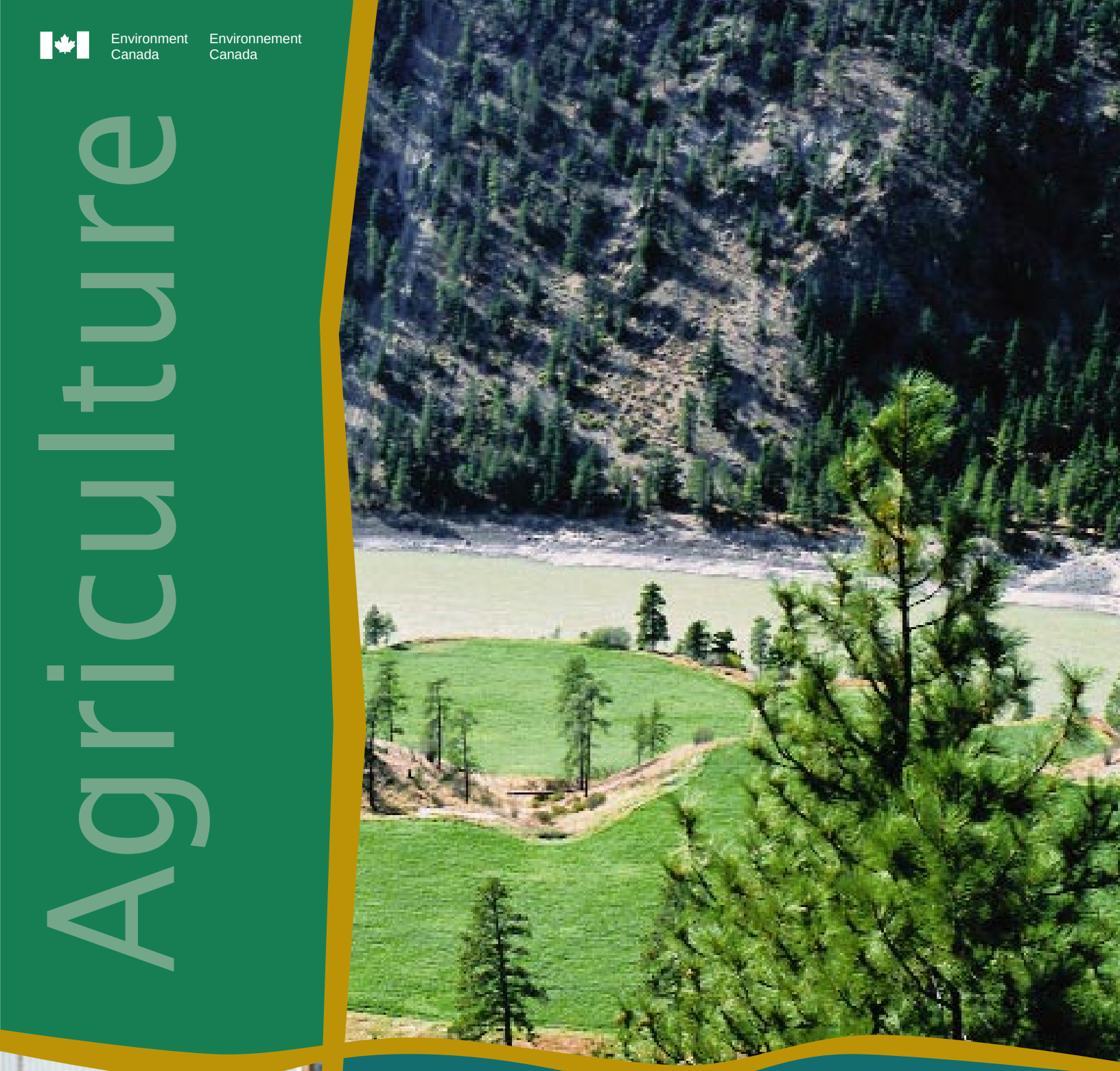
Environment Canada Environnement Canada

Agriculture



FRASER RIVER
ACTION PLAN

Canada

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FRASER RIVER BASIN

Agriculture

Agriculture in the Fraser Basin is subject to competitive pressures that are just as varied and intense as those on other resource industries.

CHRIS LAUSTRUP

farming

Dairy products, beef, pork, and poultry products, grains, fruits, and even market gardening produce are subject to intense international price competition. It is not easy to cover costs and get a return. Rising costs force farmers and ranchers to get the most out of their land, the value of which often soars near urban areas. Entrepreneurship and awareness of market opportunities are not lacking; in fact they sometimes create an over-investment that pulls prices quickly down. Moreover, new intensive methods of rearing livestock and growing crops may well create further environmental challenges.

ranching

Fraser River Action Plan (FRAP) staff developed a lot of respect for the environmental astuteness of the farmers and ranchers with whom they worked. Together they have identified harmful practices and developed more environment-friendly alternatives.

AGRICULTURE AND THE ENVIRONMENT

Agricultural activities can harm fish and wildlife in two basic ways:

- elimination of natural habitat: land use and watercourse alterations reduce and eliminate diverse, natural space, shelter, and food for fish and wildlife, generating ripple effects throughout the ecosystem.

- pollution: nutrients and pesticides volatilize into the air, seep into groundwater, and run off into streams, where they come in contact with fish and wildlife.

FRAP programs investigated issues and took action in both areas.

