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Fall 2009

More Than Trees

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More Than Trees

How Silviculture Intersects with Mushrooms, Berries, and Other Botanical Products

by Richard Winder and Philip Burton

Conventional wisdom holds that timber represents the main economic value derived from forests. In Canada, economic profits derived from Canadian non-timber forest products (NTFPs) certainly represent only a fraction of the profits developed from timber harvests. Some estimates put the direct economic value of NTFPs in the Canadian forest sector at about $240 million, annually. That's fairly small compared to the nearly $40 billion annual export value of Canadian timber harvests. But if one takes a closer look at the NTFP figure, it's still a significant level of consumption. For example, if one converts mushrooms, berries, syrup, honey, etc. into a raw caloric value, and if it is assumed that an average North American consumes about 2,000 calories per day, it turns out that Canadian forests provide sufficient calories to support a population roughly equivalent to that of Ottawa for one year. Clearly, non-timber resources are an important dimension of the forest sector.

The harvest of NTFPs such as mushrooms, berries, and floral greens also provides various indirect economic benefits. For a small forest-dependent community, an influx of harvesters purchasing supplies, etc. can result in a significant infusion of cash. Earnings from NTFPs are usually quite low, but they can supplement incomes, and thereby stabilize employment. Northern Vancouver Island, for example, probably has about 100 harvesters actively searching for a mushroom known as the Pacific Golden Chanterelle every late summer and autumn; this level of activity is roughly the equivalent of a small mill.

Of course, NTFPs are much more than an economic resource. In many forest communities, the harvest of NTFPs is a part of the cultural DNA that links inhabitants to the land. In many rural areas, and particularly in First Nations communities, NTFPs are seen as an essential aspect of cultural identity, providing food, medicine, and spiritual significance to the landscape. Berry harvesting and mushroom collecting are typically important parts of the annual cycle, interspersed with fishing, hunting, and firewood cutting. For these communities, there is a concern that the harvest of NTFPs continues as a sustainable, reliable part of life in their forest-dependant economies. Internationally, most efforts to develop criteria and indicators for sustainable forestry include an NTFP component; these components contribute to the certification of wood and paper products marketed by industry. NFTPs deserve serious consideration in the overall milieu of forest management.

Far from being a random outcome, the sustainability of NTFPs is inextricably linked to the decisions that we make as forest managers. The Pacific Golden Chanterelle, for example, is known to thrive in coastal forests of BC where Douglas-fir and western hemlock are the leading tree species, in stands that are between 60 and 80 years old. So, contrary to conventional wisdom, logging actually promotes the productivity of this mushroom, albeit over a span of decades. On the other hand, a decision to completely remove 60 to 80-year-old Douglas fir and hemlock from an area would also likely eliminate local chanterelle productivity until other stands achieve the same age. Sustainability of this mushroom resource is not then just a matter of managing certain sites, but of maintaining a steady mix of stand ages across the landscape. Tools such as GIS-based mapping and forest cover maps can assist forest managers in determining the level of potential chanterelle productivity across a given forest area.

The Pacific Golden Chanterelle

Some NTFPs are ephemeral. While they may not currently thrive on a particular landscape, they might still be a consideration for forest managers concerned with longer time frames. Morels, for example, typically become productive after forest fires. These mushrooms are now thought to fruit in patterns that relate to both physical features of the landscape (e.g., strictly mesic soil moisture) as well as associated plant communities (e.g., the yellow glacier lily). In smaller community forests, parks, etc., preserving the mesic glacier lily habitat would also preserve habitat for the unseen morels.

A black morel fruiting after a forest fire.

Some NTFP species are dominant components of forest sites. Salal is considered by some forest managers to be undesirable vegetation, often competing with newly planted conifer seedlings. However, it is also an NTFP that produces an excellent, durable floral green widely used by florists in preparing flower arrangements. The demand for this product fuels a multi-million dollar annual harvest in the Pacific Northwest. The quality of salal stems and leaves is very much linked to site characteristics. For the proper degree of healthy growth and elongation, the sprigs of this plant are most merchantable when shade is moderate and damage from leaf pathogens is minimal. Soil fertility can also affect the quality of the plant. Management practices that affect these stand characteristics can reasonably be expected to affect the merchantability of the salal.

Salal

Sometimes, the management of NTFPs can be deliberately synchronized with timber management. On Vancouver Island, examples include the extraction of cedar oils from pruned boughs, and the salvage of ferns from areas where logging roads are constructed. Cedar oils are used in a wide range of products (e.g. soaps, fragrances, polishes, and insecticides), while native ferns are in high demand for landscaping and ecosystem restoration projects.

NTFP habitat is occasionally managed in a more deliberate fashion. This is especially true where tenure holders can influence the possibilities for sustaining NTFP harvests. Pine mushrooms, also known as "matsutake", are managed in some areas of BC. The *2003 Timber Supply Review* for the Kispiox TSA resulted in adjustments (reductions) to short-term timber supply, for example. Habitat mapped in the Cranberry TSA has also affected the timber supply analysis for that region. The government of the Nisga'a Lisims controls the harvest of NTFPs on their treaty lands through a land use plan that designates special areas for pine mushrooms and other NTFPs. The policy requires that the cumulative impacts of land use on NTFP habitat be taken into account in forest management decisions.

Active management to sustain wild berry production can also be compatible with timber production. Many berry-producing species, such as blueberries and huckleberries, are shrubs that thrive in a high-light environment. Traditionally harvested from areas burned by forest fires one or two decades previously, these delicious and healthy fruits (high in Vitamin C and anti-oxidants) are now gathered primarily from recent clearcuts. Fortunately, most berry-producing shrubs readily resprout (and can even be invigorated) after mechanical damage, so the direct impacts of logging are usually short-lived. But with the reduced use of slash burning for silvicultural site preparation, there are concerns that wild huckleberry stands in today's cutblocks are not as healthy as they had been in the past. Brush control, especially if achieved through broadcast applications of herbicides, also constrains berry production. If a regenerating stand is pushed to full stocking and free-growing status as rapidly as possible, shade from the rapidly growing trees drastically reduces shrub cover and leaves a window for berry plant recovery and fruit production that is very brief. Where berry harvesting has been identified as an important value (such as in the Suskwa River valley of northwestern B.C.), guidelines can be implemented to minimize conflicts between the need for rapid reforestation and sustainable berry production. The deleterious effects noted above can be somewhat offset by setting low stocking levels (e.g., 600 stems/ha rather than 1200 stems/ha), avoiding the use of herbicides, or brushing only around individual crop trees. Such efforts might thereby facilitate 20 years of berry production (with peak yields 5 to 15 years after logging), with regional sustainability of berry crops incorporated into forest-level planning.

