Breaking trail through mountains – forest policy implementation case studies

by Guy K.M. Smith[1] and James E. Johnson[2]

ABSTRACT

Contemporary forest policy is attuned to present and anticipated future societal needs and to long-term dynamics of ecosystems. Policy regimes across North America tend to accommodate degrees of adaptive management to account for future uncertainty. The metaphor of a hiker in a mountain range illustrates the complexity of policy implementation and the need for tools and actions to manage in a changing environment. Case studies from British Columbia, Ontario, Oregon, and Virginia illustrate specific policy regimes and characterize a common "enabling" role necessary for effective policy implementation. Two key enabling functions emerge: the development of analytical tools and the development of educational programs directed to specific needs of persons charged with policy implementation. Organizational capacity in knowledge transfer and extension is instrumental in supporting policy implementation in all four cases.

Key words: forest policy, implementation, extension, knowledge transfer, enabling, case studies, policy regimes

RÉSUMÉ

Les politiques forestières contemporaines sont en accord avec les besoins sociétaux actuels et anticipés ainsi qu'avec la dynamique à long terme des écosystèmes. Les régimes politiques de toute l'Amérique du Nord cherchent à tenir compte des niveaux de l'aménagement adaptatif pour parer aux incertitudes de l'avenir. La métaphore d'un marcheur en montagne illustre la complexité de l'implantation des politiques et de la nécessité d'avoir des outils et d'entreprendre des actions pour être en mesure de gérer dans un environnement en changement. Des études de cas de la Colombie-Britannique, de l'Ontario, de l'Oregon et de la Virginie illustrent des régimes spécifiques de politiques ainsi que la nécessité d'un rôle commun de « facilitateur »pour l'implantation effective des politiques. Deux fonctions clés de facilitateurs émergent : l'élaboration d'outils analytiques et le développement de programmes de formation orientés selon les besoins des personnes en charge de l'implantation des politiques. La capacité organisationnelle dans le transfert des connaissances et la formation est essentielle pour ce qui est de l'appui accordé lors de l'implantation des politiques dans les quatre cas présentés.

Mots clés : politiques forestières, implantation, formation, transfert de connaissances, facilitateur, étude de cas, régimes de politiques

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Introduction

The story of forest policy implementation in North America is like that of a hiker ascending an uncharted mountain. Early in the trek, the focus was on locating the best route to move efficiently towards clear checkpoints. The hiker's eyes were fixed ahead a few metres along a well-marked, shady trail. It was relatively easy hiking. That was before the mud, washouts, and lost markers; before abrupt cliffs forced a search for alternate approaches. The challenge of the mountain loomed large, progress seemed elusive, and unfamiliar questions entered the hiker's thoughts. Is there a top to this mountain? Can I ever get there? Do I really want to? What is beyond this mountain? Beginning to sense a number of possibilities, the hiker scanned ahead farther and saw big patches of sky through openings in the forest. In time the hiker came to realize that the mountain was in the midst of a great range of mountains that stretched to the horizon in every direction.

Forest policy in the 21st Century presents a challenging landscape for those charged with putting policy requirements into practice. This essay explores forest policy implementation—its tools, actions and the players involved. Particular enabling functions are described, and it will be argued that these functions provide critical support for effective implementation. Following stops in British Columbia, Ontario, Oregon and Virginia, we hope that the reader will have a better "trail sense" of what it takes to implement 21st Century forest policy.

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The View from the Mountain – 21st Century Forest Policy

Tenets of today's policy making are: vision that encompasses interconnected ecosystems, discernment of patterns and dynamics across landscapes, and acuity to ecological processes that operate over natural cycles of time. Likewise, frameworks and approaches that consider a range of options and possibilities and accommodate a patchwork of interests are becoming the norm.

The hiker in our story uses all senses to assess unknowns, such as where the trail has been, where it may lead, and what hazards may wait beyond the next rise. Similarly, policy attuned to present and future societal needs and to long-term dynamics of ecosystems operates in the face of uncertainty and requires tools and actions to manage this uncertainty. We see evidence of this in the frequent updating of legislation and revising of guidelines, and in terminology such as "enabling legislation," "adaptive management," and "results-based regulation." In some jurisdictions, such as Ontario, forest policy sets its sights on a "desired future forest condition," creating present-day demands to gather and process relevant information about a range of possible future outcomes. The hiker cannot seek the solitude of a sheltered enclave, but must be out in the open surveying a forest rolling out over miles and years.

