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The Fifth International BIOECON Conference
15th – 16th January 2004, House of Estates, Helsinki

Paula Horne, Susan Tönnes and Terhi Koskela (eds.)

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Abstract
The fifth seminar of the EU project *Biodiversity and Economics for Conservation* (BIOECON) was held in Helsinki, Finland, on the 15th – 16th January 2004. The seminar was hosted by the Finnish Forest Research Institute (Metla) and the Institute of International Economic Law (KATTI) with assistance from the Forest Economics Forum of the Finnish Society of Forest Science. Under the heading *Policy Instrument for Safeguarding Forest Biodiversity – Legal and Economics Viewpoints,* the seminar focussed on the implementation of biodiversity policies in the forest sector. This publication is a collection of papers presented in the workshop, with an addition of a few BIOECON papers related to the topic of the seminar.

Keywords
Forest, forest policy, biodiversity conservation, policy instruments

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Preface

The fifth seminar of the EU project *Biodiversity and Economics for Conservation* (BIOECON) was held in Helsinki, Finland, on the 15th – 16th January 2004. The seminar was hosted by the Finnish Forest Research Institute (Metla) and the Institute of International Economic Law (KATTI) with assistance from the Forest Economics Forum of the Finnish Society of Forest Science. Under the heading *Policy Instruments for Safeguarding Forest Biodiversity – Legal and Economics Viewpoints,* the seminar focussed on the implementation of biodiversity policies in the forest sector.

The first day was in Finnish with a focus on interactions between economics and law on one hand, and between science and practise on the other hand. Researchers from Metla and KATTI presented results of studies under the BIOECON project. The invited speakers offered a wide array of topics for discussion, ranging from the conceptual differences between economics and law to the future prospects for the new Finnish biodiversity policy programme (Metso). The second day of the seminar was in English with keynote speakers in the morning and a workshop of contributed papers in the afternoon. This publication is a collection of papers presented in the workshop, with an addition of a few BIOECON papers related to the topic of the seminar.

A large group of people aided us to organise successfully the seminar. The invited speakers of the first day included professor *Tapio Määttä*, counsellor of forestry *Anders Portin*, justice of the Supreme Administrative Court *Kari Kuusiniemi*, professor *Markku Ollikainen*, senior researcher *Arto Naskali* and the representatives of the different interest groups *Tapio Nummi (The Forestry Center of South-West Finland)*, *Juha Hakkarainen (The Central Union of Agricultural Producers and Forest Owners)*, *Harri Karjalainen (WWF)* and *Matti Ylänne (UPM-Kymmene)*. Professors *Erkki Hollo* and *Olli Tahvonen* with project manager *Mikko Kuusinen* were the keynote speakers of the second day. The workshop consisted of 16 presentations and six other contributed papers. Dr *Erkki Mäntymaa* chaired two of the workshop sessions. Director *Heikki Pajuoja* from Metla, director *Pia Letto-Vanamo* from KATTI, and senior researcher *Jussi Leppänen* as a representative of the Forest Economics Forum of the Finnish Society of Forest Science, helped us in the seminar planning and also in many other ways.

The seminar was held in the House of Estates. *Johanna Hanhijärvi* was in charge of all the practical organisational matters of the seminar. *Olavi Kurttio* (Metla) took care of the audiovisual arrangement at the seminar. *Susan Tönnes* (Metla) did the technical editing of the publication and *Terhi Koskela* (Metla) finalized the proceedings. *Pirjo-Riitta Lind* (Metla) assisted in organisational matters. *Pentti Kananen* and *Antti Pouttu* (Metla) took the international group for a field trip in the snowy Finnish forests on Saturday.

We would like to thank all the people and organisations that contributed to the success of the seminar. Special thanks are due to Johanna Hanhijärvi for the excellent organising work.

In Helsinki, 23rd of February 2004

Paula Horne
Convenor of Forest Sector / BIOECON
Project Leader, Metla

Kai Kokko
Project Leader, KATTI

Incentive based mechanisms

Economic and social implications of incentive based policy mechanisms in biodiversity conservation

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Abstract

Ecological, economic and social sustainability should be simultaneously taken into account in modern forestry as well as in forest conservation. To achieve conservation goals in the long run, conservation policies should be socially accepted. Landowners' property rights are in a central role when new tools for implementing nature conservation are introduced. Finland has launched an extensive policy programme for the conservation of biodiversity, focusing on conservation issues in private forests. The METSO programme proposed new policy instruments based on economic incentives and voluntariness of forest owners, such as conservation contracts and nature value trading.

This paper is based on two studies, which aim to understand the factors affecting the social acceptability and economic implications of biodiversity conservation in private forests with a focus on the proposed new mechanisms. Finnish citizens' preferences for the conservation policy and policy instruments, as well as private forest owners' preferences for various attributes of voluntary conservation contracts, were examined using the choice experiment method. Information on preferences was collected by mail surveys to 3000 Finnish citizens in 2002, and to 3000 forest owners in 2003.

The preliminary results suggest that incentive based, voluntary policy mechanisms provide several potential advantages. First, they respect forest owners' property rights and correspond to what citizens seem to consider a fair distribution of the costs of conservation. Second, voluntary mechanisms can improve the cost-effectiveness of conservation policy. Third, incentive based mechanisms can provide social welfare gains over traditional policies. Fourth, voluntariness and participatory procedures improve the social acceptability of forest conservation and reduce the potential for conflicts. As the use of incentive based mechanisms can potentially increase the social acceptability and cost-effectiveness of forest conservation, they appear as promising new tools to complement, even though not to replace, the traditional policies. It remains to be estimated to what extent the new policy mechanisms can eventually help in implementing a realistic conservation programme.

1 Introduction

Forest conservation in Finland is very strongly centered to the northern parts of the country. In Northern Finland 17% of forest area is preserved, while in Southern Finland and in Ostrobothnia only 1.8% of forest area is protected. Forests are the primary habitat for 43% of the threatened species in Finland. Especially broad-leaved forests are important environment for the threatened species. Broad-leaved forests are mostly located in the southern parts of the country, with 93% of this type of forests in Southern Finland or Ostrobothnia. While the network of conservation areas is estimated to be sufficient to those threatened or declined forest species whose natural distribution is centered to the northern boreal forest zone, the present level of conservation is too low to maintain all the threatened or declined forest species with distribution emphasized to southern parts of the country. Thus, the need for conservation is especially strong in Southern Finland (Metsien suojelun... 2000).

In Finland non-industrial private forest owners own 61% of the forest land, while 25% is owned by the state, 9% by companies and 5% by others (municipalities, parishes, and other collective bodies). In Southern Finland the proportion of private ownership is even higher, 75% (Statistical yearbook... 2002). Because of the high proportion of privately owned forests, the private forest owners have an essential role in safeguarding biodiversity especially in the Southern parts of Finland where the need for conservation is especially strong.

Finland's National Forest Programme 2010 (1999) considered the ecological, economic and social dimensions of sustainable forestry. In addition to domestic demands, the programme is designed to meet the demands set by international forest policy norms. In 2002 Finland launched a Forest Biodiversity Programme for Southern Finland (Metso), especially focusing on conservation issues in non-industrial private forests. The Metso programme, supervised by the Ministry of Agriculture and Forestry and the Ministry of Environment, complements the National Forest Programme. The Metso programme is a plan of action to preserve the habitats for threatened species and ensure the maintaining of the nature types needed by these species.

The Metso programme proposed new policy instruments based on economic incentives and voluntariness on the part of forest owners (Valtioneuvoston periaatepäätös... 2002). While biodiversity preservation is acknowledged to be a crucial part of ecologically sustainable forest management and forest conservation policy, securing the social sustainability of the policy measures and regulations applied is vital for obtaining the objectives of preservation in the long run. Strict nature reserves provide a secure core for conservation networks and present a low risk level in the stability of conservation status. Considering only ecological values, the acquisition of forest land to the state for strict biodiversity conservation purposes would seem like an attractive option. However, the optimal choice of conservation policy and implementation mechanism is a complex game of trade-offs between ecological values and socio-economic considerations. Tailoring the policy mechanisms to suit the ecological requirements in a cost-effective and socially acceptable manner is a challenging task for the policy makers.

Nature value trading is one of the policy instruments introduced in the Metso programme. In nature value trading a forest owner gives a commitment to maintain or enhance the natural values of the site by a fixed-term contract for ten years and receives compensation for this. The forest owner offers nature sites to the transaction and forestry authorities in co-ordination with environmental authorities choose the most suitable ones. All the sites to be traded must meet the conservation biological criteria defined in the Metso programme (Metso Leaflet 2003). The pilot project of nature value trading has been started in South-West Finland Forestry Centre in Satakunta province in summer 2003 (Luonnontilan hallinnan talous 2002).

Bidding game (also called competitive tendering) is a search procedure whereby the state asks landowners for offers and price bids for specified types of nature resorts to be acquired for conservation purposes. The primary target in the bidding game is permanent conservation through the establishment of private conservation areas (retaining land ownership) or acquisition of the land to the state, but fixed-term contracts for a 20-year period are also possible. An experimental bidding game is starting under the Metso programme in 2004.

Under a **nature management plan,** the forest is managed in a way that maintains and enhances natural values. The landowner and local environmental and forestry authorities compose a nature management plan that can be established only by the application of the landowner. The plan defines the actions to protect nature values as well as the silvicultural activities in the area. Silviculture is not forbidden, but all forestry activities have to be done without endangering the nature values of the area. The plan includes estimates of the economic losses caused by the restrictions on forest use and the costs of the actions needed to preserve the nature values. There are no obligations for the landowner about the use of land after the term of the contract (Valtioneuvoston periaatepäätös... 2002).

This paper is based on the preliminary results of two studies that seek to provide an overview of Finnish citizens' as well as private forest owners' preferences for biodiversity conservation in private forests. With a focus on the proposed new policy instruments, the studies aim at understanding which factors are the most important for the acceptability of biodiversity conservation in private forests. The main objective is to consider, in the light of empirical evidence based on stated preferences, whether the incentive based, voluntary policy mechanisms introduced in the Metso programme are likely to fulfill the expectations related to the social acceptance and cost-effectiveness of conservation policy.

2 Methods and data

The choice experiment method was applied in order to examine the preferences of forest owners and citizens for the inevitable trade-offs between desirable outcomes of forest use and conservation policy. The choice experiment is a stated preference valuation method, where the respondents are given different scenarios and asked directly which one they prefer. The method is especially appropriate in situations where the scenarios are hypothetical, or when information is needed of trade-offs between different aspects of the good or service that is being valued. Louviere et al. (2000) provide an overview of the choice experiment approach, and Horne and Ovaskainen (2001) and Horne and Petäjistö (2003) give examples of earlier applications in Finland.

In the method, respondents are presented with a number of choice sets. Each choice set consists of three alternatives from which the respondents are instructed to choose their preferred one. One of the alternatives presents the current situation, while the other two alternatives are described by a set of attributes. The levels of attributes differ between the alternatives thus describing different future scenarios. Attributes can be quantitative or qualitative in nature, and the ability to combine these two types of data is one of the main benefits of the choice experiment approach.

Two studies were conducted to examine the social implications of the change in conservation policy. The first study examined the level of acceptance by Finnish citizens of forest conservation in private forest land. The level of biodiversity conservation was placed abreast with implementation policy and its socio-economic costs, including employment losses. The purpose of the study was to determine whether the use of incentive based policy mechanisms would increase the level of acceptance of nature conservation in Southern Finland and how the welfare of different segments of society would be affected by the policy change. The second study considered preferences of forest owners for implementation of conservation policy. The focus of the study was on incentive based policy mechanisms, especially on the terms of conservation contracts.

Data of the citizen survey was collected by mail in the early summer of 2002. Simple random sample of 3000 was selected by Population Register Centre to represent 15–74 year old Finnish citizens. The response rate was 45%. The survey questionnaire consisted of the choice experiment as well as attitude and background questions. In the choice experiment setting each respondent faced six choice tasks, each with three alternatives. One of the alternatives was the status quo; no additional conservation areas and no changes in socio-economic attributes. In the other two alternatives the conservation level in Southern Finland was always higher than the present level. The alternatives consisted of six attributes (Table 1). Two of the attributes presented the percentages of protected area in Southern and Northern Finland. The number of threatened species was

Table 1. The effects of programme attributes on the acceptability of a conservation option: Qualitative results of the multinomial logit model for Finnish citizens.

Variable	Effect (+ positive, – negative) Timber production oriented	Multiple values oriented
Constant (status quo)	+	–
Percentage of protected forest area in Southern Finland Present (1.8%) to 4 x present (7.2%)	–	+
Percentage of protected forest area in Northern Finland Present (17%) to 2 x present (34%)	–	–
Employment 5000 jobs lost 2000 jobs lost No change 1000 jobs more	+	+
Annual cost to households over a 10-year period 0 to 350 euros	–	–
Policy instrument		
Land acquisition	–	0
Conservation contracts	+	0
Information based	0	0

calculated on the basis of percentage levels of conservation in Southern and Northern Finland [1]. Socio-economic attributes included the impacts of employment and the annual cost to households through income taxes over a 10–year period. Three policy instruments were given as attribute options. Land acquisition was explained to present lowest risk in achieving conservation targets but with least sovereignty of forest owners. Information based instruments like extension by forest owner organizations were given as a high risk, high sovereignty option, while thirdly, the conservation contracts based on voluntariness of forest owners were presented as a middle course instrument.

The data of the forest owner study was collected by a mail survey to 3000 Finnish private forest owners in spring 2003. The response rate was 42%. The questionnaire contained six choice sets, each with the status quo and two alternatives consisting of five attributes. The attributes described alternative contract terms for conservation in private lands. The attributes included the initiator in the conservation contract, the restrictions imposed on forest use, the amount of compensation per hectare per year, the duration of the contract, and the cancellation policy of the contract (Table 2).

Table 2. The effects of contract attributes on the acceptability of a conservation option: Qualitative results of the multinomial logit model for Finnish forest owners.

Variable (effects coded)	Effect (+ positive, – negative)
Constant (status quo)	+
Compensation to landowner (euros/ha/year) 0 to 350 euros	+
Initiator of conservation contract	
Forest owner	+
Forestry organisation	0
Environmental authorities	–
Forest conservation trust (base case)	–
Restrictions on forest use	
Small patches preserved	+
Nature management plan	+
No harvesting/silviculture allowed	(–)
Strict nature reserve (base case)	–
Duration of contract	
5 years	+
10 years	+
30 years	0
100 years (base case)	–
Cancellation policy	
Forest owner can cancel	+
New owner can cancel	0
Binds also new owner (base case)	–

3 Results

For some empirical evidence on the implications and potential advantages of using incentive based, voluntary policy mechanisms in biodiversity conservation, we consider four aspects that are important to decision making: Property rights and fairness, cost-effectiveness, effects on social welfare, and social acceptability of conservation.

First, nearly two thirds of respondents in our survey of Finnish citizens preferred the use of mechanisms based on voluntariness (Fig.1). This can be taken to reflect the public's preference for incentive based mechanisms in that such instruments duly acknowledge forest owners' property rights. The use of incentive based mechanisms also seems to be in line with citizens' perceptions about the fair allocation of the costs of conservation.

Three out of four citizens considered that the landowners should at least get full compensation for the timber revenue forgone due to conservation (Fig. 2). Many respondents also thought that in addition to the forgone revenue, the compensations should cover any direct costs from measures such as restoration, or even the entire societal value of the resource, including timber as well as biodiversity values of the forest.

Secondly, the results from the survey of forest owners suggest that the extended use of voluntary mechanisms can improve the cost-effectiveness of the conservation policy. The attributes of conservation contracts considered in the choice experiment, with their levels and directional effects, are presented in Table 2. Aside

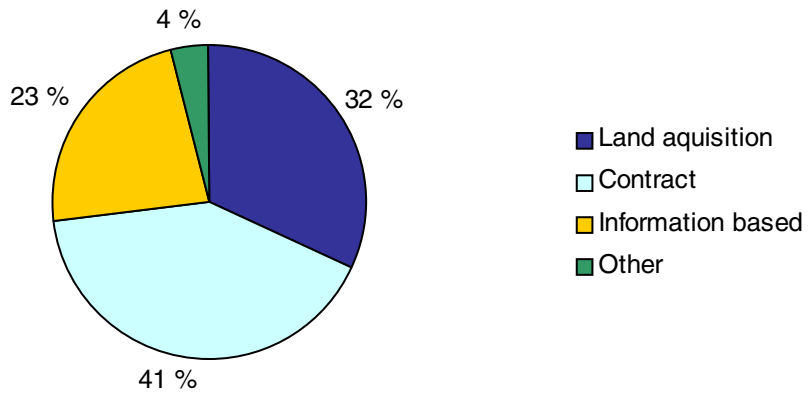

Figure 1. Finnish citizens' preferences for different conservation policy instruments.

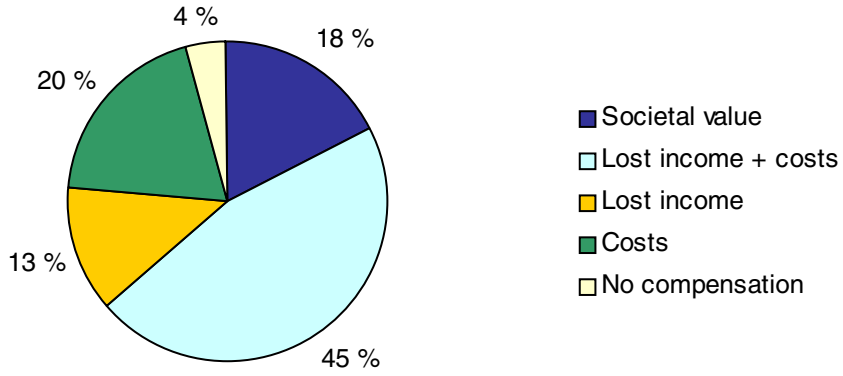

Figure 2. Finnish citizens' preferences for compensation payable to forest owners for conservation.

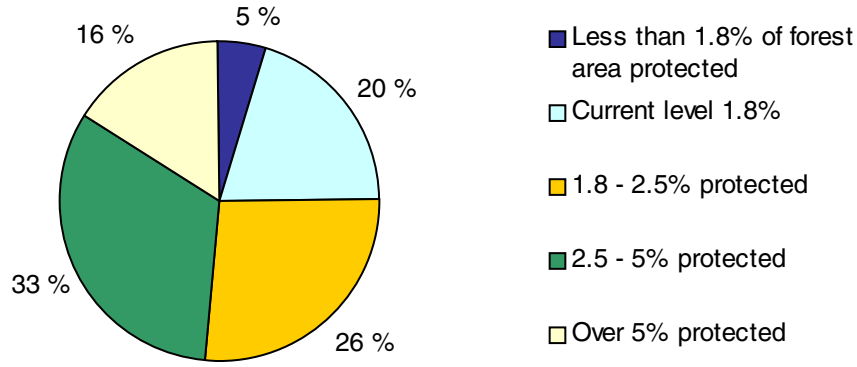

Figure 3. Finnish citizens' opinions about the acceptability of additional conservation in Southern Finland.

from an overall preference for the status quo (no increased conservation in private forests), the amount of compensation as well as other specific terms of the contract were of great importance to its acceptability to the landowners. While long-term, non-cancellable contracts with tight restrictions on (or full exclusion of) forest use are strongly undesirable, shorter contracts with more flexible terms could be much more easily acceptable. Notably, the welfare analysis showed that with more undesirable terms, the compensation claim for a conservation contract will easily rise manyfold in comparison to a base scenario with more flexible terms.

Thirdly, our survey of Finnish citizens suggests that the use of incentive based, voluntary mechanisms can provide welfare gains over traditional policies. As an example, the average welfare change (Hicksian compensating variation) corresponding to a conservation scenario that would raise the protection percentage in Southern Finland to 4.2% of forest land (2.3 times the present protected area) was computed from the estimated multinomial logit model. To allow for the heterogeneity of public preferences, and to consider both winners and losers of the project, the respondents were grouped by their attitudes on forest use and conservation (timber production oriented vs. multiple values oriented). The average welfare change turned out to be negative if the programme was to be implemented through land acquisition, while the impact was positive when contract based mechanisms were assumed to be used.

Fourthly, voluntariness and participatory procedures can significantly improve the social acceptability of forest conservation, thus reducing the potential for conflicts. Among all Finnish citizens, three out of four respondents supported increased conservation (Fig. 3).

In contrast, almost two thirds of forest owners considered the present level of conservation in private forests appropriate, and more than every fifth even thought the present level of conservation to be too high (Fig. 4). Obviously, there is a need for conservation options with more easily acceptable terms for the conservation goals to be successfully reached in the long run.

Forest owners' opinions on the factors that matter the most in regard to an acceptable conservation contract are summarized in Fig. 5. Even beyond adequate compensation, the forest owners emphasized the importance of property rights and sovereignty in decision-making as ingredients of an acceptable contract. That is, part of those forest owners who are not willing to sell their land for permanent conservation under a top-down preservation programme, might still accept a voluntary fixed-term contract with more flexible terms, particularly one which retains land ownership and allows sovereign decision making even in the future.

4 Conclusions

We examined four potential socio-economic implications of incentive based conservation mechanisms in biodiversity conservation in Finnish private forests using stated preference data and the choice experiment method. The preliminary results support the following conclusions on the implications and potential advantages of incentive based mechanisms.

First, the implied acknowledgement of forest owners' property rights in incentive based mechanisms would seem to be in line with the general public's perception of property right issues in forest conservation. Perception of property rights also lays down the basis for fair distribution of the benefits and costs of conservation. Second, the voluntary, incentive based mechanisms provide an opportunity for more cost-effective conservation policy. Forest owners differ in terms of forest management goals and preferences for implementation of conservation policy. A set of different policy instruments to choose from, and the potential of flexibility in contract negotiations, would allow forest owners to enter into a conservation contract that would best suit their situation. Third, incentive based instruments could provide welfare gains over traditional policies if they are more readily accepted by the general public. If citizens hold different opinions on nature conservation and forest use, the impact of a conservation policy would vary between different segments of the society. Finally, the use of more participatory, bottom-up approaches could enhance the social acceptability of conservation among the forest owners, and thus reduce conflicts.

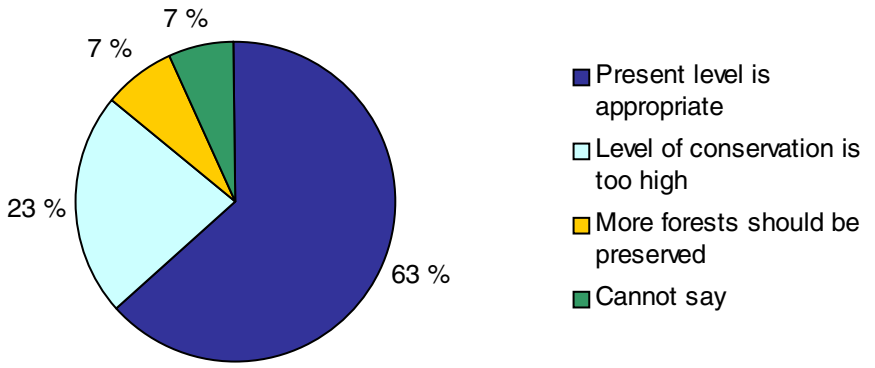

Figure 4. Forest owners' opinions about the present level of conservation.

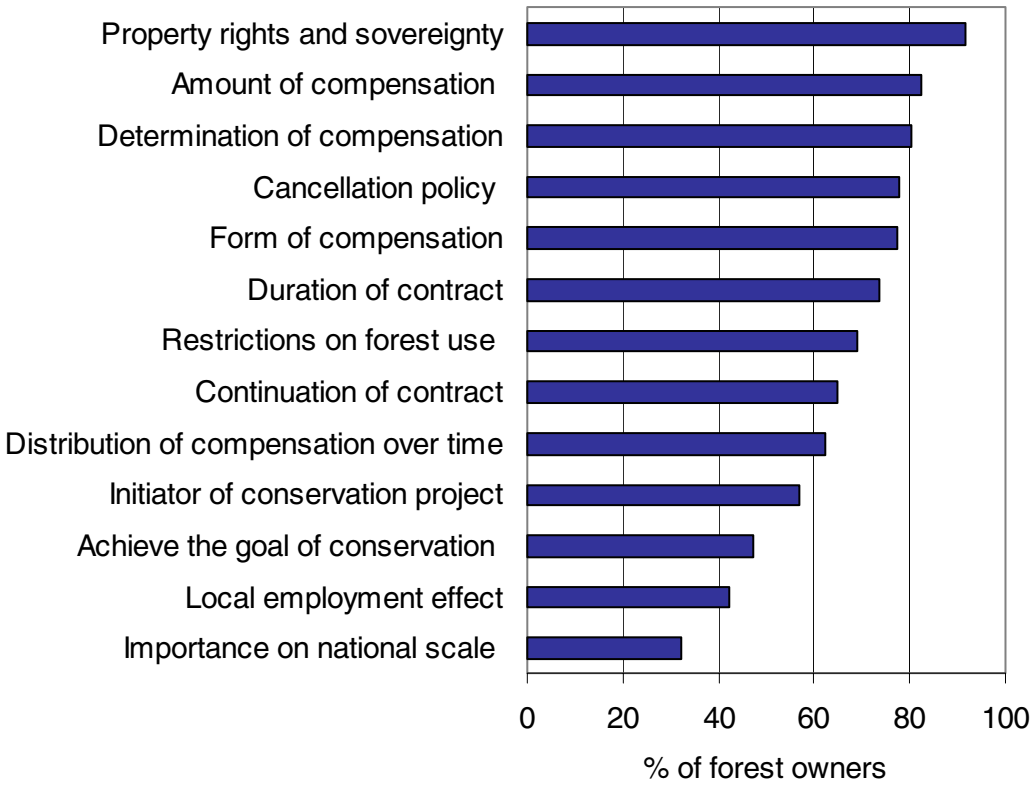

Figure 5. Forest owners' opinions on the factors that matter the most in regard to an acceptable conservation contract.

It remains to be estimated in more detail how much the suggested incentive based policy mechanisms can eventually help in implementing the realistic conservation programme. Nevertheless, our preliminary results suggest that the use of incentive based mechanisms can potentially increase the social acceptability and cost-effectiveness of forest conservation. Thus, they appear as promising new tools to complement, even though not to replace, the traditional policies.

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Footnotes

[1] Professor Ilkka Hanski from the University of Helsinki and Dr. Juha Siitonen from the Finnish Forest Research Institute calculated the number of threatened species on the bases of conservation percentages. Their contribution is gratefully acknowledged.

Spatial interactions and forest management: policy issues

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Abstract

Biodiversity conservation policies in forest systems should taken into account the effect on ecosystem services of spatial interactions within the forest landscape. These interactions between landscape components may imply the existence of spatial externalities due to the interdependence between users/managers' decisions. Thus, management decisions of any one landowner may have consequences for the decisions of neighbouring landowners. In this paper, we review the way in which spatial interactions have been analysed in forest economics and management literature, and analyse the implication of spatial interactions in forest landscapes.

1 Introduction

In the decade since the signing of the Convention on Biological Diversity (CBD), global efforts to conserve biodiversity in forest ecosystems have focused on the species-rich humid tropical forests.[1] Conservation in these areas has consisted of both *in situ* conservation measures involving the designation of protected areas, and *ex situ* measures, including germ plasm preservation in zoos, arboreta, seed banks, tissue cultures and genomic libraries. The focus on species rich areas – the so-called biodiversity hotspots – is aimed at the protection of a global public good: the global gene pool (Heywood 1995, Millennium Assessment 2003).

Historically, however, biodiversity conservation in forest ecosystems has been addressed at the local level for strictly local reasons. In productive forests, for example, biodiversity conservation has implied protection of enough interspecific and intraspecific diversity to underwrite the productivity of the system. Productivity in such systems depends on a number of local ecosystem services such as flood control and water supply, waste assimilation, recycling of nutrients, conservation and regeneration of soils and so on. Forest biodiversity

supports this set of services over a range of environmental conditions. That is, forest biodiversity protects the resilience of forest systems (Perrings and Gadgil 2003).

Two aspects of the problem are especially important. First, biodiversity conservation at the local level is a local public good. Because it is a public good, users will typically ignore the social costs and benefits of their actions unless there are incentives to do to otherwise. The incentives in this case generally stem from the nature of the property rights or the regulatory and management regimes. However, because biodiversity conservation is a local public good there are generally some rights of exclusion. That is, the access regime tends to be regulated rather than open.

Second, the relative importance of genetic, species and ecosystem diversity tends to be rather different at the local level than at the global level. At the global level the primary concern is with the protection of the global gene pool, so biodiversity conservation is focused on preservation of genetic material either *in situ* or *ex situ*. At the local level, the primary concern is with the functional diversity of species and the interaction between species and ecosystem types in the provision of ecosystem services. Biodiversity conservation therefore tends to focus on maintenance of a patch structure or mosaic of land uses. Because of this, a key element in local conservation strategies is the regulation of spatial interactions between elements in the mosaic.

It follows that local biodiversity conservation in forest systems requires decision-tools that explicitly account for the effect on ecosystem services of spatial interactions within the forest landscape. In forests that are managed by multiple users these spatial interactions may give rise to spatial externalities. Spatial externalities due to ecological (economic) interactions between landscape components imply the interdependence between users/managers. Gottfried et al. (1996) refer to this as "economies of configuration", which they define as the effect of spatial patterns on the output mix and output costs. In forest systems it implies that outputs depend both on ecological relationships between stands and on the spatial patterns emerging from land use decisions.

This paper considers the policy implications of spatial interactions in forest landscapes. In the next section it addresses the linkage between biodiversity conservation and forest landscape management as reflected in the forestry literature. Next we discuss the way in which spatial interactions in forest landscape management have been analysed in the forest economics and management literatures. Finally, we consider the implications of this for biodiversity conservation policy in forest systems.

2 Biodiversity and forest landscape management

Forest landscape management is generally understood to be aimed at achieving a set of environmental conditions, and not a set of outputs such as timber, recreation or wildlife. Nevertheless, by managing the forest in order to yield a set of desired forest conditions it is frequently possible to secure such outputs (Baskent and Yolasigmaz 1999). This broad approach has been adopted by the CBD as the ecosystem approach. One motivation for this is the difficulty in implementing a species approach given the importance of smaller organisms, habitats and processes that are poorly understood (Franklin 1993). A second motivation is the difficulty of meeting conservation goals through a reserve policy – since there can never be enough large and well-distributed protected areas to secure the conservation goal. A third motivation is that the rationale for biodiversity conservation has as much to do with the protection of a range of ecosystem services as it has with the preservation of genetic information.

In other words, the value of the mix of species depends on the value of the goods and services supported by those species. Such indirect use values comprise environmental functions such as nutrient cycling, protection functions such as ground cover for key watersheds, waste assimilation functions such as the retention or detoxification of pollution and wider functions such as microclimatic stabilisation and carbon storage. These functions all indirectly support economic activity and human welfare. The Global Biodiversity Assessment characterised these as regulation, production, carrier and information functions (see Table 1).

Table 1. Forest functions and economic goods and services.

Regulation Functions Indirect use	Production Functions Consumptive use	Information and carrier functions Non-consumptive use
– Carbon sequestration – Watershed protection – Erosion prevention and soil protection – Storage and recycling of industrial and human waste – Storage and recycling of organic matter and mineral nutrients – Maintenance of biological and genetic diversity – Biological control – Migratory, nursery and feeding habitat	– Water – Building, construction and manufacturing materials – Energy and fuel – Medicinal resources – Biochemical resources – Genetic resources – Wild living resources	– Aesthetic information – Spiritual and religious information – Cultural and artistic inspiration – Educational and scientific information – Recreation – Habitat

Source: Adapted from Heywood (1995).

Managing for biodiversity conservation implies an understanding of the effects of forestry practices on the long run dynamics of forests at stand, landscape and even at regional scales. Species-specific approaches, although important, may be too limited (Zavala and Oria 1995, Bengtsoom et al. 2000). Adopting a landscape perspective is considered essential if biodiversity policies are to focus on habitats rather than species (Hunter 1990, Oliver 1992). Habitat in this case refers to the forest structures in which species live. According to these authors, conserving and promoting biodiversity requires a dynamic balance between diverse species composition and different age-classes (i.e. stand-initiation, stem-exclusion, understory-reinitiation, and old-growth) across landscapes. O'Hara (1998) states that biodiversity is maximised with a diversity of structures over a large area including even-aged and multi-aged structures. Hansen et al. (1991) used natural forest in North America as a model to design forest practices consistent with biodiversity conservation objectives. They stated that at the stand level, attention should focus on the role of features of natural areas such as large trees, snags and woody debris, in enriching forest structure; while at the landscape level, practices should involve having a spatial arrangement (size, distribution, edge characteristics, etc.) of forest patches in different successional stages, including old growth stands.

There are certainly some studies that focus on biodiversity conservation in forests as a specific goal. Spellerberg and Sawyer (1996), for example, considered the role of forest management in the restoration of biological diversity in conifer plantations. They argue that forest planning should be located in the landscape of which the conifer plantation is part. Their argument is based on the idea that spatial requirements for maintaining biodiversity differ depending on the scale of the existing management units. Equally, differences may lie in the temporal dimension, i.e. given that the composition of a forest stand changes with time so does the level of biodiversity provided. If the emphasis should be at a landscape rather than a forest stand scale, the concepts of a recent research area, landscape ecology, are important for management of forest resources for multiple values (O'Hara 1998, Bengtsoom et al. 2000). *'Landscape ecology seeks to understand the ecological function of large areas and hypothesizes that the spatial arrangement of ecosystems, habitats, or communities has ecological implications'* (Turner 1990, p. 21). In particular, landscape structure influences the movement and persistence of particular species, the susceptibility and spread of disturbances such as fires or pest outbreaks, and the redistribution of matter and nutrients. For instance, the local rate of extinction in landscape patches and the rate of movement of the species among these patches influence species survival. At the same time, the proportion of disturbance-susceptible patches and how they are distributed in the landscape affects the spread of disturbances (Turner 1989).

Managing forests at a landscape level implies focusing on mosaics of patches and long-term changes in these mosaics to integrate ecological values, such as the maintenance of forest ecosystem health and biodiversity conservation, with the production of commodities (Swanson and Franklin 1993, Baskent and Yolasigmaz 1999). Adopting this approach is important because the collective impacts of management practices within individual stands, or even how the different patches are defined, can result in unpredictable effects with important ecological consequences. In addition, management at a single stand level impedes the assessment of the implications of management strategies at a landscape scale. The impacts of forest management practices at different spatial and temporal scales are still not well understood, but are nevertheless essential if we are to be able to predict responses in resource flows, such as timber production and wildlife maintenance (Borgesa and Hoganson 2000, Tang and Gustafon 1997, Baskent and Jordan 1996).

3 Spatial interactions in forest landscape management

A number of forestry studies have addressed the tradeoffs between tree diversity and timber revenues under different forest regimes. Buongiorno et al. (1994) and Lin et al. (1996) considered the consequences of different forest practices on tree size (diameter) diversity and on timber economic returns from hardwood stands in Wisconsin. The forestry practices evaluated included differences in the cutting cycles (i.e. intervals between harvests), and in the harvest intensities (e.g. number of trees removed or diameter cutting practices). Later, Lin and Buongiorno (1998) extended this analysis to a landscape approach taking into account stochastic variations in the growth of forest stands and market fluctuations. Biological diversity in their approach was defined as the proportional abundance of stands in different states, depending on the different management strategies. That is, they used a measure of patch diversity.

Other studies have focused on adjacency constraints or modelled species-specific requirements in harvesting schedule problems (see Kurttilla 2001 for a review). Adjacency constraints refer either to an exclusion period between adjacent harvests or to a maximum size of clear-cut which can not be exceeded. For example, Carter (1999) and Tarp and Helles (1997) applied this approach to integrate spatial interactions into the optimisation of forest management. Carter used an integer program to cover a thirty-year planning period to evaluate numerically the impacts on the optimal rotation age arising from spatial constraints. The results are compared with the optimal rotation for a single stand case. Tarp and Helles integrated the trade-offs between economic timber values and adjacency aspects in the selection of an optimal harvest schedule programme. They considered that each stand could be subject to three possible treatments (clear-cutting and re-planting; regeneration felling and regeneration; thinning followed by clear-cutting and regeneration). Following a simulated annealing procedure the value of the objective function with alternative forest configurations, including spatial constraints, was estimated. Hof and Flather (1996) focused on the importance of spatial arrangements of forest patches for the conservation of particular species. They maximised total population, taking into account that the size and location of the habitat patches affect the population through its mean and variance. Fragmentation issues are included based on the probability of patches being connected and this influences the total population mean. Spatial correlation among populations located in different patches of habitat is assumed to affect the total population variance. Simulations for an area with four habitat patches show that the spatial arrangements depend on species dispersal capability and the type of environmental disturbances that affect the correlation between patches.

Most studies of this sort are based on site-specific data and are characterised by large and complex simulation models that aim to capture the complexity of the forest ecosystem and forest treatments. Other studies adopt a more stylised view for approaching forest management with spatial interactions. Based on the traditional Faustmann framework they limit their interest to rotational age decisions. Spatial interactions between forest stands are included, making non-timber benefits dependent on the ages of the stands. The multiple forest stands are assumed to be under sole ownership (i.e. private, public or collective). This implies that the mutual spatial externalities derived of the ecological interactions between the stands are internalised in the management harvesting decisions.

In Bowes and Krutilla's (1985) model a public manager optimises the mixed age-class distribution of the forest stands by choosing the proportion of each age-class that should be harvested in each period. Forest conditions, given by the mix of ages in the stock, influence non-timber values. The standing stock may include one or several age-classes. This analysis shows empirically the potential influence of the mix of ages in the forest stock on the harvesting age decisions and the difficulty on establishing rules of the thumb. Swallow et al. (1997) generalised the Faustmann analysis to the forest level. Location aspects are included in this model assuming that the non-timber benefits of each individual stand depend on a vector of ages of stands nearby or ecologically linked. The holding owner maximises the summation of timber and non-timber benefits of all the stands. Numerical simulations are carried out setting up the multiple-stand model in a linear programming framework, representing a forest ecosystem with two substitute stands providing non-timber services. Swallow et al. (1997) show that the optimal sequence of rotations for any individual stand may differ from the Faustmann-Hartman stationary harvesting schedule. The optimal rotational periods are not necessarily constant because the manager's emphasis on timber and non-timber benefits may change over time depending on the age of the adjacent stand. For different combination of timber and non-timber qualities of the two stands, their numerical results show that optimal harvest patterns in which specialisation of the forest stands across space and time may occur. In particular, the stands alternate between short (forage production) and long (timber production) rotations. Substitution and wealth effects analysed theoretically in a two-stand setting in Swallow and Wear (1993) may be expected. Substitution effects occur because, if a neighbouring stand is clear-cut, this encourages the manager to increase the rotational period of the focal stand. Wealth effects occur because harvest in an adjacent stand causes an increase in the present value of the future environmental benefits of the focal stand and therefore also in the opportunity costs of delaying its harvest. Due to the trade-off between these two effects a clear-cut of an adjacent stand may increase or decrease the rotational age of the focal stand.

An important point here is that in multiple stand forests two adjacent stands can be spatial substitutes, complements or independent (Koskela and Ollikainen, 2001). That is, an increase in the rotation age of an adjacent stand decreases, increases or leaves unchanged the marginal amenity values of the focal stand, respectively. In a single rotation maximisation problem, if the stands are substitutes/complements, the private harvesting age will be shorter/longer, the longer the rotation age in the adjacent exogenous stand. In ongoing rotation maximisation problem the effects of these interactions is more complex. Temporal interdependence between the two stands can be constant, increasing or decreasing depending on how the spatial interdependence of the stands' changes with increases in the rotation age of the endogenous stand.

Tahvonen and Salo (1999) followed the Scandinavian tradition, which focuses on the management problem of non-industrial private forest owners, using a jump-control modelling approach. Their model is defined by three state variables: forest biomass, age of the tree and owner's financial assets. The jump points or discontinuities in the state variables are related to clear-cutting activities in the forest. Clear-cutting activities are modelled through downward jumps in the timber biomass and the age of the trees and upward jumps in the forest owner's financial assets. If spatial interactions influence forest non-timber benefits, they illustrated that a heterogeneous forest structure, in which each stand is harvested approximately halfway through the rotation of its neighbouring stand is optimal. This has the effect of distributing timber and non-timber benefits evenly through time.

Touza-Montero and Perrings (2002, 2003) used a similar approach to analyse rotation periods in a forest landscape. They adapt previous bioeconomic forest models (Termansen 2001) to include information on the age-class structure of forests. Stand interactions are assumed to influence the flow of non-timber benefits provided for the entire forest. The dynamic optimal cutting rule derived suggests that the harvest age of any stand depends on the overall condition of the surrounding forest landscape. In particular, it indicates that a stand's optimal harvesting age is a function of the importance of the stand's non-timber benefits relative to the non-timber benefits derived from the entire forest.

As expected, the optimal harvest age of any stand – for example stand i – is shown to balance the forest marginal timber and non-timber benefits of delaying the stand harvest with the forest marginal costs of waiting (i.e. forest MB = forest MOC). The marginal non-timber benefits of postponing the harvest of stand

i is determined by the difference between the forest non-timber benefits before and after the harvest of stand *i*. This difference may be denoted as "stand net contribution" of stand *i* to the non-timber benefits of the whole forest. This "stand net contribution" term indicates that the optimal harvest age of any stand depends not only on the provision of forest non-timber benefits if the harvest of the stand is delayed, but also on how the forest non-timber revenues would be affected if harvest had occurred. Therefore, it represents the difference between forest non-timber benefits with and without the harvest of the stand. If the stands are substitutes in the provision of the non-timber benefits, the "stand net contribution" has a smaller value if other stands are acting as substitute sources of non-timber benefits at the harvest instant than if they are not. For example, if the stands in the collective forest are mature stands, the marginal value of the non-timber benefits from delaying the harvest of stand *i* would be relatively small. While if stand *i* is a mature stand and the remaining stands are young – for instance, they are just being planted – the impact of harvesting stand *i* on the whole-forest non-timber benefit would be higher. Similarly, when stands are complementary, the "stand net contribution" is higher when other stands are acting as complementary sources of non-timber revenues at the moment of harvest.