Black huckleberry

Another means of avoiding potential conflicts between berries, mushrooms, and other NTFPs and industrial forestry is the designation of resource emphasis zones. With more research on the ecology of fungi and berry-producing shrubs, it is often found that preferred habitats are often not the same as those that are most productive for trees, or coincide with locations preferred for wildlife or biodiversity protection. For example, the saskatoon and the soapberry (still widely prized by First Nations people), are typically found in dry open habitats, often on south-facing slopes with minimal timber values. Pine mushrooms are typically found in the drier, lower-productivity timber types as well. And good huckleberry production is often noted at high elevations in the open subalpine forests that have minimal timber value and difficult access, or in the gaps of old-growth stands with multiple biodiversity, education, and recreation values.

It may be possible to enhance the level of NTFP harvests. While this has not been attempted on a large scale in BC, experience in other areas of the world provides positive examples. In South Korea, the harvest of native matsutake is increased by using irrigation and other methods to counter occasional dry weather. Where matsutake is abundant in North America, a similar modest boost in productivity would actually cause the cumulative value of the mushroom crop (over the span of one timber harvest) to rival the value of the pine trees hosting the mushroom. In eastern North America, the pruning, weeding, fertilization, and harvesting of lowbush blueberry, a natural invader of old fields and rocky ground, has resulted in the incorporation of this native species into the mainstream agricultural economy.

A pine mushroom (centre) with two look-alikes. Pine mushrooms have a complex cinnamon-and-mushroom-like odour. For novices, mushrooms are best identified with the assistance of someone who is knowledgeable and experienced.

Can we ensure the sustainability of NTFP harvests? It's a question that was foremost in the minds of those who established the Eastern Canada Ground Hemlock Working Group (ECGHWG). Ground hemlock or eastern yew is a species that produces taxol, a compound useful for treating certain cancers. Bringing together stakeholders that include the harvesters, tenure holders, end users, and others, the ECGHWG has established proactive guidelines to ensure the sustainability of the ground hemlock harvest. The guidelines (many of which might be applicable to NTFP management in general) promote several goals:

- adherence to applicable legislation;
- preventing diminishment of ground hemlock populations;
- ensuring that harvesting conserves biodiversity and habitats;
- ensuring that handling and transport of the NTFP maintains quality;
- assuring that harvesters and landowners have access to information and that harvesters are properly trained;
- assuring that the economic and social benefits are fairly distributed; and
- acknowledging that land use changes must be taken into account.

In the broader context, organizations such as the Centre for Non-Timber Resources at Royal Roads University in Victoria, and the National NTFP Network of Canada strive to promote the wise use of NTFP resources by coordinating and developing social and ecological research, by developing training and certification programs, and by providing various information resources. However, it's important to note that the information needed to guide the sustainable management of various NTFPs is often not yet available, especially if harvest levels are not reflected in the market economy. For example, devil's club, a member of the ginseng family, is considered to have curative properties similar to ginseng, and it continues to be valued as a medicine in many First Nations communities. There are concerns that logging irreparably damages old-growth stands of this species, and we know little about the requirements for its successful recovery after timber harvesting.

Devil's Club

Is it possible to mismanage NTFPs? Globally, there are some troubling stories. The impacts of overharvesting and poor reseeding lead some to declare the Brazil nut an endangered species. In Japan, destruction of habitat by the pinewood nematode has sharply reduced the availability of native matsutake, spurring imports of the mushroom from China and Korea (and imports of the related pine mushroom from North America). An understanding of the habitat needs and the biology of the plants and fungi generating our forest's NTFPs suggests a number of ways in which integrated forest management can protect, sustain, or even enhance NTFP production in the same forests as those managed for wood production. Forest management involves many trade-offs at various scales, throughout time and across the landscape, yet the spatial and temporal arrangement of timber harvesting can sometimes be arranged so that the needs of both NTFPs and the forest products industry can be met. The challenge is to reduce the need for compromise where possible, or to manage these trade-offs where necessary, so that there will be an optimal outcome for all of the stakeholders relying on forest resources.

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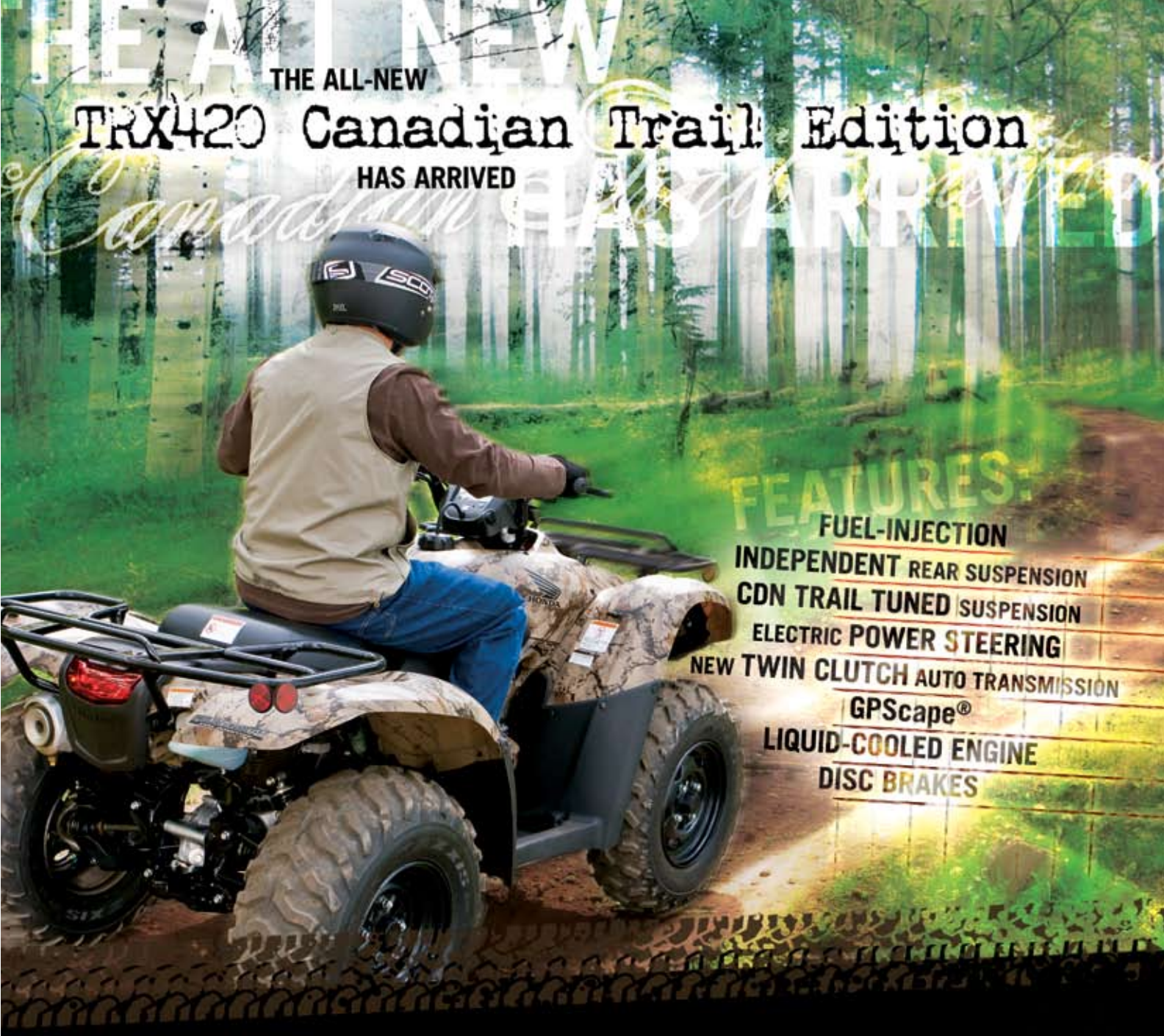

