DiGasper, Sofia Wennberg. 2008. Natural Resource Management in an Institutional Disorder. The Development of Adaptive Co-Management Systems of Moose in Sweden. Luleå: Luleå University of Technology, Division of Political Science.

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DiGasper's work on the development of adaptive co-management systems of moose in Sweden is in most ways an impressive engagement with an important and difficult problem: how do we build institutions to overcome the social dilemmas we are facing in the usage of our natural resources. The author is up to date on most margins of relevant scientific development and has organised her observations on both theory and empirical occurrences into a coherent and readable exposition. This should not be forgotten even as we acknowledge that no one is so good that no improvement is possible.

Below I will not attempt a comprehensive survey of her work. I will highlight some parts of her arguments and point to three areas where I believe she can improve on her discussion. One area where better use of theory would be important is the use of levels of analysis for rules (constitutional, collective choice and operational choice). A second question concerns the choice of unit for the analysis of an adaptive co-management system. And a last methodological question is about validation of indexes.

But before we start let me warn about my own limitations. I know nothing specific about Sweden's public administration or of Swedish forest ecology. Hence I cannot validate DiGasper on the specific information she provides here. The aspects that I can verify pertain to use of theory and methods.

Background

The tragedy of the commons is well known and the long road towards an understanding of how to overcome its destructive logic has made a lasting impact on social science, for example by establishing the commons as collective action to overcome the tragedy. Private property or state regulations were not, after all, the only ways of overcoming the tragedy. By 1990 the commons were accepted as a system of self-governance able to overcome the social dilemma in managing resources characterized by low excludability and high rivalry. But as usual, solving a problem at one level only opens opportunities for new problems at other levels. If we know how to organize the pastoralists to utilize sustainably the pastures their cattle depend on, the focus may shift to the ecosystem. What does it take to manage sustainably the ecosystems that produce the pastures that the cattle depend on?

An ecosystem goes through cycles of growth and decay but is also assumed to be non-ergodic in the long run. It will always be able to surprise its users by producing something new. For the management this means that there is no assurance that practices working well last year will work well for the next decade. Management will have to be prepared to adapt. Adaptation can best be prepared by viewing each activity as an experiment and continuously update information about

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status and development of the ecosystem. Adaptive management needs to be knowledge based.

Most ecosystems involve several and very different groups of stakeholders. Managing multiple groups within a complex ecosystem represents a new level of difficulty compared to the simple stakeholder system characterizing the ecosystems where adaptive management was developed. Co-management has usually been seen as a way of cooperation between state administrations and a stakeholder group. In a complex ecosystem with many such groups each managing their particular interest, adaptive knowledge based management has to evolve into adaptive knowledge based co-management.

Swedish forest ecosystems comprise multiple resources and are seen to have a complex system of stakeholders. It is a politically interesting and very practical question to ask how one should design a management system for the resources of these forest ecosystems. While many "know" how it should be done, there is very little empirically verified knowledge about the relative merits of the various ways such management systems have been implemented. This is the research frontier where Sofia Wennberg DiGasper's work makes its contribution. But instead of cattle and herder organisations, she takes a hard look at the Swedish management of its moose population.

Management of moose in Sweden

She focuses on the creation of the moose management units (MMUs) during the period 1987-1996 and wants to know

- To what extent are Swedish MMUs adaptive co-management systems?
- What characteristics of the public administration contribute and hamper the development of adaptive co-management systems?
- In what respect do the current structural features of the Swedish moose administrative system differ from structural features highlighted in theory as critical to an "ideal adaptive co-management administrative system"?

The findings are, I suppose, not that surprising. Moose management units lack several characteristics of adaptive co-management, and several characteristics of the public administration work against the development of a true adaptive co-management of the moose. Only one feature, the presence of key stewards, seems to be working to improve the adaptive co-management. So the present system seems to be far from the ideal adaptive co-management system for moose. We shall return to more details for some of the conclusions later.

What is adaptive co-management of ecosystems?

To appreciate her conclusions as well as understand how she arrives at them we need to know a bit more about what adaptive co-management is, what the role of the state is supposed to be and how the history of Swedish public administration (including the moose administration) shapes the options for future reforms.

A management system can be called an adaptive co-management system if it is organised from the bottom up within a frame given by the government, and is able to learn from observing the nature it is set to manage. Learning may be both scientific and based on user observations: local ecological knowledge. Improvements in such a management system can

be judged based on status and improvement in monitoring, in methods of learning, and in degree of congruence between ecosystem and management goals. An indicator of successful management for a system will be to reach its goals. For an adaptive co-management of moose the goals should include sustainable resource management.

The state is supposed to provide a frame for the largely self-governed development of the adaptive management system. In setting up the system the state managers have to consider the distribution of powers and competences among the various stakeholders and the kinds of organisations they are able to construct. The long history of moose management activities of the Swedish state provides valuable experiences and an unquestioned legitimacy for interventions. But the management infrastructure already there also poses limits to what can be achieved. In a democratic rule-of-law state legally enforced rights and liberties, privileges and immunities awarded private citizens and non-governmental organisations are very difficult to abrogate. In this story the management powers awarded the hunter organisation SAHWM (Swedish Organisation for Hunting and Wildlife Management/ Svenska Jägareförbundet) in 1938 is an example of how this may shape later management reforms.

The theoretical element promising to highlight this part is the distinction between levels of rule making. Rules can roughly be divided into those enacted at the constitutional level and those enacted at the collective choice level. The constitutional level handles rules about making rules and about creating roles. Awarding an actor legally enforced rights and liberties, privileges and immunities can, for short, be called to give this actor property rights to some valuable stream of benefit. But this also involves the creation of the roles of owners, monitors and sanctioners. At the collective choice level one makes rules. How is monitoring to be performed? How is the sanctioning authority to perform its duties? Regulations mandated by legislation will provide answers. When rules are applied in the field we are at the operational level where rules are interpreted. The current moose management system is governed by a complex of rule systems where property rights as enacted by the parliament is seen as the constitutional level, but where administrative rules at both state and county level intervene. The process of rulemaking within the NGOs is not discussed. It is my hunch that problem discussion might have improved with a more nested understanding of the concept. Particularly for co-management systems where the element of self-governance is so important one must understand that the three levels also apply to the single organisation. The concept needs to be applied in a nested fashion across the system of actors and stakeholders. The state may have to provide meta-rules circumscribing the constitutional powers of NGOs as well as the various branches of the public administration.

The origins of the MMUs (moose management units)

The reasons for reforms of the moose management go far back in history. Since 1789 hunting rights belonged to the land owner. The increasing efficiency of the hunting technology produced a tragedy of the commons during the 19th century. The tragedy was recognized for what it was also then. The hunting season was introduced. But the problems of abrogating

established rights were also understood. Efforts to redress the situation came slowly. In the new hunting law of 1938 a majority of landowners was given the right to force the minority to comply in establishing game keeping areas, and SAHWM was assigned rights and liberties, powers and liabilities of caring for the wildlife. One reaction to this was the establishment of the NHA (Hunters National Association – The Countryside Hunters/ Jägarans Riksföbund – Landsbygdens Jägare).

Since about 1950 the ecological conditions for the growth of the moose population was judged to be very good, mostly due to the introduction of clear cutting in forestry. But nothing much happened until after 1970 when hunting license was introduced and hunting rights were limited to the number of animals licensed. Then the moose population mushroomed. And new problems appeared. The large moose population caused large grazing damages to the forest. The stage was set for the reforms of 1987-1996. The introduction of MMUs (Moose Management Units) during this period is the topic of DiGasper's investigation.

Data

To find answers to her questions DiGasper collects four kinds of data:

- Documents from official investigations, preparations for legislation, and reports.
- Data for 637 moose management units from 20 counties from the year 2004 extracted from a public database of moose management units. The data for each unit originate in the management plan submitted to the county administration upon registration.
- Questionnaires sent to county administrative boards, section of hunting.
- In depth studies of two counties selected to span the adaptability range. They are presented as case A with selection based on indications of high adaptability in the management, and case B with indications of low adaptability in its management. Some variables assumed to affect adaptability are held approximately constant, such as time since establishment, relative size of county area covered and number of moose management units in the county. This in depth study comprise
  - Interviews with regional actors in the moose management administration,
  - Studies of documents from the regional moose administration, and
  - Participant observation in the meetings of the wildlife management board.

Are MMUs adaptive co-management systems?

The MMUs conform to the stipulations of co-management by being self-governed within a government framework and their goal of finding working compromises between forest conditions and moose populations suggest that they are managing the ecosystem. But do they take an adaptive approach? And is the result sustainable? To what extent are an MMU on the road to manage its moose and ecosystem sustainably? DiGasper concludes her discussion of these problems by observing that an adaptive co-management system is better if

- the monitoring of the ecosystem is better,
- the learning methods are better, and

- the management measures are tailored to the goals of long term sustainable social and ecological yield. The closer management comes towards its goals, the more successful is the management.

A goal of long term sustainable social and economic yield might for a MMU mean that the management goals should be about controlling the size of the moose population and limiting the grazing damage it causes. In practical terms this means that they have to calculate the "correct" shooting off from the moose population and the correct fraction of mature bulls in the population to guide shooting off so that an optimal sex ratio of the moose population obtains. They also have to assess grazing damage. Two monitoring methods are used (ÄlgObs and air plane inventory) but use of either one or both do not make much difference in reaching the management goals. The low fraction of bulls is seen as a possible consequence of the population growth recommendation from the 1970ies of not shooting reproductive cows, and also of the fact that moose populations for most MMUs extend to areas outside the area of the MMU.

Adding together indicators on ability to calculate correct shooting off, having a recommended fraction of bulls (not less than 40%) and perceived amount of grazing damage an indicator of management success is constructed showing that 47% have low or none success while only 6% have high success in reaching the goals of sustainable social and ecological yield.

Likewise an index on ecosystem management was constructed from three variables. The key aspect of ecosystem management is learning from monitoring. Thus the index is constructed from variables showing use of local grazing damage inventory methods, wildlife care efforts, and estimation of grazing damage for different three species. The index shows that there are no signs of ecosystem management for 51% of the MMUs.

A third index on ecosystem monitoring of the status of the ecosystem is created by counting the number of monitoring methods utilized by a MMU. Of 4 available methods, 26% use no method at all.

In an effort to assess the overall adaptiveness DiGasper constructed an index comprising indicators on ecosystem management, local ecological knowledge, learning, experiments, monitoring, and responses to environmental feed back. The index is constructed from the following variables (Appendix 4):

1. ÄlgObs (is used 1/is not used 0)
2. Helicopter (is used 1/is not used 0)
3. Winter inventory (is used 1/is not used 0)
4. Calf inventory (is used 1/is not used 0)
5. Dropping inventory (is used 1/is not used 0)
6. Local grazing damage inventory (is used 1/is not used 0)
7. Goal, number of moose per 1000 hectares (information exists 1/does not exists 0)
8. Number of Moose per 1000 hectares (information exists 1/does not exist 0)
9. The composition of the moose population (information exists 1/does not exist 0)
10. Changes in the moose population (information exists 1/does not exist 0)
11. Amount of grazing damages (information exists 1/does not exist 0)
12. Clearing of forest (is used 1/is not used 0)
13. Support feed of wildlife (is used 1/is not used 0)
14. Other wild life care efforts (is used 1/is not used 0)
15. Grazing damage on pine (information exists 1/does not exist 0)

16. Grazing damage on birch (information exists 1/does not exist 0)
17. Grazing damage on sallow[9] (information exists 1/does not exist 0)
18. Grazing damage on aspen (information exists 1/does not exist 0)
19. Grazing damage on ash (information exists 1/does not exist 0)
20. Amount of feed available (information exists 1/does not exist 0)

It is shown that the index increases the longer the MMU has existed. This is seen as an indicator of a learning process. One thing that does not improve over time is the ability to calculate correct shooting off from the moose population. Learning from the scientific inventories and combining this with local ecological knowledge proves difficult, particularly when inventory data seem to contradict personal observations. One quote summarizes it succinctly: "[…] I am chastened after 30 years. I believe information to be damn difficult. The information is not always current when you are out with your gun." It seems fair to conclude that learning depends on many factors that interact in complex ways.

DiGasper's conclusion is that local resource systems cannot be expected to develop into adaptive co-management systems solely by decentralizing management rights and especially not when subtractable resource units are mobile. Some reasons for this she finds in the "fact that there is a lack of monitoring on appropriate scales, a lack of knowledge regarding both monitoring and basic population dynamics, and a disinterest in biodiversity". These facts "mean that it is not reasonable to expect people in an industrialized country who are primarily engaged in a recreational activity to be able to manage sustainable resources with an ecosystem perspective." (p171)

Why would one expect MMUs to be sustainable adaptive co-management systems?

DiGasper's conclusions seem reasonable as far as they go. But at this point one wonders why DiGasper framed the question the way she did. Why is it in the first place reasonable to think that MMUs can be sustainable adaptable co-management systems? A reasonable inference from the theory of adaptable ecosystem management must be that there should be some congruence between the scale of management and ecosystem. MMUs might conceivably have been a part of an adaptive co-managed ecosystem, but the size of most MMUs makes it impossible to believe that they in reality could be this one by one. A reader is thus led to conclude that there is a mismatch between theory and empirical investigation. And maybe DiGasper shares this conclusion? It is one of her policy conclusions that the misfit between the ecologically relevant units and the socially relevant management units should be brought to match.

Validation of indexes

The composite index of comprehensive adaptiveness detailed above has some ecological peculiarities. It is based on the availability of information on grazing damage for five different tree species: pine, birch, sallow (willow?), aspen, and ash. At this point this reader wonders why grazing damage on spruce is not included,

9 Most species of the genus Salix will be known under the generic name of willow only a few broadleaved species are called sallow. I have a hunch that it should have said willow here.

or, for that matter, larch, juniper, oak, rowan, alder, hazel and elm? These are all found in the Swedish forest flora but perhaps not as commonly across all ecosystems as spruce. Even if I do not know that much about the forest ecosystems that is covered by the 627 MMUs included in the data base, I hope to be forgiven for wondering if all 5 tree species that are monitored are equally present in all MMUs. If there are some ecosystems where for example ash or pine are rare, would the monitoring system still record information on grazing damage for all five species? If it does not, the index values will be ecosystem biased. Getting a high score will be more difficult in ecosystems where fewer species are found.

A similar problem is the availability of various inventory methods. They are not equally distributed across Sweden (p 85). But the consequences in terms of validity of the index seems to be left out of the discussion.

A related data problem may be hidden in the emphasis on the ability of MMUs to calculate correctly the number of moose they have to shoot off to reach their management goals. The criterion for "correct" is rather strict (footnote 40, page 140) and should be seen in conjunction with the fact noted on page 186 that "... in order to be able to calculate moose shooting off, it is necessary that the local actors know how many moose their land contains, which is not possible without reliable inventory methods." Both for ecosystem reasons and for resource endowment reasons it is reasonable to suspect that the larger MMUs will have more accurate inventories of their moose populations. Hence they should have a better chance of calculating "correct" shooting off. Yet, there is no investigation of any relationship between size of MMU and ability to calculate "correct" shooting off. One is left wondering about the validity of the "correct shooting off" statistic.

There is in social science a general problem of validation of indexes. Social scientists are too happy to construct indexes but the arduous task of validation is taken too lightly. The only excuse for the missing validation is the fact that to do it properly is a huge task. It is much larger than most critics realize, and researchers attempting to do such validation will rapidly give up. Funding and project time do not make room for it. The problem is not limited to new areas such as adaptive co-management of ecosystem resources. Also in old areas such as social class analysis and occupational mobility the same kinds of problems appear. But that lack of basic research across the social sciences is another story.

The role of public administration in developing an adaptive co-management system

The problems of finding valid and reliable information on the moose population points to the next question on DiGaspar's list: the role of the public administration in promoting or hindering the development of an adaptive moose co-management system. It is difficult to see another actor than the state that might be able to acquire and distribute accurate and reliable information at scales relevant for the MMUs. This is appropriately noted by DiGasper. Besides the provision of information the major task of the state should, according to theory, be to provide arenas for resolving conflicts. On these two issues the state can be effective only if it is perceived as an impartial and just actor in the system. And on both issues there are many margins to improve performance

for the state. The current administration has no comprehensive system for supplying the needed information and there are serious problems with conflict resolution. The public servants are mandated only to mediate between forest interests and hunting interests. Other stakeholders such as nature protection interests or recreational interests (other than hunters) are left out. Also within the public administration there are conflicts at the central level for example between forest interests and nature protection agencies. In addition there is the public authority given to the independent organisation SAHWM. The reforms of the public sector appear as strongly path dependent. At any point in time only small changes at the margin is possible. On many management issues the responsibilities may appear as fragmented and actions as uncoordinated. Attention of participants is too often sidetracked from the main management task into conflicts. However, the presence of key stewards in the public administration sometimes helps to mitigate some of the problems by resolving conflict issues and keeping the attention on the main task: the adaptive co-management of the ecosystem.

In the discussion of the division and distribution of responsibilities a clearer understanding of how to apply the levels of analysis to rule systems might have been helpful. Co-management is defined by acknowledging the role of the various stakeholders. Within the legitimate framework of rules they are self-governed. This means that the constitutional level applies to each actor in the system. The state management has to consider this in designing the framework rules: what kinds of roles can be allowed to be created and what kind of rule making are consistent with a democratic rule-of-law state. Also in the division of labour between the central state and the local state such questions need to be discussed. It would be surprising if not the County Administrative Board (CAB) had some freedom of action at the constitutional level. Maybe political scientists are misled by the word constitutional?

The Swedish moose administrative system

On the question of where Sweden stands on the road towards an ideal typical adaptive co-management of ecosystems in general and moose-forest interactions in particular, DiGasper notes that the overall goals for the two management models are opposed. The current moose administration has maximum sustainable yield as its first goal. An adaptive co-management system would have had social and ecological sustainability as its first goal. If this is added to the problems noted about information and conflict resolution (plus a fair number of other problems) the conclusion that there are many differences between an ideal typical administration and the one currently working comes as no surprise.

Concluding

The difficulties of getting the institutions right may easily lead academics into despair. And the study of social traps or social dilemmas is truly a dismal science. Where we do see progress it is in historical hindsight. The moose population has gone from tragedy to over-abundance and severe problems for the forest. Next we see serious efforts to find the balance between moose and forest production. The process takes time, and in this process the weberian stick-to-rules attitude of public

servants as well as the strong path dependence in reform efforts is less a problem than an assurance that the system will find a solution to its problems sooner or later. The difficult part of the problem has in Sweden already been solved. The creation of a minimum level of trust between people and the public administration is the prerequisite for solving social dilemmas. Without it the commoners have to be left alone to have a fighting chance of extricating themselves from the tragedy. Sometimes they do.