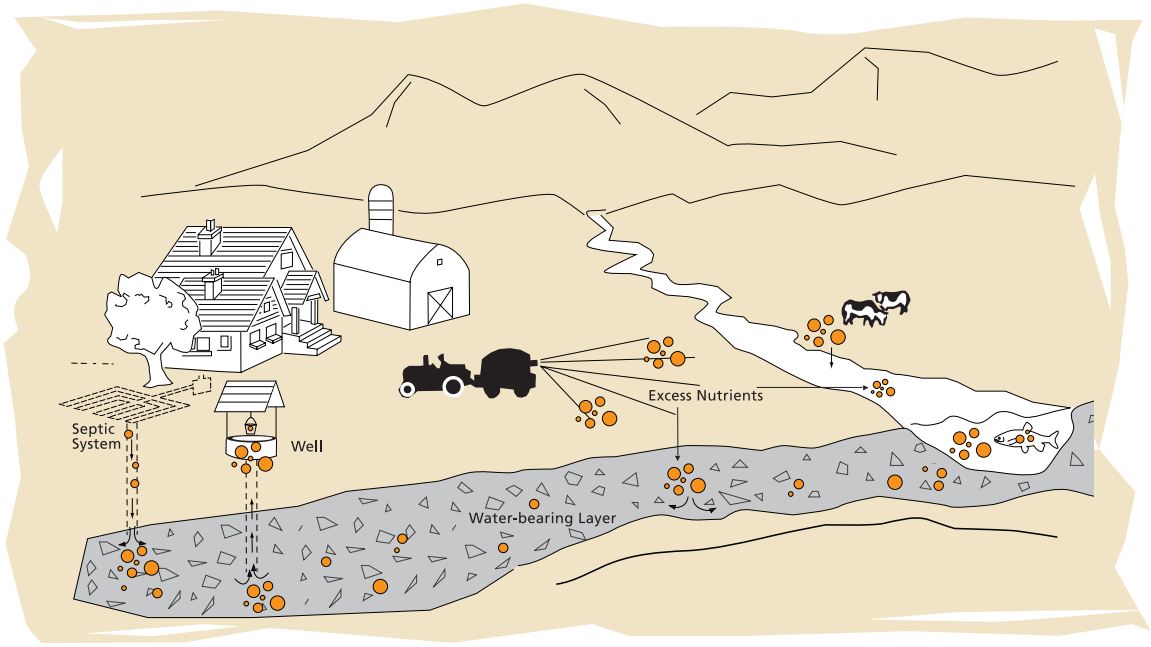
ELIMINATION OF NATURAL HABITAT

There are two forms of sensitive natural habitat which agriculture tends to threaten: wetlands and riparian (waterside) areas.

Wetlands, traditionally called (often dismissively) swamps, bogs, marshes, sloughs, etc, have been regarded in the past as waste land. In fact, wetlands shelter and nourish large numbers of birds and other wildlife. Often such land can be made agriculturally productive if it is drained. Thus the Sumas Prairie near Abbotsford, once a large lake surrounded by wetlands, was drained and diked in 1925 to control flooding and create fertile agricultural land. In this way, the expansion of agriculture and of urban areas in the Lower Fraser Valley has eliminated most of the original wetland habitat of pre-settlement times.

Riparian (waterside) vegetation provides food and shelter for many species.

Riparian habitats occur where land adjoins a water body, such as a lake, pond, stream, or river. On such banks the moist and fertile soil supports a lush and diverse vegetation of shrubs, deciduous trees, and grasses not found on drier uplands. Riparian habitat is indispensable to maintaining biodiversity (number and variety of organisms). Wildlife surveys show that riparian habitat in British Columbia provides food, cover, and nesting sites for the vast majority of all terrestrial vertebrate species. This rich vegetation is vulnerable to agricultural



Manure contaminants circulate through groundwater and surface water.

practices. Livestock in search of water may trample the bank and disturb the sediments. The farmer may reroute a stream to fill out a field or alter a drainage, run farm equipment across it, or cut down the trees and shrubbery lining it. Deprived of cool shade, the water will heat up to temperatures intolerable to fish and invertebrates. In such ways, waterside zones cease to be rich habitat.

POLLUTION

Agriculture introduces to surface water and groundwater (the water table) two main kinds of pollution: pesticides and nutrients. Although they might seem to have opposite effects – one killing and the other feeding – both can harm the natural environment.

Pesticides

Pesticides include insecticides, herbicides, and fungicides sprayed on crops to protect them from infestation. Such chemicals often persist,

Contaminants in surface water may be absorbed directly by fish and wildlife

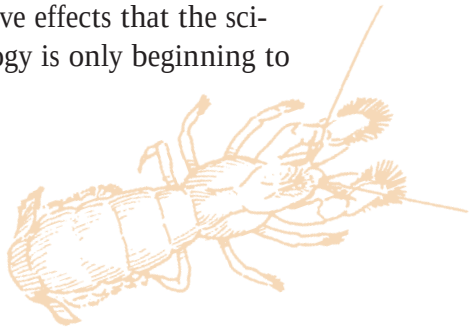
so that the residues sprayed on the soil or washed by rain from the crops or adhering to the killed material linger on the ground. They persist especially in cool, wet soils, as are

FRASER BASIN COUNCIL

Better cattle management would have protected riparian vegetation and water quality.

found in the Lower Fraser Valley. When it rains, these poisonous residues are carried by runoff into the nearest surface water or seep down through the soil into the groundwater. Contaminants in groundwater may be drawn out by drinking water wells or may leak into surface water, adding to those flushed in by precipitation. Contaminants in surface water may be absorbed directly by fish and wildlife or cling to sediment and be taken up by benthic (bottom-dwelling) organisms which are then eaten by fish or wildlife. Once in the food chain, they may bioaccumulate in living tissue, which acts as a kind of filter or sponge collecting, concentrating, and holding them. Contaminant-laden animals may in turn be eaten by other animals, whose own bioaccumulation further concentrates the contaminants, and then the cycle may repeat. This reconcentration process up the steps of the food chain is called biomagnification.

Along the way, chemicals formulated to kill living matter remain active and destructive in the living tissue holding them, including human tissue. They follow metabolic pathways with destructive effects that the science of pharmacology is only beginning to understand.

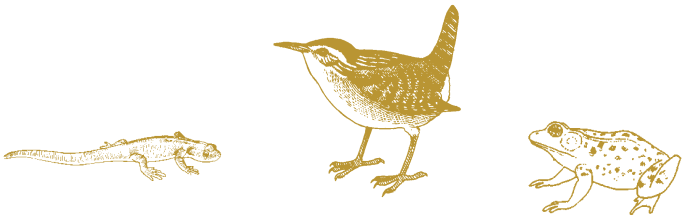


Nutrients

Nutrients pollute in a different way. They are part of the agricultural cycle, being produced by livestock and poultry in manure and spread as fertilizer on cropland. The main nutrient culprits in the Fraser Basin are nitrogen (N), phosphorus (P), and potassium (K), substances familiar to gardeners from commercial fertilizer formulations. As nutrients, they nourish living processes and are taken up by the growing crops. The problem is that they are not entirely taken up, especially when overfertilization occurs, as it does in many parts of the Lower Fraser Valley. Nutrient residues remain in the soil and follow the same pathways to groundwater and surface water travelled by pesticide residues.