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Growing Canada Yew in Plantations: Profitable or Not?

by Thomas L. Noland and Mamdouh Abou-Zaid

Planting Elite Yew

Canada yew is a low evergreen shrub that is native to eastern Canada. Over the past five years, demand for yew biomass in general has increased dramatically, because it contains chemicals called taxanes that are used to make important anti-cancer drugs.

One of these taxanes is paclitaxel, the active chemical in chemotherapy drugs such as Taxol®, which is used to treat breast, ovarian, and non-small cell lung cancers as well as Kaposi's syndrome, an AIDS-related cancer. In 2000, while still under patent, paclitaxel was the world's most valuable anti-cancer drug, with sales peaking at US $1.6 billion and current sales running at about US $1 billion per year. Worldwide demand for paclitaxel and newer second-generation taxane drugs such as Taxotere® and Abraxane® is rising by about 10% per year.

Most of the demand for taxanes is now met with biomass from English yew plantations in Europe, US, and Asia. In Canada, however, wild Canada yew is in demand, as its foliage, bark, twigs, and roots contain relatively high levels of taxanes, particularly paclitaxel. Unfortunately, Canada yew, the last significant source of wild yew biomass in the world, is not always harvested sustainably. Given the high taxane levels in Canada yew and concerns about wild harvesting, we asked the question: How can we best grow and harvest this shrub in plantations?

Research on Growing Canada Yew

In 2004, we began studying the feasibility of growing Canada yew as a value-added plantation crop, working with Bioxel Pharma of Laval, Quebec and the Thessalon First Nation BioCentre near Thessalon, Ontario. Our objectives were to determine best practices for growing yew in plantations and to find and propagate elite individual yew plants - those with superior growth rates and high paclitaxel content.

We established four plantations from wild yew rooted cuttings, and after four growing seasons, assessed the effects of plant spacing, mulch, fertilizer (nitrogen-phosphorous-potassium (NPK) applied annually), compost, mulch plus fertilizer, mulch plus compost, and no treatment on plant growth. We collected cuttings from 296 yew plants from throughout Ontario, propagated and grew them in the greenhouse, and then planted them to assess how well each grew and how much taxane each contained.

How Canada Yew Responded to the Treatments

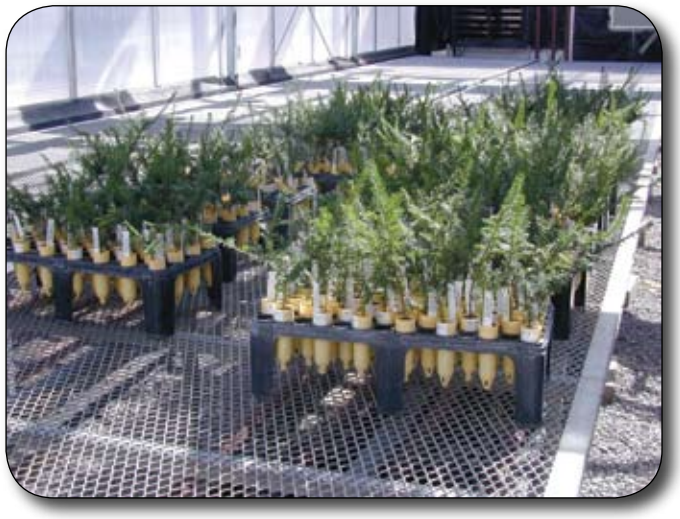
Yew plants treated with mulch plus compost produced almost three times as much biomass as untreated plants, and those treated with fertilizer produced almost twice as much (Table 1). The mulch plus compost treatment was also the most expensive - nearly $10,000 per hectare. However, this project was small-scale; costs would likely be less for a larger-scale operation. The NPK fertilizer treatment produced the most cost-effective increase in yew growth at about $400 per hectare. Neither of these treatments increased growth enough to make plantation culture profitable for a whole-plant harvest system, which calls for harvesting the entire plant every three or four years and replacing it.

Table 1. Effect of plantation treatments on total Canada yew plant biomass after four growing seasons. Means (n=840 plants) followed by different letters are significantly different (p ≤0.05).

Plantation treatment	Total plant biomass (grams dry weight)
No treatment	9.21 d
Fertilizer	20.08 b
Mulch	17.23 bc
Compost	16.17 c
Mulch+Fertilizer	16.94 bc
Mulch+Compost	26.31 a

Elite Individuals Are Superior

We found that both growth rate and taxane concentration were significant determinants of taxane production. Growing the top 10% of yew plants - those with superior growth and taxane concentrations - in a plantation would yield two to four times more taxanes per hectare than would a plantation of average yew plants.



Although the plantation treatments also affected the taxane concentrations of yew foliage (with mulch having the greatest positive effect), these effects were small compared with the effects of growth rate and taxane concentration differences.

Can Yew Plantation Culture Be Profitable?

Establishing a Canada yew plantation is costly (estimated at $60,000/ha). It would not be profitable using average Canada yew plants propagated from randomly collected wild populations. To reduce costs and increase profitability, we recommend the following:

- Since plant propagation accounts for about three quarters of yew plantation establishment costs, more research should be conducted to develop more efficient, cost-effective propagation methods.
- Screening for elite yew plants should be conducted to maximize yew taxane concentrations and growth rates and thus increase the value of yew biomass as well as production levels.
- Plantations should be harvested regularly to generate more biomass and income over time and to avoid reestablishment costs every three or four years.

Implementing these strategies will increase the likelihood that growing Canada yew will become a cost-effective option for Ontario farmers and nursery operators.

