MOOSE MANAGEMENT IN NORTH AMERICA

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Moose (*Alces alces*) management in North America has evolved into two active dimensions, namely, that involved with the resource itself and that associated with human use.

Demands being placed on North America's moose resource today are at an all-time high and will continue for the remainder of this century. Management decisions will become increasingly complex thus precision must be our ultimate goal. Because of the activity of other disciplines, biologists must begin to carry out more active management programs. In areas such as communication and economics, the services of experts in these fields must be sought to assist in preparing and presenting management plans to ensure that the highest degree of professionalism is attained. Licenced hunters, subsistence users and non-consumptive users must "bite the bullet" when populations are depressed and would be well advised to join forces in co-operative management ventures rather than continue the "confrontation atmosphere" that exists in many areas today. Governments must become more active in public education–a public informed about moose can only result in benefits to the resource in securing its future. Unless an active and well co-ordinated defence is undertaken, more areas of "no moose" will be added to that listed by Karns et al. (1974).

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Introduction

What is moose (*Alces alces*) management? Many classical definitions could be used. In the not-too-distant past management in North America was, in its very simplest terms, synonymous with law enforcement. Management today has evolved into two active dimensions, namely, that involved with the resource and that associated with human use of it. In Canada and the United States, where management authority is vested in the individual provinces and states, both are immeasureably intertwined, compounding the task of resource managers.

Karns et al. (1974) are the only authors to deal with moose management on a continent-wide basis. They confined themselves to the coniferous-deciduous forest ecotone and suggested that moose populations have been impacted most drastically by human activity. Today the area impacted by man, whether it be from hunting or developmental activities, encompasses all moose habitats in North America. Hydro development and pipelines in the north to destruction of habitat for agriculture in the south are all taking their toll. The statement by Karns et al. (op. cit.) that "unless remedial action is taken

moose may become just a memory in many areas in the not-too-distant future" is still relevant today.

Moose are of economic and aesthetic importance to man; to be conserved, the harvest must be managed with a view to obtaining a sustained annual yield (Peterson 1955). The most pressing problem in moose management in North America in 1960 was a lack of harvest data (Pimlott 1961)—the implication is that the magnitude of the annual harvest is lacking. Moose management is synonymous with animal husbandry in that breeding stock must be protected and the annual removal of surplus animals controlled. The first essentials in moose husbandry are a reasonably accurate knowledge of the size and age composition of herds, annual production and carrying capacity of available habitat (Peterson 1955). His comments that these requirements continue to present a challenge to workers in research and management are still relevant in the 80's.

The mosaic of information available is continually growing. The compendium is of such a magnitude that, given the demands placed on the time of managers, it is increasingly difficult for them to assemble the entire picture to ensure that the resource is protected for future generations and traditional use patterns maintained.

The intent of this paper is not to summarize the literature, but rather to comment on questionnaire results received from 17 jurisdictions and put forth ideas to enhance and advance the art of moose management in North America.

Policy/Management Plans

Moose in North America are regarded as a natural heritage; toward this end, moose management agencies must have clearly enunciated policy detailing all relevant particulars and strategies. Changes in habitat, increased demand and the need to maintain ecosystems intact dictate the need for such policies. In Manitoba, for example, a number of policies exist which assist greatly in developing plans and programs. Principal among them are those for perpetuating and allocating the wildlife resource.

Governments are charged with wise stewardship of the resource and have the legal responsibility for preserving, enhancing and managing it for the future. Plans must be developed to ensure this occurs. The pressures of these contemporary times demand a more active approach to management. It is interesting to note that only 7 of 17 jurisdictions have a moose management plan in place although most are developing them. Developed policy must be adhered to in these plans. Operational plans, in many instances, are those that follow tradition or are scattered on notes in files. The benefit of having a documented but flexible plan are many, not the least of which is that management activities can be clearly spelled out for user groups.

Present Status

Four of 17 jurisdictions indicate their moose populations are increasing, 3 steady, 3 declining and 7 stated their populations were variable. In the latter situation, the status of herds varied from one management unit to another.