The main environmental damage is the suffocation of underwater life by eutrophication

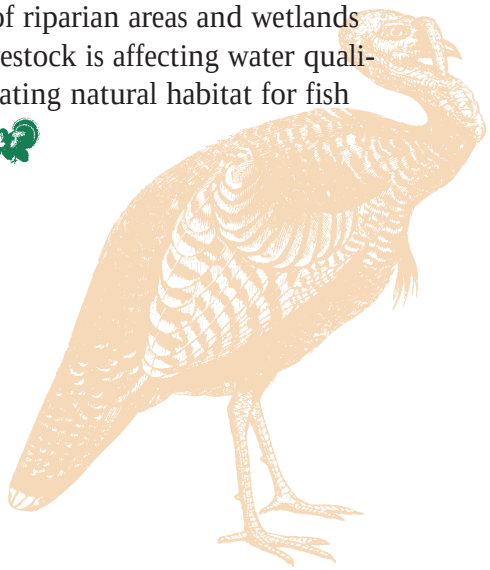
At the concentrations normally encountered, nutrient contaminants are not as dangerous to living creatures as pesticide contaminants, though some other pollutants from manure such as those associated with fecal coliform bacteria can be harmful. The main environmental damage caused by nutrient residues is the suffocation of underwater life by eutrophication. It seems paradoxical that an overdevelopment of living matter (eutrophication) should in the end be lethal. What happens is an imbalance that removes oxygen from the water. An overstimulated growth of surface vegetation (eg pond scum) cuts off light, preventing underwater photosynthesis and oxygen production. It also creates large amounts of decomposing plant material which takes up any available oxygen in the water (increasing "biochemical oxygen demand," or BOD), leaving none to sustain animal life. A pond deprived of oxygen has a green surface but a brown interior. It has ceased to be habitat for anything except algae and bacteria.



FRASER BASIN ISSUES

FRAP studies and farm visits revealed two somewhat different sets of environmental problems associated with agricultural practices in different areas. In the Lower Fraser Valley (downstream from Hope), where the most intensive agriculture in the province occurs, the elimination of natural wildlife habitat by a combination of urban sprawl and agricultural development, is far advanced. With agricultural pollution, pesticide effects remain, though they are being reduced.

In the interior reaches of the Middle and Upper Fraser watersheds, the main agricultural effects on the natural environment involve habitat degradation from ranching. Destruction of riparian areas and wetlands for and by livestock is affecting water quality and eliminating natural habitat for fish and wildlife.



Destruction of riparian areas and wetlands for and by livestock is affecting water quality

Meanwhile, FRAP scientists found that nutrient overloads are occurring because of an oversupply of manure from livestock and poultry farming. Problems of manure storage and handling, as well as an overapplication of manure and fertilizer to crops, are causing pollution of ground and surface water and even of the air in agricultural areas of the Lower Mainland.

Left–Stream banks erode where riparian vegetation is missing.

FRASER BASIN COUNCIL

Where cattle have direct access to water, vegetation is trampled.

FRASER BASIN COUNCIL

LOWER FRASER

HABITAT ENCROACHMENT: COMPETITION FOR LAND

The Fraser Delta is an important stopover for migrating birds on the Pacific Flyway. Some birds only pause to rest and feed, while others stay for the whole winter. Ducks, geese, swans, and others are attracted to the agricultural fields that have replaced their natural habitat. They are not always welcome. They feed on seeds and cash crops; their feet compact the soil surface, hampering drainage. Farmers often resent the flocks of birds they see picking over their fields and cutting into their productivity.

CANADIAN WILDLIFE SERVICE

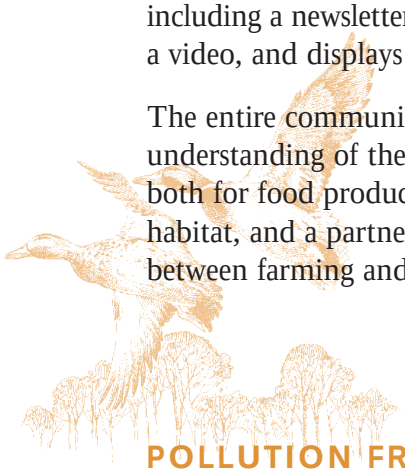
Crops provide rich forage for migratory birds.

CANADIAN WILDLIFE SERVICE

A scientist studies a patch that was protected from foraging birds.

FRAP, in partnership with Ducks Unlimited Canada, local farmers and residents in Delta, and environmental organizations, sponsored the Greenfields Program, to promote the use of winter cover crops. These non-cash crops provide winter food for birds while reducing soil erosion, enhancing soil productivity, and diverting birds from cash crops. As a result, every winter since 1991 has seen more than a thousand hectares of Delta farmland planted in winter crops. The program is now delivered by a local community group, the Delta Farmland and Wildlife Trust. Communications and extension activities are part of the program, including a newsletter, promotional material, a video, and displays at local events.

The entire community has gained a better understanding of the value of farmland both for food production and for wildlife habitat, and a partnership has developed between farming and wildlife interests.



POLLUTION FROM PESTICIDES

Agricultural sources

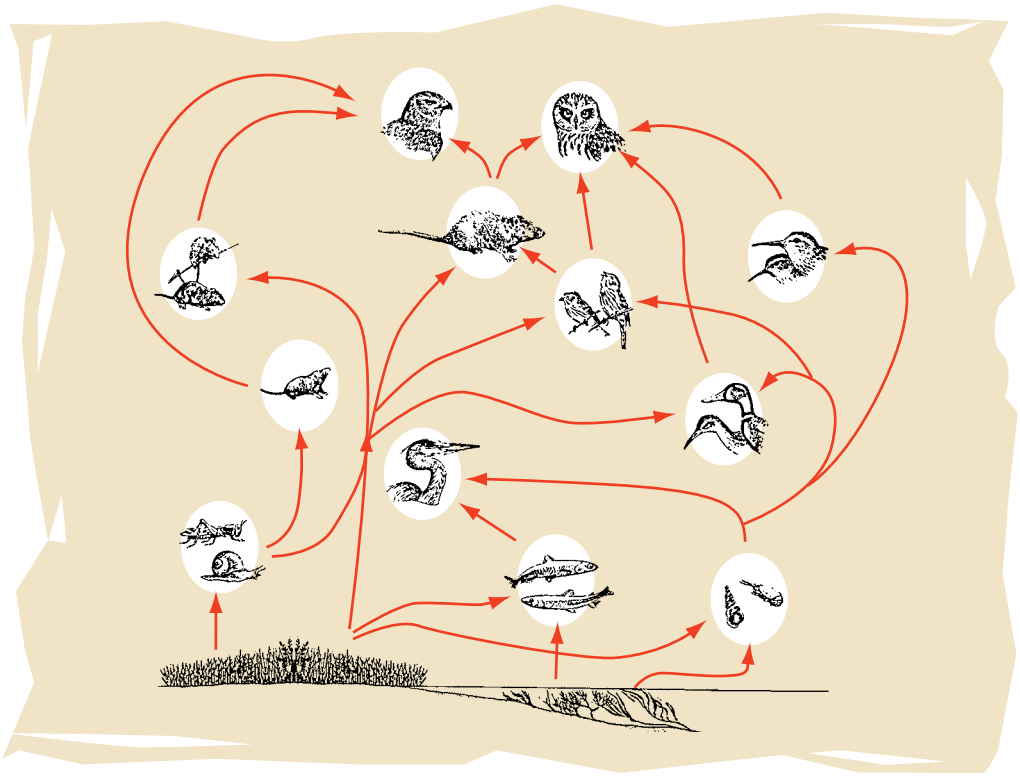
Since 1989, before FRAP, Environment Canada has been investigating pesticide poisoning of birds of prey in the Lower Fraser Valley. Scientists expected that pesticide concentrations would be highest in creatures high on the food chain, such as raptors, because of biomagnification. The studies showed that contaminant concentrations in these birds were highest in winter. In this season, scientists believe, waterfowl tend to feed in agricultural fields, ingest insecticides, fall sick or die, and are then eaten by birds of prey. The poisoning of raptors therefore indicates the prior poisoning of the birds and rodents they eat.

