MOOSE AND FOREST ECOSYSTEM MANAGEMENT: THE BIGGEST BEAST BUT NOT THE BEST[1]

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ABSTRACT: Over the last few decades, forest policies regarding wildlife habitat have evolved from featured-species oriented management to the consideration of a broader scope of interests. Ecosystem management is already or will be applied soon in many jurisdictions. A few have set habitat objectives for moose and other species, and some plan to establish relationships with population levels. Others try to define methods to plan forest interventions to imitate nature or to take into consideration the needs of the various forest resource users. Both spatial and temporal multi-scales have to be defined to implement a habitat management strategy based not only on natural boundaries, but also on the concerns of forest users. Moose habitat management has to be subordinated to biodiversity objectives and social needs, such as a sustainable food supply for the Native people or a satisfying hunting experience for moose hunters. Adaptive management, adequate funding, and involvement of forest and wildlife users are necessary to reach these goals.

Key words: biodiversity, forest landscape, forest management, integrated resource management, Native people, social needs, wildlife habitat

RÉSUMÉ: Les politiques forestières concernant la faune ont évolué depuis quelques décennies de l'aménagement de l'habitat d'espèces vedettes vers la considération d'intérêts plus variés. La gestion écosystémique est appliquée ou sur le point de l'être dans plusieurs juridictions. Quelques-unes ont aussi établi des objectifs d'habitat pour l'orignal et d'autres espèces alors que certaines prévoient établir des relations avec leurs niveaux de populations. D'autres tentent de définir des modes d'intervention qui imitent la Nature ou de considérer les besoins des utilisateurs des ressources forestières. Les échelles temporelles et spatiales doivent être définies afin d'implanter une stratégie d'aménagement, basées non seulement sur les limites naturelles des écosystèmes mais aussi en tenant compte des préoccupations des utilisateurs du milieu forestier. L'aménagement de l'habitat de l'orignal doit être subordonné à des objectifs de biodiversité et à la satisfaction de besoins sociaux, tels un apport alimentaire continu pour les autochtones ou une expérience de chasse de bonne qualité. Une gestion adaptative, un financement adéquat et une implication des usagers de la forêt sont nécessaires pour atteindre ces objectifs.

Mots-clés: aménagement forestier, besoins sociaux, biodiversité, gestion intégrée des ressources, habitats fauniques, paysages forestiers, populations autochtones

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Over the last few decades forest policies regarding wildlife habitat have undergone several changes. Prior to the 1960's, in most jurisdictions there were only a few regulations aimed principally at protecting watercourses. With the greater use of mechanical harvesting and extensive clearcutting, public pressures led forest management agencies to provide habitat for some featured species, mainly game, and moose habitat was of primary concern. By the end of the 1970's, the concept of indicator species was used in an attempt to encompass the overall complexity of biological diversity but managers soon recognized that some species need more attention than do others. In the 1990's, public expectations and international conventions state that biodiversity shall be a basic issue in forest management, the most commonly accepted approach being ecosystem management. We wondered to what extent this concept is applied in northeastern North America and where moose fit into this new management paradigm. We took the opportunity at the 34th North American Moose Conference to hold a "*Workshop on Forest Management*", the objective being to identify the strengths and weaknesses of different approaches. Speakers from Ontario, New Brunswick, Maine, and Québec were invited to discuss approaches based on imitating nature, on species-oriented guidelines, and on the needs of people. Speakers presented the forest policy applied in their jurisdiction and summarized the best strategy for their province or state. The aim of the workshop was to answer questions such as: How can we imitate nature and forest fires in forest management? Are moose a good starting point and the most useful species to use? Do wildlife users, particularly Native people, really want to imitate nature? This paper summarizes the workshop by identifying the most promising approaches to eventually satisfy concerns relating to moose habitat and biodiversity, as well as to meet public expectations.