The authors thank the Northern Ontario Heritage Fund and FedNor for funding support. Additional support was supplied by Bioxel Pharma, Canadian Forest Service, Ontario Ministry of Natural Resources, and Thessalon First Nation. Our collaborators, Drs. Ron Smith and Stewart Cameron of the Canadian Forest Service, Atlantic Forestry Centre provided 10,000 yew plants, propagation and plantation design advice, and a planting crew.

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Focus on Safety

by Reynold Hert

Safety Pays

At one time in my career, I viewed safety programs and efforts as additional costs to the business. And they are - if you treat them only as safety meetings you must have, and inspection lists you "picked up somewhere". However, if you incorporate the practices that reduce injuries and eliminate surprises, which can disrupt your operation, safety can pay off in many ways. This is as true for silviculture as other forestry sectors.

Better Operating Results

It is very important to make a clear distinction between safety, as traditionally viewed, and building injury reduction into your operation as a way of really making sure you are ready to do business. There is a world of difference between the two.

In its traditional form, safety often consisted of meetings, safety talks, and inspections that were often disjointed from what was actually taking place in the business. This approach regularly resulted in boring meetings, which no one wanted to prepare for or attend.

Using injury reduction to focus your business planning and people efforts has a very different purpose. It results in better business methods and operating results, including improved quality, cost control, and customer satisfaction.

In a well-run business, you can see a well-designed operation, good methods and carefully selected and trained people who know what to do, why they are doing it, and how to do it. They have the right tools available all the time, and are supported to think through new and different situations. Managers visit the operation to check that staff use agreed-upon methods. Ask yourself, "In a business like this, how many injuries will occur?" Very few!

Contrast the well-run business to one with inadequate planning, poor methods, and the wrong tools. The poorly planned business often is reacting to unexpected situations, and regularly has to improvise on the spot with inadequately-trained employees.

Reducing Injuries and Improving Operations

Safety is not about searching for topics for safety meetings you feel forced to hold. It's about reducing injuries by:

- Making sure your people have the skills, knowledge, and resources to do their jobs professionally;
- Discussing the upcoming block with your people, asking them to identify any difficulties and hazards, and planning in advance how to deal with these problems; and
- Leading effectively by getting people to talk about difficulties and where they feel at risk - and then finding solutions to eliminate the problems.

In many cases, solutions lead to an easier, more effective way of working that not only reduces risk, but means more productive, higher quality results.

People will often argue that they cannot afford safety. It's difficult to understand how employees who feel at risk while working with poor methods, inadequate training, and the wrong equipment, can be expected to do a better job than those who are confident because tasks are well planned, they know how to do what they need to, and have the right tools to get it done. This just makes sense, especially in silviculture operations where so many workers are relatively young.

What can a manager do to improve safety and reduce injuries? He should do many of the same things he does to improve operating efficiency, but do them extremely well. You should follow these steps:

- Design your system, plan your operations, and determine the right methods with input from your workforce so they don't feel at risk.
- Put solid thought into how you train your people, and equip them with the right tools, in great condition, so they feel they can operate confidently.
- Go out, and see firsthand how your operation is really working. See where people have difficulty or put themselves at risk; ask why that happens in your operation, and then find a solution to improve the situation.

Always put your people first, and let them know that nothing they do is worth getting injured. Ask staff to report all close calls and whenever they feel at risk. Close calls and at-risk situations are signals that your operation can run better. After all, each of them is caused by a method or tool that is not right for the situation.

Most people who are seriously injured on the job are surprised. If they had seen the problem a moment before, or understood how their tools were about to injure them, they could have avoided what happened.

Paybacks for Safety

What type of company would you personally invest in - one with great design, planning, training, tools, and commitment to doing the right thing, or one with poor planning, unskilled people, and lack of preparation that leads to kneejerk reactions? It's clear which is most likely to experience breakdowns, poor quality, higher costs, and more injuries.

The investment in operating professionally delivers a monetary payback. It brings in more business by satisfying your customers with consistently high quality products. A strong safety program also attracts better employees and reduces injuries. Safety is professionalism, and it pays in many ways, not only in making sure the people who work with you can go home to family and friends after they finish the job.

Reynold Hert has been Chief Executive Officer of the BC Forest Safety Council since March 2009. He has more than 30 years of industry experience, most recently as President and CEO of Western Forest Products where he led significant improvements in the company's safety record.

The New Carbon Economy

Economic Opportunities in BC for Living Carbon

by Briony Penn

photos courtesy of Galiano Conservancy Association

On December 8th, 2008, two events on opposite sides of the world coincided to potentially broaden the scope of silviculture in BC forever. In Poznan, Poland, the United Nations Framework Convention on Climate Change (UNFCCC) agreed to include a protocol for carbon offset forestry projects, Reduced Emissions from Deforestation and Degradation (REDD). This adds to the existing UNFCCC tools of Improved Forest Management (IFM) and Afforestation, Reforestation and Restoration (ARR). Now a full suite of carbon protocols to help contain climate change forms a continuum of opportunities, from protecting existing carbon sinks to creating new ones and in between, encouraging a mix of micro-protection and micro-sink activities across larger forest estates.

Also on December 8th, the BC government passed the first "Emission Offset Regulation" as part of their target of a 20% reduction in 2004 greenhouse gas emission levels by 2020. With the international negotiations adding biophysical analysis of forest metrics for reducing and offseting emissions, the BC legislature established the legal framework to use these tools.

Existing standing natural forests, especially old ones with large stores of carbon and high annual sequestration rates, which reduce atmospheric CO_2, are best kept as growing sinks. Converting old growth natural forests (with pools of carbon in the canopy, understory, roots, soil, woody debris, and stems) into second growth stands for fibre or bioenergy, results in a reduction of the forest carbon reservoir and large net carbon emissions. One fifth of the world's annual emissions come from deforestation or degradation of forest

carbon stock. Consequently, it is just as important to tackle emissions from forest disturbances as it is from our tailpipes. Preventing immediate emissions is also more important than creating sinks whose benefits may not be realized for decades. It is this resulting emphasis on conservation that creates forest sector anxiety about forest climate action.

Limiting emissions as much as possible for forest activities in managed forests is important. IFM proposes changes in BC's "business-as-usual" forest practices, e.g., longer rotations, fewer trees, less roads, and higher protection levels, which also give rise to economic impact concerns. In BC, the fear is that replacing harvesting with protection, or introducing new IFM practices, will cost BC jobs. What will this mean in terms of work? No one is confused about the employment and development impact of creating more sinks on already degraded lands through ARR. These protocols add activity and jobs that did not exist before. They also have precise definitions argued painstakingly through the international negotiations i.e., IPCC (Inter-governmental Panel on Climate Change) and CDM (Clean Development Mechanism), to determine how much carbon projects sequester on an annual basis. We understand now that it can take a few decades to achieve substantive carbon sequestration rates causing reduced value from future sink price discounting.