The Greenfields Program has seen more than a thousand hectares planted in winter cover crops

The studies showed that, from 1989 to 1997:

- at least 50 birds of prey were killed by pesticide poisoning, especially by granular insecticides, which persist in the sandy and wet local soils for many months.
- most were bald eagles, and a few were red-tailed hawks.

CANADIAN WILDLIFE SERVICE



The food chain causes contaminants to accumulate and concentrate in predators.

• seven insecticide chemicals were implicated: phorate, carbofuran, fensulfothion, dyfonate, fenthion, terbufos, and parathion.

As a result of the study, two of the chemicals (ie pesticide formulations containing them) were withdrawn from the local market: phorate and carbofuran. Fensulfothion is no longer manufactured. Dyfonate will be withdrawn from the local market after the 1998 growing season. The other three, fenthion, terbufos, and parathion, remain in use.

Environment Canada is collaborating with other agencies to find alternatives to these formulations to control, for example, wireworm infestations of potato crops.

As these chemicals are withdrawn from use, the incidence of pesticide poisoning has declined, suggesting an improving situation.

In 1996–97, only one bald eagle in the Lower Fraser Valley was found whose death was attributed to pesticide poisoning.

Alternative sources

Current agricultural practices are not necessarily to blame for all pesticide levels in birds and fish in the Fraser Basin. In two species of fish selected by FRAP scientists as environmental indicators, mountain whitefish and peamouth chub, the pesticides measured in highest concentrations were DDE (a breakdown product of DDT) and toxaphene. The highest levels of DDE were measured in fish and suspended sediment from the

EC AQUATICS SECTION

Lower Fraser River. DDE was also the most prevalent pesticide derivative measured in the bird and mammal species sampled. DDT and its various breakdown products have been found in suspended and bottom sediments. However, both DDT and toxaphene have been prohibited in Canada for many years. The question is: where did these residues come from?

Residues of pesticides may linger in cropland soils, groundwater, sediments, and animal bodies

One possible source is past agricultural practice. Residues of pesticides and their breakdown products that are highly stable and bioaccumulative may linger in environmental storing places such as cropland soils, groundwater, sediments, and animal bodies. Another possible source is long-range atmospheric transport, possibly from countries in Asia where these pesticides are still in use. In support of this theory, the relatively undegraded state of some DDT samples suggests they have not been in the environment very long. Moreover, toxaphene residues have been found in Moose Lake, at the headwaters of the Fraser near Mount Robson, where the only likely pathway seems to be long-range atmospheric transport, deposition in snow and ice, and then release with meltwater. If the snowpack/glacial origin of these residues is confirmed, the implications are extensive: continuing low-level contamination of the Fraser Basin; potential for increased contamination levels if global warming increases melt rates.

Yet another possibility is suggested in an apparently anomalous finding of DDT in Nicola Lake, near Merritt, in circumstances suggesting a single recent release. When a pesticide is banned, some people may have quantities in storage. Eventually they may resort to illegal use or dumping to get rid of their supply.

In general, the lesson seems to be that a chemical may continue to contaminate the environment long after its use has been banned.

Birds of prey are at the top of the food chain.

POLLUTION FROM NUTRIENTS

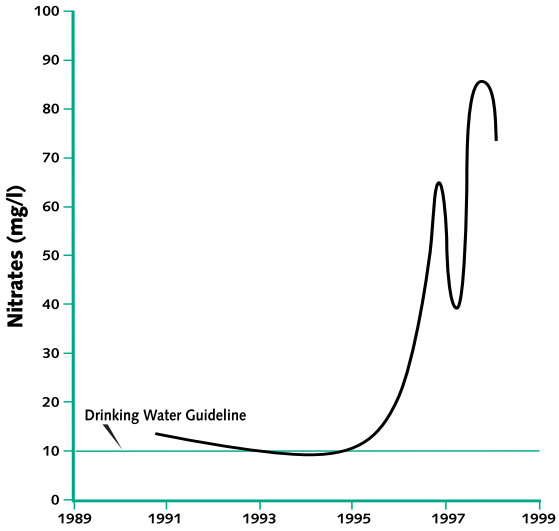
From a variety of evidence, including that of FRAP's own inspectors, FRAP scientists became aware of a "manure problem" in Lower Fraser agriculture. Surface water and groundwater are exhibiting signs of nutrient overload. The local oversupply of manure produced by intensive poultry and livestock farming is leading to handling and storage problems and to overapplication on crops. In a series of studies, FRAP has investigated the connections, the implications, and possible solutions.

