Ann. Zool. Fennici 39: 183–186 ISSN 0003-455X
Helsinki 10 October 2002

In the midst of ecology, conservation, and competing interests in the society

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Received 4 September 2002, accepted 10 September 2002

Hanski, I. 2002: In the midst of ecology, conservation, and competing interests in the society. — *Ann. Zool. Fennici* 39: 183–186.

This essay is about the role of ecologists in policy-determining and decision-making processes in the society in which research results may play, and are expected to play, a constructive role. The incentive for writing this essay came from my involvement, over the past several years, in the research and conservation-planning of boreal forest biodiversity in Finland. Forest biodiversity is a much debated issue in Finland, where forest industry represents an important sector of the economy and has become so advanced technologically and in terms of the infrastructure that the ever-diminishing work force can manage the entire area of 20 million ha of forests — practically down to single big trees. Biodiversity has become a fundamental concern in boreal forestry, because this is an industry that is based on the use of just a few species, but in a manner that will influence thousands of non-target species living in the same area. Arguably, current boreal forestry as practiced in e.g. Finland is sustainable from the perspective of the dynamics of the target tree species, but not from the perspective of the forest communities as a whole.

As an ecologist, I have supervised the work of students and researchers who are familiar with literally thousands of species, altogether comprising a substantial fraction of the some 20 000 species of fungi, plants and animals that live in our boreal forests. This research has produced evidence for gradual loss of specialist species from small fragments of old-growth forest (Gu *et al*. 2002), leading to truncated food chains locally (Komonen *et al*. 2000) and to declining biodiversity regionally (Siitonen *et al*. 2001, Pakkala *et al*. 2002), in landscapes with increasingly isolated and small fragments of natural forest in the midst of intensively managed forests.

At the national scale, the change in forests has been substantial enough to lead to the following figures, reported in the new national red data book (Rassi *et al*. 2001): 62 forest species considered to be extinct, 564 species classified as threatened. This makes a total of 626 species, which however is an underestimate of the level of threat to forest biodiversity, since sufficient data were available only for 7000 of the 20 000 forest species to classify them in the first place. A

reasonable assumption is that the level of threat is the same in both groups, those that could be classified and those that could not, which puts the estimate of the number of extinct plus threatened forest species at 1800. This makes nearly 10% of all forest-inhabiting species.

Another perspective of forest species emerged from the meetings of another government-appointed committee, which was commissioned to find ways of improving the plight of the threatened species in the southern part of the country. The high level of threat to biodiversity is primarily due to the fact that a mere 1% of the forested land in southern Finland is covered by what could be called natural or natural-like forests. The proportion of protected forests is also 1% in southern Finland. Contrary to what might have been expected from the task of the committee, I was the only ecologist in the committee, the others representing various interest groups with no sympathy for conservation (the majority) and non-governmental conservation organizations (the minority).

In an affluent society such as the one in Finland, with a well-educated population and a political apparatus committed to protecting environment as a matter-of-course, it is out of the question that any serious interest group would accept loss of biodiversity. However, in the case of forest biodiversity in Finland — which is my example in this essay, though these thoughts presumably apply more widely — it is difficult to reach an agreement that would lead to a real improvement in biodiversity conservation. Firstly, the vast majority of threatened species not only lack the charisma of many vertebrates, but they are also practically non-visible to most people: rare fungi, lichens and insects. Though the wish is expressed to maintain biodiversity, most people do not really care whether such species go extinct. Secondly, conserving forests reduces potential opportunities for harvesting timber, which makes many groups of people adverse to conservation. Thirdly, the process of biodiversity loss at large spatial scales is a slow process. One cannot assess the long-term consequences of habitat loss and fragmentation by simple observations and experiments, which might produce results that could be comprehended by non-biologists. Instead, one needs to employ the full arsenal of ecological knowledge, including models of various kinds, to predict what is expected to happen in the future. Understanding such ecological arguments is difficult for non-biologists.

All this is familiar to us. What really concerns me here is our role as ecologists in the processes in society that eventually determine what will happen to the natural habitats and to the species inhabiting them. At one level the answer is simple. The proper role of scientists is to produce factual information that can help society arrive at appropriate decisions. The proper role of scientists is not to join the ranks of activists, though we scientists can sympathise with their cause. Unfortunately, as I will argue here, this vision of our role is simplistic and detached from reality — assuming that ecologists want our research to enter and influence processes in society in an unbiased manner. Let me try to explain why.

When the position of powerful interest groups is to concur with the politically agreed goal of preserving viable populations of all native species, but at the same time there is no real commitment to the implementation of necessary actions, there is a tendency to question data and arguments purporting to show that the current state of affairs is not satisfactory. It would appear difficult to deny the need for improvement when nearly 10% of species are threatened, but this is exactly what has happened. I highlight three arguments that have been put forward to oppose additional measures to conserve forest biodiversity in Finland.

