quality water to cattle, thus encouraging them to drink and eat more. Research elsewhere has shown that this can result in increased weight gains and financial returns for beef cattle.

Because the net change to farm income from implementing many BMPs remains uncertain, WEBs economists continue to study on-farm benefits.

One example of an evaluation of the economic impact of BMPs is a WEBs cattle-exclusion fencing study in British Columbia. The practice of excluding cattle from the river provided some environmental benefits but was found to be costly for local producers to implement and maintain (see Case study 1).

Public good

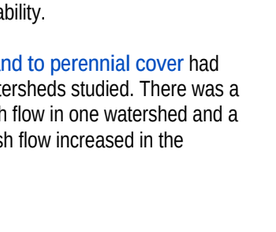
More than half of the BMPs evaluated for environmental impact have shown a reduction in contaminant loading to downstream surface waters. WEBs economists are working to evaluate these potential public benefits.

Within WEBs, combined economic and biophysical modelling is being used to help predict which BMPs might provide effective environmental protection in a watershed for the least cost. For example, WEBs results and other studies indicate that it may be most efficient to target certain BMPs to specific areas of a watershed to maximize water quality improvements.

Case study 1
Salmon River Watershed
Environmental benefits, high costs

A study at the Salmon River Watershed near Kamloops, British Columbia found that cattle exclusion fencing of a riparian area resulted in a significant reduction in *E. coli* and fine sediment contamination. Fencing also had a positive impact on other environmental indicators such as riparian vegetation and aquatic invertebrates. Yet the study found no marked improvement in stream water chemistry in terms of reduced loadings of nutrients such as nitrogen and phosphorus.

Economic analysis indicated that the local ranching industry was struggling financially at the time and likely unable to finance the high investment cost ($6,000/km) and/or provide the ongoing maintenance required of cattle-exclusion fencing. Under such circumstances, the widespread adoption of this BMP in the Salmon River Watershed may require financial or regulatory incentives.



Cross-watershed comparisons

Some BMPs are being studied in three or more WEBs watersheds. Despite differences in BMP design and landscape conditions, a comparison of the economics of these BMPs reveals some similarities but also significant differences. These varying results can help economists determine the driving factors affecting economic performance.

- Cattle exclusion fencing is being studied adjacent to riparian areas in four watersheds. Economics results are similar in all four watersheds and indicate that, although there may be some on-farm benefits in terms of increased cattle productivity, these are unlikely to fully offset installation costs in the short term.
- Manure/nutrient management BMPs applied in three watersheds were found to be unprofitable. In two watersheds using data for local cattle manure or hog slurry, estimated net income was reduced because of high manure transportation and application costs. In the third watershed, hydrologic modelling estimates indicate that where chemical fertilizer was reduced, farm income was also reduced due to yield losses caused by lower nutrient availability.
- Conversion of annual cropland to perennial cover had varying results in the three watersheds studied. There was a slight reduction in on-farm cash flow in one watershed and a large reduction in another. Cash flow increased in the third watershed.

Application of WEBs economics findings

The success of stewardship initiatives designed to minimize agriculture's impact on water quality is dependent upon both the willingness of agricultural producers to adopt BMPs and on their capacity to pay for them over the long run. WEBs economics research provides producers with credible information on the on-farm costs and benefits of implementing and maintaining BMPs. Producers can use this information when making decisions about BMP adoption, and government and other agencies interested in sustainable agriculture can use it in the development of policies and programs (see Case study 2).

Case study 2
South Nation Watershed
Contributing to policy and program decision making

WEBs economic research can help decision makers determine the merit of financial, regulatory or other incentives to enhance BMP adoption. For example, WEBs research in Ontario's South Nation Watershed shows that controlled tile drainage significantly reduces nutrient loads in receiving surface water, while providing producers with a modest but ongoing economic gain. This is a win-win for producers and the environment.

Due in part to the research conducted in WEBs, controlled tile drainage has been included as a BMP eligible for cost sharing under the Canada-Ontario Farm Stewardship Program. The South Nation Conservation Authority and the City of Ottawa (under the Rural Clean Water Program) are offering an incentive to producers as well.

Challenges

Data

The WEBs watersheds have extensive scientific monitoring data on water quality and other environmental indicators, but many have only limited crop-yield, livestock performance and other economic research data. Additional data collection and analyses are underway to continually improve the quality of the WEBs economics data set.

Scaling up

Computer models are used in WEBs to scale up (extrapolate) findings from the sub-watershed level (the study watershed) to intermediate and regional watershed levels. Extrapolating BMP economic assessments can be difficult where landscape and farming conditions are highly variable. The models used in WEBs are being continually updated with new information to help address this challenge.

WEBs economics research provides producers with information they can use when making decisions about adopting BMPs.

Next steps

The primary goal of economics research at the beginning of WEBs was to assess the on-farm costs and benefits of BMP adoption.