Imitating Nature: from Landscapes to Species — Arthur R. Rodgers

Forest management practices in Ontario are based on a broad set of guidelines and principles set out in a series of manuals published by the Ontario Ministry of Natural Resources (OMNR). The "*Timber Management Guidelines for the Provision of Moose Habitat*" (OMNR 1988) is one of the most important of these publications. These guidelines were introduced as part of a 20-year program to increase the provincial moose population from 80,000 to 160,000 animals by the year 2000 (Ontario Government Policy WM.3.01.02, 1980 12 15). The purpose of these guidelines is to help resource managers maintain or create the diversity of age classes and species of vegetation that provide habitat for moose. More than most of the other guidelines, the "Moose Habitat Guidelines" include specific recommendations concerning the size and distribution of harvested areas, as well as protecting essential features required by moose. For example, in the Boreal Forest Region of Ontario, these guidelines recommend: (1) clearcutting in blocks of 80 - 130 ha, leaving buffer zones between cuts; (2) where clearcuts exceed 100 ha and moose utilising portions of the cutover would be more than 200 m from suitable cover, conifer shelter patches of at least 3 - 5 ha should be provided; (3) shelter patches should be spaced 300 - 400 m apart; (4) cuts should not exceed 400 m in width in late winter concentration areas for moose; and (5) a 120 m reserve should be left around aquatic feeding areas, mineral licks, and calving sites.

The Moose Habitat Guidelines were intended to emulate a large forest fire of medium intensity. However, comparisons

of moose populations among landscapes disturbed by timber harvesting and wildfire-burn indicate that application of the Moose Habitat Guidelines does not result in higher moose densities than does natural disturbance or application of alternative harvesting systems such as progressive clearcutting (Rempel *et al.* 1997). Although Habitat Suitability Indices may be highest in Moose Habitat Guidelines' cut blocks, this benefit to moose is countered by a high density of roads which results in greater hunting pressure than in other landscapes. In a progressive clearcut, on the other hand, the interspersion of forage with cover may be higher than in a Guidelines' cut landscape, while road access is more restricted. Indeed, the landscape pattern created by progressive clearcutting more closely resembles large wildfire burns than Guidelines' cuts, but there are important differences.

As an alternative to the single-species approach, exemplified by the Moose Habitat Guidelines, the OMNR proposes the development of "Environmental Guidelines" intended to emulate natural disturbance. This general change in direction is reflected in many recent policy initiatives, particularly Ontario's Crown Forest Sustainability Act (CFSA) (LAO 1994). The CFSA resulted from a variety of provincial activities. These included public hearings by the Ontario Forest Policy Panel (OFPP 1993), an environmental assessment of timber management on Crown lands in Ontario by the Environmental Assessment Board (OEAB 1994), and development of complementary legislation in the form of an Environmental Bill of Rights for Ontario (LAO 1993). The CFSA states that "The long term health and vigour of Crown forests should be provided for by using forest practices that, within the limits of silvicultural requirements, emulate natural disturbances and landscape patterns while minimizing adverse effects on plant life, animal life, water, soil, air, and social and economic values, including recreational values and heritage values" (LAO 1994).

Development of Ontario's Environmental Guidelines will be accomplished through historical examination of disturbance at both the landscape and stand levels. Landscape level determination of clearcut areas, frequency/size classes, and spatial distribution of disturbance will be used to establish the overall forest pattern. Evaluation of stand level characteristics such as size, type, location, and amount of residual will be used to determine the structure of clearcut disturbance events. These assessments will lead to the development of "Regional Disturbance Plans" that will reconcile recent (i.e., mostly man-made) vs. "natural" landscape patterns to an extent that is both practical and feasible. By necessity, these broad, ecosystem-based guidelines will require management of forests and wildlife at multiple scales. At the broadest scale, overall forest pattern will be determined by "Fire Emulation Guidelines", which are intended to imitate the majority of natural disturbances in Ontario at the landscape level. Species-specific guidelines will then be applied in a hierarchical manner (Fig. 1): habitat guidelines for the most spatially demanding species will be applied first, with the intent of providing for the needs of as many other species as possible, then the species with the next broadest habitat requirements will be considered, and so on until all relevant guidelines have been applied that address habitat needs not met at a previous scale.