In addition to UNFCC project rules, the North American Forest Carbon Protocol project has developed a principle of no net harm to biodiversity for any projects.

The implications of all of this for jobs and the economy are manifold. Professional foresters will inherit new skilled jobs in the quantification and valuation of carbon for different forest ecosystems. BC is Canada's most ecologically complex province and will require professionals who can measure and accurately extrapolate the future carbon storage and sequestration rates in the province's widely varying ecosystems. We will need experts in soils and biodiversity as well as carbon and trees. The "no net harm to biodiversity" principle in all international standards will also require monitoring. Since projects will have to be integrated into other ecosystem value generation opportunities, professionals with a broad understanding of multiple forest values, including biodiversity, habitat, soil stability, water quality, and atmospheric carbon exchanges will be needed.

The more labour-intensive and long-term tasks of managing, thinning where appropriate, removing invasive species, and stewarding the forests will generate an ongoing annual revenue stream that compliments the annual return in carbon from those activities. You may wonder how thinning can create climate benefits. Thinning, in some types of high disturbance ecosystems, can reduce fuel loading to make a forest more fire proof, so this can be silviculture with a byproduct. It may create a new generation of local entrepreneurial silviculturalists that have long-term commitments to regions. Not only will these projects create revenue for silviculture contractors, they will help nature to continue to store carbon.

In the case of REDD projects in mature natural forests, the carbon revenues are immediate and can be large. However, since harvest jobs may be lost, it will be important for these conservation offset revenues to be re-invested by communities to develop alternative socio-economic pursuits.

Since we are just starting out, pilots in BC will have to be quantified for their local economic impacts. Gary Bull, of the Faculty of Forestry at UBC, states, "Carbon management is moving rapidly from concept to practice in virtually all sectors of the economy. This simultaneously creates new challenges and new opportunities. Although the science is reasonably well understood, the implications for forest operations in BC are still largely unknown among forest managers."

There is a growing recognition that the market for tradable carbon credits has presented a new and important, measurable economic value to provide incentives for conserving forests or improving management and restoration of forests. Researchers are developing pilots to assess the opportunities and impacts within different management scenarios.

Three Improved FM Scenarios

A recent economic study by Simon Fraser University forestry researchers examined three different forest management scenarios in the Fraser Valley TSA of Southwestern BC. These were:

1. Business-as-usual - logging proceeds according to current guidelines for old-growth forest within the range of the spotted owl in BC;

2. Increased conservation - all forest stands that currently meet minimum requirements for suitable spotted owl habitat are preserved or removed from the timber harvesting land base; and

3. Increased plus expanded conservation - protection of forests currently suitable for spotted owls plus adjacent logged areas that with time will develop into suitable owl habitat.

For each scenario, using three different sets of log price assumptions, the researchers calculated the economic values for timber, recreational use of forests, non-timber forest products, and carbon storage. The results indicate that, in 72 of 81 different projections, increased conservation makes better economic sense for locals and their neighbours, than does business-as-usual. The study stated, "… there would be a net benefit rather than an opportunity cost associated with increased preservation of old growth forests. In other words, the benefits of preservation in terms of increased recreational opportunities, non-timber forest products, and carbon sequestration and storage outweigh the costs in terms of lost producer surplus from timber harvesting."

"The economic impact concerns associated with conservation have kept the province from moving forward with a full spectrum of forest climate actions."

The estimated values attributed to increased conservation are conservative. The study did not factor in ecosystem services such as provision of clean water, erosion control, and flood regulation. Also the trade-offs were not "all or nothing". Both scenarios of increased conservation would continue to produce some timber: 1.07 to 0.96 million m^3/yr compared to 1.43 million m^3/yr for the status quo.

Various experimental management plans have also been developed for forests in Chilliwack, Hope, Gulf Islands, and Sunshine Coast through the University of BC Forestry Department. Modelling different management scenarios, researchers found optimal scenarios that maximize both carbon and ecosystem service values.

Nature Conservancy - Canada's Pilot Project

Actual carbon valuation is being undertaken on Darkwoods, a 55,000 hectare tract of forest in the South Selkirks, between Nelson and Creston, which has been purchased by the Nature Conservancy of Canada. Carbon pools are being valued under international compliance standards. It could well be the first extensive forest estate evaluated for compliance carbon offsets in BC. Land trusts, First Nations, municipalities and other land managing agencies are initiating several other pilot projects looking at opportunities for carbon management and conservation offsets. These projects are predominantly voluntary and proprietary, but point to an emerging body of professional expertise and potential projects.

For these new forest carbon economy initiatives to fully benefit rural BC, they have to rise on an international tide of potential future trading beyond the borders of the province. There are good indications that this is already happening.

BC's partner in the Western Climate Initiative, California, has developed the first pilots in three carbon activities: avoided degradation offsets (REDD-equivalent); Improved Forest Management; and Afforestation, Reforestation and Restoration (ARR), which have been registered with the California Climate Action Registry through the Garcia, Van Eyck and Lompico Headwaters Forest Project. BC has established its own Pacific Carbon Trust to assist the public sector in becoming carbon neutral by 2010 and next year. The government has indicated that they will be passing legislation for zero net deforestation by 2015. The California Forest Carbon Protocols for

Stand before and after treatment

the Climate Action Reserve (CAR) may well provide the model for BC's forestry protocols, which are currently being drafted.

Trading Markets

Nationally, the Montreal Climate Exchange (MCEx), a joint venture between Chicago Climate Exchange and the Montreal Exchange, was launched in May 2008 to serve the evolving Canadian emissions markets as policy guidelines continue to develop, and the federal government issued a draft *Guide for Protocol Developers* on August 9, 2008. With developments in the US, the *Waxman Markey Act* was passed in June by the House of Representatives and the cap and trade program is currently being discussed. The US Senate is poised to pass a complementary climate and energy bill, so that the President can combine the legislation from the two houses and commit the US to new targets and actions so that it can engage constructively in the UNFCCC talks in Copenhagen. Internationally, higher caps and new carbon activities are set to be implemented, and countries that ratify the protocol and qualify will be able to offset carbon emissions through forestry projects.

The Climate Exchange Company (the world's leading specialist exchange for trading emissions and environmental services) posted their returns for 2008, indicating a 2.6 times growth in volumes in 2008, and 2009 is still growing fast in a time of economic recession. The international carbon trading market was valued at more than $60 billion USD in 2008, more than double that of 2007. The international market for carbon is expected to hit $3 trillion USD by 2020. Based on recent estimates of the global cost of carbon, the carbon stored by BC's forests is worth between $500-$750 billion CDN, which compares to the timber valuation made by the MOFR several years ago.