Surface water and groundwater are exhibiting signs of nutrient overload

Signs of nutrient overload

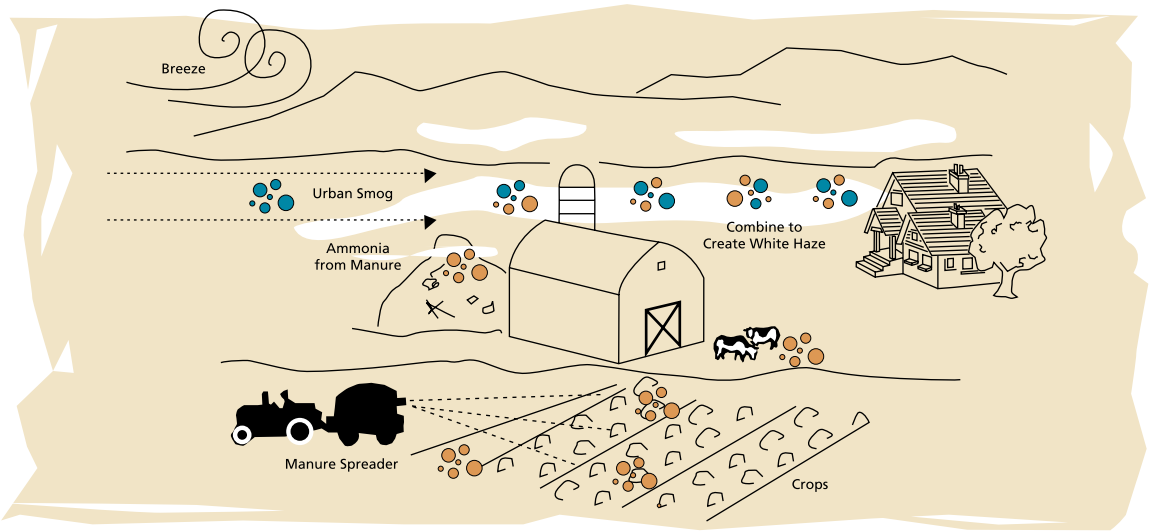
Several reports by FRAP and others confirmed that nitrate (a form of nitrogen) was present in the large groundwater reservoir called the Abbotsford aquifer, which extends west to Langley and south into Washington State. A 1993 survey showed that more than half of the 117 domestic, municipal, and monitoring water wells on this aquifer had nitrate concentrations above the Guidelines for Canadian Drinking Water Quality limit of 10mg/L. Project Enviro-health's 1995–6 Final Report to the provincial Ministry of Health stated that a series of studies of the Abbotsford aquifer "have shown that nitrate contamination is a major concern to human health." In late 1997 the City of Sumas in Washington State, which derives drinking water from the Abbotsford aquifer, requested information from Environment Canada on contaminant levels in the aquifer as part of their development of a wellhead protection plan.

FRAP looked into the sources of the aquifer contamination. One study analysed nitrogen and oxygen isotopes in the aquifer and indicated that the nitrate was "predominantly derived from poultry manure and to a lesser extent ammonium-based fertilizers." Further studies comparing local septic systems with poultry manure handling confirmed that the latter was the main source.



Left–Irrigating crops at Judson Lake over the Abbotsford Aquifer

Evidence of overfertilization in the Lower Fraser Valley: nitrate levels in water drawn from a well in the Abbotsford Aquifer



The Sumas River, which receives runoff from intensively farmed land above the Abbotsford aquifer, was studied by FRAP. Results show elevated nutrient levels (nitrogen, ammonia, and phosphorus), as well as fecal coliforms and low oxygen levels. High levels of copper and zinc were also detected, which scientists suspect may come from hog feed. In parts of the Sumas Basin, frogs' eggs no longer hatch, an indication of possible contamination. Such indications imply that a substantial load of surplus agricultural nutrients is seeping into the water table and running into the streams in agricultural areas.

The ammonia component from manure turns the otherwise yellow-brown smog into a milky haze

White haze

A white haze is experienced on calm, sunny days in the eastern parts of the Lower Fraser Valley. Scientists have confirmed that the haze is a rural version of urban smog. Industrial pollutants and vehicle emissions, from local and distant sources, combine with tiny particles incorporating ammonia from manure which have spread through the air from barns, stockpiles, and cropland. The ammonia component from manure turns the otherwise yellow-brown smog into a milky haze. This haze, whose full effects on human health are not yet known, aggravates respiratory problems for some of the people who inhale it.

Modelling nutrient pathways

To find the sources of nutrient contamination, FRAP cosponsored a set of studies of agricultural nutrient management. The studies developed nutrient-balance models based on a simple observation: in an agricultural area, nutrients enter in animal feed and commercial fertilizer and leave in crops and animal bodies. If more nutrients enter an area than leave it, the result will be a surplus of nutrients which will build up and start moving into the air and the water.

Twenty agricultural zones were identified in the Lower Fraser Valley, and for each zone the inputs, transfers, and outputs of nitrogen, phosphorus, and potassium were modelled, using 1991 census data on fertilizer use, livestock numbers, and crop production. An exact balance of nutrient input (livestock production plus fertilizer use) with crop removal was not expected. A small surplus would be consistent with careful management to ensure that the soil was not being depleted of these nutrients. But prudent management would try to keep this surplus low. With nitrogen, for example, the surplus should not exceed 50 kg per hectare per year at the very most.

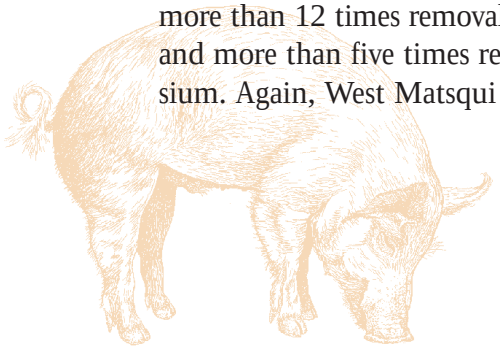
The studies found large surpluses in many zones. For nitrogen, 16 of the 20 zones, representing 78 per cent of the total cropped area, exceeded the 50 kg/ha/yr prudent maximum. In fact 10 zones, representing 57 per cent of the cropped area, had surpluses of more than 100 kg, that is, more than twice the maximum. Three zones, representing 11 per cent of the cropped land, were at the top: South Langley 108 kg, West Matsqui

New technology carefully regulates fertilizer application.

Better manure handling (below) keeps rain from leaching nitrates into surface and ground water.

202 kg, and, highest of all, South Matsqui 308 kg, or six times the maximum. Interestingly, South Matsqui sits on the vulnerable Abbotsford aquifer.

With phosphorus and potassium, the balance was measured as a ratio of the total input to the amount removed in the crops. Again, any difference would be remaining residue, which should prudently be kept low. In almost all cases, surpluses were large. With phosphorus, total input was at least twice as much as removal in 18 of 20 zones, and more than four times as much as removal in six zones. With potassium, total input was at least twice as much as removal in 12 zones, and more than three times as much in three zones. Once again, South Matsqui showed the highest surpluses, with input more than 12 times removal for phosphorus and more than five times removal for potassium. Again, West Matsqui came second.



The models are of course only approximate, and the results, being based on zonal averages, do not apply to particular farms. Nevertheless, the results in both cases create an unequivocal conclusion: a massive overloading of nutrients is occurring in Lower Fraser Valley agriculture.

Furthermore, as another FRAP study concludes: "because the residence time of groundwater in the Abbotsford aquifer is on the order of decades, high levels of nitrate will persist for many years even if the nitrate sources are eliminated."

To gain a closer understanding of the role of agriculture in water quality, a FRAP-sponsored study is under way, tracking changes in agricultural practices with changes in water quality conditions in the North Matsqui zone.

