MOOSE IN MODERN INTEGRATED ECOSYSTEM MANAGEMENT – HOW SHOULD THE MALAWI PRINCIPLES BE ADAPTED?

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ABSTRACT: Under the implementation of the Convention on Biological Diversity, a special emphasis has been put on an integrated ecosystem approach. Some of the "Malawi principles" state that management objectives are a matter of societal choice, and that management should be decentralized to the lowest appropriate level. A key feature of the ecosystem approach includes conservation of ecosystem structure and function on a long term basis, while seeking an appropriate balance between conservation and use of biodiversity. The role of moose in the ecosystem and how the Malawi principles can be adopted in moose management were a focus of the 5th International Moose Symposium. All invited speakers and session chairs were asked to provide a brief summary of how they considered the Malawi principles to relate to the topic of their respective papers or sessions at the Symposium. Those summaries are given in this paper.

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"Moose in modern integrated ecosystem management" was the main conference theme for the 5th International Moose Symposium in Norway 2002. In the last plenary session at the Symposium, two papers specifically addressing this topic were presented, followed by a general discussion. As an introduction to the discussion, all invited speakers and session chairs were asked to give a brief summary of how they considered the so-called Malawi principles to relate to the topic of their respective sessions at the Symposium. Their valuable contributions to highlight this issue are presented below.

The Malawi Principles

In a workshop organized in the African country Malawi in January, 1998, and submitted to the 4th Conference of the Parties of the Convention on Biological Diversity (UNEP/CBD/COP/4/Inf.9), the following 12 principles/characteristics of an ecosystem approach to biodiversity management were identified:

1. Management objectives are a matter of societal choice.
2. Management should be decentralized to the lowest appropriate level.
3. Ecosystem managers should consider the effects of their activities on adja-

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cent and other ecosystems.
4. Recognizing potential gains from management there is a need to understand the ecosystem in an economic context, considering, for example, mitigating market distortions, aligning incentives to promote sustainable use, and internalizing costs and benefits.
5. A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning.
6. Ecosystems must be managed within the limits to their functioning.
7. The ecosystem approach should be undertaken at the appropriate scale.
8. Recognizing the varying temporal scales and lag effects which characterize ecosystem processes, objectives for ecosystem management should be set for the long term.
9. Management must recognize that change is inevitable.
10. The ecosystem approach should seek the appropriate balance between conservation and use of biodiversity.
11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous local knowledge, innovations, and practices.
12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

A. R. E. Sinclair: Commentary on the Malawi Principles

The Malawi principles embody two fundamental principles. Firstly, all stakeholders should be involved in the process of developing conservation management plans. Underlying this is the idea that most of the biodiversity in the world lies in tropical regions that are owned and administered by developing countries. These countries must consider the development and advancement of their peoples and unless this is taken into account conservation problems will be ignored. In particular, we must pay attention to the mismatch where those that gain benefit from conservation are not the same peoples as those that bear the costs of conservation. Secondly, the Malawi principles recognize that the ecosystem is the unit of management rather than individual species. Traditionally, conservation has focused on single species, particularly those that are endangered. Yet all these species require habitat and other resources, often the loss of such resources being reason for the conservation problems, and so it is these resources that need to be conserved within the context of the whole ecosystem.

It is no coincidence that these principles have been laid out at the conference in Malawi, one of those developing countries that are confronting the trade-off between development and environment. Whilst recognizing the validity of these Malawi principles, we should not ignore the constraints and limitations that still have to be addressed. First, we must recognize that there are problems with time scale. The principles do refer to large spatial scales and long time periods. Nevertheless, they do not recognize that poor peoples do not conserve their resources because they discount the future, often the very near future of a few years or even a few months. If a peasant farmer has to cut down a tree for fuel to cook tomorrow's meal he is in no position to consider the problem of conserving the forest for next year let alone 10 or 100 years. Poverty means that people do not save for the future.

In addition, the principles have not addressed the problem of benefits for future generations. Indeed, future generations are unrepresented in any discussions when it comes to natural resource economics.