The Research Context

Industry, to date, has only undertaken a few forest carbon projects in BC. The situation is predicted to change very rapidly due to investors demanding accountability for carbon emissions and government requiring reporting for their accounting of carbon. Although the BC government has not originated any forest carbon projects, a three-year strategic plan to address ecological research, climate forecasting, ecosystem monitoring, and policy evaluation has been implemented through the Future Forest Ecosystems Initiative, where carbon is identified as a key element of the ecosystem processes and ecosystem services. Policy and research are being generated on climate change issues. Meanwhile, ecosystem-based management is being applied on the ground and expertise is developing on the coast. Although the protocols for IFM for carbon can differ from the new ecosystem-based management being implemented on the Coast, the two approaches are complementary and can be developed in conjunction with one another.

Much of the delay due to policy concerns that the carbon economy could have economic impacts through reduced timber supplies on Crown tenures may be addressed by the pilots. Clearly, the timing and therefore the present value of such impacts would depend on whether existing, harvestable timberlands or already logged lands are involved. If mature timber was involved, the first thing to consider is whether it is economically harvestable in the foreseeable future, or whether the timber is in a less operable area (e.g., where timber is of marginal quality and may be removed from the existing forest road network). There may also be existing rules that preclude harvesting, for example buffers next to riparian areas could have a formal covenant.

The protection of mature timber within operable areas in order to generate carbon credits could result in restricting harvest and therefore have broader economic impacts. However, even protection of mature, operable timber may not necessarily result in immediate harvest reductions and economic impacts for several reasons. For example, in certain market conditions (like now, particularly on the Coast), the actual, current harvest may be significantly less than the allowable harvest. Timber supply modeling would be necessary to better estimate the timing of harvest impacts (i.e., harvest flow impacts). The main point is that while assessing impacts of timber protection, it would have to be determined whether existing economic activity would be immediately reduced, or rather that potential activity in the future would be less. Delays in timber harvest impacts would also mean that transition programs from conservation revenue sharing for firms, workers, and communities would have more time to take effect.

Finally, with economic incentives for increasing biomass through ARR, more lands that are either understocked or not planted could be managed better for carbon. A spatial analysis of the potential degraded lands that could be restored may offset possible mature forests pulled out of timber projection for conservation, and with a major silviculture management investment, could result in no net loss of productive forest lands in the forest estate.

The economic impact concerns associated with conservation have kept the province from moving forward with a full spectrum of forest climate actions. But given the net neutral to positive economic impact for rural communities of planning using both conservation and ARR tools across a forest estate, and the benefits to the silviculture industry, these issues should no longer hold BC back.

The business of offsets might well outstrip any political resistance and certainly in BC, the markets are poised, coming from a variety of different sectors. It may be that incremental silviculture activity, required to implement forest carbon management across forest estates, will once again be a part of BC's future. As incremental silviculture is similar to harvesting, in that it has considerable economic spin-off benefits - increasing employment and government revenue as well as supporting a service industry in rural areas - the BC forest sector along with the strong labour interests in BC and government should all welcome this new forest carbon economy.

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Western Canada

Western Silvicultural Contractors Association

by John Betts, Executive Director

Forestry Practices as Important as Wildfire Fighting

The way the BC forest sector is these days, the province's main export product this summer was likely smoke. According to US weather maps, on some days soot and particulate matter from our Interior wildfires crossed the Cordillera with the jet stream, travelling as far east as the Dakotas. On other days it drifted south to Oregon and then east up to Wyoming. And that was just what was visible.

By early September, the province's wildfires had rapidly-oxidized 45 million bone dry tonnes of forest biomass into approximately 90 million tonnes CO2e of assorted greenhouse gases - a rate roughly three times our ten-year average and equivalent to the annual pollution of 17 million passenger cars - nine times as many as there are in BC. To put that in the timber values lost category, that is 64 million cubic metres of wood totaling $31-million in lost stumpage. Adding to that loss is the direct firefighting expense of $320 million, which was spent as of mid-September, when approximately 400 fires were still burning. If we assume that half the fires have occurred on the timber harvest land base, then it will require 126 million seedlings to promptly plant over 100,000 hectares at a cost of $156 million. The provincial carbon tax on the wildfire emissions would be $1.2 billion.

Back in 2003, I attended that year's US Western Governors' Forest Health Summit in Missoula, Montana. Considering that forest health problems don't stop at the border, it was remarkable that I was the only Canadian there among the 300 foresters, county and state politicians, environmentalists, firefighters, and general citizens. As a result, I think many in our BC political and policy community missed a critical message regarding forestry and fire, which we need to start putting into practice in this province.

The then US Forest Service Chief Forester, Dale Bosworth, remarked that the vast majority (98%) of wildfires are successfully fought, but that remaining small number of unmanageable fires were responsible for almost 80% of the damage. "We can't fight these fires," he admitted. They were simply too big, too intense, and too dangerous. "The only thing we can do to prevent these kinds of fires is to take the heat out of the woods." By that he meant that government, in order to protect its forests, its treasury, and its citizens, had to manage these forests through strategic fuel management before they burned. Otherwise they would continue to see massive catastrophic fires across the country.

Many of the conditions that led Bosworth to this conclusion are present in BC today. Our forests are as ingrown as those in the US. We have the beetle plague and assorted blights, and our human habitat continues to encroach on forests that are determined to burn. This year we likely set a BC record for evacuations and evacuation orders. We will probably face more years like 2009 soon; years in which there will be tougher decisions about the risks we take to protect communities and infrastructure as well as what we spend in dollars and, unfortunately, possibly lives.

It would seem prudent to begin a major program in this province to reduce the wildfire threat that is gaining strength across the landscape. That program would "take the heat out of the woods" through fuel management and silviculture treatments not only in the wildland urban interface, but across the broad landscape, particularly where the mountain pine beetle assault has been most concentrated. In this context, active forestry crews doing ecosystem restoration work would be as critical as fire suppression crews in managing the wildfires of the future. Recently the BC government has dedicated a vastly expanded budget, in the hundreds of millions, to fight future forest fires. It would be just as wise to set a percentage of this amount aside to implement proactive ecosystem restoration and fuel management work to reduce the severity, intensity, and scale of the wildfire threat our woods increasingly pose to the province.

Ontario

Superior-Woods Tree Improvement Association

Paul D. Charrette, RPF Superior-Woods Tree Improvement Association

Seeds of Renewal

Which came first, the tree or the seed? Tree seed is an important part of forest renewal in Ontario; however, we frequently take for granted this essential element of silviculture. Ontario used over 1 billion conifer seeds in 2006 for treeplanting and seeding operations, which is certainly no small number. In spite of the importance of conifer seed in forest renewal and the large number of seed used annually, the operations associated with collecting and providing quality seed in a timely and efficient manner usually go unnoticed. The economic downturn may lead to increased use of lower cost forest renewal techniques such as seeding, putting more pressure on cone and seed collection operations. In addition, long-term issues associated with climate change and seed source may also require greater attention to cone and seed collection operations.