Although scanning ahead, the hiker is making an imprint with his boots in the here and now. Legislation that permits "testing of different regimes," (Ministry of Forests and Range 2007) and taking "an adaptive approach … with a built-in learning process" (Ontario Ministry of Natural Resources 1994a), is the same legislation that imposes regimes of compliance, enforcement, and penalties. The hiker cannot rise above the trail in an experiment with alternatives without being accountable for present-day actions. Nonetheless, the trend appears to favour an incentive-based approach to regulation versus a prescriptive rules-based approach, as much for its realism in dealing with uncertainty as for its recognition of the limited resources available for implementing and enforcing regulation (Adamowicz and Veeman 1998).

The reality for our hiker is neither relief from the burden of compliance nor a shortcut to adaptive management. Our hiker has to be equipped to pack everything out and leave no impact, armed with the best sensors for gathering information about the trail environment, fitted with remote sensing technology to scan ahead, and tooled with predictive models to evaluate a range of scenarios. If it sounds like a tall order, it is. Today's forest policy places importance on taking a comprehensive approach to exploring all practicable management options and providing a picture of associated opportunities and outcomes, in the face of the inevitable uncertainty that accompanies forecasting the future (Erdle and MacLean 2005).

Outfitting the Hiker – Taking Care of Policy Implementation

In order for forest policy to properly acknowledge and address future uncertainty, those concerned with putting policy into effect must ensure that: plans and decisions are based on the best available science, public and other stakeholders are involved, information at the appropriate temporal and spatial scales is employed, and decision-makers are accountable for their actions. Bringing these critical pieces together within complex systems of governance and forging a coherent and acceptable course of action is akin to an act of alchemy, played out continuously on land management areas across the continent.

There is no single outfitting company that provisions the hiker. Every trail on every mountainside presents a unique set of challenges. The case studies that follow serve to show the range of approaches taken to suit a diversity of needs. What really matters is that the boots fit, the pack is comfortable, and the hiker is ready, willing and able to use the tools and equipment supplied.

The outfitting sector is described in a few familiar terms. *Knowledge transfer* aptly encompasses the range of activities that delivers relevant knowledge to someone who wishes or needs to receive it. More specific is *technology transfer*, which implies an increase in levels of skill and use of tools, often through commercialization (Perera *et al.* 2006, Reed and Simon-Brown 2006). The term *extension* has international currency, as embodied in the International Union of Forest Research Organizations (Johnson 2006), and institutionalized in the Cooperative Extension System of the United States (Norland 2006). The Canadian experience with natural resources extension is as diverse as the nation's federation, with a variety of regional partnership arrangements supported by provincial and federal government funding, and directed through non-government entities with a broad base of stakeholders. Examples include British Columbia's Forestry Forest Research and Extension Partnership (FOREX) (Morford 2003) and Ontario's Forestry Research Partnership (FRP) (Pineau and Smith 2006).

The evolution of the Cooperative Extension System in the United States, dating from 1914, is an example of an institution changing under the influence of profound changes in demographics, land ownership patterns, and societal issues at the levels of the individual and the community. The effects of a global economy, a warming climate, and intensified land-use pressures are dictating a new role for extension services across the country. Traditionally intended to provide informal education to landowners, extension focused on the delivery of "how-to" applications from science to enable more productive agricultural and later, forestry, practices and to encourage resource stewardship. Today, extension programs are filling a broader mandate of facilitated learning about options and their consequences, thereby helping resource managers and engaged citizens make informed choices and tradeoffs. In mature democracies such as the U.S. and Canada, with complex systems of governance and multiple jurisdictions overseeing uses of public and private lands, there are many interested parties with a stake in natural resources policy. The better informed these parties are, and the better equipped with sound scientific knowledge upon which to base positions, the more likely it will be that progressive policy development and change will occur (Smith and Smith 2006).

The case studies in this essay introduce the reader to various policy regimes operating in North America. Hoberg (2002) defines policy regimes as distinctive combinations of actors, institutions, and ideas that operate in a specific policy area and particular period of time. Policy actors represent individuals and organizations that play a role in the formula-

tion and implementation of policy. This essay focuses on the actors who have an interest in knowledge transfer, technology transfer, and extension, and bring resources and capacity to bear to enable policy to take effect in forest management planning and practice. Policy regimes, as influenced by the fast-changing world we find ourselves in at the beginning of the 21st century, are the mountain ranges in our metaphor. Fig. 1 is an attempt to present the concept, with the square, ovals and triangle collectively encompassing policy institutions, actors and ideas. Outside the square are the powerful pressures of change that influence policy change (Hoberg 2002).