Poultry and livestock farming create huge quantities of manure for which there is no use

The nutrient models showed a second surprising result. They differed in their assumptions about how much of the surplus nitrogen would volatilize into the air and therefore how much would be left in the soil to get into the water. These modelled losses to the air alerted FRAP staff to the possible connection with white haze and led to the studies confirming the connection.

Berry crops require even less manure than forage crops.

Surplus manure and changing crops

FRAP studies indicate that, though both manure and commercial fertilizer are sources of excess agricultural nutrients, manure accounts for the largest quantity. The reason is that the many sites of intensive poultry and livestock farming in the Valley create huge quantities of manure for which there is no use. This manure is stockpiled, is often handled casually, and is available at very low prices, or free, to crop farmers.

A second factor contributing to the nutrient surplus is a general shift away from forage crops, which use a lot of nutrients, to berry crops, which need much less. Often the change in crops is not reflected in a corresponding reduction in rates of application.

FRAP RESPONSES TO NUTRIENT SURPLUSES

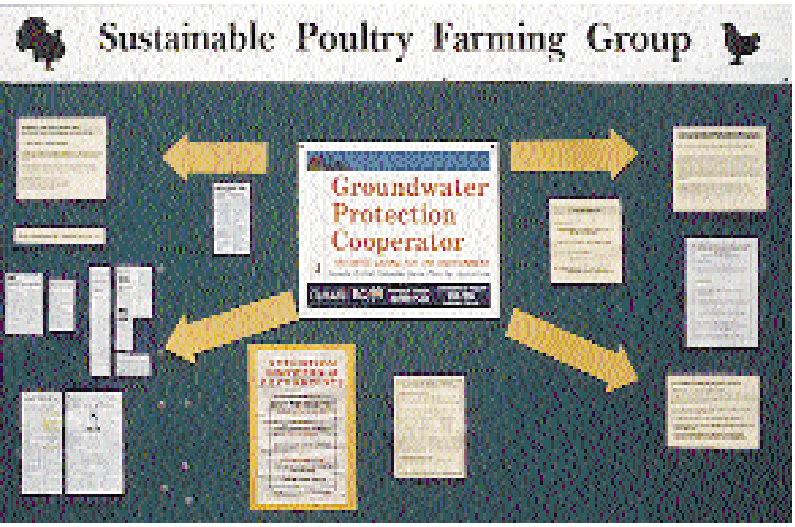
Improving agricultural practices

In agriculture as in other sectors, FRAP and its partners encouraged more environmentally aware management. They have supported the development and implementation of Best Agricultural Waste Management Plans (BAWMPs) for all Lower Fraser Valley farms. Such plans identify environmental problems on the farm, evaluate and recommend alternative solutions, and encourage the implementation of improvements. Some farms in the area have already adopted BAWMPs.

In relation to manure, a comprehensive BAWMP would address utilization and conservation, handling and storage, and off-farm movement. The goal would be to establish sustainable nutrient balances. Helping farmers develop their plans will require education, promotion, and regulatory enforcement.

Best practice, like this storage compound under construction, completely isolates the manure.

There are also technical issues that need further research and guideline development in many areas of farm practice, from cropping methods, to feeding strategies, to buffer strip and riparian area management, to optimal nutrient application rates and timing by crop and location.



Poultry growers take the initiative to move excess manure to farms in areas of manure deficit.

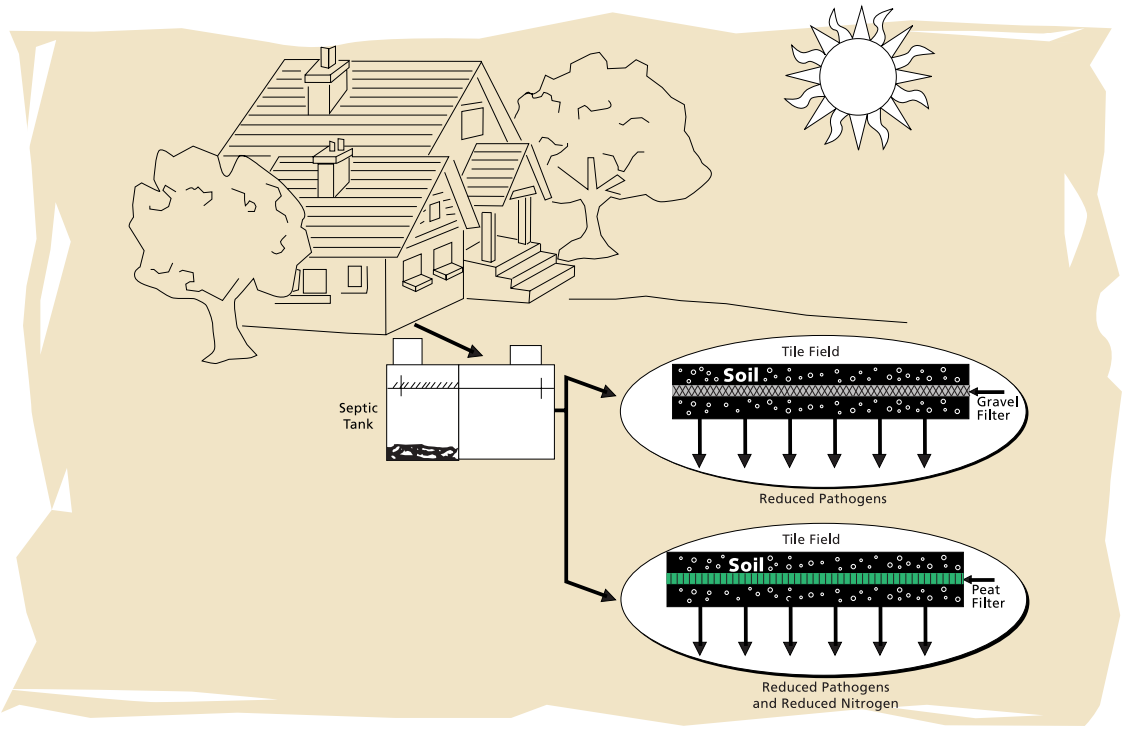
Manure transport and marketing

A direct way to deal with a manure surplus in one area is to truck the excess to other areas where nutrients are deficient. FRAP funding has helped support a program by the Sustainable Poultry Farming Group to do just that. The program aims to set up a financially self-sustaining system to remove up to 44 per cent of the excess poultry manure produced each year in lands above the Abbotsford aquifer and distribute it to farms elsewhere in the Lower Mainland and the interior. In 1997, the program reached a removal rate equivalent to about 19 per cent of total annual production.