The forest land base in Ontario is divided into a number of Sustainable Forest Licences (SFLs). Since the mid-1990s SFL managers have been responsible for conducting all forest renewal operations, which includes maintaining an adequate inventory of quality seed for forest renewal. The use of seed in forest renewal must follow provincial guidelines on seed zones and seed transfer. Separate seed banks for each seed zone are managed by each SFL. For many SFLs, the seed used for growing seedlings for treeplanting operations originates from seed orchards (i.e. improved seed), which are part of cooperative tree improvement programs. In addition, each SFL must also organize the collection of conifer seed to meet the demand for all other conifer renewal operations from uncontrolled seed sources, such as natural stands.

While treeplanting receives most of the attention when we think of conifer renewal, considerably more seed is used in seeding operations in Ontario. Renewal from seeding in Ontario consists mainly of aerial seeding, also referred to as direct seeding, or seeding with site preparation. Aerial seeding is by far the more common method of seeding, especially in Northwestern Ontario. Roughly 80% of the seed used on an annual basis in Ontario is used in seeding operations, and 20% is needed to produce seedlings used in treeplanting. In 2006, over 870 million conifer seeds were used in seeding operations of which 95% were jack pine seed. For the 5-year period from 2001 to 2005, seeding operations were used to renew over 23,000 ha per year on average. Therefore, seeding operations make up a significant amount of conifer renewal in Ontario, and collecting the seed is an essential component.

> "Tree seed is an important part of forest renewal... we frequently take for granted this essential element of silviculture."

Cone collection operations across Ontario require a mobile and largely rural labour force in order to collect over 7,000 hl (hectolitres) of conifer cones per year. SFL managers may elect to coordinate cone collection operations directly or they may work with a local silviculture contractor to coordinate the operations. Those coordinating the operations attempt to develop long-term relationships with local cone collectors to ensure the efficient collection of high quality cones and seeds from appropriate sources. Forest companies and silviculture contractors may also require cone collectors to participate in training courses prior to obtaining permission to collect cones.

The collection of high quality conifer seed is an important part of forest renewal, especially in Northwestern Ontario. Having an efficient cone and seed collection program not only makes economic sense, especially during the current economic conditions, but it may also be of increased importance if climate change results in modifications to seed transfer and seed zone guidelines in the future.

PEI
Forest, Fish & Wildlife Division

by Ken Mayhew, Information Officer

Forest Policy Implementation Update

Since releasing its new Forest Policy in late 2006, the Forests, Fish and Wildlife Division of the Department of Environment, Energy and Forestry has been working to implement the various recommendations and commitments.

Forest management programs for private and public lands are now guided by the standards contained in the *Ecosystem-based Forest Management Manual*. The manual is designed to address typical forest management issues and concerns in areas such as infrastructure, tree establishment, stand improvement, and special enhancement techniques. It builds on the principles and concepts of earlier forest management programs, but whereas earlier efforts tended to focus on forests as economic development tools, the new manual places priority on ecological principles and values.

"The Division is exploring the potential effects of climate change."

Efforts are underway to simplify the tendering process for public land products and to develop more partnerships with groups and communities that share an interest in, and commitment to, public forests. The Public Forest Council is working on recommendations for the demonstration of forest certification systems on public lands, and is striving to increase awareness of the many roles these forests play in our environment, society, and economy.

In terms of private forest lands, the Forest Renewal Program has been folded into the Forest Enhancement Program in order to provide landowners with a wider range of forest management services. Beginning in 2009, all private land clients are required to have forest management plans prepared before they can access public funding to help them manage their woodlands.

The Seedling Production Program has put more emphasis on hardwood production. The nursery has also increased the number of large seedlings it produces in order to meet the requirements of a variety of specialty planting needs, such as watershed management. Larger seedlings are better suited to the difficult growing conditions found along streams and waterways.

Work is underway for several other core commitments such as value-added forest products as well as education and training. The Division is also exploring the potential effects of climate change on Island forests and is determining which species may be better suited to future conditions. In order to fully address issues such as climate change, updated information from a new land use inventory will be required. The Forest Management Act requires an update in 2010, and work is underway to prepare for the inventory. This information will help the province to implement additional forest policy commitments as well as address the growing needs of forest managers, farmers, urban planners, and others who require accurate and up-to-date land use information.

For more information on PEI's Forest Policy, visit www.gov.pe.ca/go/forestpolicy. You can also get information on the Forest Enhancement Program at www.gov.pe.ca/go/fep, or access the online version of the *Public Land Atlas* at www.gov.pe.ca/gis.

Upcoming Issue

Winter 2010
Online January 15

- Wood Products as Carbon Sinks
- Social Impacts of Bioenergy
- REDD – Reduced Emissions from Deforestation & Degradation
- Growing New Forests to Save Old Forests

New Brunswick

AGFOR

by Gaston Damecour

ESILV Data Handling

Since 2005, New Brunswick Crown silviculture data handling has been done in real-time and is almost paperless. The system, nicknamed ESILV for Electronic Silviculture, uses a web-based interface that emulates the old paper system and is accessible by licensees and DNR and its regional offices. ESILV capitalizes on the digital tools used in the field, such as GPS and data collectors, and their compatibility with PCs and GIS. ESILV spans the licensee's data handling; planning and forest management systems from the annual silviculture proposals to DNR; execution and reporting - within 30 days; and DNR's monitoring and approval processes, all the way to final payment. Some data components, such as rate determination, go on to contribute to the following year's silviculture program.

The system has been integrated and is used by the licensees. It is fully functional within DNR and the four regional offices that monitor Crown silviculture on the ground. The entire system is at the manager's fingertips for an almost real-time picture of the silviculture program as it unfolds during the active period. Everything from scheduling and monitoring (including the stratified sampling) to budgeting is readily accessible.

> "...ESILV has met the original objectives of reducing administration, data handling, paper and cost."

Martha O'Sullivan, Crown Land Silviculture Forester, indicated that the system is the product of thoughtful development and astute integration with the province's GIS and Crown licensees' processes. Improvements to the system occur during meetings each year to review the program's operation with DNR head office, regional staff, and licensees.

New Brunswick has an interactive digital trail rather than a paper trail, with real-time geo-referenced data at every step of the process for the different silviculture program tasks. The data then goes onto the Forest Management Branch's GIS where the forest layers are updated within one month. The updated forest cover typing is subjected to validation during the provincial aerial photo-interpretation that is completed on a ten year rotation.