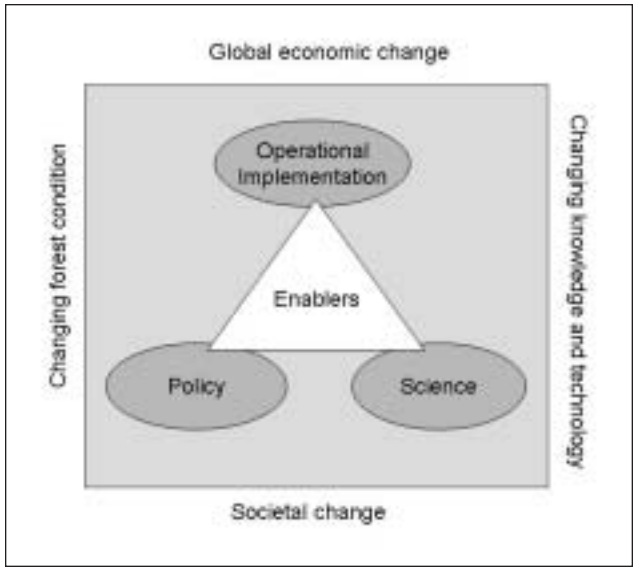

Fig 1. Policy regime operating within a larger environment of change. Enablers are a set of policy actors required to link policy and science actors to operational interests, which include the implementation of policy in management plans and practices. The regime is influenced by constant pressures of change.

British Columbia – Decision Support for Results-Based Silviculture Planning

As the dramatic physical landscape of British Columbia (B.C.) is a product of cataclysmic upheaval, so its policy landscape has been lifted, folded, and subducted over a relatively short time. The 1990s in particular marked a period of environmental and political activism prompting rapid policy change in an increasingly challenging business climate for forest industry (Cashore *et al.* 2000). The case study centres on the Kootenay–Boundary Region in southeastern B.C., where land and resource development, conservation, and planning activities are intertwined with a history of escalating land-use conflicts (Kootenay Inter-Agency Management Committee 1997).

A U.S. based company, Pope & Talbot, has responsibility for managing 556 900 ha of provincial land in the region under a Tree Farm Licence issued by the B.C. Government (TFL 23). The company's mills produce lumber from several species including interior spruce, lodgepole pine, Douglas fir, and western hemlock.

The terms and conditions of TFL 23 carry particular requirements for harvesting and silviculture planning and operations. The licence falls within the boundaries of the Kootenay Boundary Higher Level Plan Order (Integrated Land Management Bureau 2002), which established resource management zones and objectives pursuant to the province's *Forest Practices Code of British Columbia Act*. Subject to the requirements imposed by the order, Pope & Talbot is required to produce a Forest Stewardship Plan for approval by the Province under the *Forest and Range Practices Act*, out of which falls the commitment to a District Level Agreement for Management of Caribou. Adding to the complexity of the working environment is the company's own initiative to maintain certification of woodland operations according to the SFI and ISO 14001 standards.

The seemingly tangled web of policy has a common thread—considerable responsibility is placed in the hands of forest companies to manage resources appropriately. Legislation is intended to establish a "workable, results-based code," (Ministry of Forests and Range 2007); the Higher-Level plan has an adaptive management element to allow for adjustments of objectives and strategies over time as new information is made available (Swift *et al.* 2007); progress towards sustainable forest management is gauged by monitoring of indicators of the future forest condition (Bourgeois 2003).

An objective framework is needed to enable managers to exercise management responsibility in this environment and address the layers of planning requirements. Such a framework should support decision-making at appropriate spatial and temporal scales, and enable scenario planning, modeling, and trade-off analysis for multiple objectives (Jeakins *et al.* 2006).

Pope & Talbot teamed with Forest Research Extension Partnership (FORREX) of B.C. to develop a decision-making framework that linked strategic forest objectives to specific site and stand conditions on TFL 23. FORREX applied its extension specialty to guide company personnel through a decision pathway using a rational model approach. The process consisted of identifying values and setting goals, gathering pertinent information, developing and describing alternative courses of action, and implementing and monitoring a preferred course following analysis of alternatives. The complex nature of forest management required that each step be taken in a series of planning cycles, to address the full range of issues involved and ensure that all factors were considered and all relevant information gathered. The result of this systematic approach was a framework that incorporated current knowledge, available data, and operational experience (Swift *et al.* 2007).

To support the use of the framework, FORREX played the role of knowledge gatherer and synthesizer to produce the Stand Establishment Decision Aid (SEDA) Extension Notes series consisting of the latest research and experiential information related to specific factors that impact successful regeneration. A searchable on-line database is linked to FORREX's Natural Resources Information Network. The database contains the references used in the development of the extension notes, and can be searched should more information be required on a question not completely covered in the notes.