The marginal costs of postponing the harvest of a single stand in the forest landscape includes the opportunity cost of investment of timber revenues plus a term analogous to the concept of "site value" in the traditional Faustmann framework. This includes the impact of delaying the harvest of stand *i* on the forest timber and non-timber returns of the following rotation. This impact is not only the opportunity cost of a delay in future benefits but also the value of altering the age of stand *i* relative to the age of other stands in the forest landscape. Delaying the harvest decision therefore may cause a shift in the distribution of ages in the forest, altering the interactions between the stands and affecting timber and non-timber benefits in the future.

4 Implications for policy

The central stylised fact of this paper is that in forest landscapes, property boundaries do not correspond with ecological boundaries. Therefore the delineation of forest ecosystems at an ecologically significant scale includes many owners and may involved mixed types of ownership (public and private). It follows that the management decisions of any one landowner may have consequences for the decisions of neighbouring landowners. That is, it may imply the existence of spatial externality. If the spatial externalities derived of ecological (economic) interactions are neglected, and if the stands are independently managed, the optimal harvest ages will be determined by the Faustmann-Hartman rule.

However, when spatial interactions between forest stands are endogenous to the harvest decisions, recent studies have shown that optimal harvesting ages no longer follow the Faustmann-Hartman rule (Swallow and Wear 1993, Swallow et al. 1997, Tahvonen and Salo 1999, Touza-Montero and Perrings 2002, 2003). The "optimal" harvesting strategies at a single-stand scale are not necessarily optimal when a larger spatial scale is adopted and when spatial interactions are included in the management decisions. Specifically, when a single stand is managed independently, the Faustmann-Hartman rule indicates that is the flow of the stand's non-timber benefits that influences when the stand should be harvested (Hartman 1976). When spatial interactions are taken into account, it is the relative contribution of each stand to the non-timber benefits provided by the whole forest that determines the rotation intervals (Touza-Montero and Perrings 2003). That is, whether an individual stand is harvested depends on its role in fulfilling in forest landscape objectives. This conclusion may imply that non-harvesting policies may be optimal in stands that contribute highly valuable forest landscape benefits. In addition, if non-timber benefits increase with the age of the stands and are significant with respect to other uses, it may be optimal never to harvest any of the stands in the forest. Most importantly, it implies that the ecological and economic consequences of alternative actions taken at small scales (i.e. stands) on a wider spatial context (i.e. forest landscape) must be understood for optimal forest management.

What implications do these findings have for policy? At one level the implications are quite generic. Spatial externalities and spatially defined public goods are still externalities and public goods. In the case of

externalities, the first-best solution is the internalisation of externalities through either the appropriate assignment of property rights, or the use of mechanisms that confront users with the social opportunity cost of their actions. Both result in an efficient allocation of resources. World markets for fibres drive both the choice of cultivated species in forestry and the privately optimal rotation period, but do not signal the costs to society of the resulting forest structure. In principle there exists a set of prices and hence a set of market based instruments that would induce a socially optimal forest structure.

Property rights solutions to the problem of spatial externality include both the merging of rights to interacting stands and the assignment of rights to the external effects between stands. The first converts an economic problem to a management problem by directly internalising the externality. The second creates a market in the externality by allowing the source and victim of an effect to trade. While we are unable to cite examples of the development of markets in spatial externalities within forests, there is clearly considerable scope for this. Markets in such effects would involve small numbers of parties and so few transactions costs.

Other market based instruments that are currently used to address spatial externalities in forests include taxes (royalties/stumpage fees), charges, pest control subsidies, afforestation subsidies and grants. It is not hard to find examples of public payments to private landowners for biodiversity conservation through forest afforestation. In the UK the woodland grant scheme is a case in point. In this scheme, payments for reforestation depend on the potential for biodiversity conservation, and are graduated depending on the location of existing forest. Grants are highest where the proposed stand is contiguous to a large existing block precisely because of the greater biodiversity benefits this offers (Forestry Commission 1997).

The second-best solution applies where the first-best solutions are infeasible because there is insufficient information, transaction costs are too high, wealth effects are too severe, administrative capacity is too low, or because there are threshold effects involving irreversible change. In this case the solution involves direct regulation supported by enforcement and penalties for non-compliance, and the economic test is one of cost-effectiveness. Direct regulation is almost always the instrument of choice where there are large numbers of forest owners (since that implies the transactions costs are high).

Forest regulations are currently widespread. Regulations at international, national, regional or local level currently deal with a range of management issues including timber harvesting, reforestation, fire hazard, deforestation in catchments, habitat and species conservation While these can be useful tools for achieving social objectives in forest landscapes that are owned by many individuals they may not induce an efficient use of forest resources for reasons that are well understood. They do not provide users with information on resource scarcity until the penalty for non-compliance is activated. This is frequently unconnected to the opportunity cost of non-compliance. They tend to treat all users identically. Enforcement is frequently weak or non-existent and is data demanding. Spatial inventories of private forest ownerships are required. In areas such as in Galicia where there are 673 000 single forest owners with holdings of about two hectares (GEPC, 2002) these inventories can be administratively demanding.

The use of mixed instruments in forestry tends to be restricted to the allocation of harvest rights, in which a total allowable harvest is allocated between foresters through a market for harvest rights. This applies to the exploitation of natural forests in the public domain, but has little interest in areas where forests are privately owned.

If the ecological services provided by forests with multiple owners include local public goods such as watershed protection, soil conservation, habitat provision and the like, the policy problem is to persuade landowners to cooperate in the provision of such services. In certain of European forest systems this is achieved by assigning management responsibilities to a forest management company. As a result the forest is run as a single entity – which effectively internalises the externalities between stands.

Where incentives have been offered to private landowners to cooperate in the management of forest resources the results have been mixed. Klosowski et al. (2001) carried out a conjoint analysis to study the probability that coordinated management programmes would be undertaken. Results from a survey, carried out to landowners in New England, showed that this probability is very small even when substantial incentives (e.g. property tax reductions) are offered. Even though, larger tax incentives and short commitments increase

this likelihood. Landowners already involved in forestry-related organisation are more likely to enroll in these programmes.

Whether private landowners will cooperate in the absence of incentives depends on the likelihood that an agreement between them would otherwise be self-enforcing. This depends on a number of factors of which the most important are the number of parties and the incentive to defect from the agreement (which is related to the difference between the payoffs under the Nash and cooperative equilibria). Collective property regimes have been suggested as a way of promoting forest management for multiple private and public goods and services in Europe (Gluck, 2000). This requires community members to integrate both timber and environmental interests by negotiation and cooperation. It is argued that it guarantees rights without parcelling the forest, and unparcelled areas are better for biodiversity conservation. It will also internalise externalities by ensuring that decisions are made jointly.

If we now try to pull together the policy implications of spatial interdependence, the central point is that decisions should be made (or at least coordinated) at the geographical scale at which the interdependent activities operate. Since the boundaries of individual land titles almost never coincide with the boundaries of the impacts of land use, it follows that decisions should be made at (or should take into account the effects on) the geographical area in which activities are interdependent. But this is precisely the meaning of the European principle of subsidiarity. The principle is typically used to distinguish between decisions that are most appropriately taken at European and national levels. But it applies across all scales. Within individual countries the question is whether decisions should be taken at the national, regional, local, firm or household level. The existence of spatial externalities and spatially defined public goods implies that the appropriate geographical scale of decision-making is wider than the firm or household level. But how much wider? This depends of the nature of the ecological services supported by the forest system in question. Carbon sequestration implies that management should be coordinated at the global level. Watershed protection implies that it should be coordinated at the scale of the catchment. Pollination services imply that it should be coordinated over the habitat of the relevant pollinators.

In many European forests spatial interactions tend to be limited in their geographical extent. In some cases they may be limited to neighbouring stands. However, if each stand interacts with all neighbouring stands then the appropriate geographical scale at which the forest should be managed is still the whole system. Just as an individual with a contagious disease is a threat not only to the people with whom come into contact directly, but to all people with whom they come into contact indirectly – often the whole population. The relevant policy questions then concern the best mechanism for ensuring the coordination of decisions at the relevant geographical scale. As always these tend to be case specific, and sensitive to the existing structure of property rights and regulatory regime, as well as the characteristics of existing markets. Given the kinds of spatial interactions observed in temperate forest systems, and given the nature of activities undertaken in those systems, conservation policies in temperate forests generally attempt to maintain a patch structure or mosaic of land uses. The appropriate geographical scale is that over which the components in the mosaic support complementary ecosystem services.

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Footnotes

[1] Over 40% of GEF funding on biodiversity was directed to humid tropical forests in its first two phases (Pearce et al. 1999).

Economic science viewpoints

Biodiversity conservation on private lands: information problems and regulatory choices

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I Introduction

The single greatest threat to biodiversity in the U.S. and around the globe is the loss of natural habitat to development and agriculture. Changing patterns of land use have reduced the carrying capacity of the environment in terms of the numbers of species that it can sustain. As Oldfield (1984, 1991) puts it,"Developments are proposed, the development alternatives are evaluated, the social costs of habitat losses or extinction are ignored or casually considered, and the decision to develop is given the go-ahead, actually on the basis of incomplete economic information. It is by this gradual process of land conversion that entire ecosystems and wildlife species have disappeared." Agriculture is following a trend in that more productive systems tend to have fewer species (Pimm and Gittleman, 1992). Both agriculture practice and urban sprawl are converting species' natural habitats with an alarming speed - for example a net loss of approximate 65 million hectares of forests is estimated in developing countries between 1990 and 1995, representing 3.7% of the total remaining forests in these countries (UNEP, 2000, p. 38).

Current economic systems have often led to over-exploitation of biological resources for reasons common to other public goods' over-exploitation: weak ownership, missing markets, severe free ridings and large externalities etc. (see Clark, 1973a; Dasgupta, 1982; Fisher, 1981b; Norgaard, 1984 and Pearce, 1976 for more detailed discussions). Frequently, externalities exist in cases where it is not possible to identify the

particular individuals who are negatively affected by the actions of others but where public goods which accrue to society at large are affected. This holds particularly in the case of biodiversity. If a given ecosystem disappears, the negative impact on each individual might be too small to warrant individual action, but nevertheless the total impact, due to the large number of individuals affected, might be considerable and require policy intervention. Governments therefore are called upon to implement incentive measures to achieve a sustainable use of land in those cases in which private utility-maximization causes imperfect outcomes, as individuals do not take into account the impacts of their activities on the well-being of other individuals or the public at large.

Most instruments developed by environmental economists and regulators to correct for externality problems have been studied in the context of environmental pollution. Examples include the imposition of artificial shadow prices in the form of environmental taxes or charges which reflect the damage to public goods, the better definition of property rights with the enabling markets, and the payment for / subsidization of behaviors more sympathetic to public interests etc.

The situation concerning the conservation or the sustainable use of biodiversity is comparable but not identical. This is mainly due to greater information insufficiencies that prevent the regulatory measures being effective for biodiversity conservation. Compared to other environmental degradation, biodiversity losses is more difficult to measure in extent and value - oftentimes the value of biodiversity resides in its pure existence, or possibly in its – as yet still unknown – future uses. The presumption for effective government invention in correcting/internalizing externalities relies in that government has superior information and vastly reduced transaction costs in ensuring that public health and amenity considerations are adequately reflected in the actions of individual producers. This is oftentimes not true in case of biodiversity conservation. Individual landowners oftentimes either have better information on the species habituated in their lands (and the costs associated to preserve them) or are in a better position to discover this information because of legal boundaries that prevent government investigation of the lands.

This paper examines various information insufficiencies in biodiversity conservation and their impact of regulatory choices. The structure of the paper is the following: In the next section, we shortly review various types of information insufficiencies in biodiversity conservation efforts. In section 3, we examine major regulatory tools for biodiversity and their bearings on information constraints. Section 4 concludes.

2 Information insufficiencies in biodiversity conservation

Information insufficiency presents one of the greatest challenges to biodiversity conservation (OECD, 1999). Information insufficiency arises from many aspects for the regulator to take effective conservation measures. The efficiency of many regulatory tools (e.g. standards and limits, charges and taxes, contracts etc.) that are used to internalize the environmental externalities critically depends on the amount of information regulator has on the marginal benefits and costs of abatement / conservation. Besides serving as a prerequisite for effective regulation, information per se can well be a goal of regulation in dynamic settings. In this section we review various informational constraints faced by regulators and identify four types of information failures in making conservation decisions: biological uncertainty, natural variability, hidden individual information, and monitoring problem[1]. All these four types of informational failures result in insufficient information on the marginal benefit and cost curves of conservation that are essential for regulatory tools to effectively internalize the externalities.

First type of information insufficiency comes from biological uncertainty. Even though recent years ecological research has greatly furthered our knowledge of the complex aspects of biodiversity, such as ecosystem changes, habitat patchiness, and the role of natural and human-induced disturbances on biota (e.g. Reid and Miller, 1989), we still only have very limited knowledge for biology process (e.g. threshold values), which results in the uncertain forms of relationships in the system. Many fundamental questions about several aspects regarding the specific levels and their linkage at which biodiversity may be considered remain

unanswered. We do not know, for example, how many species the world holds, even to an order of magnitude, much less the range and habitat each species inhabits. The impacts of habitat loss / fragmentation on genetic diversity and how biodiversity influences the ability of ecosystems to withstand stress are poorly known; so are the impacts of landscape fragmentation on the functioning of ecosystems, population viability and the functions and activities of many individual species (Myers, 1995; Ehrlich and Daily, 1993; Myers and Simon, 1993; Perrings et al. 1992; Solbrig, 1991). The impact of changing pattern of land use upon biodiversity is highly complicated and research has just begun. We poorly understand in quantity, if not in quality, how the encroachment of agricultural production system (especially in an uncoordinated manner) cause habitat loss and fragmentation, how air and /or water pollution, excessive sedimentation of water course and excessive hunting and logging lead to species loss even when natural habitat remain intact; how adoption of new farming practices contributes to decline of biodiversity of crop species on farm; and certain agrochemicals leads to decline in biodiversity within species (Srivastava, et al. 1996).

Biological uncertainty inherent probably is the greatest obstacle for proper evaluation of biodiversity enhancing activities, but there are possibilities for improving information over time. Learning aspect of this process provides interesting research prospects. According to Tomas et. al., learning may be passive or active. Passive learning has not been addressed in any substantive fashion in the biodiversity literature, although there exist more general economics analyses upon which such analyses could be based. For example, the exact locations of the thresholds are unknown until the biodiversity loss process passes the threshold, and information jumps. Some work on dynamic resource problems with uncertain technology might offer some insights to this problem (e.g. Dasgupta and Stiglitz, 1981), but little research has been conducted in the biodiversity context. Active learning refers tosocial experiments whose main purpose is to generate information. These would involve deliberately manipulating the system in what may appear to be a sub-optimal way in order to improve our understanding of the relevant relationships. While such experiments may be politically unpopular, they might improve efficiency in the long run.

Second type of information insufficiency is natural variability. Natural variability in biodiversity conservation context is associated mainly with stochastic shocks from uncontrollable factors such as climate change and invasion of some alien species to local ecosystem. The distinction between natural variability and biological uncertainty arises from the ability to learn over time regarding the latter, while natural variability is mainly uncontrollable and stochastic. Unlike crop markets, there are not even partial risk and insurance markets to hedge/control the randomness in environmental effect. Therefore any state-contingency must be built into the conservation policies under consideration. This physical uncertainty feature implies that there will be a range of possible biodiversity outcomes observed by regulator with any conservation effort. The disappearance of certain birds in one area for example might well be a result of weather change rather than the actual logging activities taken in that area. Researchers are increasingly aware of the stochastic influence resulted from physical uncertainty (e.g. Segerson, 1988). In the model Segerson presented in 1988 in the context of non-point source pollution, for example, the ambient level is represented by a probability function that is conditional on the abatement practice. This type of models also corresponds to the situation where the environmental impact is deterministic, but the regulator can only observe the impact level imprecisely and inaccurately with a probability distribution.

Third type of information insufficiency, hidden individual information, stems from asymmetric information between the regulator and landowners. Landowners to be regulated are diverse and heterogenetic in land development potentials, production technology, conservation awareness, habitat and specie situation, conservation skills, and attitude toward risks (Smith 1995, Smith and Tomasi 1995, Horowitz and Hueth 1995, Wu and Babcock 1995), for which oftentimes landowners either have better information or are in a better position to collect the information (Goeschl and Lin, 2003). When serious information asymmetry exists between a regulator and landowners, the design of efficient environmental policy is hampered.

There are two types of information asymmetries studied by literature, one related to information stock (status information asymmetry) and the other related to information flow (ability information asymmetry) (Goeschl and Lin, 2003). Status information asymmetry comes from landowner's superior information about her own (e.g. production technology) and the land (e.g. habitat and specie situation), while ability information

asymmetry states the ability differences between the regulator and landowners in collecting these information. Conventional arguments for status information asymmetry root in specialization but recent literatures emphasize the role of self-conscious investment in information discovery (Cremer et al. 1998a and b). It is the ability asymmetry that gives rise to these investment decisions in collecting information. There are many plausible reasons that both types of information asymmetries (status and ability) exist, with legal barrier being an important one in biodiversity conservation context. In United States of America, for example, according to Natural Heritage Data Center Network's estimate, 70% of species listed under the Endangered Species Act depend on nonfederal land for the majority of their habitat (Polasky and Doremus 1998). Without land owners' consent, legal barriers exist for the regulator to enter the private land and collect biodiversity-related information on these lands, which implies the cost / ability asymmetry in collecting information between the regulator and the landowners.

Status information asymmetry, and the efficiency loss associated with it, is well studied in economics literature built on the seminal work on mechanism design theory under asymmetric information by Hurwicz (1972), Groves (1973), Mirrlees (1971), Baron and Myerson (1982) and others. Not until recent years did economists start studying ability information asymmetry (Cremer et al. 1992, 1998a, 1998b, Sobel 1993, Lewis and Sappington 1997). These studies, all starting with the assumption that there is only information acquisition cost (ability) difference between the regulator and agent, try to endogenize the information structure and evaluate the regulated agent's incentives to acquire information. Goeschl and Lin (2003) studied dual information asymmetry situation where both types of asymmetry exist in the context of biodiversity conservation. There are also some literatures on the incentives of agents to acquire information about the value of an object before participating the auction (Lee, 1982; Matthews, 1984; Milgrom, 1981; etc.).

Last type of information insufficiency arises with monitoring problems closely associated with regulator's inability to observe directly individual's conservation efforts and impact on the biodiversity or to infer them from observable inputs (i.e. land development) or the total biodiversity loss.

There are a number of contributing factors to regulator's inability to monitor input (effort level) and output (impact) of conservation measures, as Xeppapadeas observed in the context of pollution, "such as equipment and personnel limitations, or inability to enter the polluter's premises. On the other hand, while it is relatively easy to determine whether the polluter has installed adequate equipment for pollution abatement, it is difficult to make sure that this equipment is being operated at the desired level. As a result, the development of efficient measurement methods could be very costly" (Xepapadeas, 1991). Therefore, the government faces a situation where it could be prohibitively costly to measure with sufficient precision the individual's production of / contribution to conservation. In environmental economics literature, this is addressed by standard moral hazard models in which conservation efforts are privately observable (see Laffont and Tirole 1993 among others).

Monitoring problem sharpens when the number of landowners increases. When there is only one landowner in a setting – either where one farm accommodates all the species under consideration, or where many landowners are sufficiently independent one another to allow them to be regulated individually – there is no question of "responsibility" for observed biodiversity loss (Dosi and Moretto, 1994, 1997). However, it is more likely that many landowners' (diffuse) activities combine to determine a single measure of biodiversity loss at a given location. This is similar to non-point source water pollution question in the literature and moral hazard models and adverse selection with multiple firms are discussed by, respectively, Segerson (1988) and Xepapadeas (1991, 1992) and Shortle and Dunn (1988). The existence of multiple landowners raises a number of difficult regulatory issues, most of which relate to information and monitoring. It is no longer possible to attribute the biodiversity loss to the activities of any one landowner since "damages" are not separable across landowners. Thus, it is necessary to infer each landowner's potential contribution in case of violation. The larger the number of landowners, the more difficult is the monitoring, and the more difficult is the information problem for both regulator (obtaining information about landowners) and the landowners themselves (obtaining information about each other). The existence of more landowners implies a greater potential free-rider problem, if each landowner perceives its own damage to biodiversity to be small relative to the group, and decreases the likelihood of cooperation among landowners to reduce

biodiversity loss. Moreover, this observability problem is particularly severe in biodiversity conservation as many species (e.g. migrating birds and animals) roam across a vast territory. The regulator in general is in a difficult position to detect biodiversity loss /specie endanger in a certain location, not to mention to attribute this loss to individual landowners. Researchers and regulators duly discuss in this context regulatory options like team reward/punishment (e.g. Groves, 1973) and random reward/punishment (e.g. Xepapadeas, 1991), which we will discuss later.

Even though information is one of the greatest constraints in effective conservation regulation, the effort of collecting information is no less controversial. Property owners and regulators have sharply divergent view of the desirability of increased information about species status and distribution. In North America, for example, the Endangered Species Act has been the center of a fierce debate. On one side, groups representing various economic interests have called for radical reform of the law in order to reduce economic impacts and to protect private property rights. On the other side, environmental groups vehemently oppose any weakening of the current law, contending that it must be maintained or strengthen to ensure the long-term survival of endangered species. Conservation proponents favor greater efforts to collect information about the status of species, including location and health of population and habit (e.g. Wilson, 1992). By contrast, property rights advocates vociferously attack any move to expand government information collection efforts, such as the short-lived National Biological Survey.

3 Regulatory instruments for biodiversity under information constraints

Environmental economist and regulators have been developing and practicing a wide array of regulatory tools to preserve the biodiversity around the world, each of which subjects to different information constraints. We discuss in this section three major types of regulatory tools, namely land takings, environmental taxes, and contracts, and the informational constraints they face. Summarized in Table 1, these three measures portrait a wide spectrum of regulatory choices, under which many other regulatory tools, land access restrictions for example, fall into. In practice, a combination of different regulatory measures oftentimes is a more desirable choice to tackle the pressures that lead to biodiversity loss (OECD, 1999; Smith, 1995).

3.1 Land takings and land access restrictions

The traditional instruments of biodiversity conservation in Europe and North America have been the acquisition of land (takings) by the state with or without compensation and the imposition of restrictions on the use privilege of private property. Examples include establishment of national parks and reserve zones worldwide. The advantages of these approaches are that they are conceptually easy to understand and that pre-formulated

Table 1. Three regulatory choices for biodiversity conservation.

Regulatory choices	Land takings and land access restriction	Environmental taxes/ Changes and removal of adverse Incentives/Subsidies	Contracts
Producer of public goods	Public	Private	Private
Financial costs to the regulator	High	Low	Medium
Landowners' cooperation	Often times mandatory	Mandatory	Voluntary

goals can be achieved with high probability, as long as adequate monitoring and enforcement can be assured. (OECD, 1999)

These approaches however have several problems and limitations besides imposing high financial costs to the regulator. The problems have been discussed widely in the literature and many have to do with insufficient information (see Shogren and Tschirhart 2001 for a review). As a consequence of insufficient information on land's conservation values (because of any type of aforementioned informational failures), regulator's land acquisition decisions are prone to efficiency losses. Without sufficient conservation value information it is imaginably difficult for the regulator to make trade-offs among conservation projects given a limited governmental budget. When it comes to a specific land parcel, an acquisition decision has to be made upon the comparison between conservation value and market value, which is problematic without sufficient information on the former (Polasky and Doremus 1998). In the case of acquisition, the government not only asserts ownership of the land, but usually also takes on a management role. Similar to other settings, generating a public good, in this case conservation, through public production is prone to suffer from efficiency losses implicit in public production such as lower productivity and excessive opportunity and management costs of the conservation activity (Innes 2001). Apart from the problem of the government as an inefficient producer, compensation is fraught with various difficulties. If compensation is absent or too low, governments may be tempted to oversupply conservation. Also problematic incentives may be created for landowners (such as 'shoot, shovel, and shut up', see Brown and Shogren 1998), and little cooperation can be expected from landowners in prospecting for biodiversity (Polasky and Doremus 1998). If on the other hand a compensation scheme is implemented, basing compensation on opportunity costs (market value of the land mainly) may be problematic since it will encourage early development of land in order to raise the payment (Blume et al. 1984). Basing compensation on benefits (paying for number of birds increased for example) on the other hand will be problematic since, with only a few exceptions that the results can be monitored through satellite (Pagiola et al. 2003), it generally requires the cooperation of the landowner and cannot be relied on to produce a reliable result (Polasky and Doremus 1998). Imposition of land use restrictions is less drastic than land takings, but to the extent that they are imposed, their impact is fundamentally identical to that of land takings in direction, if not in volume (Innes 2001).

Both land takings and land use restrictions are quantity-base instruments. Compared to price-base instruments such as taxes discussed in the next section, quantity-base instruments were traditionally regarded less affected by environmental benefit (damage) uncertainties (due to aforementioned biological uncertainties and natural variability) (Weitzman 1974 and others). Environmental economists acknowledged that benefit uncertainty on its own has no effect on the identity of the optimal efficient control instrument, but that cost uncertainty can have significant effects, depending upon the relative slopes of the marginal benefit damage and marginal cost functions. Adar and Griffin (1976, p. 180) stated ". . . the introduction of uncertainty in the damage function has nothing to say about the choice of policy instruments" and similar views were hold other environmental economists (Fishelson 1976; Baumol and Oates 1988). Starvins (1996) observedin the real world, we rarely encounter situations in which there is exclusively either benefit uncertainty or cost uncertainty and in the presence of simultaneous uncertainty in both marginal benefits and marginal costs and some statistical dependence between them, benefit uncertainty expressed through the covariance term can make a difference for identifying the efficient policy instrument. A positive correlation tends to favor the quantity instrument, and a negative correlation favors the price instrument. Research along this direction however has been slighted since.

Apart from the theoretical shortcomings of the traditional approach of providing conservation, over the last twenty years this model of biodiversity conservation has encountered several practical and political limitations. First, conservation opportunities on public land are naturally limited when significant amounts of target species exist on private land (see for example Innes, Polasky and Tschirhart 1998). At the same time, this model of conservation cannot reach forms of biodiversity, such as agro-biodiversity, where conservation is inherently tied up with continuing private production activities. In the managed landscapes of Europe that have been in productive agri- or silvicultural use for many centuries, a significant proportion of biodiversity falls into this category. The involvement of the landowner as the manager of the essential production input land is critical in these circumstances. A second limitation has been the increasing political cost of limiting

the property rights of landowners and practical experiences with the adverse conservation incentives contained in some of these measures. The third limitation has been the questioning of the logic of public production of public goods and a shift in economic policy in many European countries, leading to a retreat of the state from production activities. This had two effects: On the one hand, for new projects there has been an interest in alternatives to the conventional model, such as contracts, through which the private production of public goods would be carried out. On the other hand, for existing conservation projects the retreat of the state has created a necessity to develop alternative instruments as a result of management of significant land assets having been transferred to newly privatised entities. To manage these fundamentally new relationships between public bodies and private corporations, new instruments have to be developed.

3.2 Environmental taxes/fees and removal of adverse incentives

One important change in biodiversity regulation over the past twenty years has been the move towards new instruments for the private production of public goods through price mechanisms – imposing environmental fees /taxes, removing adverse incentives / subsidies, or both. We include in environmental taxes the wide range of non-compliance fees, nature taxes, and conservation levies being applied around the world to discourage biodiversity damaging activities. Removal of the adverse subsidies, which are usually the results of government support programmes to agriculture, is fundamentally equivalent to imposition of environmental taxes (See OECD 1999 for a review of countries' practices).

These price-based incentives measures which aim to internalize the externalities are easily understandable but only applicable in situations where impacts are easily measurable (e.g. hunting) and sources of impacts can be easily monitored. Informational insufficiencies can greater jeopardize the efficiency of these measures. For the discussion below, we focus on two types of these taxes – the Pigouvian type and the Ambient Tax type. Most taxes we find in biodiversity conservation are Pigouvian type and ambient tax, originated in water and air pollution regulation, is often applied in biodiversity conservation projects where collective/team reward/ punishment is implemented.

There are considerable amount of literature on how a system of Pigouvian taxes can generate efficient outcomes by internalizing the negative externalities and therefore inducing individual agents to produce the public goods (biodiversity) at the socially desirable levels (e.g. Baulmol and Oats, 1988). However, this is critically dependent on the condition that marginal benefit and cost curves are observable with sufficient accuracy and at a sufficiently lost cost. Weitzman (1974) and others show how uncertainties of marginal benefit and cost curves can result in inefficiency of such taxes.

However, when an individual's damage to biodiversity cannot be observed with sufficient accuracy at a reasonable cost because of unknown biological process (biological uncertainty), stochastic influences (natural variability) and / or because of the inability to measure individual contribution to the environmental problem (monitoring problem), Pigouvian taxes will be not appropriate. An ambient tax system has been proposed by some economists such as Segerson (1988) and Xepapadeas (1991, 1992) in context of environmental pollution.

"[Ambient] taxes are essentially a charge per unit deviation between a desired and a measured ambient concentration level, and are imposed on every potential polluter once measured ambient pollutant levels exceed some desired cutoff level" (Xepapadeas, 1995a).

The approach proposed by Segerson is composed of two parts. The first is tax/subsidy payment that depends upon the extent to which the total ambient level (observable) exceed the cutoff level, the suspected polluter pays a tax proportional to the excess, while ambient levels below the cutoff result in a subsidy. The second part is fixed penalty imposed whenever ambient levels exceed the cutoff. This scheme is similar to on described by Holmstrom as a solution to free riding in the context of organizational structure. By eliminating the need for firm level monitoring of emissions or abatement effort, the mechanism can lower a regulator's administration costs. In addition, Segerson' approach solves free rider problem by imposing a penalty equivalent to the full marginal benefit of reduced ambient pollutant levels, rather than just paying a share of

it, on each firm[2]. However, Sergeson'spenalize all mechanism does not have government's budget balancing condition, which would require the regulator to dip further into a general revenues (in case of subsidies) than would the random penalty scheme proposed by Xepapadeas (1991).

Xepapdeas (1991) advocates a combination of subsidies and random penalties when only aggregated ambient level can be observed. This random penalty approach was much criticized because of its limits (Kritikos, 1993; Herriges et al. 1994). First, contrary to the original claim in Xepapadeas, random penalties cannot be used to achieve compliance if firms are risk natural. Budget balancing still requires that each firm pay, on average, only a fraction of the damages associated with pollution emissions. Second, the random penalty mechanism may face problems in both political and legal arenas, due to the random assignment of the penalty in the event of shirking. Firms that consistently comply with their assigned abatement objective can still be penalized. Finally, the random penalty mechanism relies on the assumption that each firm treats the other firms as being in compliance otherwise multiple equilibria problem remains to be solved.

Mix of Pigouvian tax and ambient tax is further proposed by Xepapadeas (1995b). The paper argues that severe monitoring problems make Pigouvian taxes preferable to ambient taxes as the latter does not require individual level of observibility. However, when the information insufficiencies increase along the dimension of natural variability or biological uncertainty, increase in observability of individual emissions through, for example, investment in pollution monitoring equipment might be desirable for both the regulator and the agents – given agents are risk averse. Increase in observability of individual emissions will lead to a reduction or even abolition of ambient taxes and increase of Pigouvian tax. Therefore, Xepapadeas (1995) shows that under uncertainty the efficient regulatory scheme is a mix of Pigouvian and ambient taxes. The Pigouvian fees are imposed on emissions / environmental damages revealed by the polluting firms in exchange for a lower ambient tax.

3.3 Contracts

Another important phenomenon of the move towards new instruments for the private production of public goods has been the rise of contracts between the relevant public entity (such as conservation agencies) and private landowners. Contract mechanisms are receiving increasing attention in recent years worldwide to encourage biodiversity-friendly agricultural practices. One example is the Regional Integrated Silvopastoral Ecosystem Management Project implemented by the World Bank in Colombia, Costa Rica, and Nicaragua (Pagiola et al., 2003). Under these types of contracts, locals are paid to generate biodiversity conservation.

A key concern for both researchers and policy makers in the development of such contracts has been to ensure that the conservation contracts are drawn up as efficiently as possible. Contract design is therefore a major consideration and has increasingly attracted the attention of environmental economists.

Initially, the literature identified as the source of such efficiency losses the asymmetry of contract-relevant information (hidden information) between the conservation agency (the regulator) and the conservation provider (the landowner) with respect to the cost of conservation (Smith 1995, Smith and Tomasi 1995, Horowitz and Hueth 1995, Wu and Babcock 1995). This perspective leads to casting the problem in terms of a standard principal-agent problem with two types (typically low- and high-efficiency) or a continuum of types (Hurwicz 1972, Groves 1973, Mirrlees 1971, Baron and Myerson 1982 and others).

It has been noted subsequently that one serious shortcoming in that literature is the underlying assumption that the costs and/or benefits of preservation are actually known to the agent. This assumption has been attacked as unrealistic on a number of grounds: Often, there are no existing markets for the outputs of conservation activities, so both agent and principal will find it hard to assign a proper cost and/or benefit estimate to a particular conservation activity. Also, collecting information about the cost structure of complying with obligations regarding inputs and/or outputs is costly so that landowners will not enter negotiations fully informed about their own costs while the regulating agency cannot collect this information without considerable cost, consent, and often support of the landowner (Polasky and Doremus 1998). A second generation has

therefore started to explore the issue of information collection in the context of biodiversity conservation in order to provide answers to situations where the both principal and agent are imperfectly informed, but differ in their ability to collect information either for technical (capital) or legal (property rights) reasons (Polasky 2001).

Goeschl and Lin (2003) studies a mixture of asymmetries between the conservation agency and the contracting landowner, one relating to asymmetric status regarding information about the type of landowner (low- or high efficiency) involved in the contract and the other relating to asymmetric ability to collect contract-relevant information that is unknown to both parties at the outset of the contract negotiations. As a typical example, think of a conservation contract that requires the contracting farmer to provide adequate habitat for some species. Informational asymmetry will arise on the one hand because the farmer will have information about the opportunity cost of giving up agricultural land based on his intimate knowledge of his land assets. This information will not be available to the conservation agency. On the other hand, prior to a careful inspection under the consideration of habitat provision neither the agency nor the farmer will know whether additional resources will be required to provide adequate habitat on the land under consideration. Examples would be measures to ensure higher soil moisture or different cultivation patterns. On one farm, the land may be adequate as it is, on another, certain measures will be required to ensure adequacy. Since there will commonly not have been a need to collect this information at some previous point in time, both the farmer and the conservation agency will not know the additional cost to the farmer of providing adequate habitat. What makes this information deficiency relevant to consider in the contract, however, is that the farmer will have much greater scope to ascertain the adequacy of his land for the activities to be contracted over than the agency for both legal and technical reasons. In situations that involve such a combination of informational asymmetries between the conservation agency and the landowner, the agency needs to consider not only the static information asymmetry, but also the differential ability of the parties to become informed about contract-relevant parameters. If conservation agencies take these aspects into consideration, we show that we would expect to observe very different contract negotiation strategies than those optimal under either pure status or pure ability asymmetry.

4 Concluding remarks

Informational constraint represents one of greatest challenges to both environmental economists and policy makers in regulatory choices. The nature, type, and extent of informational insufficiencies have profound impacts on regulatory measure choices, research of which is of both intellectual vitality and real-world relevance. This review suggests an integrated framework that explicitly consider efficiency trade-offs of different regulatory measures under various informational structures will be a key step in enhancing our understanding of this area further.

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Footnotes

[1] We refer to Dosi, C and M. Moretto's work on non-point source pollution in defining various information insufficiencies.

[2] For example, if marginal damages are valued at $100, the regulatory agency will collect $100 from each pollutant for the marginal unit of ambient pollution, for a total collection of $ (100n) (Segerson, 1988).

A utility theoretic approach to define the forest landowner's minimum price demand for a biodiversity object[1]

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1 Introduction

New cost efficient biodiversity protection tools may demand bidding price definition from the seller side. For example, the commission that analysed the protection needs of the forests of Southern Finland and Ostrobotnia (Etelä-Suomen, Oulun läänin länsiosan… 2002), introduced several new instruments focusing strongly on private forests. These include e.g. competitive bidding, transactions of sites with nature value and joint network projects on forest biodiversity. In the use of these instruments, also sellers' price demand may be asked. A low bidding price increases a chance that the forest area will be selected to the biodiversity protection program. An important characteristic of the introduced instruments is that both the seller and the buyer can retire from the negotiations if the conditions of the protection contract can not be accepted.

For non-industrial private landowners it can be difficult to define the price demand of the biodiversity object. They should be able to compare the benefits achieved from protecting the forest area (e.g. income from protecting the area, non-monetary benefits, timber production potential of the stand after protection period) to the situation where the stand remains in timber production and probably will be clear-cut and regenerated during the following years.

In addition to the price offer only from the buyer side and in addition to stand-level examinations, a broader approach is needed in the proper price definition process. Determination of the bidding price for protecting a biodiversity object should be assessed at the holding level. In addition to the properties of the protected stand, the bidding price depends at least on three holding-level factors: (i) the production possibilities of the other forest area of the owner (i.e. is there possibilities to adapt the treatments of other compartments due to the protection of the examined forest stand); (ii) objectives of the forest owner (i.e. the importance of the biodiversity goals in relation to other goals and the substitutability between the goals); (iii) the time horizon of the protection contract (permanent or temporary protection).

[1] The text of this article is condensed from original manuscript "A utility theoretic approach to define the forest landowner's minimum price demand for a biodiversity object" by M. Kurttila, J. Pykäläinen and P. Leskinen. The original manuscript has been submitted to "*Forest Science*" and it is currently in the review process.

This study aims to alleviate the problems of this new decision-making situation by presenting a method which helps forest owners in defining the minimum price for protecting certain forest area from his holding. The approach presented in this study explicitly includes all above-listed factors into multi-objective forest planning calculations where the price is defined. The method is based on the forest owner's utility function. The presented approach is suitable for situations where the ownership of the examined forest area does not change due to the protection contract. The protection period can be permanent or temporary. Furthermore, the landowner is participating to the protection program voluntarily.

2 Description of the method

In tactical forest planning, the forest owner's goals are typically strived for by formulating and solving a planning model, which consists of (i) alternative treatment schedules for individual forest stands; and (ii) the owner's utility model concerning the use of the forest resource. The utility model is optimized by searching the best combination of treatment schedules for the compartments.

In the presented method, the subsidized treatment schedules of the stand under examination for protection, and the treatment schedules of other stands, are evaluated towards the owner's holding-level utility model in the optimisation process. The result of optimization gives the optimal treatment proposal for each stand, and it also tells whether it produces more utility, at the whole holding level, to protect the examined stand with a given level of subsidy for biodiversity purposes, or is the utility bigger if the stand is clear-cut and regenerated during the planning period.

The amount of subsidy obviously affects the result of optimization. Furthermore, if the owner has biodiversity goals, the price demand will be lower. In addition, the substitutability of the objectives has an effect on the needed subsidy level. For example, if the utility loss caused by decrease in the cutting income can be partly or totally compensated with an increase in the standing timber stock, the subsidy level will be lower.

The method is formulated in the following way. Consider three goals, net income (INC), area of old forest (OLD) and timber volume (VOL), as the goal variables of the forest owner. The quantities that alternative forest plans produce the goal variables are denoted by q_{INC}, q_{OLD} and q_{VOL}, respectively. In the utility theoretic approach, these quantities are transformed to utility scale which measures the utility values that forest owner perceives from the goal variables. The first step is to specify the sub-utility functions, one for each goal. The sub-utilities are denoted by $u_{\mathrm{INC}}(q_{\mathrm{INC}})$, $u_{\mathrm{OLD}}(q_{\mathrm{OLD}})$ and $u_{\mathrm{VOL}}(q_{\mathrm{VOL}})$, where e.g. the $u_{\mathrm{INC}}(q_{\mathrm{INC}})$ indicates the sub-utility that the amount of net income q_{INC} will produce.

After specifying the sub-utility functions, the next step is to estimate the overall utility U that alternative forest plans produce. Traditional additive utility function will be used, where the idea is to calculate the overall utility as the weighted arithmetic average of the sub-utilities. For this step, the forest owner assesses also the weights w_{INC}, w_{OLD} and w_{VOL} that describe the mutual importance of the goals. Usually the weights are scaled so that they sum up to one, i.e. $w_{\mathrm{INC}} + w_{\mathrm{OLD}} + w_{\mathrm{VOL}} = 1$. The additive utility function is of the form

$$U = w_{\mathrm{INC}} u_{\mathrm{INC}}(q_{\mathrm{INC}}) + w_{\mathrm{OLD}} u_{\mathrm{OLD}}(q_{\mathrm{OLD}}) + w_{\mathrm{VOL}} u_{\mathrm{VOL}}(q_{\mathrm{VOL}}). \qquad (1)$$

To sum up, model (1) measures the overall utility that alternative forest plans formed by the compartment-wise treatment schedules will produce. The model is used to estimate the minimum price demand as follows:

a) Find a treatment schedule that maximizes the utility index U, when there are no protection limitations and no subsidy. Denote the optimum value of the utility index as U^*, and the values of the objective variables at the optimum by q^*_{INC}, q^*_{OLD} and q^*_{VOL}.
b) Find a treatment schedule that maximizes the utility index U, when certain forest stand is protected and subsidy is equal to S. The subsidy is treated as it would be timber harvesting income. Denote the optimum

value of the utility index as U_S^*, and the values of the objective variables at the optimum by $q_{\mathrm{INC},S}^*$, $q_{\mathrm{OLD},S}^*$ and $q_{\mathrm{VOL},S}^*$.

c) Try different values of subsidy and find subsidy S' such that $U_{S'}^* = U^*$. Then subsidy equal to S' is the minimum price demand that compensates the utility losses caused by the protection.