According to O'Sullivan, the ESILV has met the original objectives of reducing administration, data handling, paper and cost. The system has worked very well with few glitches and has been adopted quickly by users. "As we gain experience, we appreciate that we have not yet fully exploited the benefits and possible applications of the ESILV system. The next likely step will be the integration of harvest operations and silviculture," she said, suggesting that the success of ESILV will support that initiative.

After all, one of the most significant silvicultural treatments is the harvest.

Gaston Damecour is a registered professional forester in New Brunswick and Nova Scotia. He is the senior consultant and principal of AGFOR Inc., based in New Brunswick. AGFOR has been instrumental in bringing about significant changes in the forest sector by representing governments and industries on such issues as health and safety, standards for forestry equipment, industrial relations, wood allocations and forest management policy. AGFOR has initiated discussion and collaboration between communities, businesses, and various interest groups.

Habitat Conservation Banking

The Opportunity for Forest Land Managers

by Nathaniel Carroll

What is a conservation bank? In a nutshell, a conservation bank is a parcel of protected natural land that is authorized to sell a set number of credits, most often in the form of acres of habitat, to a customer that is required by national or state law to mitigate their impact to the same species and habitat on nearby land. The demand for these credits is created by the fact that before a land developer is allowed to harm a protected species, U.S. law requires they obtain a permit. Permits often require mitigation activities, mitigation that is increasingly being satisfied in the form of credits purchased from a conservation bank, also known as a species mitigation bank.

From an ecological perspective, a conservation bank consolidates preservation efforts on a site specifically chosen for ecological value, and guarantees no time delay between destruction and replacement/preservation of habitat. From a regulatory perspective, a bank shifts the monitoring and enforcement effort from tens or hundreds of individual sites to one single site with one party responsible for reporting and ecological performance. From a credit buyer's perspective, once a credit is purchased he has washed his hands of any legal liability for the maintenance or performance of a mitigation site. Finally, from the perspective of a landowner, a bank is an opportunity to take what is commonly considered a liability on their land - a protected species - and turn it into an asset, which in some cases can demand from $5,000 to $400,000 a transaction.

The roots of conservation banking are found in wetland mitigation banking - a similar system of credits and required mitigation, but based on wetland impacts. While wetland banking got started in the mid 1980s, the first conservation bank wasn't established until 1995. The first bank, Carlsbad Highlands, was created by Bank of America in response to the challenge of deriving value from a parcel of land they'd acquired as the result of a foreclosure on a bad loan. That land was also home to endangered California gnatcatchers. Bank of America worked with regulators to find a mutually beneficial way to generate revenue from this asset. It took intense development pressure, strong environmental policy, and the innovation of California regulators to bring forth this first conservation bank.

Today there are roughly 800 wetland and 115 species banks in the US, nearly double the number of banks six years ago. Statewide mitigation banking programs are in various stages of development across the US, from North Carolina to Texas to Oregon. Both Massachusetts and Washington have pilot programs in wetland banking. And more than geographic boundaries are being broken. There are now several banks in California that sell anadromous fish (e.g. salmon). The scientific and accounting hurdles overcome to make this happen will likely set a precedent on which similar fish banks could spread quickly into the Pacific Northwest, a region in need of tools to balance the needs of humans, salmon, and the thousands of species that depend on this iconic fish. Finally, and perhaps with the greatest impact, the newly-minted federal Office of Ecosystem Services and Markets will soon be helping to set up the national institutional infrastructure for environmental credit markets, which will benefit private farms, ranches, and forests.

So what does all this mean for forest land managers? It means there is a growing opportunity to earn revenue from managing your land, or a portion of it, for species habitat. However, as with any nascent market, conservation banking opportunities can be hard to see and a challenge to bring to fruition. To successfully navigate to the financial and ecological rewards of a conservation bank, it is critical to fully understand each ingredient of what it takes to establish a successful conservation bank. As outlined by Craig Denisoff, President of the National Mitigation Banking Association, success is a combination of capital, expertise, and opportunity.

The first ingredient, capital, you may already have. This is land, cash, or access to cash. If you already have land for a potential bank, you are at an advantage, since land in areas that have demand for mitigation can be very costly. There are also other significant capital costs such as permitting, design, construction, and an endowment. Another significant factor is the fact that conservation banks usually sell their credit over a period of more than four or five years, and it can take one or more years to bring the bank online. Your return on investment will not likely be swift.

The second ingredient, expertise, should not be underestimated. Let's admit it; species credit trading is likely out of our core competency as forest land managers. But as managers of the land, we are also likely charged with ensuring the well-being and long-term sustainability of the land, which in most cases includes profitability and tracts with protected species or high conservation value. We can be better stewards by developing diverse revenue streams from our land, but it will take diversifying our knowledge too. Permitting a conservation bank can take a wide array of specialized expertise such as biology, ecology, real estate, legal, regulatory planning, government process, marketing and sales, and financial accounting. Being familiar with each of these will smooth the bank establishment process even if you plan to subcontract most of the work.

The final ingredient, opportunity, is perhaps the hardest to get a clear picture of. Opportunity is simultaneously having the right conditions for a quality, cost-effective product, and a reliable market of buyers. This means having a bank site that not only harbours a protected species, but is also high-quality habitat that is ecologically sustainable and has desirable conservation attributes, such as connectivity for species movement. In short, it should be a site of high conservation value for the species (and the regulators charged with ensuring the species recovery), not marginal habitat with an isolated population unlikely to survive without intensive management.

On the market side, a bank must have demand within its service area - the area within which it can sell credits that are still ecologically relevant. This demand should be diverse (in both the public and private sectors) so as not to be exposed to the whim of a few customers or economic fluctuations. It must be able to compete against the other forms of satisfying mitigation requirements, such as on-site mitigation, in-lieu fees, or other conservation banks. Perhaps most important is the regulatory environment you are in. In some regions, regulators aren't familiar or favourable towards conservation banking. In other areas they understand the advantages of conservation banking, but it may be their first time permitting a bank, so they will move slowly. A good working relationship with your regulators can go a long way in the success of your bank.

Understanding your market and your place in it requires a good deal of research. Reading up on the general practice of conservation banking is a good way to get started. The industry is always changing and every region has its own flavour of compensatory mitigation. Second, a quick analysis of your particular site and market will give a sense of your opportunity. And third, go meet with your regulators (state and/or federal fish and wildlife agencies); they will be instrumental in the establishment of your bank.

This article is adapted from an article that first appeared in Western Forester, March/April 2007, Vol. 52, No. 2, Society of American Foresters.

Nathaniel Carroll is Project Manager for biodiversity markets at the Ecosystem Marketplace, a leading source of information on markets and payment schemes for ecosystem services around the globe. He can be reached at ncarroll@ecosystemmarketplace.com.

Resources

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