How have the framework and supporting tools outfitted Pope & Talbot for its trek through the policy and planning mountain range? For starters, company planners included critical information in their spatial information management system, which is used in day-to-day management activities. Subsequently, the framework served as a basis for characterizing caribou habitat requirements in meaningful terms that linked knowledge of the species to forest structural conditions and habitat elements (Hamilton *et al.* 2006). An unexpected benefit has been the opportunity for dialogue at the planning level to link harvesting and silviculture, to ensure that issues and problems are identified as a whole system rather than as individual activities.

Ultimately, policy implementation will occur as the Forest Stewardship Plan is implemented in the new results-based environment. It remains to be seen how agencies and licensees will meet the challenge of putting forward alternative approaches, and handling the risk that inevitably accompanies change.

Ontario – Meeting the Challenge of Predicting Long-Term Forest Development

In 1994, Ontario forest policy cut a new path with the release of the Policy Framework for Sustainable Forests and shifted the management of the province's forests from one focusing mainly on timber values to one which looks at the forest as an ecosystem (Ontario Ministry of Natural Resources 1994b). The announcement began an era of unprecedented change to forest management planning in Ontario, one that continues today as policy-makers, planners, and forest practitioners strive to implement ecosystem management on the province's 60 million ha of Crown forests.

A keystone of sustainable forest management on Crown land in Ontario is the definition of desired future forest condition and the planning of actions to maintain or restore this condition. Such a forward-looking view necessitates an adaptive policy approach that allows for flexibility in management practices to allow for new information as it becomes available (Ontario Ministry of Natural Resources 1994a). In keeping with this approach, Ontario introduced the *Crown Forest Sustainability Act* (1994), which is considered to be "enabling legislation" because of its requirement that specific manuals be prepared to direct planning and operations, and for the regulatory powers given the Crown to approve and amend the manuals.

Among the regulated manuals is the Forest Management Planning Manual (Ontario Ministry of Natural Resources 2004), which details the approach to determining sustainability on the province's 48 management units. The manual requires projections of forest composition and structure 160 years into the future. (In practice, however, 100 years is usually the limit because of modeling limitations). Quantifiable objectives are to be identified for productive forest area, habitat for selected wildlife species, harvest area by forest unit, and harvest volume by species group. The manual further provides a set of mandatory indicators for the assessment of management activities in relation to objectives, a measure seen as fundamental to the determination of sustainability.

While the policy requirements may be summed up in a paragraph, policy implementation is a daunting exercise that fills forest planners' days (and often nights) for months on end. Landscape-level management in jurisdictions with large public land bases, such as Ontario, needs to address complexities of ecological processes across multiple scales. It requires analytical and predictive tools for modeling landscape processes and evaluating strategic management options in the context of changing management environments (Gustafson *et al.* 2006).

Ontario's Forest Management Planning Manual and Forest Information Manual require "base model runs" that account for rates of natural disturbance and succession, and forest growth and yield. Historically, expert opinion and local experience have been key inputs to rates of change predictions. These elements alone are known to be deficient and have been questioned by various forest stakeholders and forest management plan reviewers. A further deficiency is reliance on decades-old growth and yield predictions based on a limited set of data plots that describe yield curves for seven species of trees, all of natural origin only (Pinto and Woods 2006).

The Ontario Ministry of Natural Resources (OMNR) is playing a critical enabling role in support of policy implementation, consistent with its mandate of ensuring that resource management decisions are backed by sound science and reliable data. The combined efforts of specialists from the disciplines of planning, information management, and forest science have resulted in predictive models and vastly improved yield curves based on a wealth of permanent sample plot data from across the province. Partnerships with non-government entities, such as the FRP, have added flexibility and capacity to meet specific science needs and support transfer to management units (Pineau and Smith 2006).

The improved "empirical yield curves" satisfy key requirements of both the Crown and end users: provincial in application yet locally adjustable, scientifically defensible (having been subject to testing and peer review), tailored to standard forest units of planning, able to incorporate a range of management intensities, and compatible with the provincial forest resources inventory and forest management planning process.

Adoption of the empirical yield curves in the already demanding forest management planning process has been facilitated by collaboration among OMNR's regional analysts and science specialists, who stand behind the product. Both groups have been involved in training sessions to help with knowledge transfer and to add credibility in the eyes of the end user. The yield curves are incorporated into the existing computer software platform (SFMMTool), approved by OMNR and in regular use by forest planners. In the end, the "round peg" of a science product, is tailored to fit the "square hole" of the planning framework (H. Higham[3], personal communication).