Finally, the principles stress the need to consult and incorporate the wishes of local, indigenous peoples. However, such peoples, at the scale of villages, invariably think

at the very small scale. They consider only their own local needs. Thus, the principle of large scale is in direct conflict with the principle of local involvement.

Secondly, the principles have not built in any mechanism for enforcement. In essence, these principles are a form of social contract. Developing peoples obtain some benefit in return for conserving the resources that benefit the whole world. What happens if they renege on their commitments? They could obtain the benefit and then exhaust the biodiversity under their control. As the principles stand, there is no penalty for noncompliance in the social contract. Experience has shown that without such a penalty these social contracts have not worked and are unlikely to work. We must face the hard facts, no matter how unpalatable they are, that humans act in their own short-term selfish interests so that if there is no inducement to comply with a contract they will not do so.

Thirdly, the principles purport to incorporate the concept of the ecosystem. However, this concept remains vague even for biologists and many components have yet to be defined. For example, what are the bounds of an ecosystem? Without some recognition of this boundary it can be tailored to suit the needs of anyone that wishes to exploit a system. In British Columbia this term has been used to allow mining and logging within Provincial Parks, areas previously protected from exploitation, under the guise of ecosystem conservation: the new rationale is that now conservation must take into account the combined area of park and external regions together. This has allowed exploiters to obtain greater resources inside the park while conveniently ignoring the costs of greater conservation outside the park.

Another problem lies in understanding ecosystem function. This is a term that is now frequently used in the debate on biodiversity processes and yet we do not know precisely what this term means. It can mean a number of different things and sometimes they are in conflict with each other. Thus, ecosystem function can refer to productivity, nutrient cycling, or hydrology, but it can also refer to stability, resilience, and robustness. Promoting high productivity could reduce resilience. We have to be precise in what we mean by ecosystem function in implementing conservation.

Finally, the term biodiversity itself encompasses all of living matter. As such it is not very useful. We have to address for practical purposes particular components of biodiversity that will be essential in terms of the functioning of ecosystems. However, we do not yet know what those components are. Do we, for example, pay attention to the large mammals which can act as 'umbrella species', thus protecting all those that fall within their large scale habitats or, in contrast, do we protect the microorganisms of the soil because they determine all processes that feed up the trophic levels to the large mammals? We do not know the answers to these questions yet.

Reidar Andersen: Malawi Principles and Moose Management – Challenges in North America, Eastern Europe / Northern Asia, and Fennoscandia

The Malawi principles focus on an ecosystem approach, where management objectives are a matter of societal choice and where management should be decentralized to the lowest possible level. The relevance of these principles varies throughout the moose distribution area. In many parts of Eastern Europe and Northern Asia, moose populations have declined over the last decade. The decline is most pronounced in areas with high human population density, reflecting the fact that poaching and overexploitation is the main cause of decline. In some cases deterioration of moose

habitat may also be important. Clearly, in a situation where hunting is not a pure recreational activity, and where some hunters are close to a subsistence level, each individual hunter has difficulty in seeing the benefits of ecosystem management. Thus, the Malawi principles seem to be of minor relevance, yet the goal local managers should strive for.

In North America and Fennoscandia, moose populations are managed at the lowest appropriate level; often at the level of forestry owners and hunters (Sweden) or local management within smaller districts (Norway and Finland). In many areas, vehicle accidents are on a level that needs consideration. If management objectives should be a matter of societal choice, frightened car drivers should also have a voice in setting the quotas.

Two of the Malawi principles state that ecosystems must be managed within the limits of their functioning, and at the appropriate scale. First, what is appropriate, and how could managers decide what is the limit of ecosystem function? In several places, high density moose populations are thought to have led to reduced biological diversity, still we are lacking a clear understanding of how large herbivores, like the moose, are affecting their habitats and their functioning.

One Malawi principle states that management must recognize that change is inevitable. Change not only in management objectives, but also in population densities. While most people can agree in the principles of optimal production and yield in relation to the carrying capacity of the habitats and damage to other management operations, we also need to realize that populations of large herbivores seldom are stable in numbers over long periods of time. In some areas, managers and others ask themselves; will large herbivores in areas lacking large carnivores stabilize at a certain density, or will large herbivores grow beyond their carrying capacity, overgraze their food resources, and create a highly unstable situation with large temporal variation in numbers? In that case, will reintroduction of large carnivores be able to create stabilization? Or, will hunters be able to create this stability? Obviously these two scenarios have profound effects on community structure.

One major conclusion from analysis of several long-term individual based population studies of large herbivores is that the population dynamics of ungulates in predator-free environments are strongly influenced by a combination of stochastic variation in the environment and population density. Both factors operate through changes in life history traits, correlated with variation in body weight, which generates delays in the response of the population to changes in the environment. In such cases it is claimed that in the absence of predation, a stable equilibrium between an ungulate population and its food resources is therefore unlikely to exist. Consequently, no management regime should be judged in relation to the stability of moose numbers.

Kjell Danell: "Moose in modern, integrated ecosystem management", in Relation to the Malawi Principles. Some Conclusions from the Section on Trophic Interactions between Moose and Vegetation

Management objectives are a matter of societal choice. — The food of moose constitutes, to a large extent, woody plants in boreal forests. These plants are valuable to at least 3 interest groups: moose hunters, timber industry, and nature conservation interests. For moose hunters, more food plants of better quality can mean more moose. For the timber industry, damage to Scots pine (*Pinus sylvestris*) is especially negative, both in the short and long term,

because moose can cause losses in both quantitative and qualitative terms. For nature conservation, heavy browsing pressure can depress populations of preferred woody species, such as aspen (*Populus* spp.) and rowan (*Sorbus* spp.). These deciduous species have a value as such, but also because they are host plants for a wide array of plant and invertebrate species.

Important tasks for the future are to determine how to bring these interest groups together and to find a common procedure for discussion of the appropriate moose population level. How to find a balance between different values? Private interests versus interests of society.

Management should be decentralized to the lowest appropriate level. — Which is the appropriate level for management? A small area may be good for solving conflicts between landowners, because then few landowners are involved, but a large area is often needed because moose migrate.

Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems. — So far, moose management in Fennoscandia has been very much a single species approach, especially in a situation without large predators. We need to move away from single species management plans and strategies towards ecosystem management if we are to follow the Malawi principles.

A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning. — For moose we need more knowledge of its effect on ecosystem structure and functioning. At high densities, moose can have a much more dramatic impact on landscape features and plant succession than we generally believe. In southern Sweden, high densities of ungulates cause pine forests to be replaced by spruce forests. So far, a great effort has been directed to understand the population dynamics of moose. However, we need to broaden our research approaches.

Chuck Schwartz: Application of the Malawi Principles to the Section on Trophic Interactions between Moose and Carnivores

First, science and the application of science is a major principle. All the papers presented at the session furthered our understanding of predator-moose relationships and were very much in line with the principles. Second, the principles suggest that management be reduced to the lowest level when and where possible. With rare carnivores, the opposite has occurred. The Endangered Species Act and the Bern Convention are national or international laws. They are basically top-down control rather than bottom-up. However, it was pointed out by one of the members of the audience that the principle states that authority should seek the lowest practical level. This, in the case of large rare carnivores, may in fact be at the national or international level. Finally, I summed up with the principle of ecosystem function and management and the fact that large carnivores are a major part of such function. Society has deemed it appropriate to retain or restore large carnivores and maintain healthy systems. Consequently, moose managers must view their role differently than simply providing sustainable harvests to hunters.

Rolf O. Peterson: Wolves, Moose, and the Malawi Principles

The Malawi principles relate, in general, to the difficult problem of conserving the diversity of life, which underlies the human experience. Predation by large carnivores, in particular the gray wolf, relates to the specific principles calling for maintenance of ecosystem structure and function as well as those recognizing the enormous

importance of local human attitudes.

I view the gray wolf as the most significant "stage manager" in the evolutionary "theatre" in which moose developed. From basic data on the age structure and pattern of moose vulnerability to wolf predation, we can infer that wolf predation has been the dominant agent of natural selection for moose throughout its extensive geographic range. Indeed, this notion was implied by Charles Darwin in The Origin of Species. Based on ongoing simulation work shortly before his death, A. B. Bubenik (personal communication) concluded that optimal social balance in moose populations was attained by age- and sex-specific mortality patterns similar to those produced by wolf predation.

How can we maintain natural selective forces in a human-dominated world? Remarkably, gray wolves have staged a major comeback in many parts of their historic range, attributable to changing public attitudes and formal recovery programs. Yet this has accentuated a mismatch between those people who bear the cost of living with wolves and those who derive the benefits. Wolf recovery prompts divisiveness in human responses. The addition of wolves can greatly complicate human affairs in rural landscapes, particularly where human presence is pervasive, so the greatest hope for recovery of large carnivores lies in extensive wildland habitats.

Fear of the wolf remains a key influence in the public mind. Information and education programs should be management priorities anywhere wolf recovery is ongoing or contemplated, as local people and their beliefs will greatly affect the future of the wolf.

Ecosystem processes include those that are both fast and slow, at both large and small spatial scales. The inherent nature of wolf predation, as an intensive, culling agent operating over local scales that are measured in hundreds of square kilometers, is that of a highly dynamic element operating at large scales in an ecosystem. The responses that are demanded from human societies, operating in relatively slow bureaucracies at local levels, will pose a particularly interesting management challenge.

R. Terry Bowyer: Relationship of Genetics, Physiology, Diseases, and Parasites of Moose to the Malawi Principles

Presentations in our technical session involved the Malawi Principles primarily in relation to effects of moose (*Alces alces*) on biodiversity, but also with respect to societal needs for consumptive uses of these large herbivores. The evolutionary history of a species holds implications for understanding its current distribution, but also its likelihood of persisting or expanding. Thus, information on the phylogeography of moose (Hundertmark et al. 2002, 2003) and whether speciation has occurred (Boeskorov 1996, Udina et al. 2002) are data essential for the wise management of these unique large mammals. For instance, will all subspecies of moose respond in a similar manner to environmental constraints such as severe weather or various harvest regimes (Sæther 1997)? Indeed, how these large mammals cope with climatic variation (Bowyer et al. 1998, Lenart et al. 2002) could have far-reaching implications for their population dynamics and subsequent interactions with their environment, which holds implications for biodiversity. Differences in body mass among subspecies may result in variation in life-history strategies (sensu Keech et al. 2000) of moose that may necessitate different management tactics to meet societal goals.

Clearly, adaptations of moose to their environment can lead to morphological differences that may be useful in their management, including antler characteristics (Bowyer et al. 2001, Engan 2001), and

digestive physiology (Kochan 2001). Knowledge concerning how these morphological and physiological characteristics differ among populations or subspecies will promote a more complete understanding of how moose are adapted to boreal environments, and thereby enhance opportunities for their sound management.

Society demands the ethical treatment of mammals (Animal Care and Use Committee 1998). Consequently, the manner in which researchers and managers capture, restrain, and study moose and other large herbivores affects the opportunity to meet the needs of people for subsistence or recreational uses. Capture methods, then, must be humane, effective, and result in limited mortality of study animals and minimal risk to humans (Arnemo and Søli 1994, Arnemo 1995).

Finally, the phylogeography of moose has implications for how moose interact with and affect their forage plants (Bowyer et al. 1997). Clearly, moose can drive successional patterns in boreal forests (Pastor and Naiman 1992, Pastor et al. 1993). High densities of moose can have deleterious effects on biodiversity of other vertebrates (Berger et al. 2001). Nonetheless, intermediate densities of those large herbivores can promote nutrient cycling in boreal forests (Molvar et al. 1993) and enhance rates of decomposition in aquatic systems (Irons et al. 1991). The ability of moose to alter successional patterns and affect trophic cascades makes them a keystone species (Simberloff 1998). Accordingly, moose offer a unique opportunity for single-species management to directly affect biodiversity to achieve results that benefit those components of society seeking consumptive uses of moose and those hoping to enhance biodiversity.

Göran Ericsson: Human Dimensions of Moose Management and the Malawi Principles

The human dimension of moose management (i.e., how people value moose, how people want moose to be managed, and how people are affected by or affect moose including management decisions [Ericsson 2003]), is a central part of the Malawi principles with respect to natural resource management in the boreal region. All wildlife management is based on human values, with "management" itself being a human construct (Decker et al. 2001). Thus, our societies manage moose (and other wildlife) because we implicitly view them as a resource.

Central to the Malawi principles is that the decision-making power should be handed down to the lowest possible level. However, that poses a great challenge for traditional natural resource management. Not only local groups want to have a say today in natural resource management. Most importantly, several national and international stakeholder groups want to have a say, and political oversight of management has increased. Moreover, several international agreements and conventions also regulate natural resource management (e.g., moose and other large mammals). Consequently, natural resource management now has to pay more attention to non-consumptive use as well. Moose management is no longer just about setting harvest quotas. At the same time, the consumptive use of moose is still of central importance, making moose management more complex, as non-local interest tends to be centralized around non-consumptive issues. Therefore, if we decentralize moose management to the lowest appropriate level according to the Malawi principles, we will most likely see an increased tension between local people's interest - which tends to focus on the consumptive aspects of moose management -

and non-locals' interests. Because local people normally represent a small minority of any western urbanized society, the democratic process easily, but often unintentionally, overruns their interest. However, western societies now pay more attention to local groups as well (Ericsson and Heberlein 2002). Recent data from Sweden supports this and show that non-locals support the right of local people to have the final say, even in controversial management issues. When asked "I think that the local people should have the final say in large carnivore management", 55 % of the Swedish public said that they supported this (Ericsson and Heberlein 2002). Thus, it suggests that implementation of the Malawi principles in moose management is not a controversial issue. Instead, the vast majority most likely support local moose management.

Human dimensions are still a "Management Challenge" in moose management (Crichton et al. 1998). During the sessions at the 5th International Moose Symposium it became evident that Human Dimensions so far is mostly ad-hoc to "pure" moose projects. This is most unfortunate for successful implementation of the Malawi principles and a wise, sustainable use of moose as a multidimensional resource. Thus, we urgently need to involve socioeconomic expertise from the beginning when we deal with a "moose problem", not afterwards and probably most important, don't set their agenda. Human dimensions of moose management, and a successful implementation of the Malawi principles, are far too complicated to apply a single discipline solution. Local management is here to stay, like it or not - but "John Doe" and "Sven Svensson" demand a voice even in moose management and research today. "Since the early 1970s, citizen participation has been emphasized in natural resource management decision making" (Lauber and Knuth 1999). Now we face the challenge to make this work in moose management. Remember that management is a human construct based on human values - thus we need to involve people in the decision and implementation of moose management.

A. R. E. Sinclair: Some Concluding Remarks

In conclusion, we must be honest with ourselves in recognizing that there are some fundamental problems that will either prevent the implementation of the Malawi principles or will allow them to be distorted and corrupted if they are not addressed.

Secondly, we must be flexible in implementation through the use of adaptive management. Sustainable use of resources requires flexible harvest quotas rather than constant numbers.

Thirdly, we have to implement programs to monitor any conservation initiatives to assess whether they are meeting their objectives. Finally, we should remember that had we known what was present on many of the continents in the 1700s or 1800s we would now be in a better position to know what to conserve and how to conserve. In a hundred years time, future generations may be wishing that we had been wiser at the current time. It is certain that what we are currently doing is imperfect at best and we must be constantly asking ourselves this question: what are we doing wrong now that will impact future generations?

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