This paradigm shift from "featured species" to ecosystem level management is based on the premise that wildlife has evolved with natural disturbance, so emulation of the natural pattern will maximize sustainable biodiversity. Thus, moose habitat management in Ontario will be directed at meeting the needs of a suite of wildlife

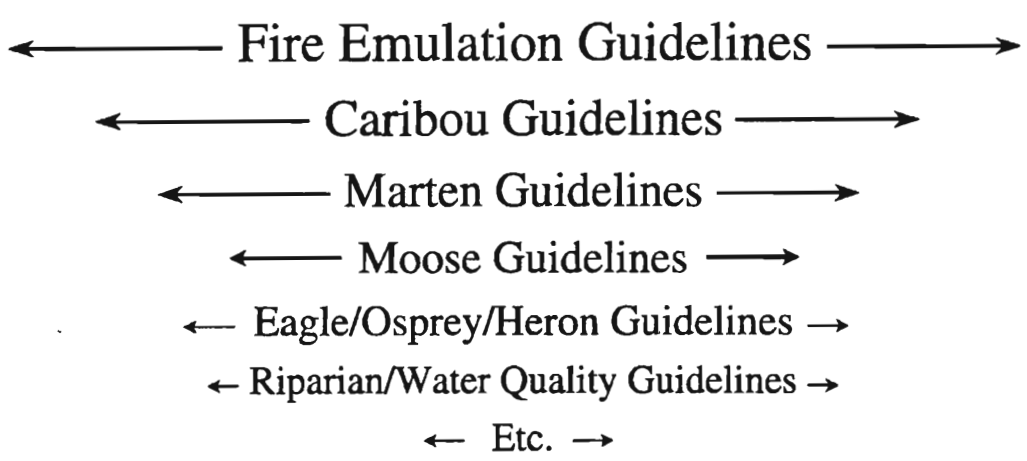

Fig. 1. An example of the hierarchical application of ecosystem-based guidelines at multiple spatial scales in Ontario.

species, rather than moose alone. Instead of maximizing moose habitat, the landscape will be managed to include moose habitat. Whereas habitat effects on moose populations have been considered separately from harvesting effects, the interrelationship of harvesting and habitat requirements will be taken into account. The shift to ecosystem-based management will require consideration of current and future moose habitat at both broad and fine scales, rather than just currently used habitat with site-specific values. Since moose population targets may not be consistent with ecosystem objectives in all regions of Ontario, a review of these targets will be required. At present moose population targets and harvest allocations are set independently of forest condition, but in the future it may be possible to develop targets and allocations that are consistent with expected productivity and forest condition.

Forest and Wildlife Habitat Management in New Brunswick — Gerald Redmond

The New Brunswick Department of Natural Resources & Energy (DNRE) is responsible for all aspects of forest management including timber, wildlife, recreation, and forest biodiversity on Crown land (NBDNRE 1995). Active wildlife habitat management planning began in 1985 following the implementation of the Crown Lands and Forest Act in 1982. Forty-eight percent of the forest land in the Province (approximately 3 million ha) is owned by the Crown (NBDNRE 1995). For the purpose of forest management, Crown land is partitioned into 10 licenses, which range in size from 72,000 - 532,000 ha (NBDNRE 1995).

Responsibility for the planning and implementation of all aspects of management rests with individual forest companies, known as Licensees (NBDNRE 1993, 1996c). Once DNRE has established the goals, objectives, and standards, the Licensees are responsible for developing management and operating plans to achieve them. Management plans forecast timber supply for 80 years and harvest blocks and specific habitat areas are mapped for a 25-year horizon. These plans, when approved by DNRE, must demonstrate that timber harvest rates proposed as part of the strategy are sustainable over an 80-year horizon and that other forest values are maintained at or above levels set by DNRE. The use of a geographic information system (GIS) is necessary for the spatial referencing of harvest

blocks and other areas that provide non-timber values for the first 25 - 35 years of the plan. Forest projection models including FORMAN+1, Woodstock, FORMAN2000, and NetHab are used for development of management strategies (NBDNRE 1995).