Oregon – Citizen Engagement for Salmon Recovery

The 1992 listing of Chinook salmon as a threatened species under the U.S. *Endangered Species Act* (1973) was followed by a cascade of legal actions and policy decisions that had rapid

[3]Resources Information Specialist, Forest Management Planning Section, OMNR.

and profound impact on Oregon forestry. Most notable was the sharp drop in timber harvests on federal land, which comprises 57% of forest land in the state, and resultant mill closures, unemployment, and socioeconomic troubles in forest-dependent communities.

Poor logging and grazing practices over decades had left their mark on streams and streamside vegetation communities that provide habitat critical to all stages of the salmon life cycle. Since the late 1980s it was known that Oregon's salmon populations were in serious decline; the effects were evident in both commercial and recreational fisheries. Several reports documented the decline and the degradation of water quality in many streams and rivers around the state. In 1993, the Oregon legislature developed the Watershed Health Program and established guidelines for creating watershed councils—citizen-led, volunteer-based groups that represent the many interests (recreational, commercial, environmental, and others) in Oregon watersheds. Meanwhile, lawsuits were being filed to have Coho salmon listed as a threatened species.

Based on the early successes of watershed councils, in 1997 Oregon created the Oregon Plan for Salmon and Watersheds (the "Oregon Plan"), which expanded the Watershed Health Program to support watershed councils and related efforts around the state. The plan merged public concern and community-based action and worked to restore and enhance salmon habitat through voluntary actions leading to measurable results, rather than through new federal regulations. Watershed councils were at the heart of the plan and were charged with identifying, prioritizing, planning and implementing projects carried out through voluntary local efforts (Conway *et al.* 2003). The Oregon Plan was put forward by the state as a recovery plan for salmon to avoid listings under the *Endangered Species Act*. Although supported by federal agencies, the bid ultimately failed in court and the listing of Coho salmon resulted in increased regulations on public lands. However, based on the strength of the Oregon Plan approach, federal agencies required only a few additional regulations for private land. (Non-industrial private landowners, who hold 16% of Oregon's forest land, are among the most active participants in the Oregon Plan). Recently, some of the salmon listings were overturned in the courts leaving the Oregon Plan in place as the primary tool for restoring salmon populations and water quality (D. Godwin[4], personal communication).

Over 100 watershed councils have been established in Oregon since 1993, a large majority of which receive grant money to provide services to the local community. Some of the most successful councils obtain a million dollars in funding a year and place 80% to 90% of the funds towards on-the-ground projects that result in improved salmon habitat and water quality—projects such as road decommissioning, culvert replacement, fish passage improvements, wetland habitat restoration, and grazing management. Private landowners—ranging from individuals to industries in rural and urban communities—are voluntarily conducting restoration work. In one year, watershed council volunteers worked over 100 000 hours (Oregon Watershed Enhancement Board 2006).

[4]Watershed Management Specialist, Oregon State University.

Despite good intentions and the availability of financial support, watershed councils are not universally successful. Many have struggled and some failed for a variety of reasons, including internal distrust, poor leadership, and non-inclusive approaches. Some have experienced decisions made on non-factual or missing information and the consequent wasting of scarce resources on unnecessary data collection and analysis, repair of mistakes, and duplication of effort (Conway *et al.* 2003).

An enabling measure to help councils overcome challenges and become more effective was initiated by Oregon State University (OSU) Extension Service in 1996. The Watershed Stewardship Education Program (WSEP) was created by as a pilot program aimed at helping watershed councils acquire science-based knowledge, tools, and skills for effective collaboration and project development and implementation. The publication, *Watershed Stewardship: A Learning Guide*, developed for the program included various fact sheets, short publications, and videos to meet specific technical needs. The program partnered with state agencies on monitoring guides, watershed assessment procedures, and riparian restoration guidelines. Results of the pilot and a needs assessment supported the creation of the Master Watershed Steward program in 1999. This program consists of eight workshops and 48 hours of instruction. These sessions are followed up by one-on-one and group training for specific projects.

Over 500 people have completed the Master Watershed Steward program. Program evaluation has documented a statistically significant increase in participant knowledge, confidence, awareness, and participation in watershed groups and activities after participating in the program. The vast majority of program graduates have completed a watershed enhancement project in their community (D. Godwin, personal communication).

In addition to its strong educational role, the Extension Service has provided councils with assistance in writing permit applications, developing monitoring protocols, and prioritizing projects using a decision support system. While other agencies may assist councils, Extension occupies a special position. It is non-regulatory, based at a state university, and educational in focus, all of which increase the level of trust by council members.