Firstly, one line of argument suggests that current forestry closely mimics processes operating in natural forests, hence the managed forests cannot be bad for biodiversity. It has been claimed that even-aged stands are the norm in natural forests, and that most biodiversity actually occurs at disturbed sites, presently represented by clear-cuts.

Secondly, it has been suggested that the changes in the practice of forestry introduced over the past decade are so significant that the threat to biodiversity is eliminated — we just have to have the patience to wait for the positive impact of these new measures. The two principal new measures are green retention trees, left on clear-cuts at the volume of around 3 m^3 per ha,

and the preservation of small patches of so-called key habitats (usually <0.5 ha), which represent some habitat type distinct from the surrounding forest (the key habitats are most frequently rocky outcrops and open bogs, but they also include patches of habitat that would potentially harbour a rich assortment of species).

Thirdly, and related to the former, it is argued that conserving 'hectares' and 'percentages' is old-fashioned and wasteful, whereas what is needed is 'precision conservation', preserving exactly those sites where threatened species occur. The tiny patches of key habitats are a prime example.

These arguments, when repeated in meetings and in media, start to gain credibility among the public and decision-makers. The argument about clear-cutting just replacing other processes that would produce the same outcome has attained public credibility also for the simple reason that most people have never had any contact with natural forests — an indication of how little there is left of it. It has been possible to mislead people to believe that mature even-aged stands of managed spruce forest, which are gloomy and lack any undergrowth, represent 'old-growth'. Essentially, not only is the survival of the actual natural boreal forest at stake, the concept of it has become endangered and twisted, in a manner that makes it appear less worthwhile to retain the real thing.

Preserving tiny patches of key habitats as an example of 'precision conservation' is another instance where the ideas of non-biologists clash with reality. It must seem sensible to protect the pieces of forest classified as representing the habitat of many threatened species (Annila 1998). And it may seem cost-effective to save just small pieces of that habitat, as stipulated by the current forest law in Finland. Whether such a network of nearly point-sized 'reserves' sparsely scattered across the forest landscape, accounting around 0.5% of the area of the forested land (Hänninen 2001), will be sufficient to maintain populations and metapopulations of the threatened species is, of course, another matter. I have no reason to expect that it would. But the non-biologist's perspective does not typically include any notion of temporal and spatial dynamics of species, in which case protecting the tiny fragments which in theory represent the habitat of the threatened species becomes approved as the most cost-effective conservation action possible.

So what should be the role of ecologists? Collect more data, construct new predictive models, provide society and decision-makers with more factual information? Yes, but this is not sufficient. As I have argued, the public perception of nature and the conditions that allow species to persist are being constantly shaped by a diverse mix of arguments in the media, and most of these arguments are put forward by people who have very limited biological knowledge and no ability nor willingness to learn from ecologists' new results.

Ecologists can make their own appearance in the media and thereby attempt to inject some scientific knowledge into public awareness. This is helpful, but this is not happening at the scale that would make a strong impact. Ecologists tend to be wary of engaging in such non-scientific arguments when the take-home message goes against what powerful interest groups would like to hear. But notice that although the forums are not the forums of science, the subject matter can include exactly those issues in which ecologists have a strong scientific interest. This is the crux of the matter. Assuming that we work on questions that relate to issues that are relevant for the management of natural resources and conservation, we and our funding agencies would like the knowledge produced to be used in an unbiased manner in decision-making in society. Unfortunately, just producing knowledge is not enough, because it may be ignored or it may be misrepresented — which will lead to decisions that are not based on the best existing information.

I come to the point of this essay. Perhaps we ecologists should collectively become more involved in processes that determine how knowledge we have produced is used in the wider context. This would be very different from becoming an advocate for some particular action, which will be adopted based on the accepted political processes. Our interest is more specific, in seeing that ecological knowledge is not being misinterpreted nor misused in the processes that eventually lead to policy and action. This involves the difficult task of effectively explaining our research to audiences of non-biologists.

The example used here is the claim that a sparse network of tiny forest fragments will maintain viable populations of threatened species, based only on the observation that, in theory, such fragments represent the appropriate habitat, but without any consideration for the actual and predicted occurrence and dynamics of the species in these fragments. If the claim becomes an overriding argument against additional conservation, and if the level of threat is so high that hundreds of species can be expected to go nationally extinct, this becomes a truly significant issue. Would it be appropriate for ecologists conducting research in this area to collectively examine the scientific evidence for the claim? And if the evidence would be found wanting, would it be appropriate for those ecologists to make their assessment widely known? My answer to these questions is yes. Similar questions can be asked about other issues that are debated in the society and in which ecological knowledge is expected to help decision-makers to arrive at policy.

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