Management performance is evaluated at 5-year intervals before the license is renewed. Public input is required in the development of operating strategies and management plans (NBDNRE 1994). Policy goals that pertain to the 25-year management plans include: (1) providing public use of Crown lands for recreational use and access; (2) maintenance of forest ecosystems by ensuring that species and species associations are maintained for biodiversity and that a full range of naturally occurring successional stages and stand ages are represented for all forest types; (3) to maximize the sustainable supply of timber while meeting identified non-timber objectives; (4) to provide habitat necessary to maintain populations of native wildlife species by developing quantitative habitat objectives for selected wildlife species or species groups for inclusion in forest management planning; and (5) to protect water quality and maintain aquatic habitat for fish and wildlife by maintaining buffer zones along watercourses and conforming to high standards for road construction and installation of crossings (NBDNRE 1994).

The goal of the wildlife habitat program is to ensure that management activities conducted on Crown lands produce distributions of forest community types and successional stages that can support native wildlife populations at desired levels (NBDNRE 1995).

Activities undertaken to accomplish this goal were: (1) assessment of long-term trends in supply of various habitats; (2) selection of species upon which to focus management efforts; (3) development of functional relationships between forest structure (habitat) and wildlife populations; (4) development of management objectives for habitat; (5) integration of habitat values with the process of developing forest management strategies; (6) development, in co-operation with the forest industry, of appropriate strategies and implementation procedures; and (7) development of assessment procedures for forest management activities as they relate to habitat (NBDNRE 1995).

To date, wildlife habitat management has focussed on 3 areas: deer wintering areas (DWA's), mature conifer forest habitat (MCFH), and watercourse buffer zones. Availability of moose habitat was not forecasted to be in short supply either in the near or long-term, given current forest habitat projections, and therefore moose were not selected as a high priority for habitat management.

Approximately 900 DWA's have been identified on Crown land from aerial and ground surveys over several decades (NBDNRE 1995, 1996a). The strategy identified to provide deer winter habitat was to manipulate stands within and adjacent to known DWA's to provide a sustained yield of habitat within each DWA. The assumption was that current use of areas by wintering deer reflects landscape-level selection and hence selected areas are more likely to provide habitat in the future than are other parts of the landscape. Boundaries of known DWA's were expanded to include stands of similar site characteristics and species composition and, if possible, of younger age. Total area of expanded DWA's was 268,000 ha (9% of Crown land) (NBDNRE 1995). Habitat area required to maintain the deer herd at a pre-winter objective level (106,000) was estimated to be 411,000 ha and the area required to maintain the proportion expected on Crown land was 197,000 ha (NBDNRE 1995). Objectives for deer winter habitat were assigned to each Crown license based

on the proportion of each license in each wildlife management zone.

MCFH was defined as habitat meeting the structural and spatial attributes for American marten (NBDNRE 1995). Of species that depend on availability of mature, conifer-dominated habitat, marten have the largest home ranges and thus require the largest patches of suitable forest. Given a predicted short supply of mature conifer-dominated communities, management of habitat to support marten populations seemed a reasonable goal in itself. However, the working assumption behind management objectives was that the provision of habitat for marten would also meet the needs of other species, primarily forest birds dependant on old conifer-dominated forest.

A minimum viable population for marten was calculated to be 250 resident individuals. A working population objective for New Brunswick was set at 4,800 resident marten to allow the current level of trapping (2,000/year) to continue. The objective was prorated to Crown land based on proportion of conifer-dominated forest to yield a working objective of 2,300 individuals. MCFH required to meet the provincial resident population objective (4,800 marten) was 720,000 ha, of which the amount required to meet Crown land objectives was 345,000 ha. This represented 11% of all Crown land (NBDNRE 1995). Trade-off analyses resulted in final habitat objectives being set at approximately 10% of the total area of conifer-dominated strata in each license, which equates to 172,000 ha for all licenses combined (NBDNRE 1995).

Specific guidelines have been developed by DNRE for determination of watercourse buffer zones and forestry activities within watercourse buffer zones (NBDNRE 1996b). The structural requirements for buffer zones differ on a site-specific basis depending on the objectives being managed for and the character of the forest and lands adjacent to the watercourse.