Virginia – Educating Loggers to meet Virginia Water Quality Law

What would a trek through the forest be without wet feet? And what would water quality be without the protection afforded by forests? The U.S. *Clean Water Act* (1972) included forestry activities as potential non-point sources of water pollution, and required that all forested states have programs of Best Management Practices (BMPs). These are operational techniques that, when properly implemented, protect stream water during and after timber harvesting operations (Shaffer *et al.* 1998). At the time, BMPs were voluntary, although some states incorporated them into law. One such effort in Virginia followed on the signing of the Chesapeake Bay Agreement among states encompassed by the Chesapeake Bay watershed. Among the commitments in the agreement was a 40% reduction of nutrients and sediments by the year 2000.

The Virginia Water Quality Law (1993) is the primary policy instrument of the agreement. This legislation was drafted by the state Water Quality Task Force, which included a wide variety of stakeholders—state natural resource agencies, forest industry, environmental groups, loggers, and the Cooperative Extension Service of Virginia Tech University. The legislation is characterized as "outcome-based," in that the process of implementing BMPs is non-regulatory while the outcome of clean water is mandatory, with financial penalties for loggers who cause excessive sediment to pollute a stream. The advantage of the approach is that it gives the logger or landowner flexibility in determining the best means of operating within required standards (Shaffer 1999). In practice, implementation of the law relies more on education and technical training than on enforcement and penalizing of "bad actors."

Even before enactment of the law, the Virginia Cooperative Extension Service (CES) assumed a key role in landowner and logger education to support BMP implementation. Key audiences included loggers, private forest owners (of which there are over 400 000 in Virginia), and professional foresters. CES developed educational materials (such as publications, curricula, and videotapes), and hosted a large number of workshops, seminars, and field tours. One of the key features of the extension effort was to change the culture of timber harvesting to include pre-harvest planning as a part of the logging enterprise. This involved planning for haul roads, skid trails, landings, and streamside management zones. Logging mitigation measures such as water bars, stream crossings, and portable bridges were also included.

The training has evolved into a strong partnership among CES, the Virginia Department of Forestry (VDOF) and the logging industry, called the Sustainable Harvesting and Resource Program (SHARP). Some 50 to 60 training sessions are offered annually reaching about 1300 Virginia loggers. Besides helping loggers meet the requirements of the law (annual monitoring and reporting of BMP implementation is required by VDOF), the program enables participants to meet the terms of Sustainable Forestry Initiative Certification.

In a comparative study to determine the effect of training, CES found that a trained group of loggers had more efficient operations and suffered fewer lost days due to weather and other factors, and also had higher BMP implementation rates than a group of untrained loggers (Shaffer and Meade 1997). Another study has shown that implementation of a system of BMPs can greatly reduce the loss of sediment and nutrients as a result of silvicultural activities in the Virginia coastal plain (Wynn *et al.* 2000).

Policy implementation presents the need for new technology in timber harvesting operations. A classic example from Virginia is the integration of global positioning systems (GPS) in the timber harvesting enterprise. The SHARP Logger Education Program has started conducting GPS workshops for loggers, and the VDOF is using funds garnered from Water Quality Law violations to offer cost-share assistance for loggers to purchase GPS units. Virginia has a notification law that requires loggers to alert the VDOF prior to commencing harvest operations. Currently, loggers use descriptive locations that are often hard to follow. The VDOF has proposed that loggers enter the location using GPS coordinates. Such technology transfer is as much a benefit to operational efficiency and cost reduction as it is to ensuring compliance with the Water Quality Law. The CES is further examining opportunities to introduce decision support systems (DSS), not currently used in the timber harvesting community in Virginia.

Sure-Footed and Trail-Ready – Enabling the Hiker to Move Forward

We have joined our hiker on four trail segments to gain insights into the implementation of forest policy. What did we learn about our trail outfitter—about the "enabling" role (Fig. 1) that equips and supplies the hiker so that he or she can advance through the mountainous policy landscape? Table 1 presents a comparative profile based on the four case studies.

Two enabling functions emerge from the case studies:

- the development of analytical methods and the tailoring of tools to meet planning and decision-making needs of end-users charged with policy implementation,
- the development of learning resources and delivery of knowledge and information products to meet educational needs of end-users charged with policy implementation.