This surplus-export approach will require marketing to find customers. An initial study sponsored by Agriculture Canada's Agricultural Green Plan looked at opportunities for marketing poultry manure outside the Lower Mainland. Among the possibilities was that of developing a high-value fertilizer that could be useful on golf courses and turf farms. In partnership with provincial and federal government partners, FRAP supported a follow-up assessment of market opportunities for a pelleted and crumbled composted poultry manure fertilizer. The study considered several N:P:K formulations, costs, prices, quantities, and markets. It concluded that high-end customers would be interested, but to make a processing plant attractive, markets outside the province would also have to be found.

Improved septic systems

The concern for organic nutrients in the Lower Fraser Valley drew attention to human waste as a possible contributing source. In most rural areas, traditional septic systems are used. FRAP recognized the environmental limitations of such systems. Because their performance is degraded with poor maintenance, public information materials and maintenance guidelines were prepared. Properly functioning septic systems are very effective at removing pathogens and protecting human health. But they do not remove much nitrogen from household effluents.



To remove nitrogen, a standard septic system requires the addition of nitrogen-trapping materials (eg peat) in the drainage bed.

FRAP therefore commissioned a study of improved kinds of septic systems (from a nutrient-removal standpoint) and their cost-effectiveness as replacements or add-ons. After a comprehensive review and exploration of alternatives, the report recommended a number of options which were quite cost-effective at removing 70 to 80 per cent of nitrogen, compared to only 10 per cent with traditional systems. The capital cost of these systems, all under $10,000, could be reduced further if local materials, such as peat, proved suitable for them.

The report also pointed out that engineering consultants and system installers would need to learn more about nitrogen-removal to make these alternative technologies effective. FRAP, in partnership with the B.C. Onsite Sewage System Association, is sponsoring a workshop on the alternatives for installers, consultants, and government regulators. The workshop will be held in October 1998 in conjunction with the opening of a new training facility for onsite sewage treatment system design at Royal Roads University in Victoria.

DUCKS UNLIMITED CANADA

MIDDLE AND UPPER FRASER

In the broad interior expanses of the Fraser Basin, agricultural production is dominated by cattle ranching. Public awareness is growing about the environmental damage certain ranching practices have been causing. As early as 1981, a Thompson Basin Task Force pointed out that livestock operations, feedlots, overwintering of cattle beside streams, and removal of vegetation from stream banks were causing numerous water quality and stream degradation problems throughout the basin. In the early 1990s, studies of the Cariboo-Chilcotin emphasized similar issues in that region.

Protected areas are improving, wildlife is benefiting, and ranchers are pleased with improved cattle health

As in the Lower Fraser, FRAP's efforts in these areas focused on habitat conservation and pollution. Both issues are of concern to residents in the Middle and Upper Fraser Basin.

Left–Fallis Pond: a demonstration wetland restoration and cattle-watering facility near Kamloops

DUCKS UNLIMITED CANADA

HABITAT PROTECTION

In the less populated areas of the provincial interior, the leading habitat concern is rehabilitation and protection from degradation.

Interior Wetlands Program

Out of primary concern for migratory birds, the Interior Wetlands Program was launched in 1992 through a partnership between FRAP, three provincial ministries (Environment, Forests, Agriculture), and Ducks Unlimited Canada, the latter being primarily responsible for managing the program. Looking at grasslands and open forest rangelands, the Program emphasizes habitat conservation and improvement, water quality and quantity, and sustainable agriculture. Habitat objectives encompass both wetlands and riparian vegetation, and the focus is on working with ranchers to improve management practices.

By early 1998, about 1375 hectares of wetland and 6344 hectares of upland habitat had been brought under improved management in 23 demonstration projects secured by 30-year landowner agreements. Many projects involved improved cattle watering facilities and fencing to keep cattle out of

ANDRE BREAULT

sensitive wetlands. The protected areas are recovering, wildlife is benefiting, and ranchers are pleased with improved cattle health and productivity as well as secure water supplies. Ducks Unlimited estimates the improvements will support an additional 2500 waterfowl every year.

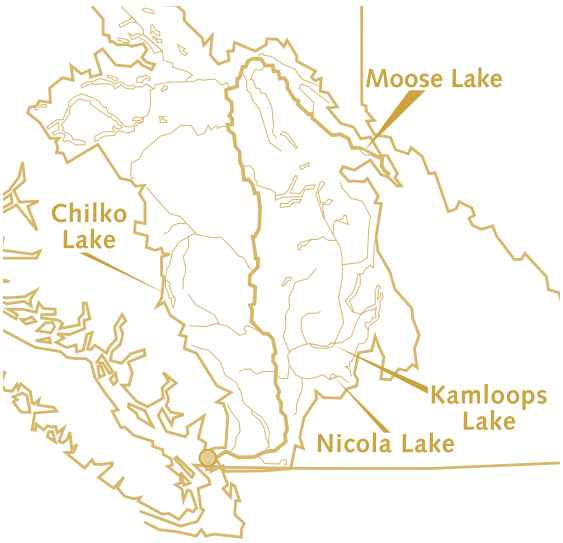
These habitat restoration practices are exemplified by two projects near Merritt, in the Middle Fraser Basin. At Peter Hope Lake, water withdrawals for irrigation during summer months used to cause the lake level to drop, exposing mud flats in which cattle would wallow and drying up valuable wetland habitat around the lakeshore. The irrigation system was also inefficient, with only 10 per cent of the water arriving at the desired destination in a clouded and unhealthy condition. In 1994, FRAP and partners worked with the local landowner on a

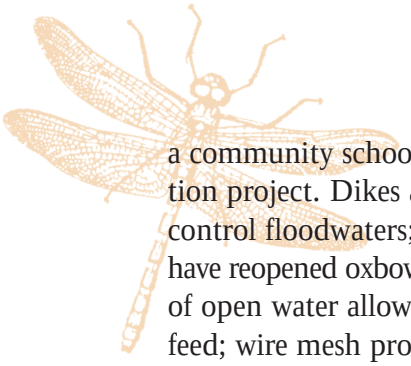
Too often, wintering cattle are allowed direct access to watercourses.

rehabilitation plan in which fences and cattle guards kept grazing cattle from the lake edge and associated uplands. A new well, pump house, and watering facility were constructed to supply year-round clean water for cattle.

The wetland has returned and the lake is once again renowned as a fishing site for Kamloops trout.