The impact of new settlements and expanding human populations in the past

have contributed to sharp declines in moose populations. However, those pressures cannot compare to the multitude being exerted today. Almost assuredly, technological advances, for the remeinder of this century, will continue to result in pressures never dreamed of earlier. Increased access resulting from roads to remote communities, roads for timber extraction, the myriad of all-terrain vehicles, high-powered rifles, more leisure time, poaching and native rights are some of the human-related factors that have and are going to continue to impact upon moose. Unless an active and well co-ordinated defense is undertaken, more areas of "no moose" can be added to that listed by Karns et al. (1974).

Public Education

Who are we catering to? In a survey (Filion et al. 1981) on wildlife in Canada, 80 % of Canadians stated that maintaining wildlife was important to them. All too frequently biologists fall short in communicating with the public. We must become more active in explaining moose biology, management and in espousing the value of moose to the public and administrators.

McKenna and Lynort (1984) stated that wildlife professionals have only begun to deal with private conservation groups regarding environmentally damaging projects. The obligation exists to communicate with them and the public since more informed user groups are an ally who will be supportive of management programs, contribute to them and in the end will enhance the status of moose for the future. In addition it will ensure that the public is knowledgeable about management programs for an uninformed public could result in charges of mismanagement against governments. Sharing information and expertise with the public and private groups has an unrealized potential in that they can ask, do and say what we as civil servants cannot. It is interesting to note that the 1984 Federal-Provincial Wildlife Conference in Canada adopted 'communicating about wildlife' as its 1985 theme in recognition of this type of need in wildlife management.

We, in our drive to maximize wildlife and the experience of it, must become better readers of the public mind and better registers of the politics of our profession (Mahoney 1983). Moose management programs will only be as effective as the public support available. It is of paramount importance that we strive to educate elected officials and appointed senior civil servants and convey to them management principles, problems and public concerns. We must become better communicators and more articulate politicians (Mahoney 1983) comfortable within our profession as moose biologists. We must remain in touch with reality and display a responsibility in the sociological and biological fields–having done this, our credibility will be enhanced, management programs more secure and personal satisfaction attained knowing our conduct was of a high professional calibre.

Five jurisdictions have indicated they have no education program, while others indicate they communicate via hunting brochures, pamphlets, etc. Public education seminars appear to be confined to Ontario and Manitoba where they have proved extremely popular. Caution must be exercised to ensure that education programs are not directed at a single user group, i.e., hunters, but rather, carefully designed to accommodate all users. Such

Table 1. Most pressing moose management problems.

Problem	No. of jurisdictions
Predator management	5
Habitat management	6
Human use (licensed, poaching, subsistence)	10
Access controls	3
Public education	4
Disease	2
Lack of harvest data	1
Population estimates	2
Lack of useful data	5

communication can only benefit the moose resource. In Manitoba, communication has enhanced many of our moose programs and raised the profile of the Wildlife Branch in the eyes of the public as well as the department executive. In addition, the Minister of Natural Resources recently completed a series of 'Wildlife Dialogues' across the Province which significantly increased understanding and education on both sides. Technological advances available make communication much easier today than in the past.

Management Problems

The most pressing management problems to be faced in North America over the next 10 years have been synthesized to 9 categories (Table 1). Noteworthy is the fact that only 4 jurisdictions considered public education important enough to be listed, yet human uses such as licensed hunting, poaching and subsistence use are listed by 10 as management problems. It is obvious that more effort should be expended in the educational field.

Although our data base has expanded greatly since Peterson's (1955) statement on moose husbandry, 5 jurisdictions indicated a lack of useful data as a major problem to be dealt with. Table 2 lists the single most important factor identified by the 17 jurisdictions to be considered in moose management over the next 10 years, while Table 3 lists the primary factors impeding sound moose management programs.

The realities of today such as financial shortages, insufficient staffing, a watchful public, competition with other disciplines and politics suggest a need for wide-ranging co-operative management and research programs. These will provide essential information in an efficient and effective manner by directing efforts at the highest priority problems.