A closer examination of the roles reveals a differing emphasis depending on land ownership in the particular policy regime. In each of the Canadian cases, the provincial government owns the forest land. (In Canada, the majority of forest land is owned by provincial governments, particularly in the cases of British Columbia—96%—and Ontario—91%). The picture is different in the United States—nationwide, non-industrial private landowners account for about 48% of forest land (United States Department of Agriculture Forest Service 2001). This group comprises individual landowners with ownerships ranging in size from 2 to 8000 ha, often not residing on their forest property and differing in their objectives for ownership. In Virginia, such owners hold 77% of forest land (Virginia Department of Forestry 1994); in Oregon 16% (Oregon Forest Resources Institute 2003). The implementation of forest policy in the U.S. cases implicates a large number of private forest owners (some 400 000 in Virginia alone), whereas in the Canadian cases forest policy implementation rests on the actions of relatively fewer actors working on singular forest ownerships. The differing emphasis in enabling roles is depicted in Fig. 2.

In the Ontario and B.C. cases, policy implementation rests in large measure on the actions of forest management planning specialists. Forest management planning is mandatory for Crown forest licence holders in the jurisdictions, and as discussed previously, specific orders and guidelines are to be met for plans to be accepted and operations to proceed on licence areas. Predictive models and decision-making frameworks are necessary for the identification of management options and selection of a preferred course of action. The adaptive management intent underlying the policies offers the opportunity to develop innovative tools and approaches and learn in the process. At the same time, adaptive management implies that practices will continuously improve, which places demands on practitioners to remain abreast of new science and new approaches to enable improved policy implementation. What this requires in B.C. and Ontario is that plans be pertinent to local management unit conditions, thus requiring that the tools employed for predictive modeling and trade-off analysis are effective at both large and smaller scales. Enablers function to help forest planning specialists

Table 1. Profile of policy actors, the interests they advance, and the strategies they employ to support implementation of policy in each case study

	B.C.	Ontario	Oregon	Virginia
Primary policy actors	Extension organization (FORREX) Forest industry (Pope & Talbot) Government and landowner (B.C. Ministry of Forests and Range)	Extension organization (FRP) Forest industry (Sustainable Forest Licence holders) Government and landowner (Ontario Ministry of Natural Resources)	Extension organization (Oregon State University) Private landowners Watershed council members Government (Oregon Department of Forestry; Federal agencies; counties)	Extension organization (Virginia Tech University) Forest industry (Loggers) Private landowners Government (Virginia Department of Forestry; Federal agencies; counties)
Policy interests and strategies	Objective framework to support decision-making, scenario planning and trade-off analysis at appropriate temporal and spatial scales; objective characterization of caribou habitat linked to specific stand types. Direct involvement of company personnel, experience and local data. Application in the development of options for Forest Stewardship Plan	Development of predictive models based on extensive literature review and peer review; incorporation of empirical yield curve datasets for a range of species and sites. Development of tool consistent with Forest Management Planning process, supported by training.	Monitoring protocols and decision support tools to support Watershed Council proposals and project implementation. Formalized training programs (Watershed Stewardship Education Program evolving into Master Watershed Stewardship Program). Application in project proposal process and in implementation and evaluation of projects.	Introduction of GPS and decision support systems to enable loggers to improve efficiency and reduce costs while complying with law. Formalized training – (BMP training evolving into SHARP logger training program). Implementation in forest operations.

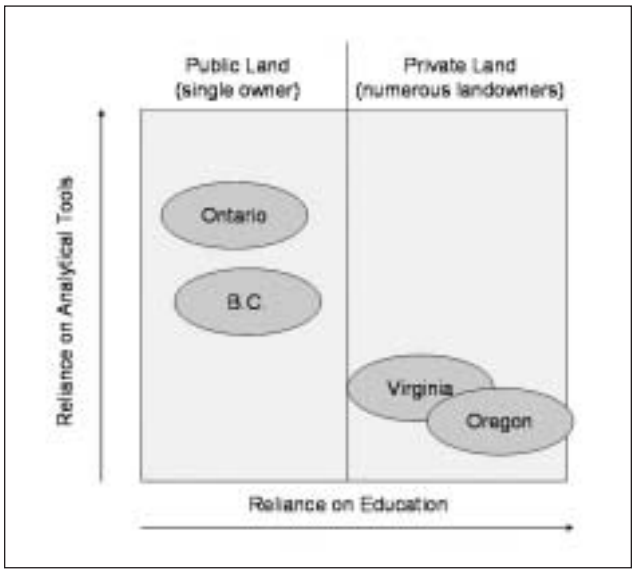

Fig. 2. Positioning case studies based on the role of enabling function.

acquire workable tools that are adaptable to local management units. In the B.C. case, we saw the decision-making framework specific to Pope & Talbot's TFL 23 operations. In Ontario we saw the tools for developing improved growth and yield curves from empirical data.