Now, according to WEBs Economics Co-chair, Dr. Carlyle Ross: “Estimates of on-farm and off-farm economic benefits are being validated, and additional BMPs are being assessed within WEBs. As more results from WEBs biophysical monitoring become available, economists will integrate these data into off-farm evaluations. This continued work will strengthen our knowledge base of the economic impact of BMPs and will help inform decisions regarding BMP adoption.”

Where WEBs research has demonstrated off-farm environmental benefits of BMPs, economists are working to value these public benefits.

For more information

More details on the results from WEBs can be found in a series of reports, including a technical report of the economics component:

Stuart, V., D.B. Harker, T. Scott, and R.L. Clearwater (eds). 2010. *Watershed Evaluation of Beneficial Management Practices (WEBs): Towards Enhanced Agricultural Landscape Planning – Four-Year Review (2004/5 – 2007/8)*. Agriculture and Agri-Food Canada, Ottawa. Ont.

Agriculture and Agri-Food Canada. 2010. *Watershed Evaluation of Beneficial Management Practices (WEBs) Technical Summary #2 – Economics Component Four-year review (2004/5 - 2007/8)*. Agriculture and Agri-Food Canada. Ottawa. Ont.

Please visit www.agr.gc.ca/webs or contact WEBs at webs@agr.gc.ca.

Publié également en français sous le titre
Aspects économiques des pratiques de gestion bénéfiques

For more information, reach us at www.agr.gc.ca or call us toll-free 1-855-773-0241.

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

WEBs Fact Sheet #8

The Economics of Beneficial Management Practices

Evaluating BMP performance at the watershed scale

Summary: Much has been learned within the Watershed Evaluation of Beneficial Management Practices (WEBs) program about the on-farm cost and benefits of beneficial management practices (BMPs) as well as their environmental performance. Most of the BMPs evaluated have high implementation and/or maintenance costs—hence the value of studying their on-farm economic impact. WEBs research has shown that the majority of the BMPs tested may contribute to improved financial returns, but in many cases, these revenues might not fully offset BMP costs. Certain off-farm (public good) benefits resulting from BMP implementation have also been identified but the magnitude of their environmental and economic effect remains largely undetermined. Research continues within WEBs to better understand the extent and significance of both the on-farm and public benefits of BMP adoption.

Background

BMPs are farming methods designed to minimize potential negative impact on the environment. The implementation of BMPs in a watershed will have implications for agricultural producers, other watershed residents and society at large. Producers need to know the on-farm costs and benefits of BMPs to make informed choices about using them. Knowledge of the on-farm and societal costs and benefits, plus a greater understanding of the factors affecting producers’ willingness to implement BMPs, will help governments to develop policies or programs that encourage the adoption of appropriate BMPs.

These aspects of BMP economics are being studied at nine watershed projects across Canada (Figure 1) by Agriculture and Agri-Food Canada and its partners through the WEBs program. WEBs economists use a variety of economic tools and models such as representative farm models (typical farm size and type) and integrated (environmental-economic) watershed models. The approach used at each watershed varies in order to reflect regional ecological, agronomic and socio-economic conditions, as well as differences in researcher specialization and available data.

The BMPs being studied within WEBs (Table 1) were chosen mainly for their potential to minimize environmental impact on surface water, groundwater and other aspects of environmental health. WEBs economists are evaluating the economic implications of these BMPs at both the farm and watershed scales.

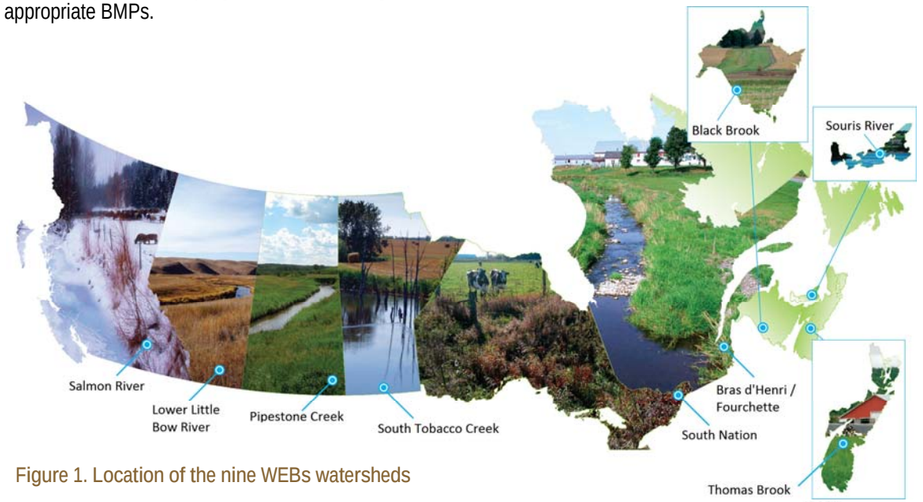


Figure 1. Location of the nine WEBs watersheds

Canada