Subsistence Use

Nine jurisdictions indicated subsistence use as a concern; 7 did not identify it as a problem, while one took a middle-of-the-road approach. Basically, the issue at present appears to be most contentious in the western part of North America's

Table 2. Most important factors respecting moose to be faced.

Managing predators
Satisfying demand
Data accuracy
Unregulated harvest
Impact of forestry
Habitat loss
Role of hunting in moose dynamics
Hunter education
Public support for management programs
Management policy
Accurate vitality and mortality data

Table 3. Impediments to sound moose management.

Lack of interest – public and government
Lack of population data
Lack of adequate funding
Lack of mandate to manage moose
Selling management concept
Habitat
Unregulated harvest
Predator management
Lack of planning and priorities

moose range. The problem in some jurisdictions is widespread, while in others it is localized. Although the definition of a subsistence user varies, as a rule, it is one of native origin, e.g., Treaty Indian.

The most acute problem arises in the three Canadian Prairie Provinces (Manitoba, Saskatchewan and Alberta) which are governed by Paragraph 13 of the Natural Resources Transfer Agreement which states:

"In order to secure to the Indians of the Province the continuance of the supply of game and fish for their support and subsistence, Canada agrees that the laws respecting game in force in the Province from time to time shall apply to the Indians within the boundaries thereof, provided, however, that the said Indians shall have the right, which the Province hereby assures to them, of hunting, trapping and fishing game and fish for food at all seasons of the year on all unoccupied Crown lands and on any other lands to which the said Indians may have a right of access."

This paragraph was inaugurated in 1930 when resource management was turned over to the Provinces by Canada. Court rulings since then have given Treaty Indians the right to hunt on unoccupied Crown lands or lands to which they have right of access including provincial parks and wildlife management areas. They are able to exercise their rights at any time provided it is done safely and are permitted to use lights at night for spotting purposes. Governments have been reluctant to enact amendments to Paragraph 13 to reflect contemporary values. In Manitoba licensed hunters are generally restricted to bull-only seasons. With Treaty Indians, evidence collected by the Manitoba Department of Natural Resources suggests that approximately 75 % of the moose harvest is comprised of cows and calves. This is not in the best interests of moose husbandry, especially when the harvest is two to three times the licensed harvest (approximately 1 700) and moose populations are in a depressed state.

Different jurisdictions are handling the issue in different ways. However, it is the author's belief that the solution to ensure the future of the resource is education and legislation. This must not be construed to imply that Treaty Indians are not willing to co-operate, but rather a minority of individuals are abusing their rights and bands have no legal control over the hunting activities of these individuals. Prior to the legislative approach, it must be demonstrated to senior administrators that other techniques such as consultation, voluntary restraints and management boards will not work because of the action of a few. The Manitoba experience vividly illustrates that many native people are concerned about the demise of moose and wish to become involved in active management programs. Moreover, many are also concerned about Treaty rights and view the terms of reference associated with management boards and voluntary restraints with skepticism. On the other hand, it has been pointed out that when

the resource is gone the need to worry about rights also will disappear. In Manitoba progress is being made, albeit slowly, in forming moose management boards. A management option inaugurated in Saskatchewan in 1983 and to be used in Manitoba in the autumn of 1984 is refuges along roads and access trails which prohibits all hunting within 300 metres of each side of the road or trail. This will effectively curtail legal hunting of moose by all hunters in these areas.

There are examples of progress being made with native people in dealing with resource issues. The most notable example in recent years is the Beverley-Kaminuriak Barren-ground Caribou Management Board operational in Manitoba, Saskatchewan and the Northwest Territories. This Board is comprised of 5 government representatives and 8 native community representatives; its objective is to develop management strategies for the Kaminuriak and Beverley caribou herds and educational programs for users.

A solution to problems associated with subsistence use will have many benefits, not the least of which is a possible change in the negative feelings toward Treaty Indians in general arising from the actions of a few.