3 Example calculation

3.1 Planning area and goal variables

The total area of the example forest holding was 89.5 ha. This area was divided into 65 stands in the forest inventory. At the beginning of the planning period, the mean volume of the growing stock was very high, 174.2 m^3/ha. The proportions of pine (*Pinus sylvestris*), spruce (*Picea abies*) and broad-leaved trees were, respectively, 46.9%, 24.2% and 28.9%. The initial age distribution was as follows: younger than 20 years 5.4%; 20-39 years 23.5%; 40-59 years 10.5%; 60-79 years 13.0%, and more than 80 years 47.7%.

The minimum price demand for biodiversity protection was calculated for an old growth spruce stand (stand number 157). The characteristics of the stand were as follows: area 8 ha; total timber volume 264 m^3 /ha (volume of the saw logs 169 m^3/ha), the mean age of the trees 160 years, and the mean diameter of the trees 35 cm. In addition to these properties, the existence of big decaying trees, made the stand valuable object for biodiversity protection (Etelä-Suomen metsien …. 2003).

The length of the planning period was 20 years, and it included two 10-year sub-periods. The stand treatments were simulated to the midpoints of the first and the second sub-period. The Finnish treatment recommendations (Luonnonläheinen … 1994) were followed in simulations. Furthermore, alternatives with delayed cuttings were added for middle aged and old forest stands. For the stand 157, three alternative treatment schedules were simulated in the first phase. The first schedule was the "no treatments" alternative without subsidy. The second alternative included regeneration during the first sub-period. In the third alternative, the stand was regenerated during the second sub-period.

The holding level goals were net income during the planning period (INC), area of old forest (OLD) and timber volume (VOL) at the end of the planning period. The utility function was derived from these goals by defining weights and sub-utility functions for these variables.

The protection period of the stand 157 was set to be 20 years. It was assumed that the stand 157 can be used for conventional forestry purposes after the 20-year protection period. Hence, the standing timber volume from the stand 157 was included into calculation of the value of the VOL goal, old forest area objective and total utility.

Monsu forest planning software (Pukkala 2002) was used in the iterations concerning the minimum subsidy level. The best combination of treatment schedules from the perspective of holding-level objectives was searched by using a modified heuristic optimization based on simulated annealing (SA) technique (e.g. Dowsland 1993).

In the reference plan (no protection alternative, no subsidy) the stand 157 was clear-cut and regenerated during the planning period. After the production of the reference plan and before minimum price iterations were started, two regeneration treatment schedules were deleted among the treatment schedule alternatives of the stand 157. After this, the subsidy level was increased through an iterative process until the total utility value achieved the utility level of the reference forest plan.

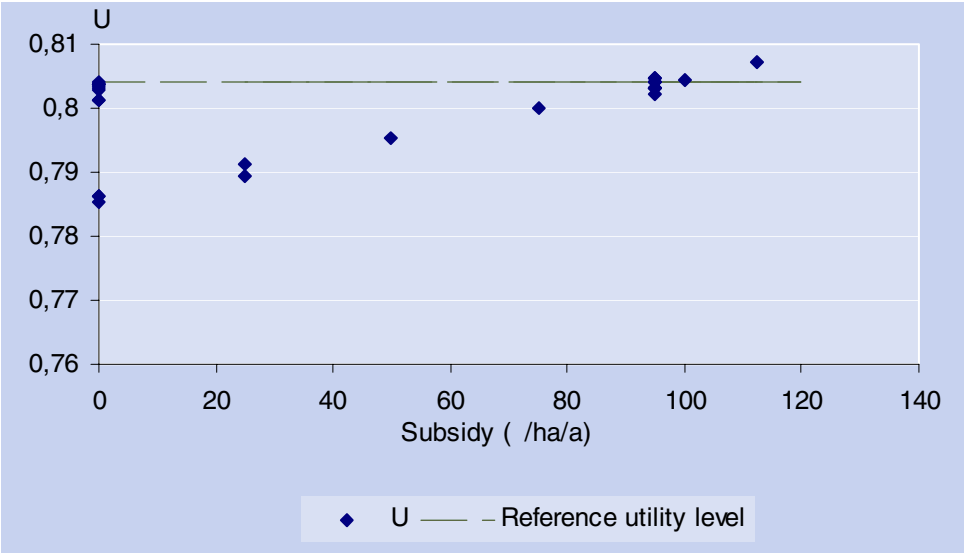

Figure 1. Development of the total utility in the 20-year protection case. The difference between two point groups at the y-axis (when subsidy=0) describes the effect of limited production possibilities due to the elimination of the regeneration alternative from stand 157.

3.2 Results

The elimination of regeneration alternatives from stand 157 caused a clear decrease in the total utility level (Fig. 1). Increasing the subsidy level increased the total utility steadily. The subsidy-level that produced the same total utility on the holding level than clear-cutting the stand was 95 €/ha/a.

The subsidy paid for the whole planning period (20 x 95 €/ha/a) was clearly lower than the stumpage value (11 400 €/ha at the midpoint of the second planning period) of the stand 157. This was due to weight given to other objectives. The stand produces utility to the owner because it is old forest and because it increases standing timber volume of the holding at the end of the planning period.

Compared to the reference plan, protection of the stand 157 changes the holding level solutions (Table 1). Due to the sub-utility formulation, net income is in all plans 300 000 €. When the stand is protected but no subsidies are paid, timber volume at the end of the planning period and old forest area are at lower level. When the subsidy is 95 €, standing timber volume and old forest area are near the amounts that the reference plan produced.

Table 1. The holding-level values of goal variables at the end of the planning period in example calculation. The subsidy is included in the net income that is presented in the table. The reference plan level situation without protection is presented in boldface letters.

	Timber volume (m^3)	Area of old forest (ha)	Net income (€)
No subsidy, stand regenerated	12 848	37.1	299 935
No subsidy, no treatment of the stand, 20-year protection	12 525	35.2	299 157
Subsidy 95 euros/ha/a, no treatment, 20-year protection	12 898	36.8	299 572

4 Discussion

Due to the holding-level analysis applied in the presented approach, the minimum price demand definition is in direct connection to the multi-objective forest planning process. Therefore, its practical applicability is rather good, as it utilizes almost the same information as the regular forest planning process should utilize.

Obligatory or voluntary forest planning process is carried out in many countries regularly, e.g. in Finnish private forests about 10 - 20 -year intervals. In this process, forest inventory is carried out, the goals of the forest owner are analyzed, and finally, the forest plan is created for the following planning period. In the inventory, the characteristics of valuable areas can be measured more accurately, and during the goal analysis the forest owners willingness to participate can be clarified. After this, the calculation of the price demand with the presented method would be rather straightforward. In addition, if the protection contract is signed, its preconditions and consequences can be included in the forest plan.

Correctness of the used utility function is a key factor of the presented method. According to other calculations that have been made with the method, the achieved price level depends strongly on the objectives, their weights and sub-utility formulations. In addition, the properties of the forest holding are, of course, important. The utility function used in the price definition can be the same that has been used to define the forest plan for all the forests of the owner. It thus has been already accepted on the holding-level. If the subsidy level defined by this utility function is not acceptable, the utility function can be adjusted. This can be the case if other factors that are not included in the utility function used in the earlier forest planning process are affecting the price definition.

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Optimal ownership of a public project, an application to conservation concessions

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Abstract

This paper addresses the issue of the management of land resources which yield conservation externalities. It focuses on the impact of ownership of a project on the investment incentives of different parties, when the project generates non-excludable benefits. The main application is a conservation project, where a conservation NGO and a governmental agency make non contractible investments, which generate an opportunity cost that has to be paid to a third party, typically a local community, in order to prevent her from destroying the value of the public project. It is shown in this context that, contrary to the result of Besley and Ghatak (2001), it is not always true that the project should be granted to the most caring party. Indeed, in some cases, granting ownership to the least caring party allows both parties to tie their own hands and leads them to maximize their investments.

The results have some implications for studying the respective roles of governmental agencies, NGOs and local communities in the management and ownership of conservation concessions, which are an increasingly used tool for conservation in developed as well as developing countries. The insights of the model are applied to a conservation concession project on a communal forest in East Kalimantan, Indonesia.

This is an incomplete and truncated version of the paper presented at the BIOECON International Conference held in Helsinki, January 15.-16.2004. The complete version of the paper, with the appendix containing the proofs of the proposition exposed here are available upon request.

1 Introduction

What is the best way to manage land resources which yield conservation externalities? Up to recently, the traditional respond to this issue has been to establish national parks or conservation areas. However, this approach has revealed a number of shortcomings and is nowadays under question, from the point of view of academics, as well as of active conservation organizations. In the mean time, a trend towards privately owned conservation projects, by conservation NGOs, private landholders or even private firms (Earth Sanctuaries Ltd for example in Australia) has been observed, with various degrees of success from a conservation viewpoint. What is the current state of the debate? Are privately owned conservation areas likely to be a good substitute to national parks? In other words, what are the respective incentives of conservation stakeholders in these various configurations of ownership?

To answer that question, one can first look at the shortcomings of the national parks approach. The establishment of national parks entails at least a limitation of use rights by local residents and sometimes land appropriation and population resettlement. One frequent criticism of this approach is the political cost of limiting the property rights of landowners or residents. For example, Innes, Polasky and Tschirhart (1998) expose the drawbacks of the land appropriation approach on species protection in the US. This issue is even more dramatic in developing countries. Cernea and Schmidt-Soltau (2003) estimate that between 190 000 and 250 000 people were adversely affected by the establishment of national parks in nine countries of Central Africa, often without any compensation. This overtaking and negation of indigenous peoples' rights is ethically indefensible, and concern about forest dependant people livelihood is increasing.

Furthermore, beyond aggravating poverty among these highly exposed populations, this approach generally backfires on the security of the protected areas. The second critic of the State driven approach indeed concerns its efficacy. A recent report by WWF-Forest Alliance relates that only 1% of forest protected areas, most of which are under State control, can be considered as fully secure, and 60% are seriously threatened. The example of Brazil shows that even though indigenous people's rights have now been recognized on large areas of forest, their uses of the resource are largely prohibited. Meanwhile, no reliable monitoring system is provided for, and no adequate compensation is offered in exchange of these limitations put on their use rights. Local people thus exploit the resource illegally, selling for example mahogany to buyers for a fraction of its commercial price.

Such a State driven approach to forest management is under serious question today, from an ethical as well as an efficacy point of view. These critics also pertain to the general questioning of the logic of public provision of public good and a shift in economic policy leading to a retreat of the State from production activities.

Some authors (Ferraro and Simpson (2002), Ferraro (2001), Conrad and Ferraro (2000)) have presented the advantages of a contractual approach over public provision of conservation. Direct payment mechanisms aim at enabling those who benefit from environmental services to reward directly those who provide such services. Providers and demanders can be anyone, individuals or communities, NGOs or governments. Conservation payments are an increasingly used tool for conservation in developed as well as in developing countries. In Europe, 14 nations have spent an estimated $ 11 billion between 1993 and 1997 to divert over 20 million hectares into long term set aside and forestry contracts (OECD 1997). In the US, the Conservation Reserve Program spends about $ 1.5 billion per year to contract for 12-15 million hectares. In developing countries, and in particular in Central and South America where they have been pioneered by Conservation International, conservation concessions are a special case of this contractual approach. Under a conservation concession agreement, national or local authorities or local communities agree to protect natural ecosystems in exchange for a steady stream of structured compensation, which emanates from conservation NGOs, governments or any other investors, including private investors.

This contracting approach has two main advantages. The first concerns its efficacy. It has come clear that forest conservation, in the face of competing land uses, requires that local people obtain some direct or

indirect financial benefit from forest resources. This cannot be ignored by any regulatory policy. The contracting approach acknowledges the importance of taking into account the incentives of the local stakeholders for which conservation must be made more profitable than poaching or illegal logging in order to have a chance to be sustainable.

The second advantage derives from a direct application of the theory of public goods due to Lindahl and Samuelson. These contractual instruments are additional tools which allow various investors other than governments to invest in conservation. Conservation NGOs or other private investors value the project and they have a willingness to pay that should be taken into account in the public good provision decision. This is essential, if we consider that biodiversity is a global public good: a national government does not aggregate the World's preferences, so additional tools for better taking into account the preferences of the rest of the world are needed. A natural question that arises is then: how does this feed back on governments' incentives to invest.

The aim of this paper is then to study the role of public and private responsibility in conservation. Increased involvement of NGOs in conservation raises two main issues. The first is inherent to public good provision, and is due to the non excludability of the benefits generated by the investments of NGOs in biodiversity protection, which shall encourage free riding by the government. One can indeed wonder whether the increased participation of NGOs does not crowd out governmental participation. For example, in Indonesia, since 1997, the PKA's (the government agency for Nature Protection and Preservation) budget has decreased by 40%, while NGOs' involvement has been growing.The second issue is linked to the complexity of investments in conservation. There are many informational problems associated to the protection of biodiversity, because of biological uncertainty, natural variability or hidden private information. Moreover, there is an inherent difficulty in monitoring performance in conservation activities. All of this contributes to contractual incompleteness. The issue of investment incentives in a conservation project is then strikingly similar to the one addressed by the economic literature on property rights and incomplete contracts in the context of firms' organization. This paper will then apply the ideas from this literature to the context of conservation.

Contractual incompleteness and the free riding effect are hence two major forces shaping the structure of partnerships between NGOs and the Government in the provision of conservation. How are the investment incentives of the parties affected in this context? Contractual incompleteness and free riding reinforce each other and lead to underinvestment. Non excludability of benefits makes breakdown from cooperation in a conservation project attractive. This is the free riding effect. Meanwhile, as contracts are incomplete, agents cannot commit ex-ante to any investments levels, so that they can easily walk away from negotiation. Contractual incompleteness also leads them to underinvest since some of the return of their investment will be dissipated during the bargaining over the surplus generated by their investments.

However, there is something specific to conservation projects: local stakeholders exert a pressure on the value of the project. If investors free ride, so that local stakeholder do not receive sufficient compensation, conservation is not made an attractive option to them, and the land ends up being converted (illegally or not) to agriculture or logged down. Local stakeholders have the ability to destroy the conservation benefits of the project to the investors. The existence of this opportunity cost of conservation, which is observable, will then be another major determinant of the optimal allocation of property rights over the project. It constitutes an additional instrument, which affects (negatively) the negotiation break down payoffs and hence the incentives of the parties to invest in conservation.

The aim of the paper is then to study the role of property rights in this situation. The general question is: What is the optimal ownership structure of an asset, when the value created by the investments constitutes a public good, in other words when disagreement payoffs are affected by the nature of externalities generated by the investments of both parties? Investments affect break down payoffs (and hence incentives to walk away from the relationship) not only through the private cost of investment, but also because of the nature of externalities they generate. In the case of a private good, granting ownership to a party is the best way to induce her to invest, because she will get the full benefit of her investment. This may no longer be true with a public good because benefits are not excludable, so that ownership loses this positive incentive effect.

The property rights issue in the context of incomplete contracting when public goods are concerned is studied in section 2 through a review of the literature. Section 3 presents the model. The main conclusion of the model is that, contrary to what has been stated in the preceding literature, it is not always optimal to grant ownership of the project to the most caring party. In some cases, allocating ownership to the party which has a lower valuation for the project allows both investors to tie their own hands and maximize their investments in conservation. The insights of the model are applied to the case of conservation concessions in section 4. Section 5 concludes. The appendix provides for a numerical example of a conservation project with two investors: a conservation NGO and a governmental agency. There always exists a transfer such that the optimal ownership structure is reached, since it is the efficient one. Yet, the example provided tackles the question whether the parties have enough incentive to reach the efficient ownership structure, in the absence of an additional transfer between them.

2 Review of the literature

The relation between asset ownership and investment incentives in a private good context has been largely investigated, in particular by Hart and Moore (1990). These authors consider a situation where two agents make complementary investments in a relationship-specific asset. Ownership of the asset allows the agent to exclude others from the use of the asset. The distribution of property rights over the assets determine the bargaining power of the agents over the returns to investment which enhances the productivity of theses assets, which in turn determines the incentives to invest. Only the owner gets the full return of his investment, while the others under invest because some of the return of their investment is dissipated during the bargaining process. Asset ownership raises the outside option of the agent: if the agent-owner walks away from the negotiation, he gets the full benefits of his (and other players') investments, while the others get zero. Asset ownership of a private asset always increases the bargaining power of an agent in surplus sharing, and thereby raises his investment incentives. The agent whose investment decision is the most important should always own the asset he works with.

Besley and Ghatak (1999, 2001) extend the issue of optimal ownership of an asset to the case of a public good. Ownership of the asset hands over the owner the decision to continue or to abandon the project in the case negotiation breaks down. This definition will be adopted in the present paper. Besley and Ghatak (2001) consider that the outside option (or equivalently the disagreement payoff) is higher for the owner than for the non owner. A key assumption in their model is that the marginal return to a given type of investment is higher in the event of disagreement when the party that made this investment is the owner. Following Hart, Shleifer and Vishny (1997), this assumption can be interpreted as saying that part of the return of the investment of a player is embodied in her human capital and cannot be realized if she is fired. In this context, asset ownership, as in the case of a private good, increases the bargaining power of an agent, and hence his investment incentives. It should then be allocated to the agent who values the project more. With transfers being possible between the parties, granting ownership to the highest valuation party raises the marginal returns to investment of all players. Nevertheless, assuming that the outside option of the owner is higher than the outside option of the non owner presumes that part of the benefits is excludable, which does not fit with the case of a pure public good.

The impact of asset ownership on investment incentives in the case of a private good and in the context described by Besley and Ghatak (2001) is the following: ownership of an asset bestows a greater outside option on the owner, and a greater outside option means a higher bargaining power in surplus sharing, and hence higher incentives to invest. However, these two positive relationships: between ownership of an asset and outside options of the owner; and between outside options and higher investment incentives; may fall apart when a public good is concerned.

A public good is defined by the non excludability and non rivalry of the benefits it generates. If benefits are not excludable and non rival, an agent can walk away from the relationship and still enjoy the benefits of his, and (more importantly) of his partners' investments. The outside option is then positive for all players (whereas

the outside option of an agent who does not own a private good is zero because there is no benefit he can capture). Investment in a public good benefits to all agents and increases all agents' default payoffs. The first consequence of this is that the positive relationship between asset ownership and higher outside option (and higher bargaining power) of the owner falls down. Since costs are, contrary to benefits, excludable, when the owner has to bear more costs than the non owner (which is likely), the relationship can even be reversed: asset ownership may decrease the default payoffs. The second consequence is to break the positive relationship between a greater outside option and investment incentives. With non excludable benefits, a higher disagreement payoff means a higher incentive to free ride, rather than to invest.

The core of the problem here comes from the fact that default payoffs are positive, what induces players to free ride. One way to decrease incentives to free ride is then to cut down default payoffs (see Matoushek, 2001). Default payoffs are minimized when parties can commit to abandon the project in the case negotiation breaks down.

A conservation project generates an opportunity cost for local stakeholders, which corresponds to the forgone development revenue of the land (in agriculture or logging). If local stakeholders are not compensated enough, they may use the asset (the land) in this alternative way, which actually destroys the conservation value of the project. This amounts for a third party (the local stakeholders) to exercising an outside option and annihilate the value of the default payoffs of the conservation parties, when the latter were unable to make conservation attractive to her.

One way to decrease the default payoffs of investors in order to increase their investment incentives is then to rely on the (often de facto) right of a private party to use the project in an alternative way that destroys the public value of the project. How can this commitment be made credible? One way is to allocate ownership to the low valuation party, since the threat of termination is credible when in her hands. This would mean that it may be socially more efficient for investors to tie their own hands by delegating the project to the least interested party, what allows them to sharply decrease their break down payoffs and increases their investment incentives. Another source of credibility is the power of the private party to destroy the public project. This actually would reinforce the argumentation of those who call for the strengthening of the rights of local people and the advocates of community based forest management.

3 The model

There are two players: the two investors in the public project: the government (G) and the NGO (N). The project is ''public'' in the sense that the benefits it generates, once G and N have invested, are non rival and nonexcludable to G and N.

The project generates an opportunity cost, B which is borne by the local users of the resource. This drives the investors to pay a cost in order to ensure the compliance of this third party. It is a compensation for the compliance of a party who does not care about the public value of the project and who is able to destroy its value. In the example of a national park, it can be interpreted as the cost which has to be paid to prevent poaching or illegal logging. In the case of a conservation contract, it is the compensation for the lost development revenues.

Timing:

At date 1, the players decide on the ownership structure. As in Besley and Ghatak (2001), it is considered that ex ante ownership provides some form of credible commitment to maintain the ownership structure ex-post. (Since parties will choose the joint-surplus maximizing ownership structure, it is in their interest to make such an ownership commitment. Besley and Ghatak (2001) consider that one way to do so is to consider a design phase at the first stage of the game in which the owner undertakes certain actions which require his continued presence until the completion of the project.)

There are two possible ownership structures: ownership by G, ownership by N.

At date 2, the two investors realize their investments. Let Y=(y_{G},y_{N}) denote the vector of investment decisions. These investments are sunk and cannot be changed.

Investments generate a non-verifiable cost: C(y_{i}). Dealing with conservation, this could correspond to the cost of the resources affected to the protection or the restoration efforts of the area (reintroduction of particular species, amelioration of the water supply, effort for the prevention of fire or salinity...). There is a quality dimension of these efforts which is not contractible. The size of these investments has also an influence on the amount of the opportunity cost: B(y_{G},y_{N}), which has to be paid to the third party.

At date 3, G and N bargain over whether to continue with the project. Transfers (between G and N and the transfer to the private party) are realized at this stage. If the private party does not receive any, or sufficient transfer, she exercises her outside option, which destroys the value of the public project.

The opportunity cost is paid at this last stage of the game; whereas the other investment costs are paid in period 2 and are sunk at date 3. However, the size of this cost is determined by the decisions taken at date 2.

As usual in the incomplete contract literature, the levels of investment in the project cannot be specified ex-ante. They cannot be guaranteed by an up-front payment. Following the incomplete contract literature, I consider that the parties bargain over the surplus once the investment is sunk using Nash bargaining, and the choice of investment depends upon the share of the surplus received by the investing party, who can here be either one of the two investors.

The ownership structure is important in defining the default payoffs in stage 3 because it affects the size of the investments at date 2, the size of the opportunity cost, and who has to pay for it.

As in Besley and Ghatak (2001), it is assumed that the owner has the residual control rights. Ownership determines who chooses to go ahead with the project in the event negotiation breaks down: the owner decides whether to continue or to stop the project. This gives the owner some bargaining power, although this is balanced by the fact that she then has to pay the outside option, which decreases her disagreement payoffs and hence her bargaining power. The higher the disagreement payoff of a party, the stronger is her position in the bargaining game. The party that values the project more has a higher bargaining position, but is hurt more in case the project stops. She will then be ready to give a positive transfer to the low valuation party in order to secure provision of the public project in the cases where the low valuation party would prefer to stop the project, whereas the reverse is not true.

The two investors, G and N, value the project to different degrees. The respective valuations by the government and by the NGO are :

theta _{G}V(y_{G,}y_{N}) and theta _{N}V(y_{G,}y_{N})
where theta _{G}>0,theta _{N}>0 are the valuation parameters of G and N.

Without loss of generality, it is considered that the NGO values the project more: theta _{N}>theta _{G}

Assumption 1:

V'(y_{G,}y_{N})}{partial y_{G}}>0, V'(y_{G,}y_{N})}{partial y_{N}}>0,
with V"(y_{G},y_{G})<0

The appendix (available upon request from the author) presents the analysis for either substitute or complement investments.

theta _{G} and theta _{N} are supposed to capture the different preferences of the agents, and V is assumed to be symmetric with respect to both its arguments.

Assumption 2:

Because this public project is non excludable and non rival, each party benefits from the other's investment:
theta _{G}V(0_{,}y_{N})>0, and
theta _{N}V(y_{G,}0)>0

This implies that the default payoff of the non owner is positive since he benefits from the other's investment without having to pay the opportunity cost.

Assumption 3:

The value of the opportunity cost is positively correlated and convex with the investment level of the two investors (for example the efforts made in water supply improvement, against fire or salinity, or more generally in restoration of the area will also enhance the agricultural value of the land):

What is more, B and its first derivative B' are assumed to be symmetric with respect to their two arguments.

Two things should be well understood. Firstly, the benefits of investment in terms of conservation and in terms of enhanced agricultural value of the land are mutually exclusive. Secondly, the benefits in land value are not externalities generated by the investments; they are rather what has to be bought off to the third part to ensure her compliance (in fact they do not come true because at equilibrium, the land is allocated to conservation and not to agriculture). This explains why B appears as a cost.

The first best level of investment is defined by:

$$\text{Max}_{y_{G}, y_{N}} (\theta_{G} + \theta_{N})V(y_{G,}y_{N}) - C(y_{G}) - C(y_{N}) - B(y_{G,}y_{N}),0]$$

The project is socially efficient when the public value of the project (minus the cost of investment) is higher than the private outside option.

In the absence of any contracting problem, the parties will choose the level of investments that maximize their joint surplus. The joint surplus maximizing level of investment by each party solves a Lindahl-Samuelson type rule.

However, when the parties do not take their investments decisions cooperatively, the owner follows the program:

$$\text{Max}_{y_{i}} \theta_{i} V(y_{i}, y_{j}) - B(y_{i}, y_{j}) - y_{i}$$
$$\text{s.t. } y_{i} \geq 0$$

and the non-owner

$$\text{Max}_{y_{j}} \theta_{j} V(y_{i}, y_{j}) - y_{j}$$
$$\text{s.t.} y_{j} \geq 0$$

We obtain the first lemma:

Lemma 1:

If investments are perfect substitute, the non owner contributes nothing and totally free rides on the owner of the project.

This leads to the first proposition:

Proposition 1:

In general, when the marginal opportunity cost is not too high, non cooperative investments levels are suboptimal. With perfect substitute investments, non cooperative investment levels are always suboptimal.

All proofs are omitted here and are contained in an appendix, available upon request to the author.

Underinvestment comes from the fact that each player does not internalize the positive externality of his investment on the other player's welfare. It is obvious that asset ownership decreases investment incentives, because the owner must bear the outside option alone. The two players must then agree on cost sharing to raise efficiency.

The model is solved backwards: the outcome of the bargaining game at stage 3 is anticipated by the agents and determines their investment incentives at stage 2. The bargaining game is solved first, and the study of the investment incentives follows.

3.1 The bargaining game

According to the timing of the game, each investor chooses her investment level at date 2. Then, at date 3, the two players bargain on whether to cooperate and share costs, with transfers being possible at that stage.

Ownership matters because it defines the default payoffs. Indeed, the owner of the project has to pay the opportunity cost, which corresponds to the outside option of the private party. The default payoffs are the payoffs the players receive in case negotiation breaks down. They are different according to who owns the project since the owner has to bear the opportunity cost. Another source of difference is the different valuations of the project by the players. In case of break-down in negotiation, the owner decides to go on with the project only if she receives a positive payoff after having paid for the opportunity cost. In that case, since she receives the benefits of the public good, without having to pay the opportunity cost, the other party receives a positive break-down payoff (denoted DP^i).

The players adopt Nash bargaining. They split their renegotiation surplus half, half, over the disagreement point.

The transfer from player j to player i, when i is the owner is:

$$t_{j}^{i} = [\theta_{j} - \theta_{i})V(Y) + B(Y) - DP^{j} + DP^{i}]/2$$

The idea is the following: When player N is willing to go on with the project alone, G cannot be induced to contribute, there is no transfer, G free rides on the NGO. When the disagreement payoffs of G and N are such that the NGO does not want to go on with the project alone, the government, if he wants the project to be completed, has to induce the NGO by giving her a positive transfer.

When G is the owner, the disagreement payoffs of both players are more likely to be zero, since G values the project less. In that case, the government terminates the project if he receives no transfer. Only the prospect of a positive transfer received from NGO can then induce G to invest.

These transfers are credible because the owner has a credible threat of termination in the configuration where those transfers take place. Transfers happen only if the owner has invested. If there is no transfer, the owner decides to terminate the project. It is hence in the other party's interest to keep his promise and give the transfer.

Since $\theta_{G}<\theta_{N}$, G is the low valuation party. When made the owner, G is less often willing to undertake the project alone than N is. N has to induce G to invest, in the cases where G would abandon the project whereas N would be willing to continue. This happens whenever the opportunity cost is higher than G's valuation and lower than N's. N can induce G to invest by giving him a positive transfer in the case he has invested. This transfer is credible. Indeed, in this range of values, if G does not receive any transfer, he does not go on with the project and the value of the project is destroyed. Concerning N, she gets sufficient utility from the continuation of the project in this range of values to be willing to give a positive transfer to G. Anticipating the positive transfer, G will invest at the second stage. In those situations, if N was the owner, she would undertake the project alone, and G would not participate.

Result 1: Public-NGO partnership occurs more often when the low valuation party is the owner, in the sense that it occurs under the same ranges of values of the opportunity cost than under N's ownership, and under all the additional values for which the NGO would have been willing to invest alone.

The anticipation of the outcome of this bargaining game determines the investment incentives of the agent at the preceding stage.

3.2 Incentives to invest under the different ownership structures

Three cases arise depending on the scale of the opportunity cost relative to the parties' benefits:

Case 1: When B(Y)<theta _{G}V(Y): the opportunity cost is smaller than both parties' valuations. Both parties value the project enough to be willing to go on with the project even if they are forced to proceed unilaterally.

Transfers are nil, the non-owner will always free ride on the owner and investment levels are suboptimal (they correspond to the non-cooperative case). NGO ownership is then the best solution, since the NGO values the project more and sets a higher level of investment in case she is the owner, than the Government does.

Proposition 2: When the opportunity cost is not so high relative to the project benefits that either the NGO or the government would want to abandon the project if it is forced to proceed unilaterally, allocation of ownership to the party who has the highest valuation is welfare enhancing.

Case 2: When theta _{G}V(Y)<B(Y)<theta _{N}V(Y). The opportunity cost is situated between the two parties' valuations of the project. This means that the low valuation party would want to abandon the project if she was forced to proceed unilaterally, while the high valuation party would like to continue.

In this ''intermediary'' situation, G-ownership improves upon N-ownership. If N is the owner, she invests since B(Y)<\theta _{N}V(Y). Knowing this, G cannot be made to contribute and then free rides on N. If, on the contrary, the low valuation party is the owner, the high valuation party has to make a positive transfer in order to induce her to internalize the positive externality of her investment on the high valuation party's welfare and thereby induce her to invest.

Allocating ownership to the low valuation party strategically compels both parties to participate, whereas only the high valuation party would invest if she was the owner, while the low valuation party would free ride. Affecting negatively the disagreement payoffs allows reaching a more efficient level of provision. By granting ownership to the low valuation party, the disagreement payoffs are nil in a larger number of cases, what compels both parties to come more often to an agreement on ex-post surplus sharing .

Lemma 2: When the opportunity cost lies between the two parties' valuations, allocating ownership to the low valuation party induces parties to cooperate and maximize the joint surplus.

The impact on parties' welfare follows:

Proposition 3: When the opportunity cost is such that only the high valuation party would be willing to go on with the project if negotiation breaks down, low valuation party ownership is welfare enhancing.

Case 3: When (theta _{G}+theta _{N})V(Y)>B(Y)>\theta _{N}V(Y). The opportunity cost is so high relative to each party's benefit, that neither the NGO and the government would want to proceed with the project unilaterally. Still, it is low enough that the project is socially desirable: in that situation, the investment incentives of both parties are identical under either ownership structures.

When N is the owner, she invests if there is a positive transfer from the government to the NGO. When G is the owner and invests, there is a positive transfer from N to G.

The players have to cooperate in order to reach a positive level of investment. Who owns the project does not affect the level of investment; it only determines who makes the transfer. Corollary: In the case where the opportunity cost is so high that neither party would go on with the project if forced to proceed unilaterally (but still low enough so that provision is socially desirable), the ownership structure is irrelevant.

4 An application to conservation concessions

The ideas developed in this paper shed some light on two very actual issues. The first issue concerns the relevance of establishing conservation projects negotiated directly between conservation NGOs and private landholders; and the main message is that these ''direct'' deals may induce free riding from the government and thereby drive away from optimal investment levels. The second issue is related to the debate on local communities' empowerment and on devolution of ownership rights to communities. The main message is here that these two approaches have very different implications on the investment incentives of conservation investors.

4.1 The impact of conservation concession deals on investment incentives

The model developed in this paper can encompass most of the regulatory instruments used in conservation. Land appropriation and the establishment of national parks would fall in what was considered as case 1: the government is the owner and provider of conservation and the NGO does not intervene. Conservation contracts between NGOs and States would fall in the ''intermediary case'': G owns the project, and N is the initiator of the project and provides a transfer to G. Conservation contracts with private landholders or communities are a special case, where the third parties, which do not value conservation per se, remain the owner of the land to be protected. What is the impact of these new conservation tools on investment incentives of conservationists.

Conservation concessions are a contractual agreement, under which national authorities or local resource users agree to protect natural ecosystems in exchange for a steady stream of compensation payments from conservationists or other investors. They require a negotiated agreement between an investor and either a government or resource user.

In the case of a conservation concession with a State, the national government remains the owner of the protected area. This case corresponds to what is considered in the ''intermediary case'' of the model. The government would not undertake the conservation project by itself (otherwise a national park would already be in place), and is assimilated to the low valuation party. Conservation concession scheme allow some NGO, who values conservation more, to invest in order to create a conservation area on a land which would otherwise have been allocated to different purposes, logging for example. According to the results of the model, a transfer should be made from the high valuation party (NGO) to the low valuation one (the government agency) in order to induce the latter to invest. Existing conservation concessions arrange for such transfers. Some conservation concessions have for example been negotiated with the government of Guyana. In July 2002, Conservation International was granted a renewable 30 years Timber Sales Agreement to manage 80 000 ha of forest. The agreement involves payment of acreage fees and royalties comparable to an active timber concession. It also provides for other payments, namely aimed at community support, rangers training or monitoring, and which are assimilated as the non contractible investments in quality in the model above. Similar agreements have also been negotiated with the governments of Peru and Cameroon, and provide similar payments from the investing NGO to the concerned government.

A few conservation concessions have very recently been negotiated with communities. The Centre for International Forestry Research (CIFOR) has proposed to establish such a conservation payments scheme in

Setulang village in East Kalimantan, Indonesian Borneo. In Indonesia, communities have been awarded back their rights over their village forests during the decentralization process (revised basic forest law (UU41)). In many cases in East Kalimantan, rights have already been sold to logging companies, and forests turned into IPPK (Ijing Penabang dan Pemeringkan Kayu, the logging licenses). The village of Setulang has however resisted up to 11 offers by various logging companies to buy the rights over its 5 300 ha large village forest reserve to log it down. CIFOR has then proposed to offer some conservation payments to the community, through the form of a community-based conservation concession, in order to secure the conservation of this forest. The understanding of the proposal by CIFOR is that ''for an amount of money somewhat less than they are being offered by a logging company, Setulang people would agree to maintain the forest and to use it for non timber forest products extraction, limited timber for subsistence use and eco-tourism''. The proposal stated on a figure of US $ 30 000 ''to negotiate such a concession and make a conservation payment to the community for the first few years''.

The setting developed in this paper can help understanding the role of the different actors concerned by such a project: the local community, the conservation NGO and the (local) governmental agency; and the consequences of this configuration of ownership on the investment incentives of the investors in conservation. Let us reconsider the model of section 3 with the new roles of the three agents : the high valuation party N, the low valuation one G and the private party. The private party does not value conservation per se. It acts as an agent whose valuation parameter for conservation is 0. The NGO and the governmental agency still value conservation, with: theta _{N}>theta _{G}>0. This assumption means that the villagers do not take into account the positive externality of conservation. The local government is more likely to take into account the externality of biodiversity protection, at least at the district level. That explains why the valuation parameter of the government is positive but lower than the one of the NGO, which is supposed to internalize the externalities of conservation at a higher scale than the government.

There are now three possible ownership structures: ownership by G, by N or by the private party. Establishing a conservation concession on a private land amounts to making the private party owner of the conservation project. The local community remains the owner of the protected area, and receives a payment from the relevant investors in conservation: NGOs, governments, or both.

According to the analysis developed in this paper, when a NGO negotiates a conservation concession directly with a community, G is inclined to free ride, which entails an efficiency loss. Indeed, if the NGO is the initiator of the project and decides to invest, the situation is identical to the case 1 of the model: the NGO invests as long as the benefits she gets from the project are larger than its costs, and the other party that values conservation less free rides. As investment is not contractible, no transfer can be made to G to induce him to invest. If the private party is the owner, G loses the threat of termination so that no transfer between N and G can be made credible. A transfer cannot be efficient either, since investments are not contractible. G then acts as a free rider.

However, there are some cases where a transfer from N to G may appear. Often, some specific investments are needed, which only the government is able to make. This is namely the case when security of land tenure is concerned. The biggest threat on the success of a conservation concession in most developing countries is indeed the insecurity of tenure rights. To come back to the example, Setulang village is in conflict with a logging company that illegally penetrates on its forest; and the situation with the adjacent villages is much tensed. The core of the conflict is the imprecise delimitation and recognition of the respective villages' forests, and the local government does not seem very eager on resolving the conflict. The security of protected areas cannot be ensured without the support and collaboration of the local government through its enforcement abilities. This amounts to saying that investments are complement: a specific investment by the government is necessary. Local governments in Indonesia, which are responsible for forest management since the decentralization laws, often back timer companies which represent fiscal (and often corruption-) revenues over conservation, which means forgone tax revenues. Although the central Government of Indonesia displays conservation objectives, the law is hardly enforced by local governments which seek to maximize their revenues and for which conservation is not an attractive option. The role of N if she wants a conservation project to be sustainable, is then to make conservation attractive to local governments. A transfer from the

investing NGO in order to induce the government to participate is needed. The question whether local governments should receive some money was a big interrogation during the design phase of the Setulang project. Some criticized this approach and claimed that it amounted to corrupting the local government. According to the insights of the model developed in this paper, this is not corruption, but rather a necessary transfer in order to induce the government to take a specific investment in the project. Without any transfer, the government will free ride.

If investments are substitute, only N invests in conservation and compensate the private party for its opportunity cost, while G free rides. If investments are complementary, there exists a possible transfer from N to G, that induces the latter to invest in conservation and share the opportunity cost with N. Hence, if G has some specific investments to make, notably in order to make property rights secure, a transfer from N is necessary (and cannot be assimilated to corruption).

The conclusion here is that establishing conservation concession on private land by conservation NGOs, without involving local governments, leads to the free riding of the government, what may raise serious concern if the government's investment is an indispensable prerequisite for the success of the conservation project. This namely appears to be the case when the rights of the local community are threatened by conflicts that involve other private parties, for example adjacent communities or loggers.

4.2 Some insights on local communities' empowerment

There is today a large debate concerning the rights of indigenous people on forest land. Facing the poor efficacy of State forestry management, from a point of view of poverty alleviation, commercial exploitation, as well as conservation, voices are raised to call for a community based management system. Securing and strengthening rural communities' forest rights do make sense, because it will certainly favour a longer term involvement of local communities toward a more sustainable management. What is more, as the possibility of exploiting the resources often exists anyway due to a poor monitoring system, the official recognition of rural communities' rights will avoid a number of conflicts and help alleviate some destructive behavior driven by insecurity. However, it seems that there is some confusion about the ways to get there: transferring or returning ownership of forest areas to the private ownership of rural communities, strengthening local use and management rights in public forests, community based management, or co-management etc. and the different consequences of theses approaches.

This paper argues that a distinction should be made between the devolution of ownership and the strengthening and recognition of local users' rights. The analysis takes as a prerequisite the necessity of acknowledging the users' rights and of offering compensation for any restriction of these rights in a conservation goal, should it be under either private or public ownership. Yet, it was shown that the control rights over the project should not lie in the hands of the private users. This means that the devolution of ownership rights to communities is not always the best solution as far as the objective of conservation is concerned. On the contrary, in some cases, granting ownership of the project to the government is the way to maximize investment incentives of both the conservation NGO and the government; keeping in mind that the recognition of the users' rights and incentives is a necessary condition for the success of a conservation project.

As a conclusion, although some may argue that local governments are an impediment to conservation, the solution here appears to be sometimes to increase the stakes and interest of governmental agencies in conservation, rather than trying to bypass them, especially if they have some specific investments to take. Indeed, securing conservation as well as community rights often needs a vastly expended capacity of the State to enforce law in forest lands to avoid invasions, squatting and illegal logging. In many countries, and particularly in Indonesia, the option is not whether occupation will continue or not, but whether such penetration will take place in an illegal and perhaps violent and chaotic manner, or instead the government will be willing and able to steer it in an orderly way. Neither NGOs, nor local communities can be relied upon for these conflicts to be avoided.

5 Conclusion

The model developed in this paper shows that the optimal ownership structure of a conservation project depends on the respective valuations of the project by the investors, and on the size of the opportunity cost it generates.

It predicts that negotiating conservation concession with States or with local communities have different implications. Negotiating a conservation concession with governments leads to a higher level of investment from both the government and the conservation NGO. However, it is an essential prerequisite for the success of a conservation project that local stakeholders' rights are recognized. Recognition and strengthening of local users' rights is indispensable, but ownership devolution to local communities might lead to underinvestment by governmental conservation agencies and hence to a lower level of provision of conservation.

6 Lead for future research

Delegating ownership to the third party may have larger implications than those exposed in the preceding section. One should also consider the investment incentives of the private party, in the case where she would be made an investor, with the investment made part of a contract. The increasing use of ''market based instruments'' in conservation are equivalent to the delegation of ownership to third parties, but also often delegation of \ the production of conservation. These ''market based instruments'' are conservation programs developed on private land, in which the private landholders sign a contract with the State or a NGO and are the one that undertake all the investments considered above as y_{i}. Conservation concessions do not exactly fit this case because they aim at the intact preservation of forest areas. But some other contracts account for some specific actions that private landholders should undertake in order to increase conservation. These contracts specify that the landholder receives a payment based on quality improvement, which could corresponds to the investments y_{i}, and is reimbursed his opportunity cost and some observable costs (for example fencing costs), which can be considered as part of B. This introduces a moral hazard dimension in the non observable effort. These contracts could then have a different impact on efficiency, according to their design, and this needs to be studied more closely. The impact on the community's incentives of a conservation contract and contract design will be the object of a future article. There are issues of moral hazard and risk sharing inherent to such contracts, which may have in turn some impacts on the investment incentives of conservationists. An integrated framework would be a very useful tool to study the relevance of different conservation tools to different institutional situations.

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Choice of the policy instruments

Biodiversity conservation competency acquisition among Finnish forest management service providers

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Abstract

After a period of intensive investment in establishment and expansion of protected areas (i.e., parks and preserves) for conservation of biota and ecosystem integrity, renewed attention has been focused on "working lands" (i.e., privately owned agricultural and forested landscape mosaics). Development and conservation of multifunctional, working landscapes is premised on the attractive idea that implementation of best management practices and resource conserving innovations will allow parcels and territories to generate sustained flows of both socio-economic and ecological services. Policy tools to stimulate changes in land management include traditional programs of governmental regulation, cost sharing, and technical assistance as well as incentives associated with more recent trends in eco-certification and corporate responsibility.

A critical dimension of a transition to rural multi-functionality is development of new technical capabilities in organisations engaged in resource management. Capabilities derive from internal and external competencies. *Internal competencies* include "in-house" human capital and organisational routines and practices, while *external competencies* take the form of status in various networks (i.e., access to capabilities of other organisations). Development of these competencies occurs within complex institutional environments including incentives and constraints stemming from state policy, commercial markets, and localized norms.

We analyse patterns of investment in competencies for biodiversity protection among Finnish forest management service providers serving non-industrial private forest (NIPF) landowners. Departing from the well-established tradition of examining attitudes and demographic characteristics of NIPF landowners to

gauge opportunities for conservation, we direct our attention to the population of technical service providers who, we believe, fundamentally shape outcomes in the forest.

Based on detailed surveys of competencies and strategic investments of public, private and collective forest management service providers in the Häme-Uusimaa region in southern Finland, we analyse the extent to which specific actors, and the territory as a whole, are positioned to establish new practices or change old practices to conserve biodiversity. Our objectives in this paper are to i) reflect on the suitability of this pilot study methodology for broader application, ii) analyse distribution of competencies in our sample of service providers, iii) explore relationships between investments in internal and external competencies to better understand patterns of complementarity and substitution. In the future, we will pursue more detailed analyses as part of an effort to identify positive models through which organisations are successfully developing conservation capabilities in line with new opportunities and constraints in forest management service markets.

1 Introdction

Beginning in the 19th century and more recently in the final decades of the 20th century, intensive investment in establishment and expansion of protected areas for conservation of species and ecosystem integrity has occurred in most forest-rich industrialized countries. Recognition of the economic costs (i.e., land purchase and administration) and social costs (i.e., diminished prospects for sustainability of rural livelihoods and traditional cultures, and further marginalisation of already poor peoples) of an environmental management strategy premised on preservation, combined with an acknowledgement that the quantity and quality of areas included in networks of parks and preserves will not ensure ecological sustainability in an increasingly crowded and economically inter-dependent (competitive) world, have served to focus renewed attention on "working lands". Working lands are generally, but not always, privately owned lands managed for agriculture and forestry. Development and conservation of *multifunctional, working landscapes* is premised on the idea that implementation of best management practices and resource conserving innovations will allow actors and regions to generate sustained flows of both socio-economic and ecological services.

This development is demonstrated in the recent changes in the Finnish forest policy institutions, an example of which is the Forest Act of 1996, where protection of biodiversity is stated as an objective for commercially managed forests parallel to the objective of sustainable production. A more recent example is the currently implemented Southern Finland Forest Biodiversity Programme (Etelä-Suomen… 2002), which highlights new policy instruments for biodiversity protection, including competitive tendering and trade of natural values. Formal policy tools to stimulate changes in land management include traditional governmental regulation, cost sharing through grants and loans, and planning and extension services (training and technical assistance). More recently, policy guidance has appeared through initiatives on eco-certification and corporate responsibility. Management practices applied in commercially managed forests are shaped by these formal policies. But, formal policy tools do not impact forest management operations in a straightforward manner.

In our conception of the relationship between policy and practice, the distribution of material practice (e.g., tree felling) in time and space is responsive to policy. That is to say, rules, norms and incentives shape the opportunity set that actors confront. These policy elements also inform actors' expectations of economic returns to the various paths of action (i.e., invest in A rather than B, make no investment and continue operations, or exit the sector). Manipulation of these external factors by actors in policy processes does not, however, translate directly into changes in material practice. The resources, sanctions and incentives flowing from national policy processes trigger strategic responses by localized actors (Wolf 2003).[1] These internal responses, for example changes in hiring practices and profile of the workforce, adoption of new administrative procedures, or investment in new patterns of collaboration, directly affect grounded material practice. Viewed in this manner, local organisations' responses to changes in their operating environment are a crucial intermediate step that lies between policy and practice. To understand how forest policy translates into changes in forest management, or to strategically pursue innovation in public and private organisations that shape forest health, this intermediate level of activity deserves attention of researchers and policy makers.

In adopting this institutional perspective, our focus is squarely on processes through which local actors create new capabilities. In the context of the preceding discussion of working landscapes, rural multi-functionality is premised on the development of new technical capabilities in organisations that shape natural resource outcomes (Blanc 2002). Applied to private forestland in Finland, NIPF owners are increasingly dependent on management service providers. Due to patterns of land ownership, the prevailing legal and economic framework, and the increasing role of technical expertise in forest management, professional forest service providing organisations are in a key position to interpret and apply new formal policies and also interpret other messages from their operational environment. In contrast to the majority of existing scholarship on NIPF, we focus our attention on the range of service providers that inform and execute forest management, rather than on the landowners themselves. Conserving biodiversity while maintaining economically viable forestry in Finland is a question of innovation within this population of organisations. In order to understand and advance such innovation, we are engaged in analysis of processes of creation of new technical capabilities among relevant organisations.

After briefly describing NIPF forestry in Finland and the organisational infrastructure serving NIPF landowners, we introduce our case study of biodiversity and forest management services in the Häme-Uusimaa Forestry Centre region in Southern Finland. We analyse the capabilities for biodiversity protection among Finnish forest management service providers serving NIPF owners. We examine the relationship between investments in internal and external competencies, and discuss these investment patterns.

2 Biodiversity policies

Following new scientific evidence of ecological degradation, a range of new formal policy commitments to biodiversity have appeared. The international political status of biodiversity has been recognized since the Biodiversity Convention signed in UNCED in Rio de Janeiro in 1992. In Finland, the Environmental Programme for Forestry, made in 1994, paved the way of biodiversity protection to forestry policy and management. Following the Programme, Finnish legislation on forestry and nature protection was revised. In the 1996 Forest act, biodiversity protection and sustainable timber production are parallel objectives. The policies aiming concurrently at protecting biodiversity and producing timber have been elaborated further in the National Forest Programme (Finland's … 1999), and the consequent Forest Biodiversity Programme (Etelä-Suomen … 2002).

In all commercially managed forests, including NIPF, the characteristics of small sized habitats of special ecological significance enjoy protected status based on the Forest Act (1996). Forest-owners can be compensated for economic loss when protecting the characteristics of these small-sized areas. Protection status, or prohibition to change, also applies to those areas that are set aside according to the Nature Protection Act (1996).

Management operations are subject to technical guidelines (recommendations) produced by the Forestry Development Centre Tapio (Tapio 2001). The guidelines address management of biodiversity through elaboration of mandated best management practices to be applied in the designated special habitats mentioned above. Additionally, other valuable habitats are identified as targets of voluntary conservation activities. The best management practices specify establishment of buffer zones, retention of live trees, and decaying wood. It is worthwhile to note that these technical practices are also addressed in the forest certification system applied in Finnish NIPF forests, the Forest Certification Finland (FFCS 1999), as well as in environmental management systems adopted by large industrial forestland owners in Finland.

3 Actors serving NIPF owners

Finnish productive forests are predominantly owned by non-industrial private forest (NIPF) owners, around 600 000 in number. This group owns 61 percent of the forestland, and produces almost 90 percent of the domestic timber that the forest industry uses for producing a significant 7.5 percent share of the country's GNP (Finnish… 2002, Karppinen et al. 2002).

While this economically significant large group of NIPF owners is only partially active in managing their own forests (Karppinen et al. 2002), and even those who carry out forestry operations are largely dependent on planning services, a number of organisations exist to provide them with professional forest management services. The service providers include public, private and collective actors, small and large organisations.

Forestry services cover operational forest management services (silvicultural services and forest improvement) as well as planning, consultation and extension services. Extension is provided by Regional Forestry Centres, Forest Management Associations, private service providers (consulting foresters or entrepreneurs), forest industry companies, and Finnish Forest and Park Service Foria[2]. Forestry Centres are institutionalised state organisations, with both fee and non-fee based services, while the three last types of extension service providers are market-based and operate on a fee. The local Forest Management Associations (LFMAs) are institutionalised with a formal legal status, despite their role in promoting forest owners' interests.

To support formal forest policy, a substantial allocation of state budgetary resources is directed to planning and extension carried out primarily by the Regional Forestry Centres. In 2002, the state budget included 16.5 million EUR for regional forestry planning and 7.4 million EUR for extension (Valtion… 2002). The Local Forest Management Associations receive a tax-like payment, a forest management fee, from the forest owners in their area, unless the forest owners have organised their extension and management services through some other service provider and applied for an exemption from the fee.

The structure of this forest management service provision to NIPF owners appears to be changing (Maa- ja metsätalousministeriö 2002). Competition among wood processing firms is leading to increased investment in procurement services and extension. Alongside with the state organisations' regional forestry services, the cooperative service provision by Local Forest Management Associations, is experiencing substantial pressure to change, as the clientele is diversifying (Karppinen et al. 2002). On the one hand, there is a growing segment of forest owners that do not have a traditional orientation toward management of their forest, and on the other, there is an important block of forest owners demanding increasingly high quality technical services. Additionally, forest entrepreneurs are a new and potentially growing class of service providers (Koistinen 1999, Kärhä et al. 2000).

4 Biodiversity conservation capabilities among the actors

The translation of biodiversity objectives into practices is dependent on creation of new knowledge and capabilities among localized actors. These structural and cognitive resources contribute to coherence (i.e., efficiency of resource allocation) at the local level where formal policy is interpreted and adapted for implementation. Within a context of increasing reliance on voluntary approaches to environmental policy, there is a need for processes through which local actors to access, generate, and integrate variously formatted knowledge to respond to new social priorities.

Forest management is a function of distributed technical capabilities. The evolving skills, knowledge, and resources are accessed through coordination of a range of heterogeneous actors. Locally adapted knowledge, practices, personnel, and routines, at the level of foresters and forest workers and at the level of industry, state and civil society organisations that support and regulate these "front-line" personnel play a key role in biodiversity conservation. While political economic considerations are fully relevant to an analysis of creation and implementation of more environmentally sensitive ways of managing forest resources, the question of development of new practices demands attention.

Much contemporary institutional economic analysis is focused on questions of incentive alignment and mechanism design. In this problematic, behaviour and material outcomes are perceived as products of a strategic interaction revolving around access to information. Here, actors are presumed to behave in ways that produce social benefits if incentives and contracts are properly constructed. The problem of actors and organisations learning to do new things or do old things differently is not addressed.

In contrast, and as a complement, to this abstracted approach, we take the problem of learning and the tacit component of knowledge seriously. In line with the now well-established refutation of the linear model of innovation, we adopt a realist perspective in which creating technical capabilities is an interactive, iterative process of learning by doing and local adaptation. Between incentives (policy) and action (material practice), individuals and organisations confront real world challenges of creating, acquiring and adapting know-how.

To analyse processes of acquisition of technical capabilities, we rely on the concept of competencies. Competencies are defined as building blocks that combine in various ways to support capabilities. Thus, having a biologist on staff or adhering to an environmental management system are examples of competencies that can potentially contribute to a capability to apply best management practices into forest management, for example retention of decaying wood on the forest floor.

We define two general types of competencies; internal competencies and external competencies. We recognize two types of internal competencies; "in-house" human capital and organisational routines. External competencies take the form of status in various networks (i.e., access to capabilities of other organisations).

Here, we have analysed and charted the strategies and the level of investment in development of capabilities directed toward biodiversity conservation at the level of the individual actors and the region as a whole. In keeping with our analysis of capabilities and innovation as distributed, we have examined the relationship between investments in internal and external competencies. Internal competencies include "in-house" human capital and organisational routines, while external competencies take the form of status in various networks (i.e., access to capabilities of other organisations). At the level of region or network, our analysis focused on potential complementarities among public, private and collective actors in creation of new capabilities for biodiversity conservation. Our aim is to develop and test this institutional approach in order to undertake a broader assessment of ecological modernization of forest resource management.

5 Methods

5.1 Structured interviews

We made a set of 16 structured interviews among forest management service providers serving non-industrial private forest landowners in the Häme-Uusimaa region in southern Finland. See Table 1. for description of forest actors included in our study. This cross-section represents the leading actors in what can be considered to be a service network.[3] The size range of the service providing organisations varied between 1 person-year and 100 person-years working in services related to protection of biological diversity. In identifying respondents to represent these variously scaled organisations, we sought out the individuals most knowledgeable about local biodiversity conservation service capabilities of the organisation in question. In the case of smaller organisations, we generally interviewed the local leader. In the case of multi-divisional private firms, we were referred to corporate headquarters. All respondents, except for one, in the study turned out to be foresters. The respondents were provided with a list of topics covered in the interview in advance of our visit. The interviews were structured through use of a questionnaire. Data reflect a combination of responses to close ended questions and narrative statements made in response to open ended questions. Fourteen of the interviews were conducted face to face and, two over the telephone. The interviews were carried out in June-August 2003.

Table 1. Respondent organisations.

Respondent type	Number of respondents
Public agencies	4
Commercial firms	8
LFMA*	3
Environmental NGO	1
Respondents, total	16

* Local Forest Management Association

The interviews were organised to 1) produce an accounting of actors' service competencies related to biodiversity conservation and 2) to identify the status of biodiversity conservation in the organisations' developmental strategies (i.e., patterns of investment). Questions covered investment in human capital (education, training and experience), organisational routines and practices (management systems, specialization and organisation training), and position in networks through communication and use of external input. In order to develop measures of biodiversity management capabilities, we assessed self-reported measures of implementation of biodiversity conservation best management practices, and we administered a series of questions to gauge respondents' assessment of the relative performance of their organisation with respect to biodiversity conservation.

5.2 Analysis of competencies

Analysis presented in this paper focuses on service providers' competencies and the relationships among different types of competencies. Consistent with the three principal types of competencies introduced above, we constructed indices of human capital, organisation routines, and external linkages.[4] In effect, our data is an accounting of resources supporting innovation.

The human capital score (HCS) is an additive measure of level of education, training and experience of employees most directly responsible for forest management decision-making. The number of employees included in the analysis per organisation depends on the size and scope of the respondent's organisation. Smaller organisations engage only one employee. In the case of large organisations we accounted for human capital resources considering the three most directly involved individuals. Education is indicated by the employee's formal degree (1-6[5]); training by the number of weeks of biodiversity related training during the last 5 years (0-55); and relevant work experience is expressed in years (1-35). The observed range of responses for each component of our indices is recorded in parentheses. To generate the HCS score, and our other indices, each component score has been transformed to a value between zero and one. This transformation allows each component of each index to potentially exercise equal weight in determining competency scores.

We capture organisational competencies through assessment of routines, practices, infrastructure and commitments that support individuals' biodiversity conservation related behaviours and intra-organisational coordination. Respondents' organisation score (OS) is based on implementation of management systems, specialization of the workforce, and commitment to training. Management system refers to procedures such as auditing, quality systems, and formal guidelines such as certification (0-15). Specialization is reflected in employees' titles[6], tasks and credentials directly related to environment or ecology (0-14). Lastly, the number of weeks of collective training (1-10) arranged by the organisation in the last 5 years is reflected in OS.

External score (ES) reflects the use of external competences by the range and depth of substantive interaction between members of the respondent organisation and external organisations positioned to contribute information, expertise and resources that support biodiversity conservation. Inter-organisational linkages

that contribute to capabilities range from of one-way communication such as listening to TV and radio broadcasts or reading research bulletins posted to the internet to more intensive interaction such as consultation and workforce training. Each respondent was asked to describe the extent to which their biodiversity conservation and relevant forest management activities were supported by contact with sixteen types of potential service providers. External service providers include input suppliers (upstream vertical linkage), clients (downstream vertical linkage), like organisations (horizontal linkages, for example LFMA accessing resources with another LFMA), regulatory agencies, scientific organisations, media, professional associations, etc. Respondents reported the frequency (quantitative measure) of external input use (2=regularly, 1=occasionally, 0=never), and the value (qualitative measure) of that input (2=extremely, 1=useful, 0=not useful). Thus, each external resource could be scored at a maximum of 4 (2 quantitative * 2 qualitative), and hence, the range of possible scores was 0-64.

In order to compare the relative level of competence and investment across our three competence measures, each of the scores (HCS, OS and ES) were standardized through transforming them to range between zero and one (i.e., respondents' raw scores were divided by the maximum score). The HCS and OS scores for each respondent were combined to reflect overall internal competencies (IC). We normalize this sum to a value between zero and one to allow us to make comparisons with actors' external resources.

6 Results

6.1 Human capital, organisation and external competences

The sample was small and therefore, strong statistical inferences cannot be made from the data. Instead, the investment in different competencies, through the constructed scores can be explored. First we will list some descriptive figures. The scores resulted as presented in Table 2.

In the possible range of 0-1, all the standardized scores fell between 0.089 and 0.687. This indicates that our accounting procedure reflects high variance in biodiversity conservation competencies across organisations engaged in forest management. The human capital score showed the least variance between organisations. As is well known, the forestry profession is a powerful institution in forest management. The educational credentials and career pathways of forestry workers and managers in Häme-Uusimaa are distinctly narrow. From a policy perspective, this can be viewed as an opportunity (i.e., intervention can be targeted narrowly, for example further development of curriculum and continuing education), or as a challenge (i.e., low diversity of education, training and experience suggests constraints on innovation, creativity and receptivity to change. In addition, control of specialized technical knowledge translates into political power to resist external stimulus to change). Within the human capital score, the experience score was negatively associated with employee training (-0.497), which indicated that the recent investment in further training was less among experienced workers. Given that we understand that younger, more recent forestry graduates from technical schools and

Table 2. Raw scores and standardized scores.

	Human capital score		Organisation score		External score		Overall score	
	Raw	Standardized	Raw	Standardized	Raw	Standardized	Raw	Standardized
Average	32.0	0.454	14.4	0.362	23.6	0.368	70.05	1.184
Median	29.3	0.448	15.0	0.368	23.0	0.359	23.62	1.218
SD	15.7	0.104	5.8	0.157	7.8	0.126	29.00	0.274
Min	14.3	0.287	4.0	0.089	9.0	0.141	125.00	0.571
Max	70.0	0.687	23.0	0.576	38.0	0.594	69.00	1.763

universities have been exposed to concepts of conservation biology in greater depth than their older colleagues, our result suggest a potentially troubling finding: those workers most in need of training are receiving less of it.

The organisation score varied somewhat more than the human capital score. Within the organisation score, the different sub-scores (management system, training and specialization) correlated positively, suggesting potentially complementarities. Particularly the management system score and organisation training score were positively associated (0.578), which indicates that those organisations that invest in management systems, also invest in training of their employees. Remaining with the metaphor of building blocks introduced earlier, it seems reasonable that capabilities rest on more than one element and that returns to investment in individual competencies is dependent on presence of complementary assets.

The overall scores are normally distributed, clustering in the middle (Fig. 1). This result suggests that our accounting approach may fairly reflect the distribution of resources in the population. Of course the potential value of our study lies in the future when we are able to test whether firms with high competency scores actually have superior conservation capabilities. If such a result was obtained, we would then confront the questions of which combinations of various competencies contribute to such a desired social condition and do these competencies support or come at the expense of competitiveness.

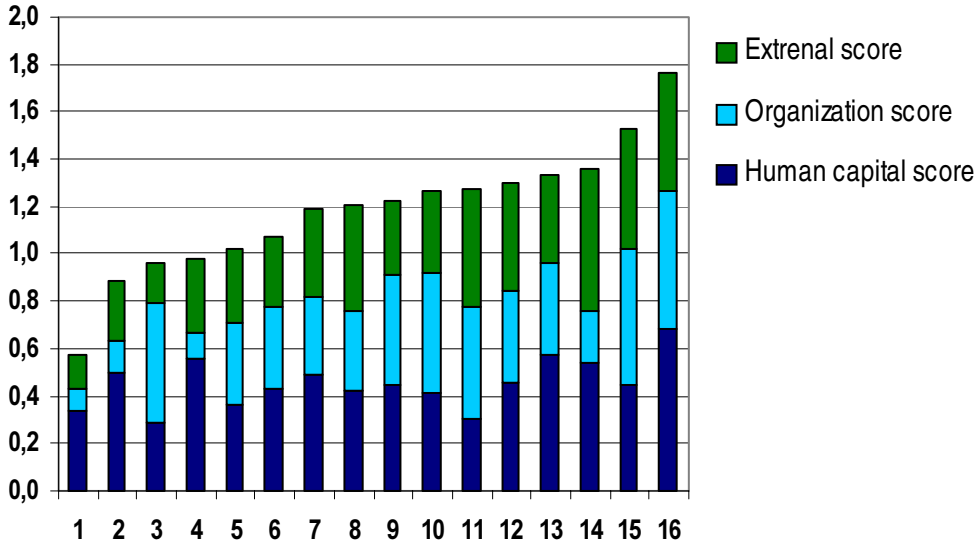

Figure 1. All competence scores organised by human capital score.

6.2 Comparison of investment in different competencies

There was no clear relationship between the two internal factors, human capital score and organisation score, (0.032), which can be interpreted as a sign of substitution. The biggest exceptions, the extreme cases of a combination of low human capital score (0.25, 0.27 and 0.36) and high organisational score (0.51, 0.47 and 0.58) were large organisations. They appeared to have invested significantly in management systems and, at the same time, have younger, less experienced and more diverse staff. Excluding these from the comparison, the correlation would be 0.342. A great share of all organisations plotted low human capital, high organisation score. Only one organisation scored clearly high-high, having educated and trained personnel combined with far-developed organisation management systems.

Human capital was clearly associated with the use of external resources (0.452, see Fig. 2.). Possible explanations for this include the ability of educated/trained personnel to utilize and also value external information. Additionally, training can offer direct links to other organisations and contribute to the use of the network this way. (The outlier that scored low human capital – high external resources, was an organisation

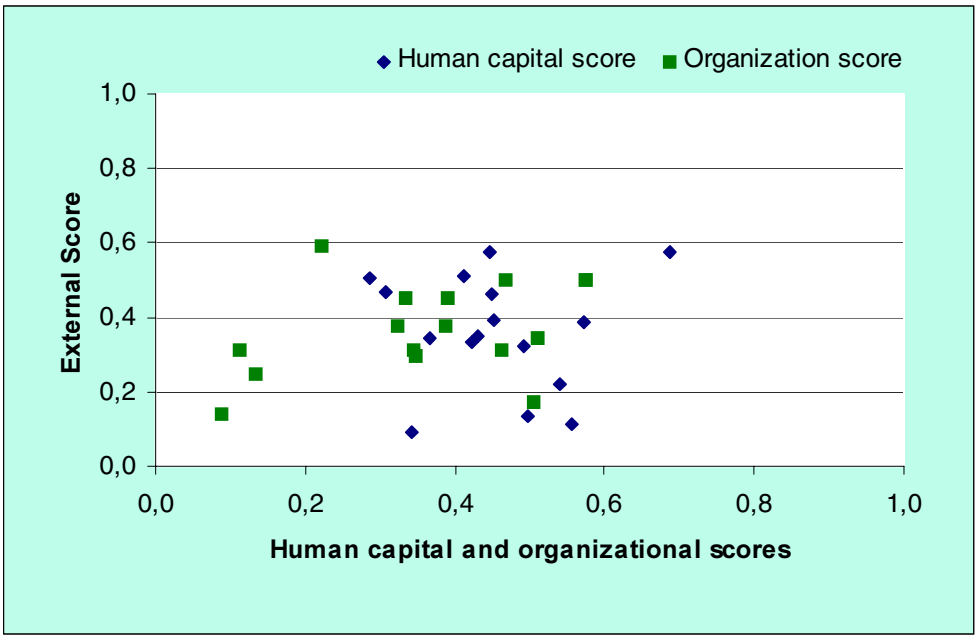

Figure 2. Human capital and organisational scores in relation to external score.

that has existed only for a short time, and has hired young staff with general degrees, and has not had time to train their staff.)

The organisational routines and practices, measured with the organisation score, were positively associated with the external score (0.359, see Fig. 2). There were two outliers. The one that scored low-high, depends on its principal organisation in management systems, but does not apply them directly in its operations. The high-low organisation is a big organisation that seems extremely self-sufficient in terms of organisation management, and does not rely on (domestic) external sources of information.

When the human capital and organisational scores were combined to construct an internal skills score (IS), and this was compared with the use of external resources, there was clear association between the competencies (0.546, Fig.3). Although, as explained above, the human capital and organisational management systems were not associated, and possibly functioned as substitutes, those organisations that invested in the aggregate internal skills also used external resources in their production function.

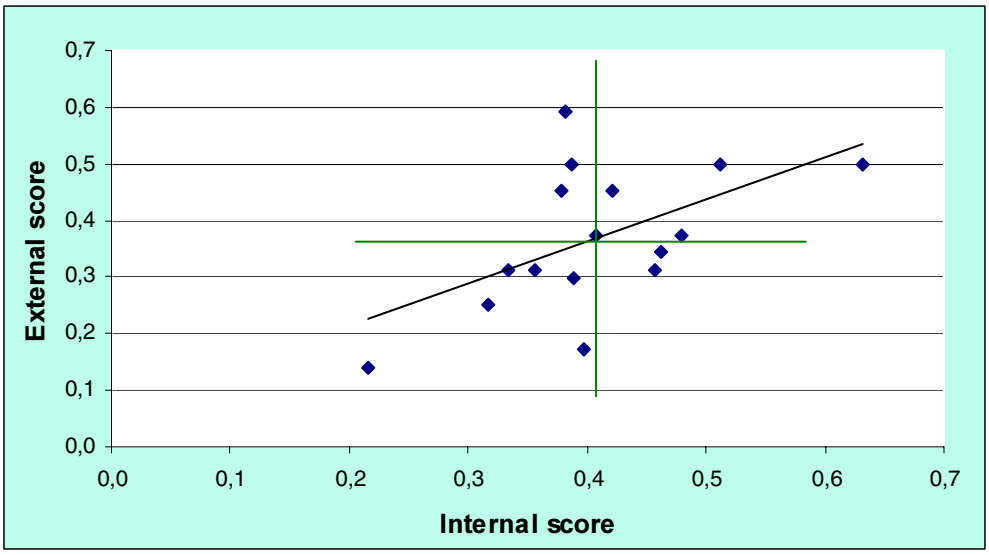

Figure 3. Internal and external scores, correlation 0.546.

7 Discussion

Our analysis highlights the distribution of human capital, organisational resources, and linkages to external sources of expertise among actors engaged in provision of forest management services. We have argued that these three distinct types of competencies directly contribute to capabilities to manage forests in ways that conserve biodiversity. At this preliminary stage of our analysis, we restrict our attention to comparisons among the various types of competencies.

Our analysis indicates a positive correlation between internal and external competencies, suggesting complementarity. We understand this relation to be an indication that successful collaboration and meaningful communication with experts outside of one's organisation is premised on sufficient internal resources. Organisations without prerequisite resources cannot ask the right questions, absorb technically formatted information, and integrate externally sourced information into idiosyncratic organisational structures. The policy implications of such a finding are profound, as our (preliminary) analysis suggests that low resource organisations (e.g., those with low human capital) are incapable of accessing technical assistance provided by public or collective organisations.

In later papers, we will seek to relate these structural attributes of organisations to measures of performance. Additionally, our data highlight the large and diverse population of service providers that shape forest management practices on privately owned forestland. Presumably, there is some division of labour (i.e., functional specialization) in service provision, which corresponds with the distribution of investment in competencies. These ideas represent a valuable source of hypotheses for future analysis.

In addition to further analysing our data to include also self-assessment of organisation performance in biodiversity protection and change in operational best management practices related biodiversity protection, we are planning to extend our study to cover the whole of Finland. This would provide us with interesting insights as to regional variation in investment in internal and external competencies. The larger data set would also allow more reliable analysis of the dependencies between different capacity categories. Lastly, national coverage would allow us to examine the effects of increased competition in service markets. Given presumed accelerated erosion of neo-corporatist arrangements governing private forest management, there is a need to assess how institutional arrangements regulate investment in forest management and natural resource conservation capabilities.

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Footnotes

[1] Of course, the chain of events flows both ways. Public bureaucracies, commercial firms and professional bodies engage in strategic construction of their operating environment through lobbying and other forms of engagement in policy processes. Actors seek competitive advantage by creating an external environment that suits their internal capabilities, just as they seek to develop and maintain capabilities in line with their environment.

[2] Foria does not offer NIPF services as of 30 January 2004. Foria was among the NIPF service providers when these data were collected and analysed.

[3] While the concept of service network will not be developed here, we are referring to a collection of heterogeneous actors engaged in patterns of cooperation and competition.

[4] The human capital, organisation and external resources scores:

1. Human Capital Score:

1.1 HCS = mean (HC_{Edu}, HC_{Tra}, HC_{Exp}), where
HCS Human capital score
HC_{Edu} Education score
HC_{Tra} Training score
HC_{Exp} Experience score

1.2 Education score (1-6 transformed to 0-1):
HC_{Edu} Average education of recorded employees (1= Comprehensive school, 2= High school, 3= Technical school, 4= Polytechnic, 5= University degree, 6= Post-graduate degree)

1.3 Training score (0-55 transformed to 0-1):
HC_{Tra} Average training of recorded employees (# weeks in the last 5 years)

1.4 Experience score (0-35 transformed to 0-1):
HC_{Exp} Exp Average work experience of recorded employees (# years)

2. Organisation score:

2.1 OS = mean (OS_{Mgm}, OS_{Spe} ,OS_{Tra})
OS_{Mgm} Management system score
OS_{Spe} Specialization score
OS_{Tra} Training score

2.2 Management system score (0-15 transformed to 0-1):
OS_{Mgm} Sum of management systems applied[5] (1=yes, 0=no)

2.3 Specialization score (0-14 transformed to 0-1):
c)OS_{Spe} [6] = 0,5 SPE_{Tit} + SPE_{Tas} + SPE_{Edu}
SPE_{Tit} Specialist title (Specialist title related to environment, nature or ecology, ecology or nature: 1=yes, 0=no)
SPE_{Tas} Specialist tasks (specialist tasks related to environment (taking special habitats into account does not suffice): 1=yes, 0=no)
SPE_{Edu} Specialist education (specialist training related to environment, ecology or nature 1=yes, 0=no)

2.4 Training score (0-10 transformed to 0-1):
OS_{Tra} Organisation training (# weeks in the last 5 years, max 10 for the reported 1-3 employees)

3. Internal resources score:
3.1. IS = (HCS+OS)/2

4. External resources score (0-64 transformed to 0-1):
*4.1 ES = sum (ES_{Fre} * ES_{Val})*
ES_{Fre} Frequency of external input use (2=regularly, 1=occasionally, 0=never)
ES_{Val} Value of external input (2=extremely, 1=useful, 0=not useful).

[5] 1= Comprehensive school, 2= High school, 3= Technical school, 4= Polytechnic, 5= University degree, 6= Post-graduate degree.

[6] with a weight of 0.5.

A legal perspective on cost sharing in biodiversity conservation

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Abstract

Cost sharing is a question of who should bear the costs of e.g. the conservation of biodiversity. Costs arise either from active conservation measures or in the form of forgone income from the use of land. Cost sharing has been addressed mainly as a question of equity: the right of the landowner to compensation because of restrictions on property rights. A cost sharing arrangement also has to address the requirements of ecological effectiveness, economic efficiency and political acceptability. These factors are illustrated by the examination of three pieces of Finnish legislation: the Nature Conservation Act and joint system of the Forest Act and the Act on the Financing of Sustainable Forestry.

The development of environmental policy instruments requires awareness of the legal culture. In relation to cost sharing, the relevant components of the legal culture are equity and the principle of responsibility for the conservation of biodiversity, the impacter pays principle and the precautionary principle. The challenge is to design cost sharing arrangements which at the same time support the coherence of the legal order, enjoy the support of the sub-surface law, and fulfil the requirements of ecological effectiveness, economic efficiency and equity, and are therefore politically acceptable.

1 Introduction

Finland has signed and ratified the binding Convention on Biological Diversity made in 1992, and it is politically committed to significantly reduce, if not halt, the loss of biodiversity by the year 2010.[1] On the national level the commitment to conservation of biodiversity is made in the Constitution of Finland (731/1999) which recognises everybody's shared responsibility for biodiversity conservation.

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Fulfilling the commitment to biodiversity conservation in practice raises strong feelings and even opposition from time to time. Landowners fear that biodiversity conservation will reduce the value of their property or restrict the use of their property without just compensation. It is argued that the conservation of natural values hampers economic activities.[2] Essentially there is concern about additional costs to proposed activities caused by the use of alternatives which would cause less adverse effects to nature or the environment. In essence, the question is about cost sharing.

Cost sharing is a question of who should bear the costs of the conservation of, e.g. biodiversity. The costs arise either in the form of direct costs of active measures or in the form of forgone income from the use of land (Arentino et al. 2001 p. 5). Those who are not responsible for financing the conservation of biodiversity can enjoy the benefits of it as free-riders. In other words, the question is whether someone is allowed to diminish biodiversity without the burden of costs and thus transfer the liability of the costs to someone else, usually the community as a whole.

Cost sharing in biodiversity conservation has been addressed mainly as a question of restrictions on property rights and compensation to the landowner in relation to environmental protection or nature conservation. In this paper the issue of cost sharing is placed into a wider perspective by examining the general evaluation criteria for environmental policy instruments used by regulation theory. The argument is that cost sharing cannot be examined separately from the overall evaluation of the acceptability of any environmental policy instrument.

In this paper I also examine the connection of cost sharing issues to the sub-surface levels of law. It is argued that successful development of environmental policy instruments with cost sharing arrangements requires recognition of the elements of the legal culture.

2 Pragmatic view: the criteria for evaluation of environmental policy instruments

Normative regulation theory is pragmatic law. The research interest lies in the critical analysis of the legislative work and legislation with the intention of assessing which of the available alternative regulation designs is the best to achieve the defined ends (Gunningham & Grabosky 1998 p. 15, Mähönen J. & Määttä K. 2002 p. 186).[3] Normative regulation theory refrains from discussion of dogmatic positions and theories (Mähönen J. & Määttä K. 2002 p. 184).

There are a number of different criteria in regulation theory for the evaluation of policy instruments. I will utilise the criteria developed by Neil Gunningham and Mike Young, which manage to capture the relevant factors of biodiversity conservation. These criteria consist of the following 14 factors: equity, dependability, precaution, adaptability, dynamic and continuing incentive, productive and allocative efficiency, low information and administration costs, communicative simplicity and transparency, permanence and political acceptability (Young et al. 1996 p. 106, Gunningham & Young 1997 p. 252–253).[4] On the other hand, these factors can be divided into four groups: *equity*, *effectiveness*, *efficiency* and *political acceptability* (Gunningham & Grabosky 1998 p. 26) (see Figure 1).[5] These groups can be characterised to serve different interests: *equity* is essential for individuals, *effectiveness* is decisive for biodiversity, *efficiency* is central from the economic point of view and *political acceptability* is a prime community concern.

The discussion in Finland about cost sharing of biodiversity conservation has concentrated mainly on landowners rights which can be defined as *equity within a generation*, while the other factors have been largely ignored.[6] Biodiversity conservation has been examined mainly as a question of constitutional rights, and it has not received similar interest in the normative regulation theory in as e.g. in the United States or in Australia.

These four groups (*equity*, *efficiency*, *effectiveness* and *political acceptability*) are interrelated. In my understanding the *political acceptability* of an environmental policy instrument rests on the other three groups. It is perhaps even unnecessary to regard it separate, yet it is a good reminder of the significance of each of the other three. Failure to address any of the other three would render an environmental policy instrument *vulnerable to changes in the public opinion* and thus without long term *political acceptability*. It may be impossible to achieve all the above mentioned factors within each group (OECD 1999 p. 68). Still, the paramount target of each group (*equity*, *effectiveness* and *efficiency*) must be achieved.

In order to illustrate the interdependence of *equity*, *effectiveness* and *efficiency* (illustrated in the Figure 1) I will examine briefly some aspects of three pieces of Finnish legislation: the Nature Conservation Act (1096/1996) and the joint system of the Forest Act (1093/1996) and the Act on the Financing of Sustainable Forestry (1094/1996). Both of them are a combination of regulation and financial incentives in the form of compensation for restrictions on the use of property[7].

An environmental policy instrument may well be regarded as *equitable*, yet it may not be *effective* and may fail to deliver what is intended. For example, the Nature Conservation Act may be regarded equitable within a generation as the owner gets compensation when restrictions on land use follow from a decision to establish a conservation duty on a site if the harm to the landowner is significant.[8] However, the factor of *dependability* is limited; the conservation provisions do not guarantee any active measures necessary for conservation of the natural habitat,[9] and in most cases the Act allows exemptions from conservation for public purposes,[10] even if the exemption were detrimental to maintenance of the favourable conservation status (Kuusiniemi 2001a p. 251, 296; Suvantola 2003 p. 683–685.). Furthermore, only the Natura 2000 network provisions require measures to compensate for the deterioration of biodiversity when an exemption is granted.

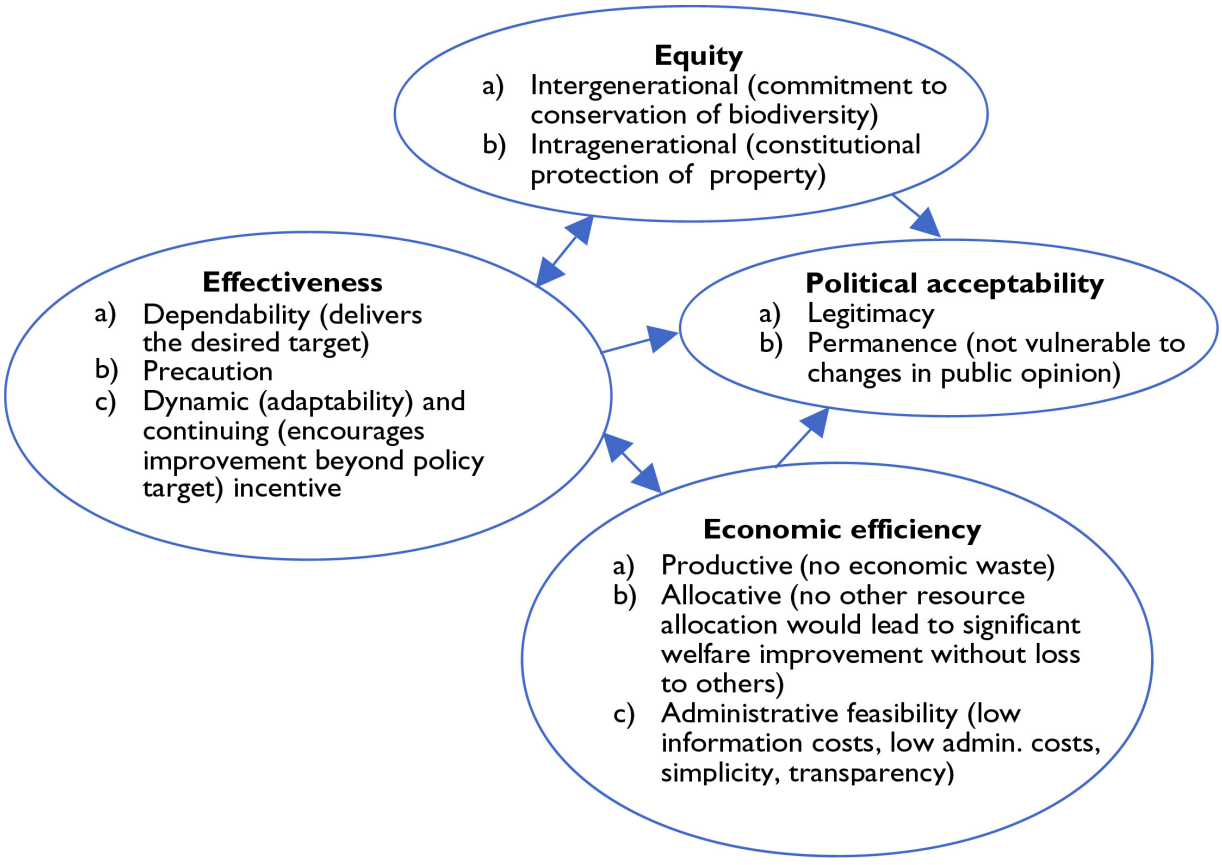

Figure 1. Evaluation factors of environmental policy instruments.

The Forest Act may be also be regarded as *equitable* because the owner is compensated for his duty to conserve certain habitats in case he would suffer more than a modest loss of income. However, in this situation the requirement to protect the habitat is dependent on the decision of the forest authority to grant a subsidy for that purpose; if a subsidy is refused, the owner is exempted from the conservation duty. The provision has been interpreted so that in order to qualify for an exemption the owner has to apply for a subsidy. In any case there should be no prerequisites to grant a subsidy (Kuusiniemi 1998a p. 99–100, Pappila 1998 p. 166–167, Kokko 2003 p. 294 figure 21).

If an environmental policy instrument is *ineffective*, it fails to reach the target of *equity between generations*. Biodiversity continues to diminish and its costs fall on future generations to bear (Gunningham & Young 1997 p. 280). The Natura 2000 network provisions in the Nature Conservation Act require that after an exemption the deterioration of the protected natural values is compensated by e.g. restoration of natural values. This guarantees that the costs to biodiversity are borne by the current generation.

An environmental policy instrument (or a combination of them) may be *dependable* and deliver the desired target, but so costly that it is *not* economically *efficient*. It may therefore be irrational from the stand point of national economy and thus unacceptable in the long run (Kuusiniemi 1998a p. 38–39, Määttä T. 1999 p. 424). For example, according to the Nature Conservation Act, the landowner is paid compensation for any significant restrictions on his land use, while the environmental authorities carry out active conservation measures on the site provided the owner grants permission. Such a system is more costly than paying the owner for the management of her property in a way which would enhance the conservation values (Farrier 1995 p. 399–405). Yet the latter situation may well be economically as favourable to the owner and thus *equitable*, while the state may pay less in total (the costs of the administration would accrue only of the inspections instead of the management activities). *Economic efficiency* in fact requires that payments be made only for work done or agreed to be done (OECD 1996 p. 91). This design would make biodiversity an asset to the owner rather than a burden; a property with conservation values would be a source of income (OECD 1996 p. 69–70). It would also satisfy the ecological *effectiveness* requirement for on-going conservation activities.

Economic efficiency and *effectiveness* are intertwined in the sense that dynamic incentives are more *effective* and *efficient* than backward-looking compensations. This brings us to the question of the true nature of these two instruments, so to say. The concept of "compensation" is used in the Nature Conservation Act, while in the Forest Act the concept of "subsidies" is used. Are these two instruments truly so different from one another that the distinction compensation – subsidy is justified, or is it more a matter of political acceptability? The concept of subsidy implies on-going activities, while compensation is a backward-looking instrument. My argument, in fact, is that they both are in essence compensatory, and neither of them has a forward-looking effect on conservation of biodiversity.

The only nature conservation instrument in Finland with dynamic incentive features is the compensation system for the damage caused to the reindeer husbandry by the golden eagle (State Council Decree on the Compensation of the Damage Caused to the Reindeer Husbandry by the Golden Eagle (8/2002). The compensation is paid on the basis of nesting and reproduction of the golden eagle. It promotes the conservation status of the species, because it discourages the disturbance of the species during nesting, and encourages the creation of nesting sites rather than their destruction. The correct term for the instrument would be "subsidy", because there is only an assumption of a connection between the damage caused and the number of the eagles nesting. No actual damage needs to be proved, if there is nesting in the area of a reindeer co-operative, and no actual damage entitles to compensation, unless there is nesting.

3 Theoretic view: elements of the sub-surface law

The above evaluation criteria of environmental policy instruments fail to recognise certain aspects of law. There is more to law than the surface level: the visible pieces of legislation, court decisions and the legal

scientific discourse. In the examination of cost sharing in biodiversity conservation it is relevant to examine also issues which are part of the sub-surface law: the *legal culture* or perhaps even the *deep structure of law*, which are made visible by legal science (Tuori 2002a p. 147, 161–196).

The above-mentioned requirement for the *political acceptability* in the form of *legitimacy* of an environmental policy instrument is not merely a matter of due process or abiding the constitutional restrictions.[11] A regulatory regime that lacks the support of the deeper levels of law lacks justification. This has been described as the *self-limitation of law* (Tuori 2002a p. 147, 217–220). On the other hand interaction of the different levels of law means that the sub-surface level law requires the *institutional support* of the surface-level law (Tuori 2002a p. 178, Tuori 2002b p. 12). Both the surface level of law and the deeper levels of law evolve as a result of their interaction and the influence of external factors. The pace of change is fast on the turbulent surface, and slow on the more stable sub-surface levels (Tuori 2002a p. 191–196).

The legal pragmatic regulation theory has generally avoided discussion of the deeper levels of law.[12] However, of the above-mentioned groups for evaluating environmental policy instruments, *political acceptability*, *effectiveness* and *equity* relate to – or are in fact themselves – issues of the *legal culture*. Only the *economic efficiency* factors are irrelevant from the legal theoretic point of view, while they still are fundamental for legislative work.

In relation to the conservation of biodiversity and cost sharing the relevant components of the legal culture are *equity* (Tuori 2002a p. 177) and certain principles of environmental law. The principles of law in the legal culture are defined as principles of e.g. administrative law, principles of private law or principles of environmental law, depending on the core area of their relevance. These principles are part of the same legal order and they should not be conflicting. Still, there are conflicts between the general legal doctrines of different fields of law (Tuori 2002a p. 173). The aim, however, is a coherent legal order. The coherence results from the elaboration of the general legal doctrines by the legal science (Tuori 2002a p. 172). One way to resolve the conflicts is priority ranking of the conflicting principles, which may change as the deep level of law gradually changes (Kuusiniemi 2001a p. 291).

The narrow meaning of *equity within a generation*, meaning protection of the *property rights of the landowner*, has been addressed extensively in Finland by legal scholars, e.g. Tapio Määttä, Jukka Kultalahti, Kalevi Laaksonen and Kari Kuusiniemi to name just a few. The intention is not to dwell on this discourse, yet some comments are made. Equity as protection of private property is a constitutional right (The Constitution of Finland (731/1999) 15 §). In relation to cost sharing the interpretation of the extent of the property rights is elemental (Kuusiniemi 1998a p. 21, 25 fn. 50); it provides a reference point to assess the *equity* of an environmental policy instrument.

Absolute *equity* in cost sharing, even within a generation, is an unattainable goal. The property owners receive different treatment both according to the Nature Conservation Act and to the Forest Act. Those who suffer *less than significant* harm (Nature Conservation Act) or *modest* loss of income (Forest Act) because of the conservation provisions bear the total costs of the conservation on their property and participate through their taxes in financing of the total conservation effort. Those who would suffer *significant* harm or *more than modest* loss of income because of the conservation provisions are fully compensated and participate only through their taxes in financing of the conservation activities. Those who are exempted from the conservation are allowed to transfer the responsibility of the conservation to others and are thus allowed to externalise the costs of biodiversity conservation. They do participate in the conservation through their taxes, but at the same time they increase the overall cost to biodiversity. Furthermore there is the question of how to account for the past loss of biodiversity i.e. how can those land users who have caused the current situation also be made to pay part of the costs (Agius 2001 p. 501).

The concept of *equity* has evolved over the past thirty years to cover not only the current generation but also the future generations. This evolution is evidenced by international declarations,[13] conventions,[14] and national constitutional provisions (e.g. the Constitution of Finland 20 §). The *equity between generations* can be regarded as the *duty to conserve biodiversity*.[15] Fulfilling this duty is a means to achieve equity between generations in this respect. This, in fact, implies that there is not only a moral commitment to the conservation of biodiversity but also a legal obligation.

The relevant principles of environmental law in relation to cost sharing are the *principle of conservation of biodiversity*, the polluter pays principle – or rather the *impacter pays principle* (as it will be called in this paper) – and the *precautionary principle*. My purpose is not to discuss these principles in detail, merely to inspect them in relation to cost sharing in biodiversity conservation.

It was argued above that *equity between the current and future generations* is at the same time a *duty to conserve biodiversity*. This has not yet been acknowledged as a principle of law, but it may be evolving into one.[16] There is *institutional support* for it in the international environmental law[17] and the national surface-level law in the Nature Conservation Act, but most significantly in the Constitution of Finland. The Constitution can be regarded as an institutionalisation of the paradigmatic choices of the society. The Constitution is in a sense a codification of the long-standing values of the society which evolve but very slowly. The Constitution is more stable than other pieces of legislation; it is amended in a complicated legislative procedure. Thus, by nature, the internalisation of the responsibility of the conservation of biodiversity in the Constitution is much more significant than the internalisation of this principle in other surface-level law instruments[18].

According to the second principle of environmental law, the *impacter pays principle*, resource users should pay the full costs of the use of resources including environmental damage and the costs of mitigating adverse effects on the environment (de Sadeleer 2002 p. 21, Birnie & Boyle 2002 p. 92–95; Määttä T. 2001 p. 326 fn. 37a).[19] Still, it is widely acknowledged that the market economy *externalises* some costs – in particular the costs to biodiversity and the ecosystem services (Määttä K.1999a p. 18–19; Agius 2001 p. 485–486).[20] The costs accrue the natural economy as the loss of biodiversity, and the economy of the society as costs of restoration or substitution of the ecosystem services when the society corrects the failure of the market economy (Plater 1998 p. 429–431). The costs are carried by the society as a whole, while the benefits are received by private individuals or companies (Farrier 1995 p. 397; Lyster 2002 p. 57). Externalisation of costs to biodiversity, in fact, constitutes a state subsidy to biodiversity damaging activities as the state carries the indirect costs while a user of resources only has to meet the direct costs and receives the maximum benefit.

The impacter pays principle entails that the one causing environmental harm has an incentive to refrain from such activities (Faure 2000 p. 469). *Internalisation* of costs to biodiversity in the total costs of economic activities would mean that a proponent has an economic incentive to find an alternative site for the activity or to choose a less damaging method of carrying out the activity in order to reduce the total costs of that activity (Agius 2001 p. 503, de Sadeleer 2002 p. 36). Thus adoption of the impacter pays principle would enhance the *efficiency* of an environmental policy instrument.

The impacter pays principle is also a matter of *equity*. It is a component of the legal culture, and it has *institutional support* in the international environmental law[21] and in the national Finnish surface level law in relation to the costs of protecting water quality, protection of the environment, and the responsibility to clean contaminated sites (Kuusiniemi 2001a p. 258). The principle has been recognised also in the legal practice of the Supreme Administrative Court in relation to waste legislation (Supreme Administrative Court 17.5.1997 record 1200 (internet)). On the background of these provisions is the traditionally valid justification for restriction on land use: the concern for human health. The provisions are, on the other hand, coherent with other legal principles such as the protection of the rights of other landowners and the liability rules.[22] However, the provisions of the environmental protection law in Finland also include permit requirements which relate to the protection of nature. The border between nature conservation and environmental protection is not clear cut, rather it is disappearing partly due to internalisation of biodiversity aspects in all land use and resource use legislation.

As a result of the impacter pays principle in the Finnish environmental protection law the proponent is not entitled to compensation, if the applied permit for the proposed activity is refused. In biodiversity conservation this principle has not been adopted in the Finnish legislation (Kokko 2003 p. 109). Consequently the legislation generally entitles the owner to compensation, if his proposed activity is not allowed due to nature conservation (Kuusiniemi 2001a p. 257–272). This can be described as the *community pays principle*[23].

The *beneficiary pays principle* has been presented as an alternative to the impacter pays principle (Arentino

et al. 2001 passim). This principle means that the responsibility for costs should lie where the benefits accrue. There is no *institutional support* for this principle in our legislation. This proposed principle does not have application in environmental protection as there is no immediate beneficiary; no one can be regarded to be a beneficiary, if someone else is prohibited from deteriorating others' environment. In nature conservation some limited applicability has been seen in the form of e.g. entry fees to national parks (Arentino et al. 2001 p. 19, Di Leva 2002 p. 86-87). This would not be applicable in the Nordic countries where e.g. free access to forests is a constitutional right[24].

The beneficiary pays principle and the society pays principle have the counteractive effect of implying that the resource user has the right to degrade the natural environment and has to be paid to refrain from it (Arentino et al. 2001 p. 22; Westerlund 2001 p. 30–31; Kuusiniemi 2001a p. 271 fn. 292). It also creates scope for blackmail (Farrier 1995 p. 390; Westerlund 2001 p. 30).

The impacter pays principle and its alternative the beneficiary pays principle to an extent oversimplify the question of cost sharing. The impacter and the beneficiary are not always distinguishable or even identifiable (de Sadeleer 2002 p. 38). Also the impacter has the benefit of clean or amenable environment. On the other hand the loss of biodiversity in some cases may eventually cause loss of economic opportunities to the impacter. Furthermore, there are three rather than two groups involved in biodiversity conservation and they partly overlap; those whose behaviour actually enhances biodiversity and who bear certain conservation costs, those who actually benefit from biodiversity and therefore attach value to biodiversity, and those whose behaviour actually diminishes or harms biodiversity and who thus affect the other groups (OECD 1996 p. 89).

The third principle of environmental law relevant to cost sharing is the *precautionary principle* according to which even in a case of uncertainty measures should be taken to prevent significant environmental degradation (Ebbesson 1996 p. 119–120, de Sadeleer 2002 p. 91).[25] The precautionary principle relates to the above mentioned *effectiveness* of an environmental policy instrument. This principle has strong *institutional support* in international soft-law,[26] international conventions,[27] the EU legislation, the national legislation and the legal scientific discourse (Ranta 2001 p. 251). The precautionary principle is regarded not only as an environmental policy principle but also as a central moral principle of our relationship to nature and future generations embedded in the sub-surface law (Kuusiniemi 2001a p. 290)[28].

4 Connecting pragmatic and theoretic law

I return to my argument that legal pragmatism, including the normative regulation theory, tends to disregard legal theoretical questions including those of the legal culture. However, the elements of the legal culture are of fundamental importance to development of policy instruments (see Figure 2, where the significance of the elements of the legal culture for development of environmental policy instruments with cost sharing arrangement is identified). These elements limit the available alternatives from which the most *effective*, *efficient* and *equitable* instruments can be chosen.

Recognition of the significance of the sub-surface law and the discourse concerning it enables the reinterpretation of the legal culture as well as that of the elements of the surface-level law[29]. It is the task of legal science to conceptualise the significance of biodiversity as general legal principles (Määttä T. 2001 p. 368) so that the overall aim of biodiversity conservation can be operationalised in the surface-level law.

Disregard for the deeper levels of law may, on one hand, lead to *de lege ferenda* proposals which could be inapplicable because of a contradiction with the underlying legal elements. For example, internalisation of all costs to biodiversity in the costs of the use of resources so that no compensation would be paid to the landowner on the basis of restrictions on land use could be argued as a wide interpretation of the *impacter pays principle*. Still, there is a conflict between this principle and that of *equity*. In practice, if the conceived costs to the objects of the regulation – the landowners – have not been left uncompensated, environmental

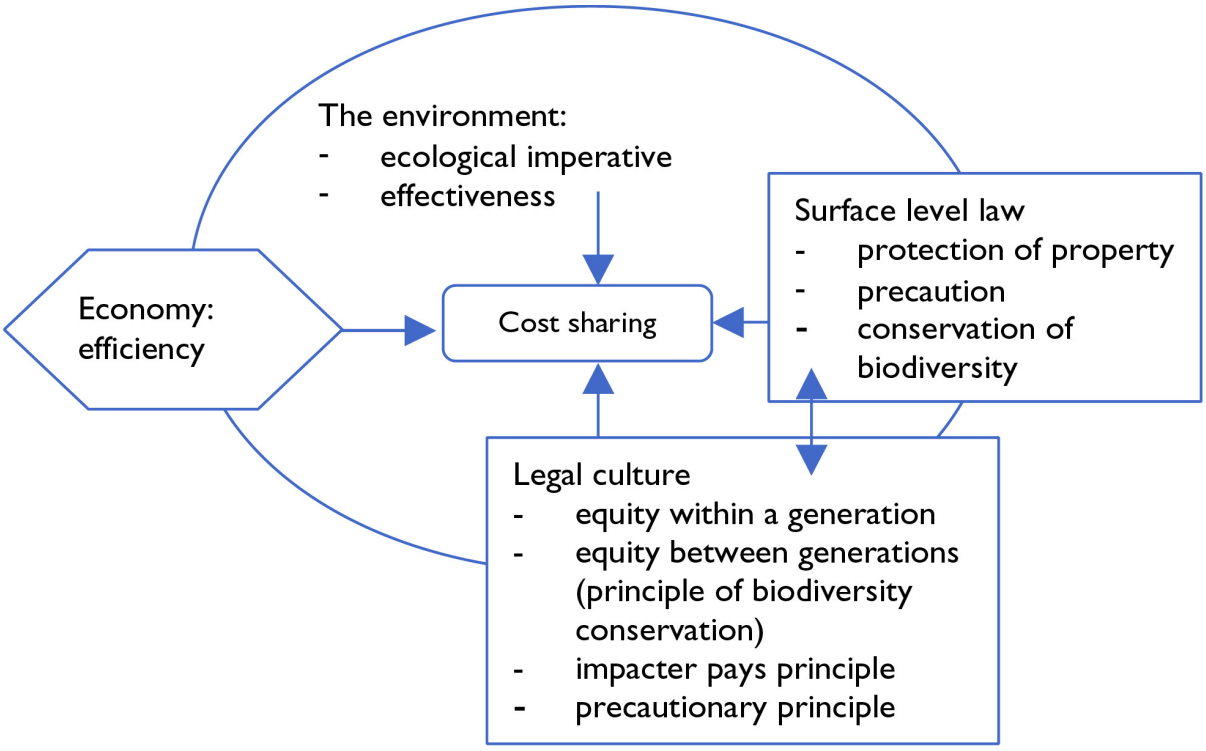

Figure 2. Factors affecting cost sharing arrangements.

authorities have been more inclined to fully implement conservation regulation. An example of this are the land clearing restrictions in South Australia where the inclusion of a compensatory element in land clearing restrictions reduced the number of exemptions granted from 80 percent to 10 percent (Farrier 1995 p. 395–396)[30].

Successful[31] legal pragmatism has been well aware of the existing dogmas, and has utilised them in the reinterpretation of the surface level law. An example of this is the reinvention of the *public trust* concept in the common law countries, the United States in particular (Thompson 1998 p. 366, Hirokawa 2002 p. 257–259, 263, 268, 281). Radical proposals to change the law have been less successful, because they would have required changes not only to the surface level law, but also to the sub-surface law, which would have shaken the legal order. This is well illustrated by Ronald Dworkin's metaphor of the law as a chain novel. Each writer – be she a judge or a legal scholar – has to write in her turn her small section, which has to be based on the work of the previous writers rather than constitute an independent short story (Dworkin 1982 p. 166–169). Dworkin illustrates the common law adjudication and legal science, but the same applies to other legal systems as well. In Finland a similar idea has been put forward by Markku Helin and Kaarlo Tuori, who advise a reformist legal dogmatist to strive to moderate objectives and to build in part on tradition. In the same way a wise man repairs a ship out on the sea: rather than tearing up the entire rotten bottom of the ship, he retains navigability by repairing the ship bit by bit (Helin 1985 p. 92, Tuori 2002a p. 173).

The turbulent surface-level law may raise false hopes of changes in the legal culture. For example, lack of compensation provisions in relation to certain conservation provisions of the Nature Conservation Act has been regarded to imply a limitation of the rights of the landowner. An example of this is the provision of the Nature Conservation Act (49.1 §), which prohibits the destruction or deterioration of the resting or reproduction site of a species of the Habitat Directive Annex IV a, to which the Act does not attach a compensation provision.[32] In this particular case the Government has already proposed an amendment to the Act (Government Proposal 76/2003) to change the situation.

On the other hand, ignorance of the elements of sub-surface law may lead to the outright rejection of proposals

based on the changing – or changed – legal culture. The paradigm of environmental law in relation to cost sharing in biodiversity conservation can be argued to be in a state of change.[33]

Paradigmatic changes in the legal culture take a long time to realise the concrete targets of biodiversity conservation, and in the meantime some pragmatic solutions are required. It does not necessarily require a paradigmatic revolution to argue for some pragmatic cost sharing solutions which are not contrary to the existing paradigm of compensation to the landowner. Some alternatives are already supported by changes in the surface-level law. In the Forest Act and in the Nature Conservation Act a partial cost responsibility has been adopted in the form of *modest* loss of income or *less than significant* harm to the landowner. The purpose may well be the minimisation of administrative costs by eliminating the need for decisions and payments for insignificant interference with the use of property. However, it can also be interpreted as a duty of the landowner to participate in cost sharing (e.g. Määttä T. 1999 p. 442).

The principle that the owner is compensated, if his proposed activity is not allowed due to nature conservation was adopted at the time when the only instrument for nature conservation was the establishment of nature conservation areas where all economic activities were virtually prohibited. With the adoption of the new Nature Conservation Act, the "tool box" of nature conservation has drastically expanded to include a number of conservation instruments[34] that do not exclude economic activities *provided* that the natural values recognised by the legislator are not diminished or destroyed. This has changed the legal environment in which the decisions are made. Nature conservation does not necessarily render a property unsuitable for economic activities. If an activity can be allowed on a scale, or in a way, that does not adversely affect the protected natural values, no compensation issues should arise[35].

The existing paradigm of the landowners right to compensation in nature conservation is evident in the recent legislation of Finland. Symptomatically, following the preparation of the Natura 2000 –network which caused significant political debate, the legislator has adopted solutions where the duty to compensate restrictions on land use arises in nature conservation issues, while a similar restriction based on environmental protection legislation has not been regarded to require compensation.[36] This has been the reason to channel compensation through nature conservation legislation even though the actual decision not to grant a permit would be based on another piece of environmental legislation.[37] This collides with the general aim of internalisation of biodiversity aspects in all land use and resource use legislation (Kuusiniemi 1998b p. 35).

An example of this is the above-mentioned Government Proposal 76/2003 for amendment of the Nature Conservation Act. In practice the proposal would mean that nature conservation areas could be established when the conservation provisions which apply e.g. to *Pteromys volans* (flying squirrel) significantly restrict the use of forest land for forestry. The proposed amendment is economically *inefficient* as the compensation would be sought from another authority than the one granting other subsidies for forestry, and thus causes more transaction costs to the landowner and additional administrative costs[38]. Furthermore, it would create *inequity*, because the threshold for compensation would be different for forest owners. A forest owner in whose forest the habitat of the flying squirrel exists in conjunction with a protected habitat of the Forest Act would receive compensation, if the restriction were more than modest. A forest owner with a habitat of similar significance, but separate from protected habitats of the Forestry Act, would not be compensated according to the Nature Conservation Act, if the restriction were not significant. Most of the conflicts between forestry and the conservation of the species could be resolved through the use of a subsidy for biodiversity enhancing activities according to the Act on the Financing of Sustainable Forestry.[39] Such an alternative would also be economically *more efficient*. It would reduce both administrative costs and the costs to the landowner, because the authority responsible for the compensation decision would be the same which receives the notice for planned forest activities and grants the other subsidies for forestry.

The overall aim of *coherence* of the legal order and the *equity* of the landowners should be kept in mind in the design of environmental policy instruments. Thus the principles of compensation should be similar nature conservation legislation and resource use legislation. Compensation according to the Finnish resource use legislation (e.g. the Soil Extraction Act, 555/1981) depends on the fact, whether the landowner is prohibited from normal, reasonable and rational use of her property (Kuusiniemi 1998a p. 26) or, in other words, if

restrictions exclude all reasonably profitable use of land (Pappila 1998 p. 168). If this is not the case, refused most profitable use of land should not entitle the landowner to compensation (Kuusiniemi 1998a p. 37). There is also a significant difference between restrictions on existing use of land and restrictions on potential, speculative use of land. The first is a real interference with the landowners activities and entitles to compensation. The latter causes only disappointment due to lost opportunities, and the potential losses cannot be quantified (Farrier 1995 p. 398). In Sweden, for example, the right to compensation has not included the compensation for lost opportunities, if a permit for a change of land use has been refused (Michanek 1995 p. 160–161; Määttä T. 1999 p. 446–447).

5 Concluding remarks

Development of effective environmental policy instruments for the conservation of biodiversity requires that *equity* be one, but not the only, significant factor taken into account in the design of cost sharing arrangements. Again, compensation is one, but not the only method of achieving *equity*; in fact, from the *effectiveness* and *efficiency* points of view it is less desirable than payments for management of sites with biodiversity values. Furthermore, *equity* has to be examined from the perspective of *coherence* of the legal order; what may seem equitable separately may cause inequity between landowners in the larger context.

The challenge in the design of environmental policy instruments is to find alternatives which

a) support the coherence of the legal order,
b) have the support of the sub-surface law, and
c) fulfil the requirements of ecological *effectiveness*, economic *efficiency* and *equity* and are therefore *politically acceptable*.

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Footnotes

[1] The World Summit on Sustainable Development in Johannesburg, 26 August – 4 September 2002, where the signatories committed themselves to significantly reduce the loss of biodiversity and the Sixth Environment Action Programme of the EU (2002), where the EU committed itself to halt the loss of biodiversity.

[2] See e.g. the accounts of Petersen (1999) about the discourse surrounding the Snail Darter Case and Flournoy (1993) about the discourse surrounding the Spotted Owl Case. Similar discussion erupted in Finland following the decision of the Supreme Administrative Court 2002:86 (internet) to deny a permit to build a reservoir and a dam on the upper course of the Kemijoki River. It should be noted, however, that the permit was denied on the basis of an absolute prohibition provision of the Water Act (264/1961 article 2.5) rather than the provisions of the nature conservation legislation.

[3] The second dimension of regulation theory is positive regulation theory. It is interested in the factors which in practice affect the choices of the legislator, because the legislator does not always adopt the best available alternative. See Mähönen J. & Määttä K. 2002 p. 187.

[4] Referred to in OECD 1996 p. 84 and OECD 1999 p. 68.

[5] See also Arentino et al. 2001 p. 6. Similar criteria (effectiveness, cost-efficiency, administrative efficiency, dynamic efficiency, flexibility) are the basic regulation standards of regulation theory: see Mähönen J. & Määttä K. 2002 p. 188.

[6] Hanhijärvi (2003 p. 53) has been one of the few legal writers in Finland to evaluate the effectiveness of an environmental policy instrument in her examination of the environmental subsidies in forestry.

[7] Note that the OECD (1996 p. 98–99) regards also compensation and land acquisition as financial incentives. However, an instrument is an incentive only, if the party receiving payments remains a subject of restrictions. Thus land acquisition is not an incentive.

[8] Such decisions in relation to private landowners are a decision to establish a nature conservation area, to define the borders of a protected natural habitat and to define the borders of a site hosting a species under special protection. See Nature Conservation Act 52 §. Meanwhile, there are no provisions for compensation of harm which may arise because of conservation of species.

[9] This is a typical problem in regulation. See Young et al. 1996 p. 135–136.

[10] Species conservation provisions require that an exemption is granted only, if it will not endanger the favourable conservation status of the species. The only exception is the exemption from the conservation of bird species referring to the Birds Directive (79/409/EU) article 9 which does not include this prerequisite. Furthermore, no exemption can be granted concerning a species is under special protection (47 §). See Suvantola 2003 p. 680.

[11] See e.g. Määttä K. (1999b p. 38–40) about the legitimacy of regulation, and the same (2002 p. 139) about the Constitutional limitations on legislation. Baldwin & Cave (1999 p. 76–79) discuss the legislative mandate and due process in regulatory decisions, yet they do not recognise the deeper level law implications.

[12] See e.g. Määttä K. 1997. Määttä K. (1999b p. 25) comments that there is a regulatory gap between the theoretical approach of the legal science and the practical legislative work. The above mentioned criteria for policy instruments in a latent way address these issues, even if not outspokenly.

[13] See the Declaration of the United Nations Conference on the Human Environment (1972) principle 2: ”The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations” and the Rio Declaration on Environment and Development (1992) principle 3: “The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.”

[14] See the Convention Concerning the Protection of the World Cultural and Natural Heritage (1972), the Convention on the Conservation of European Wildlife and Natural Habitats (1979), the Convention on the Conservation of Migratory Species of Wild Animals (1979) and the Convention on the Biological Diversity (1992). The Convention on Biological Diversity does not refer directly to the inter-generational equity, but the preamble does express determination to conserve and sustainably use biological diversity for the benefit of the present and future generations. See Birnie & Boyle 2002 p. 90–91, 574.

[15] Määttä T. (1999 p. 471–475) elaborates the equity between generations as a principle of sustainable development. Similarly Kuusiniemi 2001a p. 288–290. Both Kuusiniemi (1998a p. 92) and Kokko (2003 p. 71, 77) have noted the concentration of the legal science on the relationships within a generation and it’s insufficiency. They regard it necessary to cover also the intergenerational dimension in order to address the legal aspects of biodiversity conservation.

[16] See Ebbesson (1996 p. 239–246) for the development of the principle of sustainable development in the international environmental law. In Finland Kuusiniemi (2001a p. 290) regards the principle of sustainable development as part of the legal culture. Määttä T. (2001 p. 332) and Kokko (2003 p. 99) are cautious about regarding the duty of biodiversity conservation yet as a principle of law, they rather regard it to be in the evolutionary stage. Kokko sees it as one part of the overall objective of sustainable development.

[17] The entire Convention on Biological Diversity rests on the recognition of the ecological imperative: the recognition that the survival of the humanity depends on the conservation of nature, the natural resources including the soil, water, the atmosphere, the forests, plants and life forms sustained by them. See the Stockholm Declaration preamble 6: “Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well being depend.” Since then the ecological imperative has been referred to in e.g. the Convention on the Conservation of European Wildlife and Natural Habitats (1979), the Convention on the Conservation of Migratory Species of Wild Animals (1979), the Convention on the Biological Diversity (1992) and the African–Eurasian Waterbird Agreement (1995). In addition the intrinsic value of nature has been recognised e.g. in the World Charter for Nature (1982): ”Every life form is unique, warranting respect regardless of its worth to man.”

[18] See Tuori (2002a p. 179) who discusses the two-fold nature of the legal principles included in the constitutional catalogue of basic rights, for instance.

[19] Concentration on the first mentioned costs has led to the misconception of inapplicability of impacter pays principle in the protection of biodiversity, where there is need for precautionary measures. See Määttä T. 2001 p. 325–326.

[20] Baldwin & Cave (1999 p. 91) put it rather bluntly as they say that “polluters are externalising some of the costs of production

and are accordingly enjoying too much wealth". Conservation of biodiversity is not only a matter of protection of certain species or habitats, but also a matter of sustaining ecosystem services which include water filtration, runoff prevention, carbon dioxide sequestration, soil renewal, reduction of pests, pollination and gene banks. See Farrier 1995 p. 395, Boyd et al. 2000 p. 210–211, Salzman et al. 2001 p. 310–311, Heinonen & Kasanen & Walls 2002 p. 14.

[21] Rio Declaration principle 16. It appears in a limited number of treaties on international watercourses, marine pollution, transboundary industrial accidents and energy. The principle has been implemented rather in national legislation than on the international level. See Birnie & Boyle 2002 p. 93.

[22] See Hirokawa (2002 p. 264–265) from the common law point of view.

[23] See Arentino et al. (2001 p.19) who regard also this as the beneficiary pays principle as they see the community as the beneficiary.

[24] The Constitution of Finland 9 §. See also Määttä T. (1999 p. 327) about everyman's rights.

[25] For the Finnish discourse e.g. Määttä T. 1999 p. 468–470, Ranta 2001, and Kuusiniemi 2001a p. 291. Kuusiniemi regards it as the principle of law which ensures the conservation of biodiversity.

[26] The Rio Declaration principle 15: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

[27] The principle is evident in the preamble of the Convention on Biological Diversity which states that in the case of threat of significant reduction or loss of biodiversity, lack of full scientific certainty should not be used as a reason to postpone measures to avoid or minimise the threat. Still, the substantive articles are ambiguous. Birnie & Boyle 2002 p. 574.

[28] Note that the morality influences the legal order through the legal principles embedded in the legal culture. See Tuori 2002a p. 181.

[29] Kuusiniemi (1998a p. 95) refers to this in relation to reinterpretation of the norms of the surface level law following changes in the deeper levels of law.

[30] This is apparently different from the " regulatory capture" situation where the interests of the polluters are regarded by the regulator more important than the public interests. See e.g. Määttä K. 1999a p. 23.

[31] From the point of view of the proponents of more radical paradigmatic changes, the success of legal pragmatists has been bitter, because they have regarded such small steps – if in the right direction – counteractive for the overall targets. See Delgado 1991 p. 1227.

[32] Kuusiniemi (2001a p. 270) comments that the landowners rights do not include the right to destroy or deteriorate the resting or reproduction site of a species of the Habitat Directive Annex IV a mentioned in the Nature Conservation Act 49.1 §, because the legislation does not include a corresponding compensation provision.

[33] E.g. according to Kokko (2003 p. 109) the impacter pays principle is strengthening in biodiversity law.

[34] Conservation of the protected habitats according to 29–30 § and the conservation of species under special protection according to 47 § of the Nature Conservation Act.

[35] Kuusiniemi (2001a p. 270) is of the opinion that compensation duty will arise rarely in the application of the Nature Conservation Act 53.1 § to the above mentioned protected habitats and species under special protection, because of the requirement of "significance" of the harm to the landowner.

[36] See the comments of Kuusiniemi (1998b p. 34) and Vihervuori (2000 p. 369) on the compensation provision relating to the Natura 2000 network in the Act on Private Roads (352/1962, amendment 372/1999).

[37] A permit cannot be granted according to e.g. the Soil Extraction Act, if it were contrary to the Nature Conservation Act, because there is a reference in the Soil Extraction Act to the requirements of the Nature Conservation Act. See the Supreme Administrative Court 25.06.2003 record 1541 (internet).

[38] The administrative costs would also be significant as compensation would require first a decision to establish a nature conservation site.

[39] See also Hanhijärvi (2003 p. 62–63) who regards it artificial to limit the use of subsidies in the habitats listed in the Forest Act.

Phytosanitary measures: Preventing the introduction of exotic pests and pathogens occurring from the global trade of wood products

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Abstract

The decline in biological diversity arising from an increase in global trade is a trans-boundary environmental issue and the introduction of exotic species, have increased with ramifications for natural and managed ecosystems. Globalization and advances in technology and logistics have intensified the size and speed of the volume and transportation for international trade, and moving species between ecosystems can pose a serious threat to biodiversity. This paper will address phytosanitary measures that attempt to prevent the introduction of exotic species that arise from the global trade of wood products. Furthermore, this paper examines the biosecurity risks that a specific country can face when importing wood products, even after they have been treated by the required phytosanitary measure. The phase-out of the fumigant methyl bromide in accordance with the Montreal Protocol, will certainly affect the future cost and effectiveness of fumigation, and impair the ability of developing countries to comply with international standards for phytosanitary measures. The consequences of asymmetric information in the phytosanitary certification system are discussed using game theory to demonstrate the principle/agent problem that exists in the system.

Keywords: Phytosanitary Measures; Biosecurity; Trade; Exotic Species Invasion; Moral Hazard; Fumigation

1 Introduction

The threat to biodiversity that can arise from an exotic species invasion is significant and has consequences that cut across ecological, social, cultural, economical, recreational and aesthetic realms. There is an increasing awareness of the risks associated with trade and the introduction of exotic pests. Pest Risk Analyses (PRA) are now required by the World Trade Organisation's (WTO) Agreement on Sanitary and Phytosanitary (SPS) measures applied to trade. Furthermore, recent revisions by the International Plant Protection Convention

(IPPC) of harmonised guidelines and International Standards for Phytosanitary Measures (ISPM) provide examples of the growing need to place a higher priority on international and regional cooperation to protect biodiversity from an exotic species invasion. The IPPC and the WTO's SPS Agreement provide an international legal framework under which ISPMs are developed. The expected outcome of this structure will be greater transparency and harmonisation of phytosanitary measures based on a set of international standards and consequently, fewer disputes in trade arising from a nation implementing its own phytosanitary measures and standards.

This paper will address the issue of an exotic species invasion arising from the increase in the world trade of timber products and Solid Wood Packing Materials (SWPM). Biosecurity and quarantine measures instigated at a national level often have implications for trade. Phytosanitary measures have increased in importance with respect to facilitating the acceleration in the international trade of wood products. Growth in the world trade of timber products is expected to continue into the next decade. Consumption of lumber, structural panels, pulp and fuel wood are also expected to grow through the coming decades. Consequently, phytosanitary measures will become increasingly important from the viewpoint of safeguarding biodiversity and facilitating the trade of timber products.

The New Zealand Department of Conservation identified that "Introduced invasive species pose the single largest threat to the survival of New Zealand's threatened species and ecosystems." In the United States, approximately 400 of the 958 species that are listed under the Endangered Species Act are considered to be at risk from competition from non-indigenous invasive species, (Wilcove, Rothstein, Dubrow & Losos, 1998). According to one study, more than 50 000 non-indigenous species in the USA have caused approximately $US137 billion per year in damages, losses and control costs (Pimentel, Lach, Zuniga & Morrison, 2000). Finally, South Africa's Ministry for Water has employed a large number of local inhabitants to manually eradicate alien plants in water catchments. These exotic species are estimated to consume around 6.7% of the South Africa's water resources, (see Wilgen, 1999). The threat of an exotic species invasion is serious, particularly when it threatens the function of natural ecosystems that humans depend on for their well-being.

2 Current issues in global trade and safeguarding biodiversity

Economic agendas are evidently given priority over the conservation of biodiversity and economic activities have been, and continue to be responsible for the decline in global biodiversity. Many of the regulations and policies governments implement favor economic gain over the preservation of the environment and biodiversity. The New Zealand institutional and budgetary framework for biosecurity favored 94.4% of financial allocation on biosecurity was allocated to the Ministry of Agriculture and Forestry; 3% allocated to the Department of Conservation; 2.4% to the Ministry of Fisheries; and 0.2% to the Ministry of Health (Jay, Morad & Bell 2003). The general consequence of this allocation is that the framework is set up to contend with agricultural and forestry pests, and neglect the consequence of environmental pests. Furthermore, economic incentives for afforestation and reforestation created for carbon sequestration programs under the Kyoto Protocol are expected to result in a surplus of plantations containing fast growing alien species with a potential negative impact on biodiversity (Caparros & Jacquemont, 2003).

Quarantine and border controls are, and will become, increasingly important for the conservation of biodiversity given the growth in global trade volumes within the multilateral trading system. Currently there are few binding standards that apply to the international transport of invasive species arising from the multilateral trading arena. They are generally limited to a national level. Many countries face serious constraints on their inspection abilities and facilities, taxonomic capacity, access to information as well as human and financial resources to implement an effective and efficient biosecurity system (CBD, 2001).

The world is still developing its knowledge and databases on endangered species and ecosystems. The deficient knowledge on how invasive species may impact an ecosystem is still limited and has been discussed in

various contexts by Wingfield, Slippers, Roux and Wingfield (2001), Campbell (2001), and Pimental et al. (2000). By applying trade agreements on this limited knowledge, disputes and threats of exotic species in natural ecosystems have, and will continue to evolve. Some examples of this include the WTO Appellate body's ruling in favour of Canada, on Measures Affecting the Importation of Salmon into Australia, (WT/DS18/RW) and Egypt's Import Prohibition of Canned Tuna with Soybean Oil from Thailand (WT/DS205/1).

To give an idea of the current situation with respect to the available scientific knowledge, according to the Australian Quarantine and Inspection Service (AQIS), who consider it a priority to identify all interceptions to a species level, less than 50% of interceptions were identified to a genus level and 30% to the species level. Furthermore, 24% of the pests are not recorded in Australia and consequently it is unclear to what proportion of these can be classified as quarantine pests, see Biosecurity Australia (1999). To date, there has not been a systematic survey of forest pests in Australia. Available data on forest pests in Australia between 1971-95, identified 9 exotic pathogens on forest trees and only 2 species of exotic forest pests. In comparison, New Zealand carried out systematic forest surveillance between 1988-97. This resulted in the discovery of 91 new introductions of forest pests and pathogens, 84% were forest fungi. One can see the disparity of information and the need for regular systematic forest surveillance.

According to the Office of Technology Assessment, USA, about 35% of exotic insect species that have been known to become established have harmful effects, whereas 91% of plant pathogens established have harmful effects. The process for detecting plant pathogens is more difficult given most inspection is visual. The risk of exotic pest introduction is significant. One estimate cites plant pathogens and pests cost $US14 billion in loss of forest products per year in the USA. 30% of these pathogens and pests are non-indigenous, therefore forest losses attributed to invasive forest species are $US4.2 billion per year (Pimentel et al. 2000).

The Global Invasive Species Database (ISSG), was the result of the CBD to address this gap in knowledge in conjunction with the Scientific Committee on Problems of the Environment and the World Conservation Union. However, this is still in its most preliminary stages. There is much more work needed to integrate and update the database using information sharing as stipulated in the SPS Agreement and the CBD.

2.1 Harmonisation and international standards for phytosanitary measures

Transparency in rules will make unnecessary protective behaviour easier to detect and enhance cooperation in trade liberalisation. Generally, harmonisation of agreements can be recognised for its benefits to the economic and legal implementation of global trade. However, harmonisation does not take into account the different risks that individual members assume with respect to biosecurity, and in this case it is very difficult to set a uniform standard that will be optimal for all countries.

More specifically, given the different risks countries face with respect to timber trade and SWPMs, the trade regime must allow the ability of a nation to safeguard their biodiversity, including the right to keep their own phytosanitary standards and not admit products that do not comply with these. Currently this ability is somewhat constrained given that protective behaviour must be based on scientific evidence and PRAs. The example below provides a comparison of heat treatments between New Zealand's standard enforced by the Ministry of Agriculture and Forestry (MAF) and the ISPM No. 15 Approved Measures Associated with Wood Packing Material.

Heat Treatment	**Minimum core temperature**	**Minimum time period**
ISPM No.15	56 deg C	30 Minutes
MAF standard	70 deg C	+ 4 Hours

It is recognised in ISPM No. 15 that some pests have a higher thermal tolerance, in which identified quarantine pests in this case should be managed by the National Plant Protection Organisation (NPPO) on a case-by-case basis.

2.2 Phytosanitary and fumigation certificates

Certification is given when a product has undergone an inspection or certified process that complies with the specified phytosanitary import regulations and standards of the importing country. In this context we differentiate between phytosanitary and fumigation certificates. A phytosanitary certificate is a much broader official document and can verify whether the commodity has undergone heat treatment, prior treatment that guarantees no pests or pathogens are present, or that the commodity is bark free. In many bilateral agreements a phytosanitary certificate is accepted in lieu of a fumigation certificate. The IPPC has designed a model certificate in which the NPPO of a country can issue a phytosanitary certificate based on this standard included in the ISPM No.12.

2.3 Phytosanitary certification

A phytosanitary certificate is an official document issued by the exporting country, which certifies that the phytosanitary status of a shipment meets the specified regulations of the importing country. The practices for issuing such certificates differ between countries and the costs associated with certification also differ. There are fees that can act as technical barriers to trade that governments initiate to cover the cost of inspection and operating costs. Moreover, certificates required in the case of an emergency can have significant impacts on trade.

In May 31st, 2000, the Ministry of Agriculture and Forestry of Finland began requiring phytosanitary certificates for coniferous SWPM, from Japan, Canada, China, Korea, Mexico, U.S. and Taiwan. This action was taken following interceptions of SWPM with pinewood nematodes, grub holes, and bark. Consequently, the Animal and Plant Health Inspection Service (APHIS) recommended U.S. exporters to use non-coniferous pallets or packing material. Approximately $US100 million of U.S. exports to Finland per month had the potential to be affected by this urgent measure.

Conversely, the US has had to review its regulations with regard to SWPM and additional entry requirements for SWPM from the bordering state of Mexico and China have been found necessary. The interim rule for China requires SWPM shipped with goods into the US be 100% bark free, heat treated without moisture reduction, kiln dried, fumigated with Methyl Bromide, or subject to a preservative pressure treatment (USDA, 2000).

2.4 Fumigation certification

Fumigation certificates are particularly relevant to the import of timber products. They verify that a commodity has been fumigated to the required standard of the importing country. The standards differ across nations; however, methyl bromide is the most preferred chemical for effective fumigation. In many cases, particularly from Asia, fumigation has been ineffective.

Table 1 provides a comparison between four countries that have an advanced biosecurity framework and the IPPC. It demonstrates the potential difficulty of harmonising fumigation standards facing wood products. There are many different standards and treatments that can be certified that apply to a specific range of products. Small differences in temperature, concentration of fumigant and exposure time have a vital function for ensuring the wood is free of pests. For example, phosphine is a highly toxic fumigant killing pests, humans and animal life, but contains no fungicidal properties. Sulfuryl fluride has also been used to kill wood-boring insects, however, the eggs stages of wood-borers and bark beetles are more resistant. The dose required to attain 100% mortality is 130g/m^3 for 24hrs at 15 deg C. This is considered too high to be practical, see Dwinell (2001).

At this point in time, Methyl Bromide is still considered the most effective fumigant for pests, nematodes

and most fungi. However, there are several predicaments with using this substance that not only affect phytosanitary measures, but more importantly the social, environmental and economical consequences must be considered in the context of sustainable development.

Firstly, methyl bromide has been identified as an ozone depleting substance and under the binding Montreal Protocol it must be phased-out in developed countries by the year 2005. Developing countries have an extra tens years to comply with the ban. This has important implications for phytosanitary measures as Methyl Bromide will become increasingly prohibitive in its cost and primarily affect the phytosanitary measures specified in ISPM No. 15. Since its phase-out which commenced in 1999, the average price of methyl bromide has more than doubled.

Secondly, methyl bromide affects human health both directly and indirectly. It is hazardous for people who work or live near it and its toxins attack the central nervous system. Indirectly, as an ozone depleting substance, its affect on human health is primarily in the form of skin cancer. Methyl Bromide is a regulated substance in some countries, for example, the Environmental Health Authority (EHA) in Singapore prohibits fumigation with methyl bromide at rates above 40g/m3 for occupational health reasons. Accordingly, a bilateral phytosanitary agreement is necessary for the trade in wood products.

Table 1. Comparison of methyl bromide fumigation standards.

Prescribed minimum concentration of methyl bromide for various temperatures						
	Average commodity temp	**General rate grams/m^3**	**Exposure (hrs)**			
Australia Quarantine regulations for fumigating 20 ft / 40ft shipping containers of personal effects / household goods and commercial cargo containing wood / timber / bamboo	min 21 deg C or + 16 deg C 11 deg C 6 deg C 1 deg C	48 56 64 72 80	24 24 24 24 24			
Canada Bamboo poles, torches, stakes and other reg. bamboo products, decorative wood items, tree branches, tree roots, cones without seed	21 deg C or + 16-20.9 deg C 10-15.9 deg C	48 56 64	16 (24 regulated bamboo products) 16 (24 regulated bamboo products) 16 (24 regulated bamboo products)			
USA Wood products including containers as such undergoing treatment T404-d MB at NAP.	27 deg C 21-26 deg C 15.5-20 deg C 10-15 deg C 4.4-9 deg C	45 58 77 96 116	Extend normal 16 hr exposure time to 24 hr for poles and garden stakes made of bamboo. Refer to Treatment manual as times vary depending on the Minimum Concentration Readings. NB: Figures converted into metric system			
New Zealand Applied only to bamboo, cane, willow and rattan. For other timber and wood products, refer to specific requirements for wood packing material	20+ deg C 16-20 deg C 11-15 deg C 6-10 deg C	48 56 64 72	24+ 24+ 24+ 24+			
IPPC Applied to wood packing material			Min concentration (g/m3) at:			
			0.5hrs	2hrs	4hrs	16hrs
	21 + deg C	48	36	24	17	14
	16+ deg C	56	42	28	20	17
	11+ deg C	64	48	32	22	19

Sources: AQIS, CFIA, USDA, MAF and IPPC

Finally, most research on alternative fumigants is currently in relation to agricultural and horticultural crops. Many of the alternative fumigants for timber apply to specific pests and pathogens, and do not successfully destroy the variety that methyl bromide does without environmental consequences.

3 Risks and responses associated with the import of wood products

In Australia, imported timber products comprise the greatest proportion of imports involving quarantine breaches. Since 1986, AQIS has recorded over 13,000 interceptions of pests on imports of timber and wood products. The overall annual rate averaged 900 interceptions a year until 1996. After increased efforts in quarantine following the Nairn Report (1996), the number of interceptions averaged 1,500 a year (Biosecurity Australia, 1999). Many of the breaches have been cleared through quarantine upon certification with respect to fumigations performed overseas. In all, 82% of timber pest breaches are suspected for failed fumigation (AQIS Import Operations, 2000).

AQIS has identified that failure can occur from a variety of reasons, including untrained staff, inadequate equipment, fraudulent activities, time delays between treatment and export, and commercial pressures. In response, AQIS has suspended the acceptance of certification from 80 overseas fumigation companies (AQIS 2000).

One particular source that must be addressed at a global level is SWPM. This should be of particular concern because SWPM is generally made from low quality wood that is normally unacceptable for higher lumber grades (Allen, 2001). Moreover, it is not a commodity, unless traded for packing purposes, which makes it difficult to monitor during inspection procedures. Between 1996-98, the USA's Animal and Plant Health Inspection Service (APHIS) inspectors recorded 1 205 interceptions of live wood pests associated with quarantine significance with SWPM alone (USDA, 2000).

The USA now requires all SWPM from China to undergo special treatment as it was discovered that the Asian Long Horned Beetle and other closely related species were in SWPM imported from China into the US. This resulted in substantial damage to urban trees in Chicago and the State of New York.

A Canadian survey conducted in 1997, found that bark was present and usually hidden in layers in 90% of wooden spools shipped from China, Korea and Malaysia, 14% of the spools contained live insects. Another survey of wooden packing materials used to brace granite blocks, conducted by Canada, found 32% of wood packing pieces contained live insects and 50% had bluestain fungi (www.apsnet.org).

Table 2. Breaches recorded by AQIS since July 1997 by commodity/pest type.

Pest type	Number of breaches	% of breaches
Timber pests	80	83
Storage Pests	5	5
G.A.S.	3	3
Grain	2	2
Straw	2	2
Seeds	1	1
Bark	1	1
Ants	1	1
Soil	1	1
Bamboo	1	1
Total	**97**	**100**

Source: AQIS 2000

Table 3. Comparison of timber pest detections in consignments covered by valid fumigation certificates with the total number of consignments subject to quarantine from origin. Source: AQIS 2000

Source region	% of timber pest detections where consignments covered by valid fumigation certificates Jan 98 - Jan 2000	% of total consignments subject to quarantine July 98 - Jun 99
SE Asia	48	6
Rest of Asia	38	20
Rest of World	14	74

Table 4. Continents of origin for cargo from which exotic pests were intercepted with SWPM at US Ports of entry during 1996-98. Source: USDA 2000.

Continent of origin	Number of interceptions 1996-1998	% of interceptions
Asia	633 (7 uncertain)	52
Europe	451 (1 uncertain)	37
North America	38 (4 uncertain)	3
South America	34	3
Africa	30	2
Oceania	4	less than 1
Unknown	15	1
Total	1205	100

AQIS has identified three factors that are significant to timber pest breaches.

1. The commodity
2. Country from which the product was exported
3. Ineffective fumigation undertaken at the point of origin

Asia has recently been identified as the most risky continent given the number of breaches with certification of fumigation. Interestingly, AQIS has required mandatory fumigation of all timber imported from South East Asia and Africa.

The risk arises from the lack of capacity to effectively detect, through inspection, potential exotic species given the timber volumes, and instead an Import Risk Analysis (IRA) is used to identify potential infested consignments. The global change from bulk to containerisation cargo, which is more sea worthy, affects SWPM inspection capacity. The increasing use of containers is a global trend. Interestingly in the USA, "importers must pay high fees ranging from $US800-$1,500 per container for removing or unloading cargo to facilitate inspection. Inspectors are often reluctant to impose these additional costs on importers unless there is reasonable certainty that pests will be found. As a result, APHIS inspectors do not gain access to most imported SWPM." (USDA, 2000).

The economical costs of fumigation, phytosanitary certification and inspection should not be underestimated. It was identified at the 18th Session of the Global Biodiversity Forum, September 2003, that "the economic, administrative and legal costs of certification and labeling can also present a market liability to small producers, producing the opposite result of the one intended." Treatments are estimated to increase the cost of SWPM

by 10%, or even double the cost of SWPM in some cases, see Illman (2001). Since SWPMs are made from low grade lumber, this may become an economically unviable option. Moreover, many developing countries are constrained by relatively poor scientific and technical infrastructure and are therefore less able than developed nations to use the procedures established by the SPS Agreement, see Henson & Loader (2001).

In the case of Australia, given the number of wooden artifacts that have been infested by exotic pests from Africa, AQIS requires that all consignments of wooden artifacts and natural forest products from Africa are unpacked and inspected regardless of fumigation certification. Border response and the targeting of high risk commodities is becoming increasingly important to prevent timber pest breaches in imported wooden artifacts into Australia. However, it is important to recognise that this mode of extreme response is only viable given Australia's low trade volume of wooden items from Africa (AQIS Import Operations, 2000).

4 Information asymmetry and fumigation certificates

In the timber market, it is difficult to acquire complete information about the standard (in this context, disease free, with no invasive species, and has undergone fumigation) of the import except by observing the average quality in the market. Inspections at the port may provide some form of estimation of quality through examination and appraisal but this will only reduce, not eliminate the risk of exotic species and pathogens.

In this context we analyse the principle/agent problem with respect to the fumigation and inspection of wood products. Given the lack of inspection ability, that is, low probability of inspection or difficulty in detection from importers, fumigators from exporting countries may not have the incentive to apply prudence and assurance in their process. Increasing volumes and global movement of timber and wood products make inspection and detection more difficult and a costly process. Consequently, quarantine and inspection services are going to rely on valid fumigation certificates to ensure the product is pest and pathogen free.

There is a significant presence of asymmetric information in the case of trading effectively fumigated timber products. Exporters have access to full knowledge of the type of product they have, generally where it has come from, and the risks of pathogens and pests. They also have the information on the phytosanitary treatment of the product and the credibility of the certifier. On the other side, importers are limited to Import Risk Analysis, probability of interception through inspection, and largely depend on the certificate to verify regulations are met. This has led to the increasing incidence of moral hazard experienced in particular by the USA and Australia receiving imports with fumigation certificates from Asia.

4.1 Moral hazard and fumigation certification

When comparing the current AQIS import requirements for green, sawn timber with those of the USA, New Zealand and Canada, AQIS currently inspects 1-2% of external surfaces for insects compared with 10% in New Zealand. The USA and Canada require mandatory treatment of high risk commodities. However, the USA defines its capability to detect breaches as limited. In the largest US container port, if inspection was to occur in all SWPM containers, this would require inspectors to search 39 000 containers a week. Currently APHIS is able to inspect 120-200 shipments of SWPM per week (USDA, 2000), quite a fraction.

The inability of importers to observe the care and effort of exporting fumigators is difficult if not impossible, and thus forms the basis of moral hazard in the enforcement and monitoring of fumigation certification. Fumigators have an incentive to cheat given the low probability of being detected. In this particular case, the prisoner's dilemma is used to depict that the current system does not necessarily lead to the most effective outcome.

To clarify Table 5, the entries in each cell of the matrix represent the utility that each agent assigns to the various implications, such as detection of infestations, paying the cost to comply with fumigation regulations

or the hazard of an exotic species invasion. Benefits accruing to importers and exporters are (9) and (8) respectively; fumigators that co-operate with the importer's phytosanitary standards create the optimal efficient outcome given the probability of inspection. An exporter can improve their economic position from (8) to (10) if they choose not to pay for complete fumigation and/or reproduce a fraudulent or invalid certificate. In this case, given the rate of inspection, there is a high probability that a breach in quarantine may occur, leaving the importing nation worse off both economically and environmentally, hence (3) this is the worst possible scenario. As a response to the incidence of infestations occurring in wood products, the importing nation must induce a policy of 100% inspection to detect exporters that cheat. 100% inspection is expensive, time consuming and in most cases impossible, as a consequence the importing nation is economically disadvantaged to (5) and may even attempt to transfer a proportion of this additional cost associated with inspections to fumigators (7). The exporting country can slightly improve of their economic position from (5) to (6) if their policy of 100% inspection can identify cheat fumigators and halt the economic and environmental damage caused by quarantine breaches. As a result of the identification of cheat fumigators, the importing country can induce a policy to suspend the acceptance of certification from cheat fumigators (4).

Inspection is costly and the optimal rate of inspection given manpower, budget and trade volume of a state is considered consistent with the countries rate of inspection probability (1-p) defined by the Import Risk Analysis.

However, if there are fraudulent fumigators, they will be better off economically under a low probability of inspection, and as a consequence, there is a greater risk of exotic specie invasion into the import destination. This may become an increasing dilemma considering the cost of using methyl bromide for fumigation will continue to increase. 100% inspection is non-optimal, even when the detection of a fraudulent fumigator occurs, while it can mediate the information asymmetry and potential consequence of an exotic species invasion, it is a costly and difficult control to implement.

Some solutions to remedy this problem may be to internationally regulate who carries out the fumigation of exports and accredited fumigators that comply with international standards may solve a small proportion of this problem, however as demonstrated before, countries have different standards for fumigation. Currently there is a plan by AQIS to certify credible fumigators, whose products do not have infestations.

By following the harmonised guidelines for phytosanitary certificates (ISPM No. 12), border control and information regarding different consignments will make multilateral trade in wood products less risky under the assumption that both importing and exporting parties co-operate to insure against the risk of pest and pathogen introduction. However, the incidence of invalid and fraudulent certificates continues and provides a good reason for a state to implement their own standards. It is interesting to note that in the harmonised guideline for phytosanitary certificates (ISPM No. 12); the inclusion of a financial liability statement in a phytosanitary certificate is optional, thereby creating a case of adverse selection. In other words, those exporters that can guarantee that their consignment is 100% pest free will have incentive to sign a financial liability statement, whilst exporters that can not guarantee, will choose not to sign the statement. Perhaps a mandatory financial liability statement attached to a phytosanitary certificate will eliminate some problems of moral hazard and adverse selection.

Table 5. Prisoner's dilemma payoff matrix between fumigators in exporter countries and inspectors in importers countries.

	Exporter (E)			
Importer (I)	Fumigators		Cheat Fumigator	
Inspection (1-p)	9_I	8_E	3_I	10_E
100% Inspection	5_I	7_E	6_I	4_E

5 Conclusions

Nations do not have uniform ecosystems and the risks associated with exotic pests through trade differ significantly. While standardisation may provide a basis for setting safe minimum standards, it should not undermine a states ability to implement its own controls. Trade volumes in wood products are likely to increase in the future, and as a result, inspection at the port of entry will continue to become more difficult. Therefore, if wood products and materials are to move globally, without causing environmental harm and threaten biodiversity, coherent regulations and policies are needed to ensure that the wood materials transported are free of pests and pathogens.

Given the number of exotic specie invasions and interceptions that have occurred in relation to SWPMs, phytosanitary measures must be taken seriously to safeguard biodiversity. Emergency restrictions to trade can have significant implications. Therefore there is a growing global need for credible certification that guarantees the phytosanitary status of a containment or product requiring treatment. This may turn out to be a costly measure and in an attempt to liberalise trade, it may also create a barrier for developing countries through extra value added costs.

A more concerning, short-term feature of harmonising phytosanitary standards is that the use of methyl bromide must be phased-out under the Montréal Protocol. This phase-out may have several implications for trade and phytosanitary measures. The developed world must comply with a complete phase-out of the substance by 2005. If a viable alternative for fumigation is not found to meet international standards in the meantime, a new assortment of bilateral agreements may evolve concerning the use of different fumigants. From the developing country perspective, methyl bromide will continue to become an increasingly expensive fumigant, particularly for those deriving their income from trading wood products. Given the asymmetric information associated with the fumigation market, this may provide a greater incentive for exporters to pursue invalid certificates of fumigation.

The real challenge is how to make exporters more accountable for their commodities, and by what means can this be successfully attained. Phytosanitary and fumigation certifications still have a long path of development given the current number of “certified” consignments infested with pests. The difficulty that faces policy makers and scientists though, is not so much how to kill pests, but how to meet the inconsistent regulations and enforcement procedures of individual countries without endangering the unique arrangement of biological diversity inherent in a nation.

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Evolution of biodiversity policies on the territory of the Cevennes National Park (France): some contractual approach issues

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Abstract

National Parks constitute key elements of the French biodiversity conservation policy. The Cevennes National Park in an interesting case since it is the only one inhabited in its Core Zone and an important point is that the action of man is considered as having a quite positive impact on the conservation of biodiversity.

Since its creation in 1970, the Park developed many actions that can be ordered following four axes: action in favour of endangered species, ecosystems and landscapes, management of hunting, management of forested lands, and agriculture and breeding. In all these actions, a common evolution of the Park strategy can be identified: a move from command-and-control and direct action towards indirect incentive approaches.

A tentative interpretation of this evolution is suggested that tried to replace it in the general context of the European and French biodiversity policies. The main lesson is clearly the statement that the main local driving force is the continuous learning process, both on the socio-economic and the ecological dimensions, which, despite the loss of legitimacy of the State, allows the Park to improve the efficiency of its actions.

1 Introduction

The first delimited and regulated land in Europe are probably related to feudality: hunting reserves aimed at preserving game resource and managing water and wood reserves. In France, during the 19th century the first national legal structures related to the "uses of nature" were established. "Forest artistic series" were described to designate trees excluded from standard exploitation because of exceptional qualities. By the end of the century "forest biological reserves" were created while the large national hunting reserves were already

constituted, namely in the massif of the Mercantour. The Law on the protection of natural monuments and artistic, historic or picturesque sites was voted in 1930. At the beginning, the protection of nature was mainly justified by aesthetic considerations.

The idea of creating National Parks then appeared as the result of the crossing of several policies: cultural, aesthetic, scientific and technical. It was strongly related too to the action of an administrative body, well established on the French territory: the Waters and Forests Administration ("Administration des Eaux et Forêts"), which, even before the National Parks Act, contributed to the protection of several sites.

At the end of the Second World War, France was one of the rare developed countries that had not yet voted any legislation related to National Parks. There were only Natural Reserves created and managed by the Waters and Forests Administration, or NGO like the Birds Protection League ("Ligue de protection des oiseaux") or the National Society for Nature Protection ("Société Nationale pour la Protection de la Nature").

The National Council for the Protection of the Nature was created on November 1946 and aimed at designing the statute of National Parks in France. The act instituting the National Parks was prepared by the Department of Agriculture and finally voted on July 22nd, 1960. The seven existing Parks were then created by executive acts[1].

The French policy draw some lessons from foreign experiences, namely the Park model initiated in the United States, in order to create its own National Park concept with a Core and a Buffer Zone. National Parks are public establishments whose policy is designed by a board of directors that gather representatives of several administrative bodies, local communities, staff of the park, academics, and specialists of the environment and the tourism. The Director of each Park is nominated by the Ministry of the Environment.

The parks have mainly been created in geographic zones with limited human activities, namely mountains massifs. The first objective is to protect not too widely transformed nature if not wilderness. Created in 1970, the Cevennes National Park ("Parc National des Cévennes" -PNC- see appendix 1) then appears as an exception since its core zone is inhabited by permanent residents. The population density is actually rather light, but the natural environment is profoundly transformed.

Its starting objectives of nature and landscapes conservation were conceived as a prospect where men only had a very limited role to play: they were likely to involve degradation processes that had to be supervised and countered by strict rules. The place of the man as an active and positive element of the evolution of ecosystems, and what was later called "biodiversity", was taken into account only later and progressively. In the Cevennes, nature management is organized along three main objectives: the dynamic conservation of biodiversity and landscapes, the promotion of a rich cultural and rural heritage and the implementation of a sustainable development including green tourism. That has resulted in the evolution of PNC's strategies at various levels. Several planning schemes are established periodically to organise PNC's actions for four to six years, on the basis of the priorities adopted by the Administrative Council of the PNC and the opinions of its Scientific Committee. Today, one of these priorities appears to relate to maintaining the openness of landscape that are more and more threatened by the agricultural land abandonment and the progress of spontaneous forestation.

The objectives of this paper is to give a brief survey of the many actions undergone by the Park in order to protect the biological diversity on its territory, and to give some insight on the underlying rationales that lead to these choices, both in terms of objectives and policy tools.

From an historical perspective, we will show that many evolution can be analysed as a learning process. National Parks have been created with complex objectives and the genuine nature conservation is clearly only one of them. In the Cevennes, since a long time before the creation of the National Park, the relations of the Park's structure with the local population have been the key variable to understand the strategic choices and the resulting conflicts. These relations both determined the nature of the conservation issues and the means used to answer them.

2 Strategic actions in favour of biodiversity conservation in the PNC

The strategic actions of the PNC for biodiversity protection widely relate to species and ecosystems. The management of hunting appeared very early as a specific cultural problem, crucial for the future. Similarly, the management of forested and agricultural areas led the PNC to elaborate strategies each time better targeted and adapted to the evolving context.

2.1 Species, ecosystems and landscapes

The Core Zone of the PNC is very rich in biodiversity. Since its creation, the PNC aims at characterizing this biodiversity, reintroducing recently disappeared species, preserving the natural ecosystems, habitats and landscapes. But since its creation the design of the tools to reach these goals evolved even if the objectives essentially remained the same.

2.1.1 PNC's actions on special interests habitats and species

The first action of the PNC was to inventory animal or vegetable species in order to establish the benchmark and identify what were the conservation priorities. The existing data were incomplete and disparate. Moreover precise and geo-referred localizations of vegetable species and their insertion in well-identified natural ecosystems, habitats or landscapes were missing. Only in the 80's, and even more in the 90's, the interrogations, in terms of biodiversity and landscapes, and methods able to answer them, have been taken into account. The installation of an Observatory of the Park in 1995 results from this inventory approach and aims at facilitating the implementation of effective and efficient management measures.

This approach allowed to take into account in the analyses, and according to a systemic method, the socio-economic aspects and the influence of human and practical activities, primarily of farmers and foresters. This is one of the reasons that engaged the PNC in participative approaches of sustainable management. One can thus notice that the evolutions noted in PNC's strategies as regards to the management of species, natural habitats, hunting and forested areas were accompanied by these researches, undertaken in close relation between PNC and some interdisciplinary teams.

Now, vertebrate species are rather well listed, but lacks remain for invertebrates and underground fauna. The stations of nonvascular plants still have to be inventoried. But the influence of agricultural or forestry practices, and more generally of human constructions and management ways on the various ecosystems and their evolution is still badly known.

A key mission of the PNC is to preserve the present species. But the difficulty is to supervise the factors that contribute to their presence. Regarding these issues, the strategy evolved. In a first period, from the creation of the PNC to the beginning of the 90's, the PNC mainly supports, when necessary, the preservation of this biodiversity: clearing of undergrowth, operations through contracts, purchase of plots it wished to safeguard...

In the same period, various research programs suggested, in partnership with farmers, to implement management ways more adapted to the preservation or the increase of biodiversity. For example, "LIFE-Nature" (since 1990), funded by the European Union, made it possible to specify the objectives and the conditions and procedures to reach them by taking into account the concept of natural habitats and landscapes, in particular on the Causses. More recently, the "Recreate the nature" national research programme, funded by the French Ministry of the Environment, proposed technical patterns for ovine stockbreeders in the Causses in order to preserve or rehabilitate open agro-pastoral lands that are more favourable to biodiversity, while ensuring farms viability. Thus the PNC can develop incentive actions more able to convince direct managers. But that does not exclude the necessity of following the effects of these presumably efficient practices in the medium and long run.

Existing species on the territory of the PNC

In the PNC, the 35 main kinds of ecosystems (forests, moor lands, steppes, meadows, wetlands...) and 200 kinds of natural habitats (more than thirty are listed in the Habitats and Birds Directives, or more generally in Natura 2000 areas) favour the presence of a great diversity of fauna and flora. Moreover, since the middle of the Eighties, about 270 000 hectares of Ecological, Faunistic and Floristic Interest Zones (40 000 hectares in the biosphere reserve) were identified (French classification for key natural areas: "Zones d'Intérêt Ecologique, Faunistique et Floristique"). Lastly, Important Zones for the Conservation of Birds were located.

According to the last inventory, of the 2 410 species founded in the PNC (Core, Peripheral Zone plus the biosphere reserve), 89 are mammals (on 135 in France), 208 are birds (135 nest there), 18 are amphibians, 17 are reptiles, 24 are fishes, 1 824 are insects (846 are beetles), 53 are spiders, 12 are shellfishes, 106 are gastropods, 26 are nematodes... According to IUCN's lists, there are 4 species know as extinct in the wild, 42 threatened (11 endangered and 31 vulnerable), 18 rare, 14 with data deficient and 20 to keep watch. 29 species are listened in annexe II to the EU Habitat Directive (2 are priority species), 62 in annexe IV and 12 in annexe V. 48 species are listened in the EU Birds Directive (one is a priority species: tawny vulture). Finally, 229 species are protected through French legislation (law of 1976 for nature conservation).

Concerning the flora, about 2 200 vegetal species were listened in the biosphere reserve, i.e. 40% of French species on only 0.5% of the national territory. Of the 400 species protected in France, 33 can be found in the PNC (Lilium martagon, Adonis vernalis, orchids...). The PNC specialises in the conservation of 48 indigenous species and another hundred rare or threatened plants. A large number of the latter exist only in open lands (meadows, moors, prairies, pathways) that are maintained by cattle grazing.

2.1.2 Reintroductions of species

Very early the PNC was involved in a policy of reintroduction of species(tawny and black vultures, beavers, moufflons, grouses and crayfishes) formerly present and disappeared because of human predation, a too important hunting pressure or because they were classified as harmful species. The protection of ecosystems also helped the natural re-colonisation of several species such as otters, black woodpecker, owls, vultures, frogs etc.

The protection of the species pledged to characteristic ecosystems leads the PNC to work on the Core Zone of the PNC (much more rarely in the Peripheral one) on some threatened spaces, especially if the usual

Species reintroduced in the PNC

Vultures were reintroduced since 1970 by the PNC and the National Society for Nature Protection, relayed since 1980 by the French Funds of Intervention for Rapacious ("Fonds d'Intervention pour les Rapaces"). This operation was a great success[2] and 200 couples are currently counted. It also allowed the re-colonisation by tawny vultures (some couples remained in the Pyrenees) and created an important tourist promotion (form 15 to 20 000 visitors per annum) that had to be organized in order to ensure reintroductions durability.

Reintroductions of small grouses (French rooster) from1975 to 1985 and big ones since 1978, emblematic birds of steppes, were carried out with much more difficulties. Because of the brittleness of these species and it is uneasy to ensure an efficient protection: predation is important (hunters are sometimes concerned in spite of the absolute protection concerning the big grouse in the PNC) and accounting difficult. In spite of a release of ten couples each year, the population drops locally and there are only more or less twenty couples.

Various birds pledged to the ecosystems of the Core Zone (some are listened in the Birds Directive, and the Core Zone is classified Special Area Protection) were reintroduced, for instance grey partridges, disappearing in the zone, and grouses. The majority of these species disappeared recently.

Other animal wetlands species such as otters (reappeared at the end of the Eighties) and beavers (reintroduced in 1977-78) reinstalled themselves because they are protected in the Core Zone. These actions are linked with the increasing interest of the PNC for wetlands in the 80's: rivers, brooks, peat bogs, humid and non drained talwegs etc.

managers lose interest in them. It can for instance encourage the owners to manage their lands in order to protect the corresponding species. We will later see (section 2.4.) that the agricultural policy of the PNC strongly relates to this objective (the tool generally used is the "fauna" contract but the more recent Natura 2000 procedure can also be used). Finally, the PNC can be brought to acquire hot spots that are then protected and supervised by PNC's agents; it is the case of some peat bogs for instance.

2.1.3 Landscapes

The chestnut-trees of the Cevennes (more than 120 varieties) make up a typical landscape. It is the product of a secular human activity in terms of space planning (terraces, systems of irrigation etc.) and management (selection, varieties grafting, implementation of specific cultural practices etc.). Beyond the revival of a typical and quality product, the conservation of varieties intra-specific biodiversity and chestnut-growing landscapes mobilize important tools since the Eighties. A support to researchers, to chestnut-holders with regards to the production, the transformation like marketing, and more direct incentives to the communes for landscape protection (within the framework of the Environment-Landscape Plans ("Plans Environnement-Paysage") that are an initiative of the communes to protect landscapes through a limitation of forest progression, the installation of paths etc.).

The preservation of open lands on the Mont Lozère and Grands Causses, following "LIFE-Nature" and "Recreate the nature" programs, can also involve the intervention of the PNC, for instance through Local Scheme of Concerted Planning ("Plan Local d'Aménagement Concerté" or PLAC) such as the PLAC of the Causse Méjan funded by the Région Languedoc-Roussillon and the European Union and that aim at supporting projects and activities that use or arrange space and respect the natural inheritance. These actions often concern the agricultural or forest policy of the PNC. Implemented since 1992 and especially since 2000, they call upon a partnership more or less negotiated with farmers, foresters and private landowners.

This land acquisition or spaces control policy also fits in a prospect for constituting an ecological references network and major strong degree of wilderness or transformed habitats (patrimonial aspect, eco-systemic, ecological, specific or genetic and functional diversity), within the framework of European directives application. The specific issue of forest habitats management will be analysed later (section 2.3.).

2.2 The management of hunting

From the creation of the PNC, hunting is a key issue. A great part of the articles of the decree of creation relate to hunting[3]. Hunting is authorized today on the whole territory of the PNC except some areas more strongly protected that represent 15% of the surface. However, it is subjected to a particular monitoring that makes it possible to obtain a balanced development of hunting livestocks, their conservation and that of natural environments, especially forests.

One can distinguish two periods in the evolution of the PNC's strategy. The first one is dominated by regulations that allow the replenishment of game resources. Releases were associated to a very strict protection until the 80's, through controls and even hunting prohibition. The PNC also maintained law and ordered and helped the clarification of eligible hunters population.

The replenishment of game resources, significant from the middle of the 80's, makes it possible for each party involved to adopt at the end of this first period a more reconciling attitude. In this lapse of time each one progressed in the comprehension of the issues of sustainable and partnership resource management. PNC's agents improved the dialogue with hunters and these became aware of resource abundance (7 000 wild boars and 300 stags shot in 1998 and 400 wild boars in 1970, for approximately 1 500 hunters).

It is enough to count hunters' expenditures (from 2 to 4 000 euros per annum per hunter) and evaluate their receipts (Lundy, 2001) to realize the evolution of hunting and its economic impact at the local level (on the Causse Méjan game sales bring as much as ovine breeding). In addition, hunters have important tourism repercussions on the area that include hunting allowances paid to the State and trophies re-sale.

Reintroductions of game species in the PNC

In the middle of the 70's, the PNC proceeded to reintroductions of Elaphe Stags from wild origin resulting from breeding, disappeared at the end of the 18th century. These reintroductions, which also concerned roe-deers from 1976 to 1983, affected the Mont Lozère and the Bougès. Hunters associations also released.

From 1973, an Hunting Management Scheme is worked out by the PNC after a formal consultation of hunters. The Minister of the Environment decides hunting periods on proposal of the Administrative Council of the PNC (being based on the opinion of the Scientific Committee and the Hunting Commission). The implementation of this Plan allows the replenishment of hunting livestock thanks to releases of deer tribes and genetically tested wild boars.

Conditions to hunt in the Core Zone of the PNC

To get a hunting allowance in the Core Zone it is necessary to be resident of one of the 52 communes having a part of their territory in the Core Zone, or to be the owner (either a moral or physical entity) of more than 30 hectares in the Core Zone, or to be a first generation descendant (or the spouse) of an owner of more than 10 hectares in the Core Zone who lives in a commune of the PNC. Furthermore, a "stock" of 10% of the number of hunters corresponding to the "guests" and "historical" hunters is managed by hunters associations.

The success of the reconstitution of the wild fauna and the joint evolution of the spirits lead (oblige) to negotiate with hunters associations and control the resource together. Indeed, reintroductions made it possible to constitute a consequent number of great quality animals, but the growth of the species threatens the equilibrium of the forest and the damages caused by wild boars to some agricultural and forest land uses[4], make it necessary to regulate their growth by hunting. Integral reserves are regarded as an additional source of risks for close timbering. Hunting Schemes for deers were thus established since 1981, in consultation with hunters associations, discussed and proposed to the agreement of the Minister who promulgates a decree for each hunting campaign. The consultation of hunters is not any more formal but the co-administration of the resource becomes gradually a reality. In addition, the Hunting Commission of the PNC welcomes representatives of landowners, nature associations and scientists specialized in wild fauna. Interns dialogue and collective training intensify.

2.3 The management of forested areas

The future of forests in the PNC was considered by its founders as naturally evolving. The very strong increase of set-aside lands in the 70's accentuated lands liberation. Private owners entrusted their lands to neighbour farmers when they still remained, or retimbered them with the assistance of the French Forestry

Characteristics of the forest in the PNC

More than 1 500 km² of forest cover the PNC (Core and Peripheral Zone). The forest occupies 63% of the Core Zone (about 58 047 hectares) in three stages: Holme Oak (up to 500 metres), deciduous woodland and chestnut-trees (between 500 and 900 metres) and beech woodland (between 900 and 1,500 metres). Two-thirds species are indigenous; The others are evergreens introduced in the area: 15 000 hectares of beech bush (3 000 hectares are mixed), and approximately 30 000 hectares of coniferous tree (Spruce, Pine with hooks, woodland Pine, Austrian black Pine and Laricio pine) in the Core Zone. There are also 4 000 hectares of chestnut-trees in the Core Zone (40 000 hectares on the totality of the PNC).

The forest is half private and half public in the Core Zone. In the PNC, the State owns 30 000 hectares and private owners 15 000 hectares. The really managed forest represents 33 000 hectares (25 000 ha are managed by the ONF). The preservation of the last natural beech and pine woodlands found on the northern slopes of the Mont Lozère constitute an imortant role in the PNC 's forestry management.

Funds ("Fonds Forestier National"). Moreover, the PNC encouraged afforestation in public forest. The French Forestry Office ("Office National des Forêts" -ONF), institution in charge of the management of public and publicly administrated forests[5] belonging to local territorial authorities, was then considering itself as the most vouched for biodiversity management.

During the first period from 1971 to 1990, the PNC let the owners and the ONF act. It did not have a well-defined strategy, and just intervened when necessary, for instance to preserve an interesting forest (forest relics, particular tree species, pine of Salzmann, Douglas...). With the ONF, the PNC kept the order, maintained the forests and receipted the public, even if they are two different institutions with different funding.

But, coordination issues arises in forest policies, especially related to the objectives of environmental protection, since the ONF also has an owner stake (a share of its incomes comes from the exploitation and the sale of wood) and did not always take into account PNC's wishes. Conflicts born between the two institutions, even more because the ONF already had a hundred years of presence and experiment in the Cevennes when the PNC was created and constituted to some extend a competing "higher authority".

For instance, on the Mont Aigoual where the existing forest results directly from the work of foresters by the end of the 19th century, the PNC owns 1 200 hectares and the State 17 to 18 000 hectares of forests on which the PNC cannot act as it wants but that it has to manage jointly with the ONF. This limitation of PNC's prerogatives is awkward because two thirds of the Core Zone are public forest whereas it is the only area where PNC's regulations apply.

A convention was signed between the two institutions for the management of PNC's territory in 1990 by which, the ONF is committed to take into account PNC's opinion and manage the forest according to biodiversity issues. This convention aims at providing a general framework of more ecological actions. It creates a compromise between an acceptable management at wood production economic level and the maintenance of a high biodiversity level: it takes into account the secondary productions and the various amenities of forests management. All modifications and works (public and private) are subjected to the acceptance of the PNC's Director and the convention defines the cases in which the ONF can complete work without the authorization of the PNC (subject to the respect of the specifications envisaged). Then the ONF becomes a member of the PNC's Administrative Council and the Scientific Committee contributes to validate ONF's plantations in the Core Zone.

Since, the PNC tries to be in relation with the Regional Centre for Forestry Property (Centre Régional de la Propriété Forestière -CRPF), i.e. with the institution that represents private forest owners, and helps the implementation of the Simple Management Schemes ("Plans Simples de Gestion") that give subventions to sustainable management practices in private forests. For farmers who cannot subscribe a PSG, an equivalent program called "country forest" is proposed. Probably, in the future, one can hope for a convention with the CRPF.

The stake of the collaboration between the PNC and the ONF is thus double: first the maintenance of plots in the long run to support some species with cuts regulations in some areas and second the implementation of contracts on ageing forest plots and the control of set-aside lands with a prohibition of afforestations (in particular on the Mont Lozère and the Causse Méjean).

2.4 The agricultural policy of the PNC

Three periods can be distinguished in the evolution of PNC's agricultural strategy. In the first one, the PNC did not have any strong strategy and simply tied to facilitate the maintenance of farmers in the area. This vision corresponds to that of the Departmental Agricultural Professional Organizations ("Organizations professionnelles agricoles") with which the PNC tried to maintain reinforced co-operation relations. Thus, one can note the implementation of the so-called "Mazenot contracts" (from the name of the prefect who devise them) to clear undergrowth plots or access paths and that represent an additional income: farmers are

remunerated for these tasks on the basis of estimate additional costs. The support to agro-tourism development and rural lodgings are ways to diversify the activities through an assistance for investments as well as for the purchase of local animal domestic races disappeared in the Seventies (Mérens horse, Raïole goat, Aubrac cow...) and related to the Cevennes' traditions. These actions aim at reinforcing the diversity of local livestock races adapted to the local edaphic conditions, as elements of biodiversity.

The Agricultural Commission of the PNC only had a blow by blow strategy and privileged the reinforcement of farmers incomes to maintain the agricultural activity, hoping that this will favour, in an indirect way, biodiversity preservation. Subsidies for investments (purchase of animals, fences, clearing of undergrowth...) have been distributed between farmers on a criteria of use and ecological management of ecosystems but without really being sure that the results are in conformity with the objectives stated in the specifications.

Gradually, during the 90's, conceptions evolved towards the use of agriculture as a tool in biodiversity management and an evaluation of the impact of PNC's specific actions in favour of the agricultural sector. Contracts more in relation with PNC's objectives of biodiversity protection such as the patrimonial contracts ("contrats patrimoine") appeared. Indeed, as quoted in the report on the evaluation of the PNC in the agricultural field (Inspection Générale de l'Agriculture, 1999), "*the publicly-owned establishment can with*

Characteristics of agriculture in the PNC

In the Core Zone of the PNC, one counted 120 farmers in 1970, 106 in 1980 and only 95 in 1999. There are 283 farms in the close periphery (most also own lands in the Core Zone). In the 52 communes of the PNC (186 500 hectares) and more particularly in the Core Zone, the evolution of agriculture is analysed in four areas: the Causse Méjan, the Lozère-Northern Bougès, the Cevennes-Southern Bougès and the Aigoual Lingas. The rate of disappearance of farms is very strong on the Aigoual Lingas (-82%), Lozère-Northern Bougès and Cevennes-Southern Bougès (-70%). The reduction of the total area of farmland in use is more accentuated on the Southern Bougès (-66%), relatively limited on the Aigoual Lingas (-20%) and weak on the Causse Méjan (-5%).

Milk or meat sheep farms dominate on the Causse Méjan; Sheep and caprine farms as well as chestnuts exploitation characterize the Cevennes and the Southern Bougès; Milk and meat bovine farms colonize the Mont Lozère and the Northern Bougès. The number of animals is maintained or increases. The evolution of set-aside lands is thus dependant to each area.

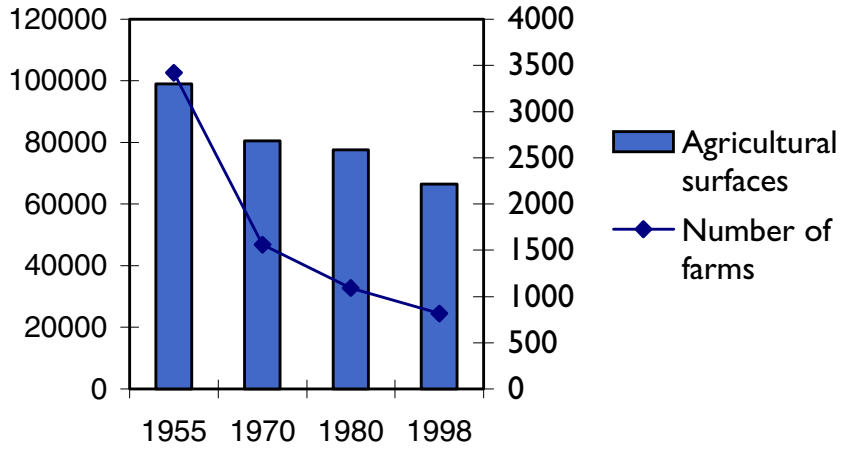
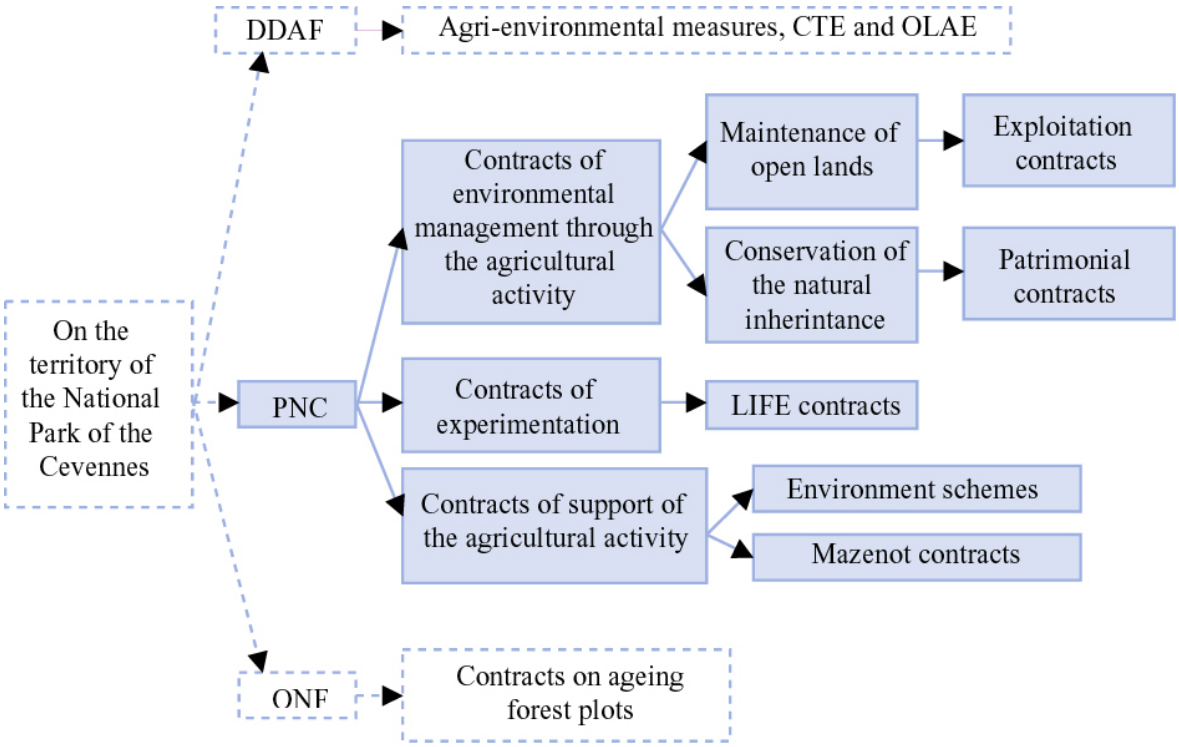


Figure 1. Number of farms and total area of agricultural land in use in the communes of the Core Zone of the PNC (180 000 hectares). Source: IARE, 1991.

the agreement of concerned owners and in connection with the DDAF proceed to operations likely to involve an improvement of agricultural and forested exploitation conditions".

The PNC has thus vocation to support husbandries that contribute to the safeguard of key ecosystems, mainly wetlands (peat bogs), habitat of the Apollo butterfly, nesting zones of key birds and some raptors hunting areas. It primarily bases its contractual policy on its collaboration with farmers and stockbreeders. Through contracts, it aims at making possible for farmers to improve their system, diversify their activities (including handicraft activities) and, finally, improve their living conditions. In addition to the traditional agri-environment measures and their French variations, CTEs and OLAEs, and to Natura 2000 contracts, managed by the Departmental Direction of Agriculture and Forests ("Direction Départementale de l'Agriculture et de la Forêt" -DDAF), the representative body of the French Ministry of the Agriculture in the departments, farmers can contract directly with the PNC (see appendix 2): Mazenot contracts, farming contracts ("contrats



Maintenance of extensive breeding on the Massif de l'Aigoual and Mont Lozère

On the Massif de l'Aigoual, the PNC repurchased all properties on sale and that were on the way to transhumance. Stockbreeders then gathered and the PNC signed with them 30 years beams (with specifications on the type of management they must apply on these lands: conditions of hiring are established in order to encourage stockbreeders to have once again a pastoral use of these moors -a financial and technical support can even be provided- even if these specifications often are difficult to make), thus guaranteeing the continuity of the contract on the group and not only on one person. The PNC thus ensures a better control of space and stockbreeders can have decisions in the long run since they know that they are there for thirty years. Finally, in this area, the PNC owns 1 200 hectares and rents 800 to transhumants (more than 3 000 hectares its whole territory).

The situation was the same for lands located on the top of the Mont Lozère and on which a regular summer transhumance took place. But transhumance concerns 20 000 animals in the sixties and approximately 10 000 in 1977, and that was notably insufficient to maintain the quality of the lawns. In this case, the 18 bovines stockbreeders of the massif created a co-operative to rent the 1 600 hectares bought by the PNC and use them. Private lands were also rented in the vicinity, increasing by the same occasion the space available thus used for a modern transhumance.

d'exploitation") which can be regarded as a early forms of CTEs, environmental schemes ("plans d'environnement"), LIFE contracts and patrimonial contracts ("fauna" and "flora" contracts), and traditional tools of National Parks used in the PNC in favour of biodiversity such as pluri-annual pasture conventions ("conventions pluri-annuelles de pâturage") (see appendix 2.).

Two main types of contracts are used: contracts with obligation of means such as "fauna" contracts and contracts with obligation of results, increasingly frequent, such as agri-environment contracts complementary of DDAF's. Even if a priori there are no preferences for the definition of contracts between the Core and the Peripheral Zone, interventions are carried out especially on the communes having a part of their territory in the Core Zone. The most concerned areas are the Causse Méjan and the Mont Lozère which constitute the most open lands.

However, "*the lone preservation of exploitations is not enough for a good management of ecosystems, landscapes and biodiversity*" (Atlas of the PNC). The evolution of agricultural technical routes influencing the space management, the preservation of opened lands through the safeguard of extensive pasture is encouraged. Indeed the summit lawns are the result of several centuries of ovine and bovine transhumance and include species linked to these pastoral practices. However, concerning agro-pastoral practices, partnerships were not always easy because, for a long time, transhumants used pastures without contracting formally with landowners and thus did not have incentives to protect them in the long run.

The publicly-owned establishment acts in order to curb the increase of set-aside lands for twenty years and such permit to lose two times less farms than in neighbouring areas. Thus it contributes partly to the safeguard, even the restoration, of the quality of the PNC's territory. Various complementary operations, such as using gyratory crushers or clearing of undergrowth, are also helped (IARE, 1990).

Finally, the PNC leads some projects to install farmers. In general, it intervenes when these farms can be affected by economic projects that are not compatible with biodiversity preservation (especially tourism projects). When farms whose lands contain natural habitats remarkable for some species are released without transferee, the PNC purchases it and entrusts the exploitation to a farmer. This must take on the commitment to implement agricultural and pastoral practices compatible with conservation objectives identified. Thus a 500 hectares farm located on the Causse Méjan was repurchased and leased in 2001. A contract was signed and financial support, complementary of usual ones to mountain farming, are provided by the PNC as well as a technical support for environmental management of the plots. This operation is carried out in dialogue with the Chamber of Agriculture ("Chambre d'Agriculture", the institution that represents all the farmers of a department or a region). Altogether, since its creation, the PNC bought approximately 5 000 hectares of land. However, this management of the lands is not always correctly assured and thus poses problems with farmers who own an exploitation in the immediate vicinity.

Finally, the PNC supports actions that recognize the quality of the products and their geographical origin through labelling based on the fact that marketed products are obtained by respecting technical practices good for biodiversity, landscapes and more generally PNC's environment. This action consists in subsidies to an association rather than to a farmer but also in a support for financial engineering to gather all funding necessary to the implementation of the files relating to each one of these operations. It relates to organic farming and its role on space maintenance, the "PNC's Authentic" ("Authentiques du Parc"), including the production of range lambs (15 owners), "fat Easter ox" sold fattened at 3 years (10 owners) and endurance horses used as reproducers (9 owners).

This is only during the third period, which starts in the years 2000', that the PNC moved toward a more contractual way with objectives better defined and negotiated with farmers and the development, not yet completed, of an Agricultural Charter. It will comprise a general shutter of engagement recognizing that PNC's farmers are in a protected space and committed to take into account the problems of biodiversity, landscape and nature preservation, but that they are also confronted with constraints of economic viability. A second shutter, more technical, will specify the good practices and methods of a contractual policy with counterpart a financial support of the PNC. In parallel, the PNC will continue its efforts to encourage the supply of quality products, including wood, whose PNC's origin can be certified. More generally, this Agricultural Charter explicitly recognizes the role of agriculture as a management tool of biodiversity.

Finally, on the various dimensions of the PNC's actions for biodiversity conservation, a global evolution can be observed from direct actions and administrative regulation towards incentive policies and the building of partnership with others institutions and concerned population groups. In the following section we analyse this facts and their economic meaning.

3 On the economic meanings of partnership emergence

Following the general evolution of environmental and nature conservation policies, PNC's actions in favour of biodiversity moved, since its creation, from a heterogeneous set of direct conservation measures towards a tentatively better integrated sustainable management. In this move a parallel evolution of the objectives and the means can be observed. This report leads to several questions. What is the meaning of this evolution? How to analyse its efficiency, both in terms of coordination and incentives? Is this evolution completed?

Several reasons can be suggested that explain locally the observed changes. A more precise analysis of the contract mechanisms actually used there will enable us to advance some elements of conclusion.

3.1 From direct actions to incentives and partnership

Following the four axes on which the PNC's biodiversity policy is developed, a rather similar evolution can be observed. At the first stages, the action was essentially direct: the PNC created regulation that framed the behaviours of various categories of agents (hunters, foresters, farmers, tourists…) or made the things by itself (bought and managed some land, carried out species inventories, reintroduced endangered species…). Then several management agreements with other institutions involved in environmental and biodiversity conservation were negotiated and signed. During this same period, the PNC seeks to encourage private actors, in particular through contracts. Lastly, it is today more and more interested in private actors groups and seeks to draw up more global conventions with them, by activity.

3.1.1. The evolution of PNC's policies: some facts

Even at this early stage, the relation with local actors, that had often not seen the setting up of a new public structure on what they consider as their territory, had to be improved. Since the incomes were mostly quite low and the beneficiary activities partly seasonal, the so-called "Mazenot contracts" aimed at joining environment and landscape maintenance, on one hand, and complementary income on the other hand. Then, step by step, the idea of joining the two ranges of objectives became more and more a structural characteristic of PNC's actions.

This new way of establishing relation with actors is clearly more appropriate when it appears more and more obvious that most agents are "multi-objective". They must, of course, comply with all the rules and regulation, set by the PNC or any other public body. They are obviously interested in maintaining or developing their income and, finally, their welfare. This last point is actually the more interesting one since the various arguments of their welfare function vary widely with each agent. For some agents, the environment and biodiversity protection is very clearly the function of public bodies and, more especially, of the PNC. Some others are willing to contribute to the production of this public good, since they consider themselves as concerned consumers.

At the current stage of this evolution, two main points must be reported. The first one relates to a wider and wider use of contracts mechanisms to establish common objectives with agents, mainly farmers and foresters, and, to some extend, hunters too. Contracts mechanisms, better than undifferentiated subventions, appear as a practical way to join environmental and income objectives. On the other hand, the PNC is establishing conventions with other governmental institutions, such as ONF, or representative organisations of agents (Chamber of Agriculture, hunters associations…) in order to define common objectives before defining the

policy tools, namely the contracts menu, that will be set up towards agents.

These facts being reported, two questions can be addressed. At a first level we have to try to better understand why is the PNC acting this way and how this evolution is explained and construed by its staff? As analysts, we must then try to assess in which way it is efficient?

3.1.2. The evolution meaning

In the economics literature, many reason can be found to explain the superiority of incentive and co-ordinated actions on regulation and non co-ordinated policies. Actually, the question is often to understand why is there still so many non incentive policies. The basic answer lays in the classic Coasian analysis : transaction costs and practical difficulties to define appropriate rights. When analysing the field practices on the PNC's territory, and analysing the explanations given by its staff or other local administrative executives, several motivations appear as significant.

The first one is probably information both for asymmetry and completeness issue. Obviously, during all the first period, when Park's policy consisted mainly in direct action and regulations, many tensions existed with the local population and several concerned groups facing poorly anticipated and, to some extend, poorly adapted constraints (hunters, foresters, farmers or stockbreeders). The point is probably not mainly the informational rent of the private agents, but the question of commitment: the Park's policy was probably not perceived as enough secured, not enough understood, probably not sustainable, and, finally, not really legitimated. Then, the main interest of the incentive approach is that, practically, it constitutes a symmetric incentive to the Park and other administrative bodies to acquire a better information on the wishes and possibilities of the agents to change their behaviours. As it will be analysed in the next sub-section, the incentive approach is to some extend symmetric since it leads the principals to search better *a priori* information before they get more through the contracting mechanism.

Another reason is obviously the fact that incentive and, namely, contracting approaches allow the agencies to join together two of the main objectives in the zone: protecting the environment and biodiversity, and bringing new income opportunities. Maintaining the population on the territory was, since the beginning, strongly related to the opportunity to help farmers to improve their income in order to make them stay in the rural areas. This was one of the main objectives common to the PNC, the Chamber of Agriculture and the DDAF of the department of Lozère (Chassany and Miclet, 2003). One way for that purpose was the development of tourism. Tourists may constitute a significant source of income through several kind of expenses (hotel, restaurants, local shops, tourism events); but the more significant for joining the two objectives was probably the development of "green tourism", especially the increase of "rural lodging" that supported contacts with local people and, by the way, incite farmers to improve the quality of environment and landscape in the vicinity of their farms.

More generally, contracts were appropriate tools to link explicitly complementary income to the respect of environmental constraints and ecosystems conservation. The main point to stress is the frequent existence of several contracts with several institutions (all public bodies!) that were often proposing alternative and sometimes contradictory objectives. The main opposition was often between environmental friendly contracts versus productivity improvement incentives and explains why the establishment of a convention with the ONF and the agricultural administration were so important since they helped at diminishing these contradictions (see next paragraph)[6].

The last important point is probably the more interesting, since it expresses a change in the conception of the relation between human activities and biodiversity conservation. The fact that the territory of the PNC, including its core zone, is constituted of profoundly transformed ecosystems was already emphasised. It was said too that the existing biodiversity on this territory is, to a rather large extend, dependent on the maintenance of these activities. If it is remembered that the general socio-economic context in all French[7] mountain areas is agricultural land abandonment, the logical consequence is that the local biodiversity was in fact mainly threatened by this decrease of human activities.

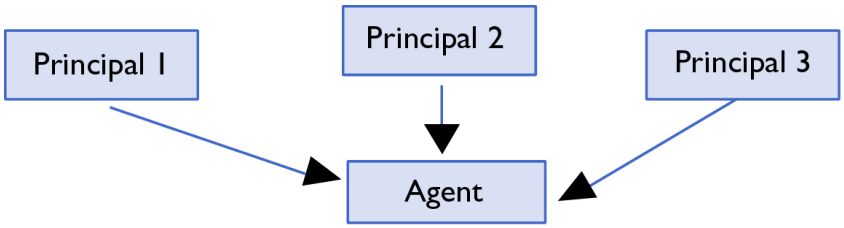
Rather paradoxically it appeared that there was sometimes a real convergence between the two apparently opposite objectives of biodiversity conservation and productivity improvement. The explanation lays is the report that without productivity improvement, farming and breeding practices were loosing their competitiveness in the CAP context and would have been abandoned. It is then needed to search a compromise between these two apparently contradictory targets.

The preliminary conclusion is firstly there that in the local context of transformed ecosystems, the maintenance of human activities, as far as they are kept in appropriate technological limits, is necessary to the conservation of biodiversity (and namely the kind of biodiversity preferred by policy executives). Progressively, the impact of human activities on the conservation of biodiversity was no longer negatively perceived. It became an element of the "anthroposystem" that appears at the core of the conservation strategy. Secondly, this situation implied clearly that agreements were to be found between the institutions in charge of the various public policies implemented on the Park territory.

3.1.3. Managing the multi-principal issues

Multi-principal issues arise when several authorities are implementing pluri-objectives incentive policies towards the same agents. The solution may lay in the signature of convention between the principals that aim at improving the consistency of the incentives. For a better understanding it is convenient to oppose the situation without agreements and the resulting situation after the signature of the appropriate convention.

Before the signature of the conventions with the other institutions, the implementation of contracts can then be regarded as involving several principals (the PNC, the ONF and the Regional Centre for Forestry Ownership, the DDAF and the Chamber of Agriculture)[8]:



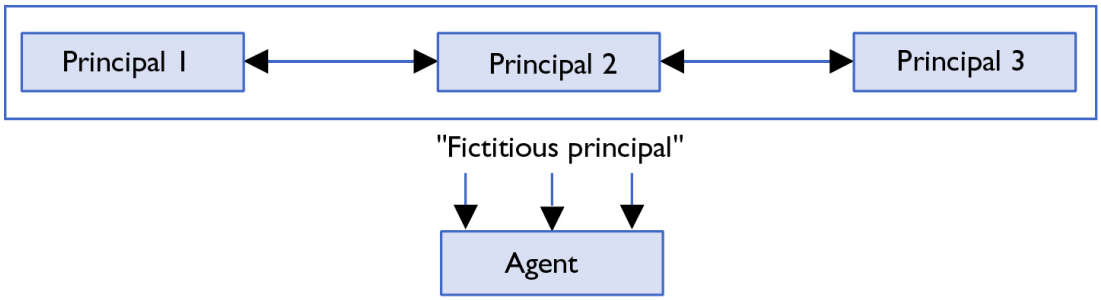
The main question then becomes to know whether the activities the agent is committed to carry out for the different principals (Martimort, 1992) are substitutable or complementary. The problem is essentially substitutability since we consider only contracts related to biodiversity protection. According to D. Martimort, in the substitutable case, there is only one increasing monotonous solution, but we are not going to characterize it, since the signature of the conventions resolves our problem.

Indeed, the difficulty that arises in multi-principal case is that an agent can contract with several principals, on same surface, for the same practices… Thus, inefficiencies appear, as highlighted by D. Martimort in its chapter 5: "*for the principals, the non-cooperative situation [decreases] their expected welfare*" and it is then necessary to co-ordinate the actions between the various agencies involved in nature protectors, possibly through contract among them, or more precisely conventions.

After the signature of the conventions, the tasks and prerogatives of each principal are well defined, and thus, the principals must be considered as subdivisions of one sole principal called "*the fictitious principal*" (Martimort, 1992 ; cooperative case):

The next sections of this chapter will be dedicated to the sole contracts managed by the PNC. For more information on other contracts signed on the territory of the PNC but with the other principals, the reader is referred to Rutagungira (2002).

The principal is in charge of designing and proposing the contract and the agent can accept or not. If he is



interested, he will have to carry out some sort of task. The result depends on the effort of the agent, but also on a random variable. Then, two types of asymmetries of information situations can occur.

The problem of "adverse selection" or "hidden information" arises "*when the agent has some private knowledge about his cost or valuation that is ignored by the principal*" (Laffont and Martimort, 2002). Indeed, in the case of agri-environment contracts, farmers know the cost of compliance with the principal's contract, since each exploitation has its own characteristics in terms of farm size and structure, site history and position, natural resource endowment... But the principal does not.

As a consequence of the learning process that we highlighted, the PNC is able to reduce the adverse selection since it knows the agents who are the most favourable to it and therefore to biodiversity protection. The adverse selection issue should then disappear, but, in fact, the PNC does not have the legal possibility to differentiate transfers to farmers in a unique contract and it must use the menu of contracts offered as in the adverse selection case.

The other type of information asymmetry is the "moral hazard" or "hidden action". This question arises "*when the agent can take an action unobserved by the principal*". In our case, there is no real problem of moral hazard since the PNC inspects almost the totality of farmers (contrary to the DDAF that inspects only by some 5% of them per year). It has for this task trained guards who know the rural socio- and ecosystem since they live there permanently. But this great quantity of inspections is not related to a maximization of the use of funds but rather on a will of the PNC to reduce the possibilities of cheatings (Rutagungira, 2002). The moral hazard issue could nevertheless be studied in order to determine the ideal contract allowing to minimize information and monitoring costs (see Moxey and White, 1998). Actually, a double moral hazard issue can be identified since the PNC also sets up its own policies of biodiversity protection. The main question then becomes to know who is creating biodiversity (which moreover, as one knows, is difficult to assess) and the PNC can have interest not to reveal exactly what it observed. The question of the distribution of benefits then becomes central. In this case, the PNC's efforts of inspection cannot be considered as observable and adds constraints in the principal's maximization programme "*to incite it ex-post to choose the level of effort of announced control*" (Macho-Stadler and Pérez-Castillo, 1991).

Actually, at this stage of our work, the only point that must be emphasised is that the signature by the PNC of conventions or other types of co-ordination tools with the other actors, either governmental institutions or bottom-up organisations of concerned groups, appears as an efficient way to improve the efficiency of its strategy towards biodiversity. At least, it is easy to construe since it directly suits what is suggested by the more recent literature on multi-principal issues.

Nevertheless, the efficiency issue is still addressing several questions that must be answered. The first one being to get more precise results of the choice of the "support" for contracts with the agents : production quantities are not necessarily the more appropriate one.

3.2 Study of contracts

During the second half of 2001, 44 contracts have been signed. A great variability is possible in their definition because, if there are ten standard contract forms, there is no obligation to follow them. However, as we will see, the menu of contracts offered by the PNC is not sufficient to encourage the agents to contract according to their "type".

Contracts are generally carried out on small surfaces. They can be of very variable duration, according to farmers' individual strategies even if, those we studied were generally signed for five years. The actions they are developing on are very targeted: contracts are signed in their great majority with farmers (between 80 and 90% according to PNC's agents). A large majority of PNC's actions in favour of the biodiversity are thus studied by the Agricultural Commission of the PNC.

These actions fall under a design of the management of natural habitats and landscapes where the local actor (farmer, forester...) appears to be essential for the safeguard of this type of biodiversity.

3.2.1 Method, ways of identification and information of the targeted actors

Until the end of the 90's, financial assistances primarily came from individual requests (farmers initiatives). Today, the PNC defines a collective project before implementing contracts, in connection with CTEs. The PNC seeks synergies between the existing activities and its own objectives. The first contact in the contractual relation can be from farmer's as from PNC's initiative. During the first period, the farmers usually avoided to take any initiative toward the Park. With the Agri-Environment Measures they came to work with the Park that appeared to act in accordance with the DDAF for the implementation of the farming contracts.

PNC's point of view: there are GIS (Geographic Information System) which can be used before any negotiation.

Farmers' point of view: farmers raise a lack of transparency, even if they do not feel a lack of information on the PNC and its activities. The guards appear to correctly fulfil their managerial role but are confronted to decisional problems that are within the Director's province. Farmers indeed perceive some inconsistency in PNC's management in the long run that contributes to reduce its credibility[9]. They feel that some decisions are imposed without preliminary dialogue and, once carried out, are not always followed or continued and that decisional choices are arbitrary. This behaviour was at the origin a demonstration of hostility of some farmers who are not willing any more to dialogue and negotiate.

Farmers also raise a problem of listening. Interlocutors are not always available to answer their requests when difficulties arise, in the execution of contracts for instance. In addition, they seem to wish their know-how and knowledge of ecosystems to be better taken into account in the definition of the measures taken by the PNC, within contracts' framework as in the regulation of the use of the resources (especially in the management of hunting). They ask for a partnership in the design of the contracts.

3.2.2 Selection of the candidates

PNC's point of view: whatever the contractual relations, the PNC privileges relational dimension. Contracts are primarily proposed to farmers with whom PNC's agents think it will be possible to work. The PNC thinks in terms of "*potentially favourable situations*".

Farmers' point of view: the choice of the partners is strongly constrained by the perception farmers have of the PNC. Moreover, ewe's milk producers who provide Roquefort, even if they are located in the Core Zone, do not need subsidies and are thus not interested by the contractual approach. Other farmers who live thanks to subsidies are better disposed to accept contracts and listen to the PNC.

Three main types of potential contractors can thus globally be distinguished: those who are a priori favourable to the presence of the PNC and its method, in particular in terms of biodiversity protection, those who are rather opposed to the PNC and its policy, and finally the unconcerned.

3.2.3 Terms of the contracts, nature of the incentive

The main constraint for the signature of the contracts by the PNC is that of the working time in diagnosis and monitoring. At the beginning of the contractual approach difficulties arose in contracts formalization and negotiation experiment. Farmers were more accustomed to sign contracts than PNC's agents.

PNC's point of view: the PNC has a very broad contractual capacity within its budget[10]. The Director can sign contracts with private or public agents. The PNC also has a great autonomy of action: it has a budget of a little more than 76 000 euros per annum to sign contracts with farmers (the specific budget affected to agriculture is approximately 122 000 euros). The planning scheme determines the limits in the definition of contracts and the assignment of PNC's fundings is more or less free even if it is made in dialogue with agricultural actors via the Agricultural Commission (very little money is actually directed towards forests). Funding and co-funding are carried out when there are not other possibilities of subsidies. Contracts objectives are defined by sector related to patrimonial species identified through inventories.

Farmers' point of view: the base of the contract consists in a standard contract that is adapted to the particular case of the concerned farmer. The difficulties raised by farmers come primarily from reserves about the wish of the Park staff to intervene in the farming choices, namely the dates of harvest, or differences in diagnosis concerning the role and the frequency of burn-beating and utilization of gyratory crushers.

Farmers ask for a simplification of contractual procedures. The standard contract for Mazenot contracts is often quoted as an example by farmers whereas they may be abandoned. The role they fill is built-in in exploitation contracts that include investment for the safeguard of country roads and open lands (utilization of gyratory crushers, burn-beating etc.).

Another problem is that of deadlines of compensation payments envisaged by the contract and the lack of dialogue relating to some constraints not specified directly in the contract but to which the payment is subordinate. The PNC is shown "to misuse" the goodwill of farmers to include some constraints without preliminary dialogue.

3.2.4 Methods of control and sanctions

In the particular case of agri-environment contracts, the farmers get the transfer payment when he complies with specific constraints. The question of the control of these constraints must be emphasised: should the PNC control the efforts (does it really have the means to do it?) or the results (whereas one cannot quantify biodiversity etc.)? Moreover, monitoring costs are important and as we previously saw, the PNC does not maximize the use of this expenditure but prefers to make sure that farmers will not cheat.

PNC's point of view: the PNC reserves the right to visit the plots to check the application of the contract. On the basis of the report such established by its agents, it can apply sanctions and not pour the subsidy. The DDAF also manages funds and distribute assistances. In terms of inspection, it acts very few on the territory of the PNC and generally, PNC's or DDAF's staff in charge of control act in concert and split the task. Among the signed contracts, in half cases, agents respect the contract, except unexpected difficulties that can give place to endorsements. 45% of contracts are respected but a regular inspection (at least once per week) is considered necessary. The remaining contracts is not yet functioning (but means of pressure exist).

Farmers' point of view: the proximity of the PNC facilitates the creation of trust ties between guards in charge of the inspection and farmers. The guards are perceived favourably because they are part of the Cevennes community and thus have common values, concerns, representations etc. This situation generates "social learning" (they do not have always the same interests but at least the same representations). The farmers did not raise any special problem.

In order to improve the efficiency of the process, sanctions should be implemented in case of non-respects of the contracts terms. Actually, nothing is really done at this time, but the idea of an existing "social control" of free-riders.

3.2.5 Effects on biodiversity

The main assets of the PNC are the following : it can control the land on important sites, make an expertise on its territory for the selection of farmers and retrocession of the management of its land (pluri-annual conventions of pasture and exploitation-patrimonial contracts), has been the support for the putting-up of the files for contracts MAE and has a good capacity of inspection. These assets helped it in the implementation of its own contracts.

But, in the design of agri-environment contracts, the practices the agent had before are not really taken into account. Thus, he can be remunerated for practices he already had and that reduces the effects of the contracts on biodiversity, even if, as shown by Motte et al. (2003), such contracts make it possible to protect the biodiversity in the long run by guaranteeing the maintenance of these practices for at least the term of the contract. Furthermore, the lack of precise data on the initial state imply there does not exist any usable benchmarks of the biodiversity and environmental quality that can be compared with. And the problem is to find the adequate "transition" between the old practices and the new ones.

Moreover, the menu of contracts offered by the PNC is *a priori* too narrow (and contracts are not enough differentiated) and is not build in order to allow agent that wish to act in favour of the biodiversity to sign contracts appropriate for them. It seems that the most difficult point for the PNC is to initiate the first contact with the farmer, who thereafter will sign several contracts and benefit from the opportunities offered to him.

Finally, the identified and analysed move from direct action of the public bodies, towards incentive policies appears unfinished. Despite quite a profound change in the way the park and its now partner institutions design and implement their conservation objectives, there are still several important points that have to be clarified in order to insure that these policies will keep their efficiency and their stability in the future. The main point being the question of assessment: what and how to assess? With which indicators? With what kind of participation of the farmers?

4 Conclusion

The analysis of the numerous actions carried out by the Cevennes National Park towards biodiversity conservation since its creation shows a real evolution that we tried to characterise properly. Through this evolution several constant lines can be seen and the first one, according to the objectives of this paper, is of course that biodiversity protection was since before its creation one the major axes of PNC's strategies and actions.

On the three decades of the existence of the PNC, the evolution of these strategies and actions can be summarised as a move from direct towards indirect action. Realities and practices are of course a bit more complex, but this move appears as a significant trend and is probably not quite achieved or terminated. The unfinished part of this evolution can mainly be identified in the little concern of the Park and its staff on formal control and sanction of free riding behaviours. It is quite easy to draw some conclusion of this fact. The evolution from command-and-control towards incentive policies and the weakness of sanction procedure may have a common ground: the loss of legitimacy of the State and of centralised policies. In this perspective, the implementation of contracts mechanisms means that, by now on, the state has to pay the citizens in order to have them recognise the interest of its policy[11].

Finally, the main meaning of the reported facts and evolution might be to consider their learning aspects. This process can be identified in several dimensions of the biodiversity policy.

The social or socio-economic dimension is essential. After a bit more than three decades of action on a limited territory, the Park's staff (in which the renewal rate is quite weaker than in most administrative body) developed a very strong relation with its territory and a profound knowledge and understanding of its "anthoposystem". The setting up of the various forms of incentives can be constructed as an appropriate way to take into account the preferences and differentiated objectives of the local population and its various concerned groups.

The ecological or environmental dimension has already been emphasised. The conservation strategy moved from an approach in which the populations and human activities were tolerated or seen as part of the cultural patrimony on the landscape to preserve. It has long been a joke in the scientific advisory committee of the park to ask genuinely "*why would you prefer to conserve the 1950's landscape, rather than the 1700's ('Camisards War') or from the Neolithic era?"*. The current answer is to recognise that the existing ecosystem and biological diversity were designed by the secular effects of human activities. Maintaining existing landscapes and biodiversity requires to allow and favour human settlements and type of activities that maintain the same kind of pressure on the environment.

Three decades of learning, of try-and-error process have given to the PNC quite a better understanding of the effects and meanings of its action. The current situation appears nevertheless rather fragile for many reasons. The loss of legitimacy of the public bodies is real and seems to be continuous since the current idea in France is to give to regional authorities the responsibility of environmental policies. Even if this trend is conform with European policy principles, it can be dread that the future strategies will be more oriented towards satisfying local populations wishes and favouring economic development and tourism. On the other hand, the whole PNC's territory will be included in the Natura 2000 framework. This status might give new financial resources to develop the incentive policy and finally strengthen the local legitimacy of landscape and biodiversity conservation.

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Appendix I

The Cevennes National Park

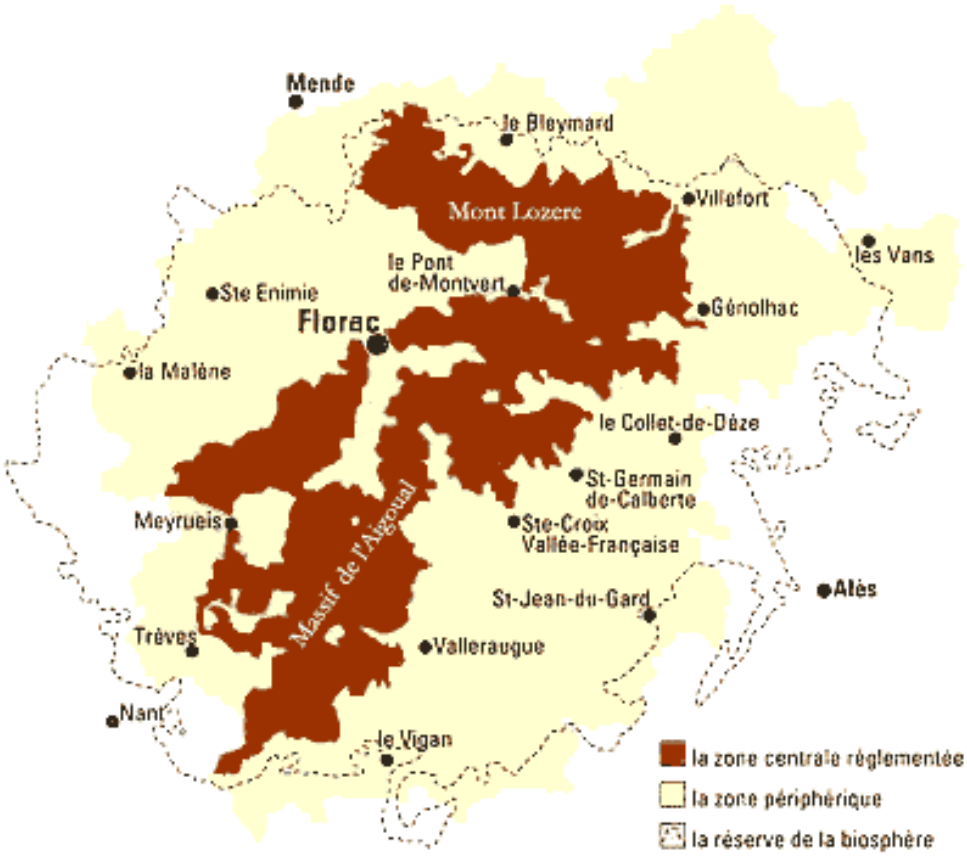
Located in the south of France, on the southern slope of the old Central Massif, the Cevennes National Park covers a total area of 3 210 km².

Source: site Internet http://www.parcsnationaux-fr.com/cevennes/

- 913 km² in the Core Zone in which 590 people are permanently living (0.6 inhabitant per km²). The Park itself owns only 3% on the land; 7% belong to the communes and sections of communes; 30% belong to the public domain (the State); and 60% to private owners. 63% of the core zone are covered with forests. Meadows, moors and pastures covers the remaining 332 km². One hundred farm are using these open fields.
- 2 297 km² in the so-called Buffer Zone that joins together 65 communes for about 4,000 hamlets and gather 41 000 inhabitants.

The whole park is a Man-and-Biosphere reserve (UNESCO) since 1985. With altitudes from 380 up to 1 700 metres, the Cevennes National Park can be divided in five geographical areas:

- The Méjan limestone plateau with an average altitude of 1 000 meters, mainly devoted to sheep breeding (for milk and meat);
- The Lozère mount, a granite massif culminating at 1 700 metres, dedicated to bovine breeding and ovine transhumance;
- The Bougès mountain, a granite and schist massif culminating at 1 420 metres, dedicated to bovine and ovine breeding and forestry;
- The three Gardons valleys, dug in schist and dedicated to sheep and goat breeding, and to apiculture and chestnut groves;
- The Mount Aigoual and the Lingas, schist and granite massifs, culminating at 1 565 metres, dedicated to pines, firs and epiceas forestry and ovine and bovine transhumance.



Source: site Internet http://francecevennes.free.fr/PnC.html

The Park is hosting quite a rich biological diversity (on 0.6% of the national territory):

– More than 2 400 animal species (45% of the vertebrates living in France);
– More than 2 200 vegetal species (including 35 floral protected species and 21 endemic species) 40% of the total French flora.

An interesting point is that a scientific consensus seems to consider that this diversity is strongly related to the presence of human activities that are responsible for the maintenance of open landscape. The current dynamic of agricultural land abandonment and the correlative closing of the landscape is resulting in threats on this diversity, both on animal and vegetal species pledged to these open environments.

On the territory of the Cevennes National Park, the management of the natural environment is then organised following three major axes: the dynamic conservation of the biological diversity and of the landscape; the valorisation of a rich rural heritage; a tentative implementation of a sustainable development.

Aside from the standard board of directors, the Park created several specialised Commissions that gather members of the board and personality of special interest for the theme. The Agricultural Commission is probably the more important one with more than 30 members that follow with a intense interest all the tools and especially the incentive ones that aim at influencing the agricultural practices.

Appendix 2

The Contracts in the Cevennes National Park

1 The Mazenot Contracts

The Mazenot contracts are the oldest contracts of services provision financed by the PNC with its own capital stocks; The first have been signed in 1972. They owe their name to their inventor, former under-prefect of Florac.

Objectives: they aim at taking part in the maintenance of a minimum population in the Cevennes, but also at allowing the safeguard of the ways, paths, low walls, irrigation canals, seedbeds, game cultures, natural sites… They are contracts of determined duration that allow the co-management of natural and rural space by farmers in partnership with PNC's actions.

Application: farms located on a commune of the PNC. The contract can be widened with non-agricultural residents.

Effects: they do not have direct effects on biodiversity. Their principal objective is the improvement of farmer's annual average net incomes. But, by supporting and maintaining an activity that used ecosystems and landscapes, especially remarkable ones, they indirectly safeguard vegetal and animal species pledged to these habitats: farmers keep the natural and rural spaces and take part in their restoration, in particular by the reappropriation of old techniques. He can also accompany excursions organized by the PNC.

Quantitative importance: each year, between 40 and 50 Mazenot contracts are signed for a variable individual amount between 2 000 et 3 000 euros (seldom more than 7 700 euros) and a total envelope of 28 965,31 euros. In 2002, 71 contracts were envisaged including 14 with farmers and 1 with a forest group.

Procedure: the PNC carries out an inventory of natural sites and access roads to be maintained on the farm's territory. It works out the specifications that are submitted to the contractor. If this accepts them, the contract specifying engagements and obligations of each part, is signed for five years between the PNC and the farmer. It is not renewed by tacit agreement.

Other characteristics: in spite of the little funding, Mazenot contracts are generally *very appreciated by farmers* (Inspection Générale de l'Agriculture, 1999), because they advance the expenditures and thus facilitate the exploitation's treasury. Thus, they play an important role in the maintenance of rural populations within the PNC. According to the PNC, this type of contract is thus interesting because they make it possible on one hand to consolidate the links between agriculture and environment and, on the other hand, to insert Cevennes' agriculture within the national CTE's framework.

2 The farming contracts

Objectives: farming contracts aim to develop a project of improvement of agronomic and environmental performances of the entire farming system.

Application: farms located in a commune of the PNC and able to fit in a PNC's Authentic. A priority is given to contracts concerning ovine breeding meat for a management of moors and lawns, the promotion of the specific products of the PNC under the name of PNC's Authentic and of organic farming, the support to the transhumance and the maintenance of open lands of the peaks and the agricultural and patrimonial valorisation of hamlets.

Effects: they do not have direct effects on biodiversity. Their principal objective is to support financially farmers in order to help them to maintain their activity. But, indirectly, they allow the maintenance of an agricultural activity likely to maintain and/or improve the quality of open lands, under economically viable conditions. The protection of key ecosystems and landscapes thus leads to safeguard pledged vegetable and animal species.

Quantitative importance: 7 contracts are under development.

Procedure: the PNC carries out with the farmer a diagnosis of the exploitation, its system of production and sale, its territory and inheritance. It works out specifications which are submitted to the farmer. If he accepts them, the contract, specifying engagements and obligations of each part, is signed for five years between the PNC and the farmer. It specifies the engagements and obligations of each party. Endorsements can be carried out by mutual agreement. The contract is not renewed by tacit agreement. Exploitation contracts are centred on the projects of PNC's agricultural orientations documents, validated by the Agricultural Commission and registered in the planning scheme.

Other characteristics: they can be proposed as an additional option to the free choice of farmers who sign a CTE.

3 The environmental schemes

Objectives: from the creation of the PNC to the Eighties, the environment schemes were especially used to supplement farmers' financial support for the construction of agricultural buildings (modernization phase). Since, they enable them to improve their farming system and often to reconvert them by limiting their own investments. They are especially global aids for the farming development, with, sometimes, a collective dimension (for instance for the improvement of the grounds: irrigation, fertilization...) and of the landed control.

Application: farmers who respect the environment in accordance with PNC's objectives.

Effects: they can have very diverse consequences: installations of accesses, creation of water points, reintroduction of the Aubrac race, introduction of Mérens horses...

Quantitative importance: the amount of the subsidy was reached a maximum to 50 000 French Francs (7 622,45 euros) in 1985 (Inspection Générale de l'Agriculture, 1999).

Procedure: the Agricultural Commission of the PNC decides to grant the aid. These environment schemes are similar to the Sustainable Development Schemes (Plans de Développement Durable), that are a French variation of European Agri-Environment Measures and whose implementation is an adaptation to individual situations.

4 The patrimonial contracts

Objectives: patrimonial contracts aim at allowing a conservatory management of remarkable species, natural habitats and landscapes. The most important objects of conservation, i.e. vegetal and animal species, but also ecosystems, with a strong patrimonial value, are part of the Actions schemes (Apollo butterfly, grey partridge, messicoles plants, wetlands of the Mont Lozère and Aigoual, nesting zones of key birds...) which can relate to agriculture but not only.

Application: farms located in a commune of the PNC and whose property contains landscapes, ecosystems and natural habitats likely to enclose a strong fauna and flora diversity. But, as we have just said it, these contracts are not specific to agriculture. These contracts only exist since 2001.

Effects: they are within the scope of PNC's natural inheritance conservation and in particular the maintenance of the quality and quantity of open lands. They make it possible to protect vegetable and animal species threatened, but also key ecosystems and landscapes and then leads to safeguard the vegetable and animal species pledged. One can thus say that these contracts intervene on ecosystems as well as on species. They improved a system of incentive of landowners on the basis of more targeted objectives on biodiversity.

Quantitative importance: they are now around fifty, with up to 3 048,98 euros. From 2 to 4 contracts relating to grey partridge and Apollo have been signed. Currently, there are few debates and negotiations, and thus few contracts.

Procedure: the PNC inventories on its territory the natural landscapes, ecosystems and natural habitats having a strong biodiversity. It works out specifications that are submitted to the farmer who owns this key element of biodiversity. These specifications, as well as the management plan, relate to the object the PNC wishes to protect. The contracts correspond to a standard measure and are used in articulation with CTEs either in space, to take into account a patrimonial target for which no measure can be contracted within CTEs, or to take into account a patrimonial target when the farmer does not wish to commit within CTEs. The contract, specifying the commitment and obligations of each party, is signed for five years between the PNC and the farmer. Endorsements can be carried out by mutual agreement. The contract is not renewed by tacit agreement.

Patrimonial contracts for messicoles species: it is important to exploit the Causse Méjan that shelters 80 messicoles species unique in Europe. The PNC pours 1,524.49 euros per hectare over 5 years. This contract is exclusive to the cereal one (for which the farmer would get 304.90 euros per annum but only during two or three years), but it is advantageous because it generates less expenses (ploughing every two years and less inputs). The PNC must thus convince: by disseminating information and responsibilising farmers, understanding how these constraints are integrated in farmer's strategy, the durability of these contracts and perenniality of its action.

5 The LIFE contracts

In the framework of LIFE program, the PNC could decide the use of the funds whose annual amount was approximately equivalent to its total budget (half from the European Union, a quarter from the Ministry of the Environment and a quarter from local resources).

Objectives: the common objective of the party is to try out one (or more) mode(s) of pastoral management of Community interests ecosystems. In particular, it must check the relevance and feasibility of the reintroduction of breeding (in particular of ovine transhumance) on mountain pastures that are rich in biodiversity but threatened by the invasion of undergrowth.

Application: properties of the PNC and those of the ONF. It applies only to agricultural and forested exploitations.

Effects: they leave the assumption that ovine breeding system gives the best results for the safeguard of ecosystems and restoration of natural landscapes quality. However, they were implemented only in 1998 and it is difficult to check the exactitude of this assumption, even if the PNC considers that ovine transhumance on these pasture mountains constitutes an ecological requirement for the management and conservation of open lands.

Quantitative importance: the total amount of the aids is given from the current pastoral management potential of each stockbreeder, namely from the number of animals it has and the duration of pasture balanced by a threshold of good management, while knowing that a contractual compensation is proposed per hectare whatever the type of measure (maintenance or improvement) implemented and the initial state of the vegetation.

Procedure: the implementation of LIFE contracts' management plans by stockbreeders is based on voluntaries.

The inscription of a zone in Natura 2000 network[12] makes it possible to profit from an increase in the percentage of granted subsidies (from 60 to 80 or 100% in the case of tree cuts). After the validation of the plan of each mountain pasture by the steering committee of LIFE program, the contract is established for 6 years between the owner and the PNC. An endorsement is envisaged at the end of the third year and will be established on the basis of first assessment. It will in particular make it possible to add to the contract the necessary recommendations due to the experimental character of the management plans. The payment of the aids is subordinated to the establishment of a verbal lawsuit by a technician of the PNC that confirms that the state of the ecosystem is in conformity with the awaited result.

The owner thus commits himself to respect the pastoral management plan, and on the other hand, the PNC commits himself to provide him *before the beginning of each season of pasture such as defined in the pastoral management plan, a model of pasture calendar. He also commits himself to take care of 80% of works and equipments necessary to the engagement of a sustainable management of the ecosystem [...]* (standard specifications).

Other characteristics: If each contract may contain recommendations more specific to the local stakes, all stockbreeders must take part in the development of the pastoral management plan containing at the same time the objectives to reach, means to implement, recommendations to achieve these goals, durations of rotation, sizes of the pens, an animals rotation plan on the various plots and the burn-beating plan (indeed, the specifications consist both in an engagement of result expressed in the rate of undergrowth and a set of recommendations to reach that point). They must establish the contractualized equipments and respect their use (for example electric fences), eliminate quasi- systematically pines' sowings (these trees are at the origin of ecosystems closure), complete restoration works and establish pastoral equipments envisaged in the management plan within one year and hold a book of annual pasture.

6 The pluriannual convention of pasture

The pluriannual convention of pasture is a contract signed between a farmer and the PNC, leaving it the possibility to include in the specifications of biodiversity protection measures.

Objectives: it aims to make it possible to an owner to entrust the maintenance of its site to a third person without being obliged to resort to a lease subject to the tenant farming statute. But the PNC generally chooses to add a second objective of biodiversity protection by integrating into the specifications some measures encouraging the tenant to protect ecosystems and species.

Application: zones of mountain and pastoral or extensive activities delimited by ministerial decree.

Effects: it makes it possible to emphasize the plots of the exploitation and to fight against the evolution of set-aside lands. This leads to safeguard the vegetable and animal species pledged to open lands. Moreover, some work realized on the exploitation contributes to the improvement and restoration of biodiversity (maintenance of low walls, burn-beating...).

Procedure: in accordance with the article L. 481-1 of the French Rural Code, the PNC rents to the tenant who accepts. Rights and obligations of the two parties are fixed by the convention (with respects to the conditions of civil beams). In particular, the farmer must respect some practices, and the PNC can recommend others. The prefect fixes the duration of the convention and limits of the rent after consulting the Chamber of Agriculture. At the end of the contract, if the tenant remains and the PNC does not intervene, it is renewed by tacit agreement (Article 1738 of the French Civil Code).

Control: the PNC, by a general declaration, must inform the tenant on the methods of valorisation of goods given to convention. The taker will not be able to make, without the explicit and written assent of the PNC, any changes in the rented places, others than those put at his load by the convention.

7 The contracts on ageing forest plots

Contracts on ageing forest plots signed between the ONF and a forester and/or the PNC.

Objectives: they aim at creating forest belts allowing the development and conservation of animal and vegetable species pledged to the final phases of the forest cycle (maturity, senescence, deterioration, death of the trees). These forest belts are of reduced size (1 to 7 hectares). One lets them evolve without intervening.

Application: exploited parts of forests and distributed on the territory in such way that the average distances between the centres of the plots lie between 500 and 1,000 meters, 800 meters being regarded as an optimum distance (they should not be coupled to surfaces not exploited that are in fact big ageing plots). All the main types of station, types of settlement, tree species, must be represented. The ONF privileges, if that are possible, masts sand settlements and settlements from natural origin. Conventions concern forestry but also roadwork.

Effects: they make it possible to develop a natural dynamics of renewal after the operations of improvement that will ensure the stability of the stems constitutive of the plots and to safeguard the animal (insects…) and vegetal species pledged to the final phases of the forest cycle that would have disappeared in an ordinary forest operating system.

Quantitative importance: in the PNC, from 3 to 7 hectares of cumulated surface are concerned by this type of contract, for each approximately 100 hectares exploited plots. Unit surface lies between 1 and 7 hectares. One has at the optimum 2 to 3 plots for 10 hectares.

Procedure: designation is within the ONF's province. It must be carried out in installations of more than 15 years and will progressively be continued through revisions of installation. The PNC, associated to these revisions, will propose the most judicious localizations. The ageing plots will be mentioned on the card of the concerned plot. If the choice of an establishment does not (or no more) seem in conformity with the aims in view, a working group made up of ONF's and PNC's agents will be able to decide the replacement of the plot.

Control: the working group is also in charge of the development of a protocol of monitoring and inspections. In case of pullulating primary pests, threatening to extend to close settlements, the ONF will propose to the PNC the methods it will have to implement.

Footnotes

[1] The National Park of the Vanoise was created on July 6th, 1963, the Port-Cros' on December 14th, 1963, the Occidental Pyrenees' on March 23rd, 1967, the Cevennes' on September 2nd, 1970, the Ecrins' on March 27th, 1973, the Mercantour's on August 18th, 1979, and the Guadeloupe's on February 20th, 1989.

[2] The installation of tranquillity zones and the provision of mass graves on the entire territory (where the guards of the PNC put down the corpses of dead ovine animals from breeding) played a crucial role, the mass graves being re-enrolled in the old functioning of the agro-pastoral economy.

[3] In spite of long lasting preliminary negotiations with hunters associations, this decree was immediately attacked and the Conseil d'Etat broke it in 1973. The modifying decree of creation of the PNC was promulgated only in 1984.

[4] The damage made by deers in forests are not compensated (thought they are for arable lands) because wild fauna is considered as part of forests natural biodiversity. This generates conflicts between the PNC and forest owners.

[5] Subjected forests are the forests owned by territorial bodies (communes, departments, regions) and managed by the ONF.

[6] These improvements did not resolve all contradictions as it can be understood.

[7] And European if not worldwide.

[8] Actually, informal agreements or, at least, dialogue, existed between the various institutions since each one is represented in the technical commissions of the Park (for instance the Agricultural Commission or the group dedicated to the implementation of the Natura 2000 area), and the contract appears then mostly complementary to this dialogue.

[9] For example the PNC created on its territory a game reserve delimited without dialogue by fences that disturbed the stockbreeders who worked on bordering exploitations. After a period, the PNC allowed this reserve to become overgrown, but without eliminating the fences.

[10] Approved by the Ministry of the Environment that is in charge of National PNCs and after the advice of its (specialized) Commissions (in particular the Agricultural).

[11] On the other hand, it must be quoted that, according to externality theory, there is nothing irrational in subsidising the agents that carry the costs of these policies.

[12] Note that the Causses Méjan and Aubrac did not accept Natura 2000.

Reconciliation of multiple objectives in forest sector

Policy science in making national forest programmes work[1]

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Abstract

National forest programmes (NFPs) arose from the international deliberations on forests for ensuring sustainable forest management (SFM). They are new policy instruments in addition to existing ones. In order to learn more about them, the COST Action E19 "National Forest Programmes in a European Context" was launched in 1999; its main objective is to provide policy makers in Europe with an improved means for the formulation and implementation of NFPs. This objective represented a real challenge to the participants of the Action because of the following analytical problems needed to be solved: vague objective of SFM; vague concept of NFPs; interpretation of basic elements; institutional/procedural requirements of substantive NFPs; supportive and impeding factors of substantive NFPs; difference between NFPs and other policy means. The paper describes how the challenges were handled in order to achieve propositions on procedural aspects of NFPs, as well as on the influence of external factors on NFPs.

Keywords: forest policy science, national forest programmes (NFPs), substantive NFPs, basic elements and procedural requirements of substantive NFPs, supporting and impeding factors of substantive NFPs.

1 Introduction

The international forest policy dialogue since the UN Conference on Environment and Development (UNCED) in 1992 has proposed new policy means in addition to existing ones for ensuring sustainable management, conservation and sustainable development of all types of forests, in short: sustainable forest management (SFM). These are at the management unit level certification of sustainable forest management and national forest programmes (NFPs) at the national level. Another instrument at the international level, namely a global forest convention, is still subject to international deliberations of the UN Forum on Forests. Many of the Proposals for Action of the Intergovernmental Panel on Forests (IPF) and the International Forum on Forests (IFF) refer to NFPs for their implementation, and they are the core of the Council Regulation (EC) 1257/1999 on Support for Rural Development. Having their roots in the Tropical Forestry Action Plan for

combating deforestation, NFPs became a remedy with high expectations for resolving forest issues in the developing world, as well as the developed world. Policy science has contributed to all three new policy means, but in particular to NFPs by the establishment of the 4-year research action COST E19 on "National Forest Programmes in a European Context", launched in 1999. More than 70 researchers from 20 European countries and the United States of America were involved.

2 Work programme of COST Action E19

The main objective of the COST Action E19 "National Forest Programmes in a European Context" was to provide policy makers in Europe with an improved means for the formulation and implementation of NFPs for ensuring SFM. The work programme of the COST Action E19, as stipulated in the Technical Annex of the Memorandum of Understanding, has proposed the following tasks for accomplishing this objective:

– to interpret the basic elements and institutional, as well as procedural requirements of NFPs
– to assess the effects of these elements and requirements on NFPs
– to assess the supporting and impeding factors for the development of substantive NFPs
– to evaluate the significance of NFPs in comparison to other policy means.

This work programme represented a real challenge to the participants of the Action because of the following analytical problems needed to be solved: vague objective of SFM; vague concept of NFPs; interpretation of basic elements; institutional/procedural requirements of substantive NFPs; supportive and impeding factors of substantive NFPs; difference between NFPs and other policy means.

3 Handling of the analytical challenges

3.1 Objective of SFM

The notion of SFM as defined in the Statement of Forest Principles and Helsinki Resolution H1 is not an intersubjectively assessable objective. It is instead, a model. Although the term SFM is vague in content and may be deemed an empty phrase, it functions to describe a desired final state and therefore, indirectly governs and co-ordinates political-administrative and individual private actions. For the planning process, this means that the objective of SFM is not yet operationally defined, but is undergoing a communicative, co-operative process, reflected by the pan-European, as well as national criteria and indicator processes. The outcome of these processes will depend on the participating actors, their interests and empowerment, and above all, the context, such as policy style, institutional aspects, basis of knowledge and innovative climate in a country.

The creation of an operational definition of SFM could be made if it was filled by value judgement of the participating researchers. During the negotiation and review process of the proposal to launch a COST Action on NFPs in a European context - it was submitted to the COST Technical Committee on Forests and Forestry Products the first time in 1999 - some reviewers were afraid that social scientists could become competitors of the existing political actors in the field of forest policy with their interpretations of SFM and its basic principles. Fortunately, during the review process several voices became paramount, which expected positive contributions from social sciences to the political negotiation process and relied on the participating researchers to refrain from value judgements. From its very inception, the COST Action E19 was a challenge to researchers not to cross the border between positive science and politics and to leave the operational definition of SFM to politicians.

3.2 Concept of NFPs

Though the international forest policy dialogue from the Rio Summit of 1992 until UNFF 3 encouraged countries to develop, implement and evaluate NFPs, in which there was no clear idea about the content and impacts of NFPs. It was only known from the literature that NFPs are to ensure SFM and apply a series of basic elements or principles such as participatory mechanisms, an adaptive iterative planning process, a holistic and inter-sectoral approach etc. We concluded from these characteristics that NFPs are a new means of policy planning differing from traditional technocratic policy planning. But many questions left open, for example: What is the delineation to other policy means such as legal regulations, financial incentives etc.? How can one distinguish a substantive NFP striving for policy change in the management, conservation and development of forests from a symbolic NFP which attempts to maintain the status quo?

The effort to make a distinction between a substantive and a symbolic NFP calls for an operational definition of an NFP. However, the notion of NFPs was quite vague when the action was started, and the politically defined elements have been formulated in a very elusive and equivocal way; the descriptions provided have been rather far from an operational definition. But only when the definitional question has been answered, i.e. when the dependent variable ("substantive NFP") has been defined and operationalised in an adequate way, one can then go on to ask the analytical question of which factors support or impede the formulation and implementation of such an NFP.

COST Action E19 approached the question of substantiveness not at the level of NFPs as such, but at the level of the elements that constitute an NFP. By splitting the NFP concept into its constituting elements the definition problem is shifted to another level. The question is no longer "What is a substantive NFP?", but rather "What is substantive participation?", "What is substantive inter-sectoral co-ordination?", and so on. Furthermore, the group tried to approach the question of "substantiveness" by differentiating between the different stages of policy processes (policy formulation - policy outputs - policy outcomes). For each stage a specific concept of "substantiveness" was provided (see Figure):

a. At the *policy formulation* stage, one can assess the substantiveness of an NFP only by means of procedural elements, because the NFP process has not (yet) delivered policy outputs and outcomes. Accordingly, "substantive NFPs" at the policy formulation stage were defined as processes which are characterised by a "high" degree of participation, inter-sectoral co-ordination, iterativeness, etc.
b. At the *policy output* stage the assessment of an NFP's substantiveness can be based on its procedural elements (as under a.) and on the policy outputs it has produced. The policy outputs of NFP processes are expected to mainly comprise politically agreed sets of policy targets and policy instruments (e.g., forest strategies, guidelines, regulations, subsidy schemes, and a revised definition of SFM). A substantive NFP at the policy output stage (i) defines targets which are consistent, consensual among the main stakeholders and which operationalise the dimensions of the SFM concept (ecological, economic, and social) and (ii) defines policy instruments which are controllable by policy makers and which appropriately match their targets.
c. When, finally, an NFP process has reached the *policy outcome* stage, the assessment of its substantiveness has to evaluate whether it meets the targets it set forth. Accordingly, a substantive NFP at this stage is characterised by such procedural elements and policy instruments that effectively meet the NFP's targets.

The agreement of the participating researchers on this conceptual approach was a necessary precondition for integrating the different scientific disciplines which they represented. The action assembled forest policy scientists, policy scientists, lawyers, sociologists, economists, regional planners, and geographers.

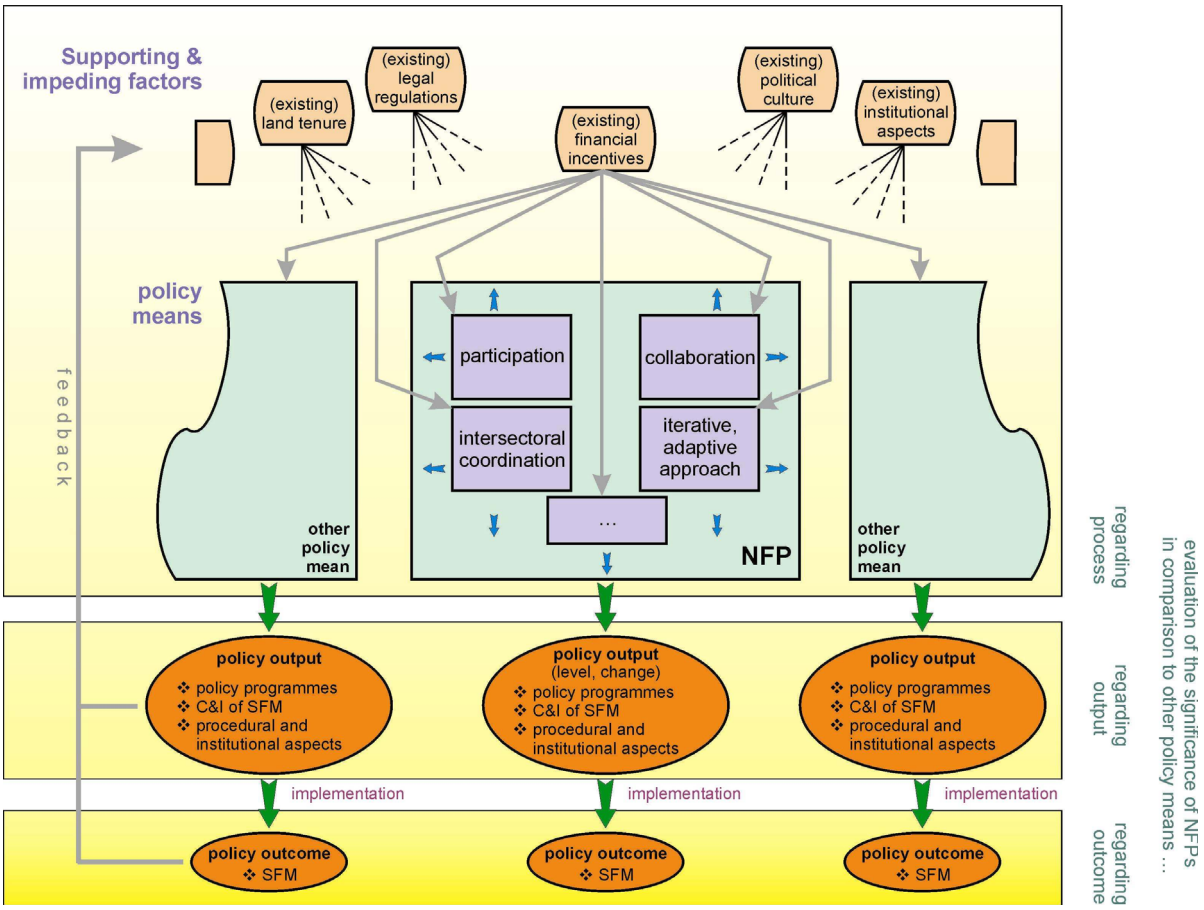

Figure 1. The conceptual approach – an overview.

3.3 Interpretation of basic elements

The IPF/IFF process and the FAO's (1996) Guidelines on the Formulation and Implementation of NFPs enumerate a number of basic elements/principles which constitute NFPs. Out of these, the following principles are rather new in forest policy: public participation, long-term iterative process, holistic and inter-sectoral approach, as well as decentralisation. There is still the question of whether all of the basic elements constitute an NFP or at least the most decisive ones.

The Action proceeded on the assumption that at its core the concept of NFPs shares those main characteristics which are postulated for the concept of modern policy planning, i.e. long-term iterative and adaptive processes, participatory mechanisms, and broad co-ordination of relevant actors and sectors. Based on the work performed by FAO (1996), the international forest policy dialogue by IPF (1995-1998) and IFF (1998-2001), the results of the international NFP Seminar held in Freiburg (1998), and the MCPFE Workshop on NFPs in Tulln (1999), the following four "conceptual essentials" to be dealt with in detail were proposed:

- participatory mechanisms
- collaboration approaches
- inter-sectoral approaches
- procedural approaches (iterative, adaptive and learning processes)

These conceptual essentials have much in common with the corresponding "main principles" (FAO) and "basic elements" (IPF/IFF).

3.4 Institutional/procedural requirements of substantive NFPs

Having the goal of substantive NFPs in mind, what are their institutional and procedural requirements? In order to establish a code of conduct for the formulation and implementation of NFPs one cannot know enough about these requirements, although the potential success of an NFP process is very much context dependent and difficult to control. For example, if the policy style of a country is anticipatory and open for achieving an agreement between interested parties the chance of a substantive NFP is much greater than that in a country whose government is reactive to societal problems and tends to impose decisions on society.

Other examples of *institutional aspects,* besides policy style are political culture, property rights tradition, ownership structure, legislation tradition and institutional commitments. They all have in common the situation to where changes in the short or medium term are hardly possible because they are external factors to the NFP process. On the contrary, the *procedural aspects* referring to characteristics of the process (e.g., voting rules, used documents, access to relevant background material) and participants (e.g., number of actors permitted to participate, mandate, qualification) enable the responsible policy makers to have an impact on the output of the policy planning process.

The Action focussed on the four essentials (dependent variables) and attempted to explain them by institutional and procedural influence factors by employing promising theories and concepts, as well as through already existing experiences. In the course of discussions, many propositions arose about the influence that factors of institutional and procedural aspects have on policy outputs (e.g., NFP documents, forestry guidelines) and policy outcomes (e.g., final solution after implementation of NFPs).

3.5 Supportive and impeding factors of substantive NFPs

In discussing the institutional and procedural requirements of substantive NFPs it was found that there are *internal factors* (e.g., characteristics of the participants, characteristics of the process) and several kinds of *external factors* (e.g., policy output such as legal regulations, policy constraints such as lacking capacity of policy planning, and uncontrollable factors such as political culture, ownership structure etc.) which may support or impede the formulation and implementation of substantive NFPs. Whether an external factor supports or impedes a substantive NFP depends on the definition of SFM and the internal factors determining the content of the basic elements. Thus, it is not possible to claim a priori that financial incentives for the formulation of NFPs as provided by Regulation (EC) 1257/1999 support substantive NFPs unless specific goals (e.g., SFM, characteristics of basic elements) are specified.

External factors determine how an NFP process works in a particular country (see Figure). The definition of external factors was simply a “negative” one: an external factor is any factor that is not itself a procedural element of an NFP and is part of the context for developing the NFP.

The Action agreed on the following list of supporting and impeding external factors in the course of discussions within the group: political culture and social context; legal aspects; financial framework and incentives; advocacy coalitions; institutional aspects; multi-level governance; and land tenure.

This list comprises two kinds of external factors:

– those that are policy instruments and may become a policy output or policy outcome of NFP processes (for example, legal regulations, financial and other economic instruments).
– those that will remain outside the scope of direct control of the actors involved in the NFP process as exogenous factors, or policy constraints of the NFP process.

Finally, the question had to be answered as to when an external factor is a supporting one and when it is an impeding one. The only general answer to this question that the group was able to provide is that a supporting (impeding) factor contributes positively (negatively) to “high” degrees of those elements that constitute NFPs and to the achievement of NFP targets. Whether a certain factor supports or impedes the development of a substantive NFP in a certain country depends on the context.

3.6 Difference between NFPs and other policy means

The distinction of an NFP from traditional forest policy means causes difficulties. It is argued that SFM can also be achieved by the existing policy means. If for some reason an NFP is superior in that respect, what then is its comparative advantage?

National forest programmes do not compete with any existing forest policy tool, instead they are meant to supplement them. In its essence, an NFP is a policy planning instrument for ensuring SFM. It distinguishes from the traditional technocratic policy planning by the main essentials. Thus, one can speak of a new mode of governance which strives to render forest politics on forests more rational and oriented to the long-term, and better co-ordinated. In the new understanding of policy planning the rationality of policies will be ensured by interconnecting policy networks instead of hierarchical or corporatistic governance by the state. Public participation makes sure that all relevant actors and stakeholders are involved in the planning and communication process. The idea of pursuing a long-term orientation of policy decisions through scientific forecasts has been replaced by adaptive and iterative learning processes. The co-ordination of political actors should be comprehensive, holistic and inter-sectoral, making sure that all sectors affecting forestry and is affected by forestry are considered and that externalities are internalised. Although information and persuasion strategies are important, they may fail in co-ordinating various stakeholders. Intra-bureaucratic intermediation processes and capacity building become more important (see Table).

An essential precondition for the success of policy networks are communication and trust among the actors. In which they provide additional informal linkages by information, persuasion, and experience, and thereby help produce the collectively desired outcome. Furthermore, the participants agree on specific rules, norms and values for achieving the common goal. With regard to NFPs, there is agreement on 10 basic elements of which a number serve the resolution of specific co-ordination problems (e.g., participation, inter-sectoral co-ordination, adaptive and iterative planning).

Table. Policy planning and elements of NFPs.

Objectives	General paradigms	National Forest Programme
Enhancing the rationality of policies	- policy networks and bargaining systems - participation of all relevant actors	- participatory mechanisms - decentralisation - empowerment of regional and local governments - respect for local communities
Ensuring long-term orientation	- fragmentation of the long-term strategy into an iterative planning process - review and assessment of the achieved goals	- long-term iterative process
Improving co-ordination of political actors	- consensus building processes via information and persuasion strategies - intra-bureaucratic intermediation processes and capacity building	- consistency with national policies and international commitments - integration with the country's sustainable development strategies - holistic and inter-sectoral

In summary, the novelty of NFPs is to deal with an enlarged definition of SFM, to promote a new mode of governance focusing on all kinds of co-ordination problems, and the fact that an NFP is not an end in itself, but an open-ended and iterative process.

4 Working procedures

To practically implement the analytical framework presented above, COST Action E19 focussed its efforts on the elaboration of propositions with regard to the formulation and implementation of NFPs. These propositions are based on the presentations of theory-oriented research papers, on the one hand, and experience reports, from the member countries on the other hand. It is hoped that this approach serves the main clientele: the forest policy makers and the scientific community. Correspondingly, two types of products had to be delivered. For the political community, the Action aimed at providing decision-support, *inter alia*, by means of propositions based on theory and/or empirical evidence. For the scientific community, the COST Action strove to formulate "bold" hypotheses, to point out interesting research questions, and to indicate gaps in the current state of knowledge.

Propositions state the nature of a relationship between relevant variables (e.g., actors, institutions, procedural aspects, external factors, policy outputs). Most usefully to the purpose of the COST Action, they can guide the design of NFP processes by providing insights into how different elements of the process may relate to each other and to the desired product. Some propositions may take the form of testable hypotheses, but often the factors affecting the nature of the relationship are external and too many to actually control. As COST Actions are not research programmes, but rather exchange programmes, it was not possible to generate complex and consistent theoretical frames and to test hypotheses empirically. Accordingly, the propositions presented in the following chapters have to be seen as products of working group discussions.

5 Propositions on NFPs

The final result of the COST Action E19 are propositions about actors participating in NFP processes, procedural aspects, the expected content of NFP outputs, and the supporting or impeding influence of external factors. Due to the characteristics of COST actions, the propositions on NFPs are neither complete nor universal, but they provide a basis for achieving a better understanding of NFP processes. In the following, some examples of these propositions are provided.

Before an NFP process is commenced, one of the basic questions is: "Who participates?" The answer depends on several factors, among others on the potential actors' abilities and willingness. Participation requires collective organisations. Groups affected, but not appropriately organised run the risk of being unheard. Actors will invest more time and efforts the more they can assume to influence the expected outcome. The likelihood of substantive agreements seems to increase with an adequate representation of the affected actors. If some of the participants have no clear mandate, the probability of substantive agreements decreases.

The participation on an NFP process will normally be time- and resource consuming. This implies that actors who are well endowed with resources are likely to be favoured. Furthermore, process management and facilitation also require adequate resources. In particular, employing external consultants and/or independent moderators to run an NFP process might help to achieve widely accepted compromises. Other procedural aspects of NFP processes refer to goals, principles and clear decision rules to be covered in a "code of conduct" or "process guidebook". It is a necessary precondition for long-term, iterative collaboration processes between multiple stakeholders. Otherwise such processes are apt to end in trivial and unfocussed results or in discontent leading actors to withdraw from the process.

The success of an NFP process depends not only on internal procedural aspects, but also on external factors

constituting the environment of an NFP. They comprise the specific characteristics of the political system of a country and may be supportive or impeding. A neo-corporatistic mode of governance, i.e., a tradition of close co-operation between the government and a small number of selected interest groups, is an impeding factor, whereas a proactive and consensus-seeking policy style of the government can be seen as a supportive factor. Whatever political culture actually exists, it can hardly be influenced in the short and medium term. By contrast, clientele capture of forest administration often impedes inter-sectoral co-ordination, but must not be taken as unalterable. A legally binding framework of an NFP could support the institutionalisation of an adaptive, continuous co-ordination process.

6 Conclusions

When COST Action E19 started in 1999, an NFP was a strange idea for most European countries connected with discouraging experiences with Tropical Forestry Action Plans. At this time, there was no COST Action, at least in forestry dealing with social sciences. Thus, the decision of the COST Technical Committee on Forestry and Forest Products to approve the proposal of a COST Action on NFPs was courageous – in which it needed two years. Some European forest policy makers were afraid that the Action could become an additional player in the forest political arena, the impact of which was uncertain. In order to destroy such reservations from the outset the researchers agreed to not cross the border between positive science and politics and to refrain from value judgements. The focus was on the elaboration of propositions with regard to the formulation and implementation of NFPs. As far as the propositions that refer to procedural aspects of NFPs, they can be used in the codes of conduct of national NFP processes. Another set of propositions deals with impeding and supporting factors, which are in many cases external to the NFP process and difficult to change. However, they enable the policy makers to assess whether the NFP process in a country will lead to a substantive NFP with the chance of policy change or to a symbolic one that maintains the status quo.

The main objective of COST Action E19 to provide policy makers in Europe with an improved means for the formulation and implementation of NFPs was oriented to practice and attracted researchers, as well as civil servants from 20 European countries and the USA. As the topic requires interdisciplinary research in the sense of integrating several scientific disciplines, the participating forest policy scientists, policy scientists, sociologists, lawyers, economists, regional planners, geographers and so on had to agree on a common conceptual framework which was eventually agreed upon after one and a half year. To ensure transdisciplinarity, i.e., the applicability of the research results in practice, the theory-oriented hypotheses have been confronted with the practical experiences of the civil servants by a permanent discussion process.

Since many members of the COST Action E19 closely co-operated with their national governmental teams in formulating and implementing NFPs, as well as with the process of the Ministerial Conference on the Protection of Forests in Europe (MCPFE), practical application of the research results lies close at hand. The research results based on the Action's report "Making NFPs Work" (2003), proceedings of the seminars in Madrid (2000), Aberdeen (2001), Oslo (2001), Savonlinna (2002) and Vienna (2003), and a special issue on NFPs in the reviewed journal "Forest Policy and Economics" (2002) facilitated the agreement on MCPFE Vienna Resolution V1 on cross-sectoral co-operation and national forest programmes and provided a common understanding of NFPs in European countries.

Footnotes

[1] Extract from Glück, P., Carvalho Mendes, A., and Neven, I. (eds.) 2003: Making NFPs Work: Supporting Factors and Procedural Aspects. Report on COST Action "National Forest programmes in a European Context". Publication Series of the Institute of Forest Sector Policy and Economics, vol. 48. Vienna.

Strong policy through national consensus: Canada's forestry policy experiment

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1 Introduction

Canada has one of the largest expanses of natural forest in the world. Recognising a need to preserve its natural resources, Canada, through the 1980's, became the first nation to form a national forest strategy, by establishing a clear and widely based commitment to the pursuit of the sustainable forest.

Several years before the UNCED "Earth Summit" tied forest use to sustainable national policies, Canada had begun setting its own course for sound forestry. In the 1980s, Canada developed two national strategies to help guide the forest community's actions. In 1990, largely in response to the call for sustainable development from the influential Brundtland Report of 1987, Canada embarked on a far more extensive and consultative process.

That year, the ministers responsible for forests at the federal, provincial and territorial level began to seek out a nation-wide consensus on how Canada's forests should be managed. The consultations engaged governments, wildlife groups, industry, First Nations, professional foresters, lobby groups, private woodlot owners, universities, and academics.

In March 1992, Canada unveiled its new policy document, entitled "National Forest Strategy, Sustainable Forests: A Canadian Commitment". At the same time, the first-ever Canada Forest Accord was signed by 29 government and non-government forest representatives. Five years later, the National Forest Strategy was updated (1998-2003), and the second Canada Forest Accord was endorsed by 52 stakeholders. Now, the

recent "2003-2008 National Forest Strategy" continues to provide a model for involving the public and gaining the co-operation of all interests groups in crafting sustainable forest policy.

Canada's National Forest Strategy has served as the guiding policy document for the forest industry in the pursuit of sustainable forestry, and has lead to new forest legislation and policies, renewed national programs, local and regional strategies, and tools and practices for sustainable forest management.

Canada's National Forest Strategy attempts to reconcile diverse expectations for forests, their managers and users. These expectations are embodied in the document's eight strategic directions:

1. Ecosystem-based Management
2. Sustainable Forest Communities
3. Rights and Participation of Aboriginal Peoples
4. Forest Products Benefits
5. Knowledge and Innovation for Competitiveness and Sustainability
6. The Urban Forest and Public Engagement in Sustainability
7. Private Woodlots' Contribution to Sustainability
8. Reporting and Accountability

Creating the National Forest Strategy has been an exercise in consolidating expectations and building consensus. This is a particular challenge in a country such as Canada where the forest spans over many regions and forest policy is heavily decentralised from the federal government's control, as 71 percent of all forest land falls under provincial jurisdiction. This has provided unique challenges, some of which are only now being addressed.

One particular challenge is that Canada's National Forest Strategy is voluntary, not regulatory, and places the onus for sound forest management squarely on the forest community's shoulders. The strategy outlines objectives set by the Canada Forest Accord signatories, but it is up to individual organisations and industry participants to decide how to meet them.

The National Forest Strategy has been influential internationally as a model for other countries to follow. With the 1992 strategy, Canada became the first country in the world to commit to sustainable forest management on a national level. The strategy has served as a template for other countries that are engaged in designing their own national forest policies.

The strategy has attempted to provide a model for how countries can balance the many different concerns, policies and practices in the industry, such as the conservation of biological diversity, Aboriginal Peoples' rights, rural community well-being, employment, private land ownership, international trade and environmental protection. Most importantly, the model should promote sustainability.

While there are significant challenges still facing Canada's National Forest Strategy, Canada's experiment has shown that it is possible to develop a strong national policy on safeguarding forest biodiversity that brings together diverse values and that ensures environmental health, social and cultural well-being and economic growth.

2 History of Canada's forest policy

For generations, the link between Canada's well-being and its forest has generated much concern, which, in turn, provided the impetus for Canada's national forest strategies, beginning in the 1980s. These forest strategies have evolved over time accompanied by new challenges and attitudes and increased knowledge, understanding and participation. Each forest strategy has led to a more concise definition of the sustainable forest, stimulated wider networking and attracted the participation of more members of the forest community. These strategies are:

– A Forest Sector Strategy for Canada: Discussion Paper, 1981–1987
– A National Forest Sector Strategy for Canada (1987–1992)
– National Forest Strategy (1992–1998) – Sustainable Forests: A Canadian Commitment
– National Forest Strategy (1998–2003) – Sustainable Forests: A Canadian Commitment
– National Forest Strategy (2003–2008) – Sustainable Forests: A Canadian Commitment

Over the years, forest-related interests, benefits and values have evolved and expanded. As a result, new knowledge and technologies, responsibilities and partnerships have emerged that constantly increase the understanding of Canada's forest and how its citizens relate to it.

Canada attempts to ensure that everyone in the Canadian forest community has a role to play in ensuring their forest heritage. This community has grown to include governments, Aboriginal Peoples (Indian, Inuit, and Métis), the timber-based industry, non-timber forest product organizations, academia, research institutes, the recreation and tourism industry, forest practitioners, private woodlot owners, environmentalists and an increasing number of women and youth in these groups. With increasing knowledge, even more organizations and individuals are participating in forest-related decisions.

Forest management has become more challenging as forest managers attempt to balance many different concerns, policies and practices. For example, forest-related objectives and commitments now encompass matters such as the conservation of biological diversity, Aboriginal Peoples' rights, rural community well-being, employment, private land ownership, international trade and environmental protection. As well, newly discovered uses for non-timber products, such as medicinal plants and bio-plastics from forest products, have been added to the traditional, industrial uses of the forest.

Sustainability, widely seen today as the foremost goal of forest management, is at the centre of this continually changing arena of forest policies, practices, and interests. The National Forest Strategy, a broadly based public initiative, identifies and charts the direction that Canadians, as stewards of the forest, need to move toward in order to deal with evolving social, cultural, institutional, environmental and economic factors in their journey toward sustainable forest management.

3 Canada's forest framework

Nearly 94 percent of Canada's forest is public land. Only six percent is under private ownership. In some parts of Canada, particularly British Columbia, an increasing amount of land is coming under Aboriginal jurisdiction as land issues are settled.

The forest is not confined to rural or wilderness areas, but is also found within municipal boundaries. Eighty percent of Canadians live in or near the urban forest. This forest is the major connection between them and the forest's environmental benefits and services, such as wind screens, energy reduction in the heating and air conditioning of buildings, air purification, wildlife habitat, carbon sequestering and oxygen production and protection against erosion. As well, this forest connects urban Canadians to other benefits such as recreation, aesthetic enjoyment, increased property values and physical and mental well-being.

Canada's forest figures significantly in the Earth's forest. It represents over 10 percent of the world's forest cover, 25 percent of the world's natural forest, 30 percent of the world's boreal forest and 20 percent of the world's temperate rainforest. Canada's forests include some of the world's largest intact forest ecosystems.

Under Canada's Constitution of 1867, the provinces own and regulate the natural resources within their boundaries, with exclusive powers to legislate for the enhancement, conservation and management of forest resources. The federal role in forestry is grounded in its responsibilities for the national economy, trade and international relations, science and technology, the environment, federal lands and parks and Aboriginal matters. The territories now have responsibility for their own resource management.

Aboriginal and treaty rights are primarily exercised in the forest and are constitutionally protected by the Constitution Act of 1982. Over the last 25 years, Canadian courts have affirmed Aboriginal and treaty rights. Thus, forest policy and forest management practices have to reflect the constitutional protection afforded Aboriginal and treaty rights. The federal government also has a lead responsibility towards Aboriginal Peoples, including for Indians and lands reserved for Indians under section 91(24) of the Constitution Act of 1867.

Forest resource users are meeting the increasing obligation for sustainable forest management in the managed areas of the publicly owned forest. In addition to the legal framework underlying sustainable forest management practices, markets are having a growing impact on these practices through their demands for forest certification.

Forest issues also remain high on the international agenda. Their resolution is a major challenge because of the magnitude of the land area and the multiplicity of the jurisdictions and interests that are involved. