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Abstract:

# IMPROVING BIODIVERSITY POLICY: WHAT DO WE NEED TO KNOW?

The paper considers the problems encountered in the political process of managing biodiversity. What does it take to change the current relations between humans and nature? Discussing this problem it is common to talk of nature and biodiversity as if human society were not part of nature. As a first cut at the problem this is permissible. But in this discussion we have to ask: what are the boundary assumptions we make about politics and society, and what are the boundary assumptions about nature and biodiversity?

By boundary assumptions I mean something like constitutive ideas. The ideas and conceptions we usually take for granted and help us delineate abstract phenomena from the background. Thus in talking about political systems and political processes our ideas are usually circumscribed by taking for granted that we talk about democratic polities and democratic political processes. Even if we know there are changing conceptions of what democracy means and even if we know there are different opinions of how best to achieve the ideal democracy, we do know it is different from tyranny or oligarchy or autocracy. In arguing about what policies need to be enacted to protect or use nature sustainable the boundary conditions of the political system excludes other systems of governance than democracy. Likewise the boundary around nature is taken to exclude humans and human activities. Thus nature is seen as threatened by human activities and in need of protection.

If nature and society are conceived in these ways, what do politicians need to know to protect nature? Do we know enough today to do so? If not, what is the lacking information? In a democratic polity there are limits to permissible actions. Given current understanding of the problem and available legitimate political actions, is it possible to protect nature?

Some say yes, it is just a lack of political will. Others say no, we need a new ecological morality among people before we can expect improvements. It will be argued that both answers underestimate the complexity of the interrelations of morality, political will and human activity.

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# IMPROVING BIODIVERSITY POLICY: WHAT DO WE NEED TO KNOW?

## Introduction

Politics has traditionally been developed on a trial and error basis. Only during the last 50-100 years has policy development based on scientific knowledge been tried, and, admittedly, on balance, not with any remarkable success. But there is no turning back. Social and environmental change occurs at a high and maybe increasing frequency. The environmental problems have to find their solution more quickly than the ordinary trial and error approach can promise.

So, what does it take to develop biodiversity policies based on scientific facts? Definitive answers cannot be promised, but the problem will be discussed.

Listening to public discussions of environmental policy questions is in many ways illuminating. For example, it seems that most people think of nature and biodiversity as if human society were not part of nature. Often the discussion is framed in words showing that people think nature is in a precarious state and needs protection against human predation. Sometimes the most vocal lobbyists of nature advocate rather strong interventions by the state, so strong that they cannot have thought through the implications. Their proposals require other political means than democratic polities allow. In a democratic polity there are particular limits to permissible actions.

Thus the problem needs reformulation. If nature is seen a threatened and society is assumed to be governed by democratic processes, how can we develop good biodiversity policies? What do politicians need to know to protect nature? Given current understanding of the problem and available legitimate political actions, is it possible to protect nature? Some say yes, it is just a lack of political will. Others say no, we need a new ecological morality among people before we can expect improvements. The answers beg the questions: exactly what is political will and where does it come from? And how do you go about creating a new morality?

The questions are of course rhetorical, and the answers are too simplistic. However, "political will" may be a convenient starting point in our investigations of what it takes to govern nature wisely.

The discussion will begin by reviewing two current cases of biodiversity policy in Norway. Then it will go on to review in more general terms the "lack of political will". This leads up to a discussion of what kind of information politicians need to exercise any "political will" they might have. At the end some more philosophical ideas about the development of living systems such as ecologies and human societies will be introduced. Our belief in the possibility of governance of both human societies and natural ecosystems may be in need of some revisions. However, there is no way back to the laissez-faire of ignorance.

**Two cases of biodiversity policy in Norway**

Norwegian news media frequently reports on problems in the management of biodiversity. During the last few weeks we have had discussions around two invasive species: Gyrodactylus salaris, a parasite infecting and destroying particularly wild salmon, and Paralithodes camtschaticus, or the King Crab, a commercially very valuable crab transferred to the Barents Sea from the Pacific by the Russians.

These two rather recent introductions to Norwegian ecosystems, one a costly pest, the other a potentially very valuable resource, illuminate in a simplified version some of the dilemmas encountered by a government. Let us take a brief look at the dilemmas.

The Gyrodactylus salaris is unwanted by everybody. Potentially it may destroy most of our salmon rivers. The convention on biodiversity encourages the destruction of alien species and legitimizes drastic actions. The Norwegian authorities have tried to eradicate the parasite from some rivers by poisoning all life in the rivers. They have thus been able to remove the parasite from a few small rivers. In larger rivers they have been less successful. In some of them the parasite has returned. However, questions are raised: How far can we go down this road before the remedy is worse than the problem? Killing all life in a river is not something one should do as a routine policy. There is political will to eradicate the parasite, and we do get action, but does the action solve the problem? The case is open. My point here is that political will is not enough.

The King Crab represents a more complicated problem politically. It is complicated by two factors. First, we know very little about the ecological consequences of this introduction, and, second, it is an international policy issue. The crab was introduced to the Murmansk area by the Russians in the 1960ies. In 1978, as part of the negotiations about a boundary between Norway and Russia in the extended economic zone, they demanded an agreement on the management of the King Crab. It was to be considered a common stock and rules for its management had to be negotiated. Until the stock was large enough, catching the crab should be forbidden. Since its introduction in the 1960ies, the crab has been migrating

westward. By the early 1990ies, the local fishers of Eastern Finnmark were complaining about large by-catches and destruction of their fishing gear. From 1993 on, the Norwegian Institute of Marine Science started to monitor the by-catches and track the spread. By the end of the 90ies, the local fishers had had to abandon some fishing grounds in eastern Finnmark and stories of marine wastelands created by the crabs started to circulate. Could the stories be believed? Nobody knows. Almost no money for research on the ecosystem impacts of the crabs has been available.

By 2001 the Russians agreed that commercial catch of the crab should be allowed, and in 2002, a few of the displaced local fishers of eastern Finnmark were allowed to harvest from the crab stock. During a few weeks effort, they were able to earn 2-3 normal yearly incomes. They were happy again. However, biologists were more worried than ever. By the summer of 2002 crabs were observed half way to Bjørnøya. If the current population explosion and westward migration go unchecked, what are the consequences for other species? What happens to fish roe deposited on the bottom? What species will be able to escape form the hungry crabs? Will the addition of a commercially valuable species be bought by the disappearance of whole chains of other species? The regrettable fact is that very little is known about such questions. The good news is that in 2003, for the first time, money for looking into ecosystem effects has been added to the monitoring budget. Some might reasonably argue that it has been looking like the governing authorities did not really want to know. Some might despair and say there is a lack of political will.

**"Lack of political will"**

From time to time one can see this expression used also in public media[1]. The expression seems to be used as a way of allocating blame to the political system: "They could have saved the ecosystem, but they would not!" Such a reaction may be understandable. However, no matter how tempting the expression may be in our frustrations, we ought to think seriously about where political will comes from. In the case of Gyrodactylus salaris the political will to action obviously comes from the pressure of all the people with economic interests in wild salmon. The lack of "will" to investigate the "gift horse" from the Pacific may likewise be related to the income it potentially may generate.

When we find that the political will is missing, there may be three reasonable interpretations of why it is missing

[1] For example in the September e-mail conference on "Auditing the ark - science based monitoring of biodiversity" Allan Watt (e-conference chair) 05/09/2002 wrote "Although the current state of monitoring may result from **a lack of political will**, inadequate research also contributes. "

- It may mean that the government really does not believe there is reason to do anything. In a state of ignorance one may be permitted to believe that the King Crab is a valuable additional resource.
- It may mean that there is a large gap between what the government says it will do, and what it really does. This is not unusual.
- It may mean the government does not know how to do something they want to do if possible. This is probably more common than the biodiversity lobby likes to think.

However, in neither of the cases is the expression "lack of political will" particularly illuminating or helpful. If the interpretation is either of the first two, the usual outcome of a debate will be to focus on public opinion and stronger lobbying as means to put pressure on the government. It is generally recognized that one source of political will is public opinion. Thus, information to the public is high on the agenda of all research organizations. However, the competition for the attention of the public is fierce. Only unusual or scandalous stories reach the front pages. Concerned journalists or despairing NGO's may be tempted to slant the stories and stretch the facts. Sensations do get the attention of politicians. Sometimes they will throw money at the problem, demanding more research or establish a commission to allocate responsibilities. At other times they become suspicious, doubting the facts behind the stories. Thus, stretching stories and slanting interpretations may backfire. Predicting doom and disaster that do not happen will only detract from the credibility of serious facts.

**Informed governance of biodiversity**

In general it seems that crying for "political will", or relying on arousal of the public to put pressure on politicians, are poor approaches to the governance of biodiversity. It presumes that we know what to do, and that what we want done can be done within democratic polities[2].

Usually political will in democratic societies comes from widely shared understandings of a problem and shared opinions about how to go about doing something about it. Thus, information to, and engagement of the public is essential. But developing a shared understanding of a problem even scientists do not really comprehend will at best be a slow process, taking years and years most concerned people say we do not have.

The alternative to support from public opinion and activist lobbying for biodiversity politics is informed government leadership and enlightened policies to counter the dismal trends we observe. However, in this game the rules are quite different. Moral appeals and sensational stories do not work. Scientific facts may

[2] For more about democratic governance see for example March and Olsen 1995

be nice by themselves, but politicians will ask, "What shall we do to improve the development"? Unless the facts are accompanied by specific policy advice, assuring specific results for biodiversity, a government will not do much. Even when specific advice is offered, the policy will have to compete for resources with a host of other good causes.

What we need to advice politicians are causal theories linking political action to environmentally preferred outcomes. OK, you may say, isn't that exactly what we offer the politicians?

Looking over some of the available literature shows that one or more of the following factors often are mentioned as causes of natural resource depletion and biodiversity loss

- The unsustainable high rate of human population growth
- Deficiency in knowledge and its application
- The steadily narrower spectrum of traded production from agriculture, forestry and fisheries
- Legal and institutional systems promoting unsustainable exploitation
- Inequity in ownership, management, and flow of benefits from biological resources
- Economic systems and policies that fail to put high value on biodiversity
- Habitat destruction
- Introductions of alien/ exotic species

I am sure you have seen similar lists. The list has at least two interesting features.

First, it does not say anywhere: bad governance! Even though disastrous policy outcomes like war and large scale population displacements may rival anything in destructiveness of nature.

Second, and maybe of more practical significance: where are the policy variables in the list? Take for example population growth. In democratic countries population has almost stopped growing and except for immigration it may, during the next 50 years, start to decline. In much of the rest of the world population growth seems to be a very touchy issue even though there are very many good reasons to reduce it besides concern for the environment. There also is a fairly effective public policy that will reduce population growth: increasing education for women. This is by itself a policy one might want to follow for a host of reasons besides it impact on population growth. Yet, education of women is not promoted, at least not very strongly.

We also should ask about the facts in this "obvious" link between population and resource depletion. Is it as simple as it appears? A meta-analysis of the link between population and deforestation concludes with no direct relation (Palloni 1994). The impact from population variables to deforestation was mediated by interactions and indirect links. Fairhead and Leach (1996) show how, in the wake of new village settlements, forests grow where no forest grew before.

The point is that general statements linking social change to loss of biodiversity is singularly unhelpful to informed policy development. Even the more specific questions of how to stop the invasion of Gyrodactylus salaries or Paralithodes camtschaticus do not have any feasible answers. Recently a politician in the Norwegian Parliament demanded that the King Crab be eradicated, just as the Convention on Biodiversity advices for introduced species. It is a rather incredible demand given the circumstances. Nobody can seriously believe it is possible. Unrestricted license to catch the crab may be the only force that could slow down the spread of the crab sufficiently to give the ecosystem at least some time to adapt. It might even give us time to find out about the consequences of the introduction. However, that is exactly what the agreement with the Russian authorities does not allow.

We have to recognize that policy development always has to balance competing interests. Only solid facts about problem development, probable consequences, and feasible remedies can compete with the short term lure of profits. To have any chance at all in the game of informed political decision-making, we need causal theories linking political decisions and actions to specific changes in biodiversity. Moreover, the link between decisions and outcomes must be proven by facts, and not based on wishful thinking. Can such causal theories be established?

Let us look at what it takes. In particular, let us leave aside the big bad problems, the easily grasped but politically difficult issues, such as war, displacement of people, rainforest destruction, oil-spills in the mega class etc. Let us look at what Emily Russel (1993) calls the subtle impacts on ecosystems.

**The subtle impacts on ecosystems**

In the Cary-conference in 1991 Emily Russel divided human impacts on ecosystems into

- The Good
- The Bad, and
- The Subtle

While human activities clearly have both singularly beneficial and destructive impacts on biodiversity, the most important class of impacts in the long run is the subtle. Russel maintained that biologists for long had tended to ignore the last

class. This class is important not only because it mostly has been ignored. It is important because it poses challenges more in line with how democratic polities redirect their development. Democratic polities seldom resort to dramatic revolutionary shifts in policy no matter what some politicians may claim or want. The development comes in small steps, one at a time, taking society down uncharted paths not necessarily going where politicians thought they wanted to go but nevertheless driven by political action. Cumulatively the steps define the direction. By solving small problems and improving current practice marginally a new practical morality may emerge, ultimately with implications also for the big bad problems.

Let us take a brief look at one example where subtle impacts can be observed. Oliver Rackham (1989) study "The Last Forest. The Story of Hatfield Forest." provides a fascinating study of the intimate interrelations between a forest ecosystem and the humans living off it or in other ways depending on its resources. Among the many issues Rackham discussed was the apparent changing composition of trees in the forest. Studies of pollen deposits show that traditionally the most important tree species in Hatfield Forest were Ash, Maple, Hazel and Oak. Rackham found that since about 1920 new types of trees had started to invade the forest, most notably birch. He asked himself why and tried to find explanations. He noted that both oak and birch have changed behavior. Oaks have more or less lost the ability to sprout from their seeds and birch has started to prosper on all kinds of soils, not just sandy soils. However, he found these internal ecosystem changes insufficient as explanations for the fairly rapid changes observed.

The changes in the forest were also caused by activities of humans and animals. He noted that

- Around Hatfield there were planted coniferous trees several places. Not all plantings were successful. As the coniferous trees died or were logged the openings in the forest were easy prey for the birch seeds. This established a large area of birch close to Hatfield. The birch seeds were only waiting for openings to establish themselves in Hatfield.
- In 1924 a large part of Hatfield forest was logged.
- The fences around the logged areas had not been kept in order. This gave both cattle and deer free access to browse on the coppices, thus preventing these from re-establishing themselves.

Thus he concluded that logging and browsing created opportunities, particularly for birch to expand into Hatfield. The changes in the composition of tree species in the forest were related both to changes in the internal dynamic of the ecosystem and to the ordinary daily activities of humans in and around the forest.

**Finding causal relations between human activity and ecosystem change**

Rackham's study of Hatfield Forest is a very detailed case study using both historical data on humans and forest, as well as intimate knowledge of forest ecosystems. Returning now to the problem of giving policy advice, we may ask if it is conceivable that such relationships as those detected in Hatfield can be generalized. For example, if we do not want birch to replace oak, what can we do given that birch has adapted and become better at surviving on all kinds of soils and oak has problems sprouting from its seeds? A reasonable conclusion based on Rackham's study would be to adapt the rules governing logging, planting, and fencing.

However, the general lesson for biodiversity policy is the fact that policies have to affect people before they can impact biodiversity. Only as people change their behavior, for example by fishing more or less crabs, by cutting more or less oak timber, or by building and maintaining fences or not, will biodiversity be affected.

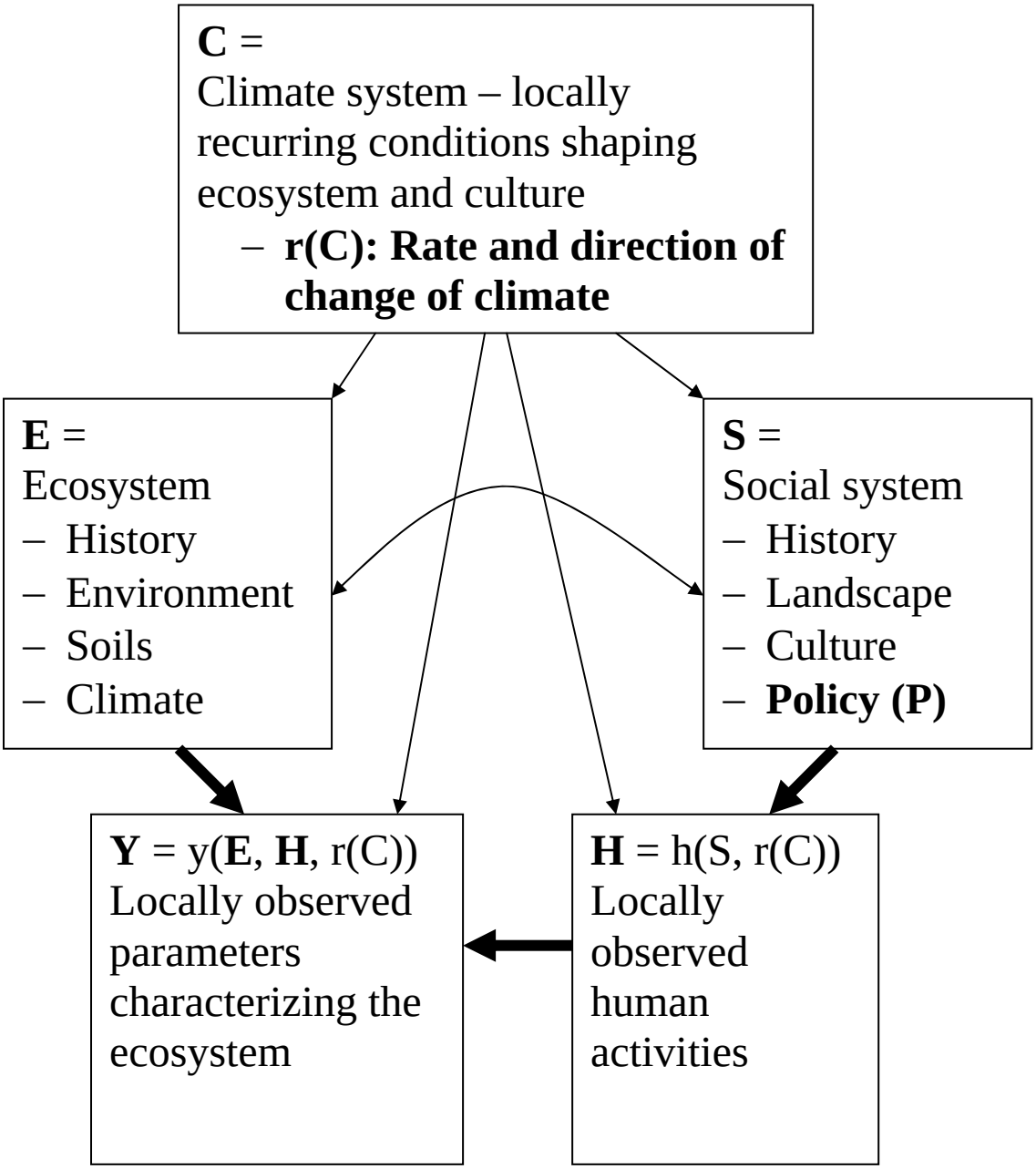
For the scientific study of the relation between policy variables and ecosystem characteristics this means that investigations of causal links need to focus on analytical units where human activities and ecosystem dynamics can meaningfully be linked, just as in Hatfield forest (see also Ostrom 1995). The analytical unit must be the smallest unit relevant to human motivation and decision-making. In most cases, we will recognize such units as property units (or land tenure units). Ecosystems will of course be larger than this, but also human activity systems will be larger than the analytical units are. Still, the property unit is the place where human motivations and activities directly can affect ecosystems. There the forces of human society and the forces of nature meet and we can observe an outcome.

However, locally generated impacts of human activity are not alone. Sometimes they may not even be the most important factors. We need to include impacts from a distance in time and space both from ecosystems and from human societies. Modern societies impact on local parts of ecosystems from a distance through such means as acid rain and other kinds of fall-out from the sky, substances brought by rivers or irrigation water, humanly generated noise or light, far off fragmentation of landscapes, tourist activities displacing or concentrating ecosystem activities, etc. Besides such impacts from a distance we need to understand the internal dynamic of the social system. We need to see how the historical path of distant changes in society: changes in the governance system, the economy, the markets, etc. impact the local social system through changes in the motivation driving the local actors. Small shifts in the relative price of work in the timber industry compared to work in other industries may cumulatively protect (or destroy) larger areas of forest than any political will may be able to.

The local impact of the internal dynamic of an ecosystem, the links between ecosystems as observed on a property unit and the dynamic of the functional ecosystem need explicit inclusion along with local boundary conditions. Without the human impact local geo-physical characteristics such as length of season, variation in temperature, soil type, amount of precipitation, orientation and inclination of habitat, elevation above sea, and local characteristics of natural disturbances together with the long-term trends in climate change will shape and the local ecosystem characteristics and condition its dynamic. In addition the ability of different species to flourish and compete may evolve. Rackham gives us a glimpse of how such changes may interact with human activities. However, the problems of correcting for the internal ecosystem dynamic are for this writer basically unknown. For the discussion it will be assumed that a reasonable approximation can be found.

In addition to locally observed direct and indirect impacts from ecosystem and human society we also need to account for local variations in climate and its long term trend. For ecosystems this is a major driving force. However, also human societies react to changes in climate and adjust behavior. Climate and its rate of change are clearly relevant as causal factors for locally observed characteristics. They are also relevant as indirect causal factors for relevant changes in the dynamic impacts from both ecosystems and human societies.

The discussion so far seems to structure the problem of investigating causal relations between human activities and ecosystem changes like this:




The symmetry in how the ecosystem and the social system enter the model is intended and based on a view of both systems as living, evolving systems with emerging properties. It should also be noted that we can structure the discussion of how ecosystems and climate affect human activities in the same way by changing the direction of causation to run from the locally observed ecosystem parameters to locally observed human activities. Causal impacts run both ways. However, here we shall confine the attention to implications this model might have for empirical investigations of the causal link from social system to ecosystems.

**Empirical investigations**

In order to empirically determine the causal links between policy variables (or political instruments) and ecosystem states, it would seem reasonable, as a first approximation, to apply regression techniques. Using regression techniques we need observations permitting tests of hypotheses like $\rho(y_i, p_j) = 0$, establishing direction of significant impact from a well defined policy variable to a well defined ecosystem parameter after control for other factors with an impact on the ecosystem parameters. If we are able to estimate true regression parameters, $\beta_k$, for the impact of a policy variable we also want to rank these, establishing which policy variable has the largest impact on each ecosystem characteristic.

If $\varepsilon$ is the error term satisfying appropriate distributional assumptions conforming to the regression model applied, we may write

$$Y = y(E, H, C, r(C), \varepsilon),$$

where Y, E, H, C, and r(C) are vectors of appropriately defined parameters.

To study the impact of policy variables net of all other causal variables we must assume that the group of policy relevant variables (P) can be separated from other variables in the equation. H must be decomposed into the groups P, S-P, and r(C).

$$Y = f(E, P, S\text{-}P, C, r(C), \varepsilon).$$

The actual functional form needs not concern us here. We are only looking for an outline of the practical problems we will encounter in the investigation.

The difficulties are many. If we set aside the substantial problems in defining the vectors E, P and S-P, the problems of using regression techniques are determined by the assumptions which go into the different kinds of models. Some of these are generic and will be the same for all kinds of regression models. The most relevant assumptions from a practical point of view are:

- The requirement of a simple random sample of localities where both ecosystem parameters and human activities are observed.
- The requirement that all relevant variables are observed.
- The requirement that all relevant variables have sufficient variation.

The requirements of a simple random sample where all relevant variables are observed are fundamental, and ensures that only the observed variables can have an impact on the dependent variable. Thus estimated impacts of policy variables will be the true impacts, other variables being held constant. Selecting a simple random sample may pose some difficulties, but more important at this stage of the discussion is the question of what we mean by "relevant variable". The number of variables and the requirement that they all vary within the sample will to a large extent determine how many cases one needs for the analysis and how the sampling have to be performed.

Any variable that has a causal impact on an observed ecosystem characteristic is obviously relevant. However, also variables that cause co-variation between some ecosystem aspects and some social system characteristic are relevant. In general, because of correlations and interactions among variables across groups, it is difficult a priory to exclude some group of variables.

For example:
**Correlations of Ecosystem and Culture**: A long line of studies, particularly in anthropology, documents that there are mutual adaptations between the ecosystem and the culture of a local community. Long time interactions between humans and nature will shape both the ecosystem and the practices and beliefs of the people[3]. Since cultural practices also correlate with policy, leaving cultural variables out of the analysis will confound the estimate of the impact of policy.

**Interaction of Climate and Culture**: In addition to, and maybe independent of, the adaptations between ecosystem and culture there will be a cultural adaptation to climate[4]. Communities will adapt to changes in climate by using resources in new ways and by revising values and priorities. These changes will have observable outcomes on behaviours. It also seems reasonable to assume that the size of impact of a given practice (for example clear cutting of forest) will be contingent on the climate. If climate variables are left out of the model, the estimates of the impact of culture will be confounded with those of climate.

**Interactions of Climate and Ecosystem**: Ecosystems adapt to prevailing climate[5]. Length of seasons and variations in snow cover and precipitation are only the most obvious conditioning factors affecting the dynamic of naturally occurring disturbances. Since the rate of change in climate varies among localities, also the rate of change needs to be included as a correcting factor.

The general conclusion is that because of correlations and interactions among variables from various groups, they all need to be included if we want true estimates of the impact of policy variables. This means that the number of variables will be very large. Since regression techniques require more cases than variables to determine causal impacts, the number of cases will be even larger than the number of variables. In addition, we need to keep in mind the requirement that all variables vary. For example, many policy variables will be constants within a single country. The size of the sample is maybe the largest practical problem.

[3] For a recent survey see Bates and Plog 1991, also Bennett 1976, Vayda (ed.) 1968, and Forde 1934 surveys the same theme. Also Folke and Berkes 1995.
[4] To some small extent, local climate may be affected by such activities as humanly created changes in tree cover. However, the important direction of causation in this case will be from climate to culture.
[5] See e.g. Walker and Steffen 1997

In the world of social science an investigation of the impact of politically manipulated variables on ecosystems will be a mega project rivaling in cost anything known to this writer. In the world of biological science it may be different. Be that as it may. The point is that it is possible to improve on the traditional trial and error approach also in biodiversity policy questions. However, it is costly.

**Causality in living systems**

Having reached this conclusion, however, we need to step back a bit and think hard on the question of whether the suggested approach really will help us determine causal connections. And if not, is it still worth doing?

Causality is a difficult concept. In order to establish causal connections the basic requirement is that "other things being equal", that we were able to include all relevant variables. This amounts to a complete list of all initial and boundary conditions of the system we study. If this requirement is met, we are assured that our estimates, within the sampling error, are true estimates of the impact of causal forces. We are confident that the ecosystem will respond to equal quantities of impacts in the same way, every time. Hence, we are able to predict outcomes and able to advice on changes in policy.

However, there can be presented reasonable arguments that the assumption of a complete listing of all initial and boundary conditions relevant for a study of system changes is untenable not only for human societies, but also for biospheres. Stuart Kauffman (2000) in his book "Investigations" argues this rather convincingly. He first conjectures that it probably is theoretically impossible to state the initial and boundary conditions for a biosphere. However, he argues, even if we grant that there perhaps is a theoretical possibility, it probably is practically impossible within the lifetime of the universe to enumerate all initial and boundary conditions relevant for the evolution of a biosphere. And moreover, the practical problems are of such a nature that it also is impossible to establish the distributions required for a statistical study of the possible outcomes.

The conjecture sounds familiar. The debates about research methods and goals for research in social science revolve around the question of predictability. What we are most interested in, social change and innovation are inherently unpredictable. On the other hand, most of human activity is rather routine and repetitive. People do react in predictable ways to changes in their physical and social environment. Hence local and short term predictions are feasible.

One reason for the practical impossibility of stating initial and boundary conditions completely is that for every stimuli and every level of stimuli there are vastly more

possible responses than what in reality can happen and therefore be observed. With no practical way of listing the state space of our problem analytically, life will always have a potential for surprising us. Life is inherently unpredictable. Yet, it is not chaotic. In hindsight, we do see the paths taken and the causes forcing the development.

Oliver Rackham in his careful study of Hatfield forest is able to weave together ecosystem dynamic and social dynamic in a way explicating the evolution of the forest. We get a glimpse of understanding of why the forest is as it is today. We see where human intervention has caused small disasters and we see how the ecosystem has responded to ordinary human activities. However, we are not allowed to think that the same interventions and activities will elicit the same development elsewhere. A case study like this does not establish causal theories.

So what will the results of an integrated large-scale study be? If we cannot establish causal connections, what do our findings mean?

If we have to abandon the ambition to generalize, we will at least be able to establish empirical connections with some validity in the short run and for the areas studied. How good we are at selecting relevant variables will determine how good our predictions are, and for how long they will be valid. As long as the goal of protecting biodiversity is clear, this will be a vastly better guide to policy than ordinary trial and error. However, it also means that results are not guarantied. We need to supplement any policy intervention with a learning program[6]. Every change in policy should be viewed as an experiment from which we can learn.

**Conclusions**

It should be noted that the choice of policy instruments or policy variables are strictly circumscribed in democratic polities. The debate around differences between democratic polities and other kinds of governance systems may not be conclusive, but there are some strong indications that some kinds of policy instruments are impossible to use regularly in democratic societies. Among these are all policies that rely on physical coercion of large groups of people, or large-scale takings of established property. In general, it is conjectured that systematic violations of human rights will generate political and social backlashes that negate and aggravate any possibly laudable goal one wants to further by such policies.

This means we have to put aside all grand revolutionary solutions. In democracies choice of policy instruments need a foundation in the values and opinions of the public in order to have a beneficial impact. What politicians actually can use are the subtle tools of ordinary democratic political action, the piecemeal and small

[6] See for example recommendations from Hall 1981

scale measures. They need advice on how to fashion taxes and subsidies, and on how to formulate the marginal changes in legislation that directs behavior towards sustainable use. Politicians need evidence of how changes in priorities of land use planning can further sustainable resource usage. They need a map of which marginal shifts in values should be reinforced, and not least, they need knowledge about the internal consistency of various policy measures. Political rhetoric and public information campaigns have their place in biodiversity policy. But they work only if they are integrated with institutional changes and are fashioned to reinforce these.

The conclusion from this line of argument is that in order to further the goal of sustainable use of biodiversity we need to know not only the direction and size of the impact from a change in a policy variable, but also how the impact changes from context to context. The systematic collection and quantitative analysis of case studies may be the only feasible way of approaching the problem of democratic biodiversity policy. Ultimately, political will comes as much from the ability to do something as from wanting the thing done.

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