As shown in Fig. 2, the Oregon and Virginia cases reveal less reliance on specifically designed analytical tools for use by planning specialists (decision support tools in the cases are aimed at helping watershed councils prioritize projects and helping loggers make more cost-effective operational decisions). What stands out is the importance of education in enabling landowners, loggers, and other stakeholders to understand policy requirements and effectively implement them. In both cases formalized programs have evolved, complete with curricula and supporting learning resources drawing upon a variety of proven adult learning methods. The U.S. extension system is particularly well grounded in the application of "learner-centric education," which fundamentally means focusing on what the learner needs to learn, not what the teacher wants to teach (Reed and Simon-Brown 2006; E.R. Norland[5], personal communication). The approach has been successful in environments where voluntary actions by landowners are important factors in policy implementation—the Oregon Plan for Salmon and Watersheds being a classic example. Regulatory components of the Plan draw upon state and federal laws, while program components provide for the technical assistance and educational programs that enable watershed council members to implement the Plan. In Virginia, logger education has gone hand-in-hand

[5]National Program Leader, Forest Resource Management, USDA Cooperative State Research Education and Extension Service.

with implementation of the Water Quality Law, with the regulatory agency (Virginia Department of Forestry) working closely with the educational provider (SHARP Logger Program based at Virginia Tech), to enable implementation of outcome-based legislation.

The cases further show the importance of collaboration among policy actors to enable effective policy implementation. Table 1 identifies primary policy actors in each case. Understanding roles requires a closer look at the sub-sets of organizations and more importantly the individuals whose interests and ideas cross organizational boundaries to influence policy implementation. We have already mentioned the close working relationships among regulatory and educational interests in the Oregon and Virginia cases. In the Ontario case, science met policy via the interaction among different entities within the Ontario Ministry of Natural Resources working at regional and provincial levels. In the course of developing the science (empirical yield curves) and adapting it to the planning process, science and policy interests aligned with the common interest of bringing the best available science to practitioners at the forest management unit level. Typically, such relationships require give and take on both sides; in the Ontario case, science occasionally required early intervention to ensure it remained practical and relevant, while policy required early awareness and continual encouragement and support to change when changes were required.

The B.C. case is illustrative of the role of a third-party extension organization, FORREX, in facilitating the learning process for practitioners, enabling an objective assessment of options and consequences, and working to synthesize relevant science-based knowledge to support decision-making. In each of the four cases, such a non-government / non-private sector entity had a role to play (Table 1). In the U.S., extension is based at land grant universities, whereas the Canadian experience involves consortia of interested parties organized as partnership arrangements or incorporated as not-for-profit entities. Such a non-partisan role establishes a valuable "trust factor" with parties responsible for complying with policy. Extension organizations do not have a policing function but rather an educational role in helping groups and individuals make appropriate decisions in their particular policy contexts. A key role for such groups is to direct human resources capacity to helping bring relevant science-based knowledge and technology to bear on specific local challenges. This involves working closely with scientists and those who will use the science to meet policy requirements in operational settings.

Conclusion – At the End of the Day Some Practical Points to Ponder

At the end of a long day the hiker rests, takes off the boots, and lies back for a few moments gazing at the stars. It is a time to gain perspective on the trail completed and contemplate the unknown path ahead. Our brief encounters with a variety of forested landscapes on the continent may not provide answers to his or her higher philosophical questions, but we can offer some trail sense to help make the next day a little easier. Here are a few practical points for our hiker to keep in mind:

1) Science is critical to good policy formulation and implementation. The policy regimes we studied embody elements of adaptive management, calling upon scientists, policy-makers and those responsible for implementing policy to be aware of one another's interests and to continually seek to bring the best available knowledge to decision-making. This point is not lost on forest science organizations in North America and around the world, which are turning attention to bridging the gap identified between the domains of science and policy (Guldin 2003, Guldin *et al.* 2005).
2) Putting the science to work in policy is facilitated by enabling roles that help to transfer knowledge and information among policy actors (often helping to join the working circles of science, policy, and operational implementation). Knowledge transfer and extension specialists fill such enabling roles, and operate in a variety of organizations including government, private, academic, and partnership organizations. Dedicated transfer capacity—as found in the U.S. Cooperative Extension System, and Canada's FORREX and FRP models—is instrumental in supporting the needs of persons charged with policy implementation through the development and delivery of analytical tools and of both formal and informal education programs.
3) Relationships based on trust among various policy actors are critical to successful policy development and implementation. Knowledge transfer and extension "enablers" are effective in helping to build trust-based collaborative relationships. Having good companions on the trail makes for better hiking, with memorable stories to share and future excursions to plan together.

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