Enforcement

Enforcement is still an integral component of moose management, however, it has evolved to a point where a detailed analysis of the effort is mandatory. The work of Bessey (1983) is one of the best analyses of enforcement effort and effectiveness recently conducted in North America. Although restricted to deer (*Odocoileus virginianus*) in Manitoba, there are a number of aspects applicable to enforcement in general. Enforcement agencies across North America, in evaluating their programs, have discovered an acute inability to measure effectiveness. Bessey (op. cit.) suggests that wildlife and enforcement managers must avoid neo-classical approaches to program assessment and concentrate on what the agency does rather than the aftermath of what the agency does. Two aspects of program development and management become important (Bessey op. cit.):

1. Determination of optimal combinations of program inputs (i.e., patrol type, timing, use of public, use of education, etc.) in terms of setting priorities and regional demands; and,
2. ensure that program activities are based on and directed by a fundamental understanding of the social groups being regulated.

There is a great need to generate more effective and efficient enforcement programs for moose. Bessey (op. cit.) states "a progressive approach to enforcement management promises improved relations with other wildlife organizations and the general public and fulfillment of responsibilities in the production and protection of wildlife for the enjoyment of all, both now and in the future."

Enforcement agencies must become more efficient in terms of time, dollars and techniques. Administrators must be certain that expenditures result in the greatest benefit for moose. More productive enforcement will also lead to an increased public awareness of this effort, the problems and enhance the image of enforcement officers in the public eye. An effective enforcement program involves communicating with the public and agencies fall short in this regard.

Aspects such as compliance rate must

be carefully examined—is it necessary to increase enforcement effort for moose with a compliance rate approaching 100 %? A more effective approach would be to concentrate on uncontrolled aspects such as poaching which can have a more pronounced impact on the moose resource.

Manitoba's Department of Natural Resources (1983) "Five-Year Report to the Legislature" cautioned that big game populations, particularly moose, are in jeopardy largely due to the uncontrolled harvest. It is anticipated that the most significant problem (in Manitoba) to be faced by enforcement staff and wildlife managers in the next five years are:

1. night hunting,
2. illegal sale of wild meat, and
3. illegal hunting on private land.

Predation

This subject is being reviewed by Ballard and Larsen (1987). Other than disease, a potential natural limiting factor to moose populations is predation (Karns et al. 1974). They specifically mention wolves but suggest that bears also may be a factor. Work since then (Ballard and Larsen 1987) has illustrated the prominence of bears as a mortality source.

Moose versus predators is an emotional issue that quickly polarizes people, including biologists, into two groups. Is predator control necessary? Have all the data been thoroughly analyzed? There are few other issues that must be handled as delicately as predator control to ensure that sound advice is given, policies are written and explicit and the resource and users will benefit. Everyone must realize that in an analysis of the dynamics of moose populations, all factors must be examined.

Gasaway et al. (1983) found that predation by wolves can exert substantial control over ungulate prey populations; Larsen (1983) demonstrated the impact of grizzly bears on moose, while Franzmann et al. (1980) have done likewise for black bears and moose.

Where predation is the primary factor limiting moose populations, managers are faced with two choices once the predator has been identified, namely, wait for a natural recovery of prey while reducing or eliminating harvest, or reduce the number of predators while controlling harvest of prey (Gasaway et al. 1983). The periodic removal of wolves is suggested by Gasaway et al. (op. cit.) as the most practical and this also would be the preferred plan for bears.

Moose/predator interaction is taking on increased importance, especially where moose populations are low, however, the issue must be carefully analyzed prior to action being taken. Toward this end a proposal has been put forward for a Canadian co-operative predator/ungulate research program. The aim of the proposal is to assist in providing answers to questions faced by wildlife agencies in Canada in their management of predator/ungulate systems through high-quality, integrated research directed at the highest-priority problems. It is hoped that a co-ordination of existing and possibly additional studies will occur to ensure comparability of methods, the generality of findings, the pooling of expertise and the focus of work on management problems. Concensus amongst resource management agencies as well as a detailed policy and procedure manual available for public scrutiny in this regard are also important. Such an approach will demonstrate that the prov-

inces are managing predators and their prey in the truest sense of the word and will go a long way to deflect criticism for actions taken.

Habitat

Maintenance and production of moose habitat is contingent upon two things: logging and fire. The former is a 2-edged sword as with logging comes access and clear-cuts allowing hunters with modern conveniences to exploit moose populations once thought remote.

Forestry interests in many cases are willing to work with moose managers, however, we must define precisely a recipe for moose habitat. The dependence of moose habitat on commercial logging is evident when one considers that much of our moose range in many areas is under the control of private paper companies (Karns et al. 1974). Governments, because of economic importance of the pulp and paper industry, have signed long-term agreements with logging companies giving them exclusive rights to large areas. Noteworthy is the fact that moose biologists have little control over the habitat of the species they are attempting to manage. As this is not likely to change, it is essential that biologists work closely with forestry interests during the formulation of logging plans.

Fire is important in the creation of moose habitat. Gasaway and Dubois (1983) found that fire did not disturb moose or kill them. The author has information on moose mortality due to fire. However, it is probably the exception rather than the rule. The "Smokey the Bear" syndrome which pervades North American society from the classroom to the upper echelons of government must be overcome—fire has a definite value for many wildlife species and controlled fire is a useful management tool. Fire is the single most important factor responsible for creating moose habitat in North America, annually producing more high-quality habitat than all other factors combined. One concern regarding fire is that the increased sophistication in fire detection and suppression may significantly decrease the amount of habitat produced. It is the author's view that a combination of the right factors will continually occur, resulting in the production of prime habitat via fire.

The value of fire in producing prime moose habitat has been well documented and more effort should be made to use controlled fire as a management tool. Skepticism will exist. However, if the concept is accepted by administrators and the public and it can be shown that the risk is minimal, it should be employed.

Mortality Factors

Mortality factors affecting moose populations in North America can be lumped into five categories: hunting (licenced, subsistence, poaching), predation (wolves, bears), disease, weather and accidents. Crête (1987) has reviewed the impact of sport hunting on moose in North America, while Ballard and Larsen (1987) have summarized the relationship between moose and predators. The latter two factors are more ambiguous than the others and, in a fashion, constant from year to year. The remaining factors vary from jurisdiction to jurisdiction and from year to year. Noteworthy is that most jurisdictions in considering mortality due to hunting have not documented that by subsistence users. As the magnitude and impact

of this can be substantial it must no longer be overlooked—attempts must be made to document all facts related to it.

Karns et al. (1974) reported on non-hunting mortality in New Brunswick, Nova Scotia, Maine and Minnesota. There is nothing to suggest this has lessened, and may in fact, be increasing. Child (1983) reported on the loss of moose to trains in central British Columbia and predicted that this will continue to accelerate as trains are used to extract resources from the interior.

Disease is a problem in specific areas, particularly those caused by *Parelaphostrongylus tenuis* and *Fascioloides magna*. The winter tick (*Dermacentor albipictus*), under the right conditions, also has the potential to be a major problem with moose wherever it occurs.

Management decisions must be cognizant of non-hunting mortality. More effort must be expended to ascertain the impact of diseases and other factors on moose populations especially those subjected to significant losses due to hunting.

Value of Moose

What is the value of a moose? Too frequently, biologists have been reluctant to stray into the area of economics which is an important issue to be considered. In Manitoba, for example, wildlife biologists were recently asked to submit data on the value of the various resources to assist in compiling a priority fire-fighting plan. Economics is an issue which, if treated properly, can enhance the status of moose. These considerations, in the past, have been used sporadically but with encouraging results for the wildlife resource involved (Mahoney 1983). More effort must be directed in this field.

Crichton (1979) computed the capitalized value of a moose from a consumptive point of view and found it to be $1 173.10. In 1984 dollars, this is about $2 000.00. In Manitoba an analysis of the value of wildlife revealed that for every dollar allocated to wildlife, the provincial treasury received $2.00 in return and $66.00 were generated in the provincial economy. It was further pointed out that the Manitoba Wildlife Branch budget was at the point where further cuts would result in reduced revenues to the Crown and have a negative impact on the provincial economy.

A comprehensive survey conducted by Statistics Canada (Filion et al. 1981) revealed the value of Canada's wildlife resources. Wildlife-related activities emerged as one of the most prevalent forms of recreation and 4.2 billion dollars were injected into the economy, however, these activities excluded the commercial value of wildlife. The fact that 80 % of Canadians indicated that maintaining wildlife was important to them suggests there is a broad base of support for wildlife management in Canada. Non-resident hunters are spending up to $2 500.00 for a week's hunt in Manitoba, with an average hunt costing about $1 500.00. In some jurisdictions this cost is even greater. Also of importance in Manitoba is that every two non-residents require a resident guide for moose hunting.

Conclusion

The aforementioned facts, combined with natural events, will test the imagination and ingenuity of every biologist to ensure the rightful place of *Alces* in the future of this continent. Demands being placed on the moose resource of North America to-

day and for the remainder of this century will continue to escalate. Management decisions will become increasingly complex and precision must be our ultimate goal. Increased access and modern conveniences will result in once-inaccessible herds no longer remaining isolated. The activities of other disciplines will also negatively impact the resource. Because of this we must begin to carry out more active management programs. Such programs will definitely need additional funds to augment those already identified for data gathering and program implementation. However, before categorically rejecting these ideas, administrators would do well to assess the overall economics related to such funding. Licensed hunters, subsistence users and non-consumptive users must "bite the bullet" and would be well advised to join forces in cooperative management ventures to the benefit of the resource rather than continue the "confrontation atmosphere" that exists in many areas today. Moose biologists must become more involved in public education—a public more informed about moose can focus attention on management problems, assist in securing its future and generate action for active and beneficial management programs. We have a moral as well as legal obligation to secure the resource for future generations. The costs of re-introductions or whatever activity is needed to rejuvenate depleted herds may be mind-boggling, leading all to ponder at some later date why those of the past did not think about future consequences. The mandate of all governments is to manage the resource in a professional manner and anything short of this could result in claims of negligence by the public should we fail to act accordingly.

Biologists, in many ways, are not equipped to handle the myriad of management problems. We are all well trained in biology, but few possess the techniques to carry out a situation appraisal, problem analysis, potential problem analysis or decision analysis. Biologists would do well to acquaint themselves with techniques such as those described by Kepner and Tregoe (1981), that is, determining the right solution to the right problem as opposed to leaping to conclusions and alternatives. Another aspect to be considered is communication—all too frequently, we closet ourselves in our respective niches, failing to recognize who we are serving and fail to convey the results of our work to users of the resource. This does not mean publication in scientific journals, much of which is foreign to users, but rather, use of information seminars and other media techniques detailing information on biology and management of the resource.

Page (1983) pointed out that many of the most advanced and powerful ideas available to the biologist are couched in mathematical terms and formulations obscure to biologists. There has been little attempt by biological mathematicians to reach field-level biologists (Page op. cit.) and, conversely, biologists have been negligent in seeking out the assistance of mathematicians, economists and others who may have ideas. The difficulties experienced in working with native people in an attempt to involve them in management schemes may be a problem in communication that could best be addressed by a psychologist—in many cases, the stumbling block to more innovative approaches is our imagination. Page (op. cit.) asked the question, "How can the ideas being developed in theoretical popu-

lation dynamics and other fields be applied to the next generation of moose management?" His solution is modelling and he proceeds to deal very concisely with the subject. With the multitude of data, this is our only hope of adequately handling the problems to be faced.

Concepts of management of North American moose herds have changed greatly over the last decade. Declining populations have resulted in management strategies paralleling those seen in Europe. Increased knowledge of the resource and management problems have been responsible for changes seen over the past decade. Our data base will increase, thus we must remain flexible to accommodate new information and develop new strategies. We must maintain professional integrity and recognize that there is a largely untapped resource out there, namely, the public who expect their moose populations to be managed properly and who, given the knowledge, are receptive to playing a key role in moose management into the twenty-first century.

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