Nearby, the meandering Nicola River has created an oasis of marshy oxbows and fertile floodplain within the dry southern interior landscape. Over the years, the lush ribbon of cottonwoods, shrubs, and thick grasses that bordered the river was stripped away for agriculture and other land uses. The river banks began to erode and collapse, affecting water quality and fish habitat, while the overgrazed riverbanks provided little cover, food, or breeding areas for birds and other wildlife. In the floodplain, cultivated crops had replaced native vegetation. FRAP and partners worked with local landowners and





a community school to launch a rehabilitation project. Dikes and drainage channels control floodwaters; natural inlet channels have reopened oxbows to river water; passages of open water allow waterfowl to alight and feed; wire mesh protects surviving cottonwoods from beaver; new vegetation along the banks reduces erosion, provides shade for fish, and rebuilds the bank by trapping sediments. With these and other improvements, the riparian habitat and diversity of this reach of the Nicola River is rapidly restoring itself.

To raise awareness and understanding of wetland conservation and sustainable agriculture, the Interior Wetlands Program has produced many publications: brochures, stewardship guides, posters, a newsletter, a web site, a video, and profiles of every demonstration project. These materials were distributed and advertised widely among the ranching community, government agencies, and the general public. Workshops on wetland management were held with participants from the ranching community, conservation groups, government, and the interested public. Cooperation and partnerships among participants and their constituencies have been promoted by the extensive activities of the Program.

Opportunities

Some ranchers foresee non-agricultural opportunities resulting from sustainable practices. To help investigate some of these, FRAP sponsored an analysis of opportunities for the Douglas Lake Ranch to capture

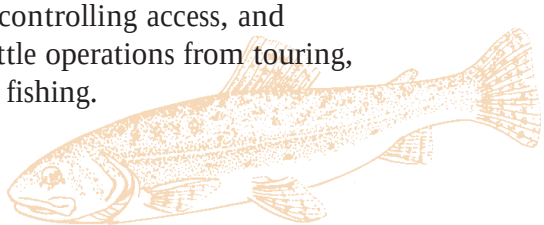
FRASER BASIN COUNCIL

Nicola River

increased tourist revenues. The study concluded that there is an increasing market for ecotourism activities such as bus trips and guided tours. These activities do not generally conflict with the cattle operations if managed carefully. But to take advantage of this market the ranch must protect and enhance its wildlife and natural ecosystems.

Of particular importance is edge habitat between grasslands and forests and riparian zones between grasslands and water bodies. Among other things, these zones provide cover for game birds. The study suggested that the Douglas Lake Ranch could develop a stocked gamebird shoot that would increase the occupancy season of lodge operations currently geared mainly towards recreational fishing.

Other ranchlands in the Basin could similarly develop tourist revenues by protecting biodiversity, controlling access, and separating cattle operations from touring, hunting, and fishing.



FRASER BASIN COUNCIL

Watershed restoration: a foundation is laid for new riparian growth.

WATER QUALITY AND COMMUNITY ENVIRONMENTAL MANAGEMENT

The deterioration of water quality caused by common agricultural practices is an issue in many interior communities. Broad use of the practices, and their embeddedness in community life, demonstrate why management for sustainability requires local leadership. Ending damaging practices and making needed improvements will mean that some community habits must change.

These changes cannot be imposed from outside, and not only because of the resentment and opposition such an attempt would create. The real reason that the change must come from within is that the essence of managing for sustainability is to take responsibility. Community members must understand that their well-being and the quality of the landscape in which they live is ultimately theirs to determine – and in fact that they are the only people who combine the local knowledge with the commitment needed to make the changes that will sustain their desired way of life.

Understanding the fundamental nature of community initiative, FRAP and its partner agencies accepted that sustainability was something they could advocate, facilitate, and support but not something they could legislate, regulate, or in any way accomplish from outside by themselves. Yet one vital kind of help they could give was to encourage forms of community environmental planning and decision-making that arose locally.

For example, FRAP supported a consensus-based community planning initiative in Salmon Arm. Though forestry and recreational activities occur in the area, it is mainly a diversely agricultural region of dairy farming, ranching, and crop production. Many community residents had for years been active in stream restoration projects, concerned about a decline in salmon populations and in water quality and quantity. In 1993, some restoration groups came together to create a community-wide umbrella organization

FRAP supported a community planning initiative in Salmon Arm

called the Salmon River Watershed Roundtable which would take a holistic, ecosystem approach to managing the whole Salmon River watershed.

The members were diversified. Partners and participants included residents, farmers, environmentalists, sawmill owners, community organizations, First Nations, local

Showing a resident how to take benthic samples to monitor river quality

businesses, and representatives from all levels of government. Their goal was to try to find among their differences the common ground that would make the Roundtable a knowledgeable and effective watershed manager.

With FRAP's help, members learned about environmental interactions and how to monitor them. By joining their local knowledge to scientific findings they gained a practical understanding of the workings and problems of the watershed. Deliberating over issues, learning to empathize with alternative perspectives, and negotiating solutions to conflicts, the Roundtable members gradually developed a set of goals and objectives for the watershed which reflected a consensus vision for the future. Much more than a wish list, these objectives resulted from an informed understanding of the changes and efforts needed to realize them and a determination to move ahead with them.

The project succeeded in bringing the community together, surmounting their differences, in support of a shared vision. It showed the power of a watershed management approach to bring conflicting interests into effective cooperation.

The Salmon River Watershed Roundtable provided many lessons for participants and observers about dealing with government agencies and their institutional differences, about the importance of commitment and the dangers of volunteer exhaustion and burnout, about the need for communication and education as well as for positive feedback and recreation. The project generated a well-organized decision-making process based on community participation; it educated local residents about their watershed and its issues; and it encouraged a variety of initiatives, including re-establishment of 10 per cent of the riparian corridor along the Salmon River.

Attention is now shifting from habitat enhancement to agricultural practices. Water quality monitoring shows increasing concentrations of fertilizer residues, particularly phosphorus, as well as growing turbidity. It seems likely that the intensive irrigation in the watershed is increasing runoff and contaminant flows in groundwater. As in the Lower Fraser Valley, agricultural practices in the Salmon River watershed will come under increasing scrutiny.

The Salmon River Watershed Roundtable has not been alone in attempting watershed management. The Nicola River Watershed Committee, the Quesnel River Watershed Alliance, the Chilliwack Watershed Alliance, and emerging groups in communities along the Squamish and Coquitlam Rivers provide other examples of community groups that apply similar principles to local environmental issues.

WHAT'S NEXT

best practices

The agricultural sector faces growing competition both in markets for its products and for arable land. Farmers face strong incentives to resort to non-sustainable practices for short-term survival. FRAP studies have shown that environmental management is an indispensable part of sustainable agriculture. Important early steps have been taken in identifying forms of deterioration and alterations in farming practice that could correct them. Basin residents and stakeholders, including Environment Canada, must continue to work with farmers and ranchers on developing best practice guidelines, environmental management plans, and other methods of making decisions on farming practices which are sustainable and friendly to fish and wildlife.