Specific objectives have been developed for various components of buffer zone management and include: (1) maintenance of water quality parameters within naturally occurring levels and structural conditions that allow the resident aquatic community to persist; (2) identifying watercourses that provide important recreational activities (e.g., canoeing, angling) and minimizing visual perception of human disturbances such as timber harvesting; (3) providing suitable nesting habitat adjacent to watercourses that are identified as important waterfowl production areas; (4) providing wildlife with access to hiding cover for concealed movement within the forest landscape; and (5) maintaining large-sized standing and downed, dead and dying trees where local availability is limited (NBDNRE 1996b).

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Private Land, Public Interest, and Politics: A Review of Forest Practice Regulations in Maine — Karen I. Morris

Many Mainers have a strong tie to the forests of the state. There is a long tradition of access to private forest land for hunting, fishing, camping, and other forms of recreation. In addition, many Mainers are dependent, either directly or indirectly, on the forest and tourist industries for their livelihood. As a result, there is concern for the condition of our forests from the economic, esthetic, and ecological standpoints.

This concern has resulted in a variety of attempts to regulate the activities of the forest industry. Because almost all of Maine's forest land is privately owned, these

attempts have usually relied on laws restricting forest harvesting. To date there has been no need to revise forest practices to benefit moose, and regulations have not been directed at maintaining or improving moose habitat. In fact, the activities of the forest industry have created excellent moose habitat. Furthermore, the number of moose is above our management target but still well below carrying capacity.

Initially forest harvesting was regulated by zoning areas such as deer wintering areas and riparian areas, and restricting harvesting activities within the zoned areas. Over time, these restrictions were modified to increase the amount of cooperative management plans, primarily for deer wintering areas, between the landowners and the Department of Inland Fisheries and Wildlife.

In 1995, a forest practices bill was enacted that put restrictions on forest harvesting outside of these areas. Very briefly, this bill limited clearcuts to 75 acres (30 ha) and required that clearcuts be separated by an area equal to the size of the cut for large parcels of land, or by 250 ft (76 m) for parcels under 100 acres (40 ha). Landowners with more than 100,000 acres (40,500 ha) could cut up to 1% of their land per year and landowners with less land could cut 100 acres (40 ha) or 10% of the area per year, whichever was greater. A permit was required for clearcutting and could be granted to harvest a plantation, for a variety of silvicultural purposes or to improve or create wildlife habitat with a plan by a certified wildlife professional. Variances could be granted under specific conditions.

These regulations were considered inadequate by some people who felt there was excessive clearcutting, and enough signatures were gathered to put a referendum to ban clearcutting on the ballot in 1996. A group including some landowners, some environmental groups and government regulatory agencies supported an alternative strategy called "The Forestry Compact". The Compact proposed more stringent harvesting regulations than the 1995 law but still permitted clearcutting. This resulted in a referendum with 3 choices: (1) ban clearcutting; (2) maintain the *status quo*; or (3) adopt The Forestry Compact. None of the options received a majority of the votes and the 2 options that received the most votes (Compact or maintain the *status quo*) were presented as a referendum question in 1997. The Forestry Compact was rejected by the combined efforts of groups who thought it was too restrictive and groups who thought it was too lenient.

In the last legislative session many bills to regulate forestry were considered and a revised forest practices act was passed. This bill amended the 1995 bill to clarify some definitions, and require a plan for clearcuts over 35 acres (14 ha). It establishes reporting requirements for landowners and requires the director of the Bureau of Forestry to prepare an annual report on clearcutting and a biennial report on the state of the state's forests. The bill also establishes a Forest Resource Assessment Program to identify future demand, trends, shortfalls, and sustainability. The details of this program are to be developed over the next 5 years and are to include development of standards for soil productivity, water quality, timber supply, aesthetic impacts, biological diversity, public accountability of forest owners and managers, and traditional recreation. A system to monitor the progress in achieving these standards is also to be developed.

Wildlife and Clearcutting in the Québec Boreal Forest: Effects of an Approach using Restraint and a Strategy Proposal — François Potvin, Réhaume Courtois, and Louis Bélanger

Clearcutting is the prevalent logging

technique in the boreal forest and is often regulated by a management approach using restraint in the harvesting of wood products. This approach has been used in Québec since 1988. Logging is done using a technique known as clearcutting with protection of regeneration (CPR), a careful logging technique using equally spaced logging and skidding trails. Clearcut patches range in size from 100 - 250 ha (150 ha since 1996), are separated by buffer strips 60 - 100 m wide, and are usually distributed in a clustered pattern. In a 5-year study, we evaluated the effects of large clearcuts on 12 wildlife species in western Québec (Potvin and Courtois 1998). Changes in density and habitat use were noted following clearcutting in most species, except for the ruffed grouse which lives in stands that were only slightly exploited. Small mammals, the species group with the smallest home ranges ($\leq$ 1 ha), were either maintained as before in the clearcut patches or found suitable habitat in the buffer strips. Most species with intermediate home ranges, up to 25 ha (spruce grouse, snowshoe hare), were excluded from clearcut areas and could barely find suitable habitat in the thin buffer strips. Species with home ranges > 5 km^2 (marten, moose) were maintained in the forested parts of the clearcut landscape and used clearcut patches where the shrub layer and coniferous regeneration were very dense. As a rule, clearcut areas are not a suitable habitat for most wildlife species in the short-term. The principal limitation is not the size of the clearcut patches, but the extent and configuration of the remaining forest (buffer strips, immature or low-volume stands dispersed in the clearcuts, adjacent forest patches). For example, marten require that >40% of the forest be maintained inside of 5 - 10 km^2 blocks. Although forest practices compatible with the habitat needs of each wildlife group can be formulated, we suggest that a better solution is to view wildlife and forest management as a multi-scale issue, and at the landscape level. We propose a 3-scale strategy where wildlife and forest management can be integrated: (1) on a regional scale (> 10,000 km^2), where the main objective is to maintain the overall biodiversity in a forested region; (2) on a forest landscape management scale (1,000 - 5,000 km^2), where maintaining ecosystem supply is the main goal; and (3) on a local scale (50 - 500 km^2), where resources other than wood fiber are considered in an integrated management process that takes into account the specific needs of the public. This last management scale would be of particular benefit to moose hunters, who are highly critical of clearcutting.

Moose: a Key Species in Traditional Management of Traplines — Steve Morel and Michel Mongeon

First Nations of Québec, especially Algonkian, use almost all of the boreal forest. The traditional trapline system (traditional family land units) is formally recognized through the provincial beaver preserve. The cultural survival of Algonkian trapline users is closely linked to the quality of their practice of traditional activities and the capacity of the ecosystems that characterize the boreal forest to support such activities (Mongeon 1998). The forestry regime in effect in Québec only partially meets Aboriginal land quality requirements for Native users (Morel and Bélanger 1998). To better meet these needs, there is an urgency to adapt the existing management and development processes to the Aboriginal reality (Morel 1996). The use of traplines as a forestry planning unit is a key factor in the harmonization of activities. This unit is also compatible with the establishment of forestry practices based on both ecological principles and the traditional management method, which seeks to ensure that the

biological productivity of the land is shared fairly (Mongeon 1998). This management scale lends itself to the setting of habitat objectives for the species of interest to Aboriginal peoples and includes some elements of their holistic perception. Furthermore, there is a direct linkage between those socio-ecological needs particular to Algonkian trapline users and an ecosystemic approach in integrated resource management (Table 1).

Moose are a priority species in the management of traditional territories (traplines). On the one hand, moose are a major meat resource in the diet of several communities, including the Crees of North-

Table 1. Wildlife preservation objectives of Algonkian trapline users in integrated resource management[1].

Habitat component	Protection objectives, socio-ecological needs, and scale	Linkage with ecosystem management
Trapline (trapping territory)	Maintenance of ecological components based on the carrying capacity to ensure suitable traditional activities; Traditional land use unit: 300 - 1,000 km^2	Management by forest landscape unit
Wildlife habitat	Full protection or particular management practices to preserve traditional use; Biological production unit to support subsistence: 0.1 - 30 km^2	Maintenance of biodiversity and wildlife productivity
Moose	Maintenance of moose habitat element: 1. Strategic hunting areas: 10 - 20 km^2 2. Threshold of habitat availability linked to TEK[2] (calving site, travelling corridor, protection refuge)	Maintenance of wintering areas and special productive habitat for moose (forest and aquatic environment)
Lynx/hare	Maintenance of a productive habitat; Threshold of habitat availability linked to TEK	Maintenance of young coniferous forest
Marten	Maintenance of a productive habitat; Threshold of habitat availability linked to TEK	Maintenance of mature coniferous and coniferous-mixed stands
Bear	Full preservation of sensitive sites or areas; Bear den and bear denning areas linked to TEK	Preservation of non-permanent den and special denning areas
Beaver	Maintenance of a productive habitat linked to TEK	Maintenance of aquatic and riparian environment
Fish	Preservation of productive habitats: Spawning sites, raising areas, and special fishing sites	Preservation of aquatic and riparian environment
Waterfowl	Maintenance of a productive habitat; Staging areas and hunting sites	Maintenance of aquatic and riparian environment

[1]Further information can be found in Mongeon (1993, 1998), Morel (1996), and Morel and Bélanger (1998)

[2]TEK: traditional ecological knowledge

ern Québec (Scott and Feit 1992) and the Algonquins of Barrière lake (Tobias 1995). On the other hand, as this species is widely distributed, its presence on each of the family territories represents a decisive food security element for the family exploiting the territory.

Ecological knowledge transmitted orally by means of participation in traditional activities is the basis of traditional ecosystem management (Mongeon 1998). Traditional knowledge illustrates the important place that habitat holds in the characterization of the land by Aboriginal peoples (e.g., preliminary assessment works carried out regarding the traditional method of managing ecosystems, Mongeon 1993). As they depend on the natural environment, it is extremely important for Aboriginal peoples to have a good understanding of their ecosystem and the related wildlife, to enable them to predict its productivity. In a context where the natural environment is managed by a growing number of intervening parties, it is important that all of the development conditions be compatible with the Aboriginal peoples' method of managing the land and its resources. That way, forestry practices will fit in with the natural evolution of the environment as they will reflect traditional ecological knowledge. Aboriginal peoples' way of using the land will be protected, resource managers and aboriginal users will continue to plan their harvesting activities taking into account the expected evolution of the environment as well as the needs of Aboriginal peoples.

SUMMARY

Forest policy in eastern North America has evolved rapidly over the last few years toward the implementation of sustainable forest management or ecosystem management principles. However, the situation in 3 provinces and 1 state clearly shows that there are no clear trends as to how to achieve this. Methods vary from management emphasizing restraints (Maine and Québec) to management by ecosystem supply objectives (New Brunswick) and to emulation of the natural evolution of the forest (Ontario). In all cases, featured species management is being relegated to a secondary role though not abandoned.

The right equilibrium between ecosystem health and people's needs is not easy to find. In some jurisdictions, ecological considerations are more important in the long term than social demands. In other agencies, people's points of view are a major concern due to the use of wildlife by the Native nations or to the influence of interest groups. As almost all jurisdictions are progressing from an "administrative forestry" to a more "ecological forestry", social pressures force the elaboration of another paradigm to forest management: "social forestry", defined as a balance between ecological, cultural, social, economic, and managerial considerations (Kimmins 1995). This new paradigm can be located at the intersection of 3 points of view: social acceptability, economic feasibility, and the natural range of variability (Fig. 2). Even if a clearcut covering 300 ha is acceptable to mimic a natural disturbance regime and it is not necessarily detrimental to moose at the landscape level (Rempel *et al.* 1997, Courtois *et al.* 1998), it is contrary to the values of moose hunters. In Québec where moose hunting pressure is high in most areas, the competition for hunting territories implies that a hunter can have access to only 100 - 200 ha; hunters also show great loyalty to their hunting territory (Courtois *et al.* 1998). Over the short term, very few, if any, moose are found in cuts of this size, particularly if many are juxtaposed, leading to a low hunting quality. Similarly, such landscapes are poor producers of food for Native peoples. Thus, the planning of forest management cannot rely solely on ecologi-

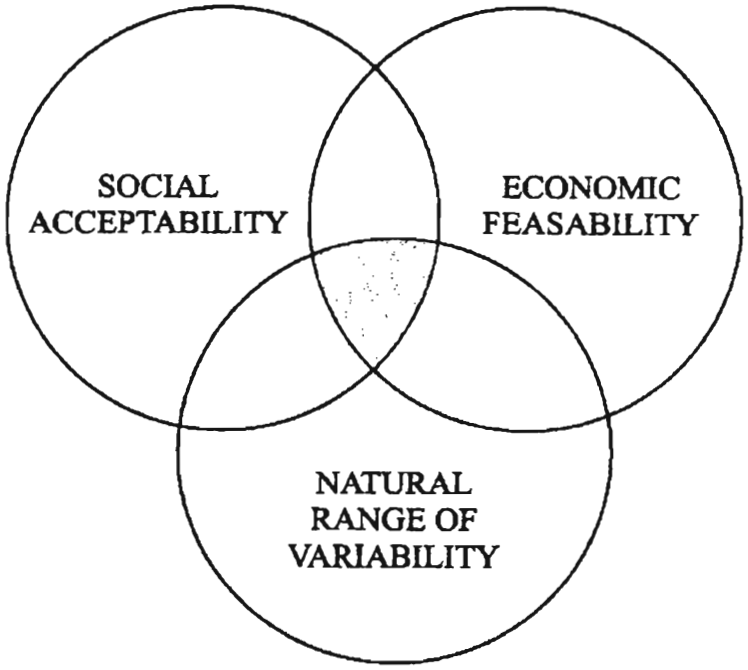

Fig. 2. Integrated resource management: the convergence of potential conflicting ideologies.

cal considerations. It must also deal with the needs of various users, at least on those parcels of Crown lands devoted to recreational activities.

Consequently, social forestry suggests that moose will remain a crucial management species in eastern Canada. There is continued interest for this species by important groups of forest users. In particular, the key role moose play for the aboriginal communities of the boreal forest, as demonstrated by Morel and Mongeon in this paper, implies that landscape level management will have to consider their needs.

Two distinct approaches for managing moose habitat can be identified: guidelines and habitat objectives (Thompson and Stewart 1998). While the former are relatively easy to implement, they suffer from some weaknesses. Among these, Thompson and Stewart (1998) noted that guidelines are rarely connected to forecasts of effects on the target population, so it is difficult to evaluate the outcome relative to a stated or measurable objective. As reported earlier by Rodgers in Ontario, studies have concluded that the benefits of implementing the moose habitat guidelines could be countered by a greater moose harvest (Rempel *et al.* 1997). This kind of study is needed to monitor the results of the application of any forest guidelines. This is especially true for harvested species, hunting being an important mortality factor. The use of guidelines does not guarantee the long-term occurrence of sufficient habitat to maintain moose, due to a lack of long-term planning taking into account the expected moose population (Thompson and Stewart 1998).

The alternative approach to guidelines is setting a specific amount of habitat necessary to sustain a moose population at a level that permits hunting or viewing opportunities. This is similar to the approach adopted in New Brunswick for marten habitat. Thompson and Stewart (1998) considered this latter approach to be more complicated to implement. However, habitat ob-

jectives have a greater promise to achieve the supply of moose habitat at both the temporal and spatial scales.

The application of habitat management by objectives will require a precise definition of spatial scales to be used. Indeed, there is a dichotomy in spatial scale of management between ecological classification (ecoregion, landscape, forest stand) and management units (political boundaries, forest management agreement areas, wildlife management units). In order to apply social forestry, we suggest defining the current forest management units at a scale consistent with the concerns of forest users. The proposed use of traplines as a forestry planning unit, where Native people depend largely on wildlife and other forest products, is a good example of the application of this principle.

Adaptive management strategies are needed to address uncertainty in planning (Thompson and Stewart 1998). The achievement of a forest management approach that will consider every user of forest resources should involve each interest group, not only in the planning process and the identification of the objectives but, ideally, also in the data gathering and analysis necessary to reach objectives shared by society.

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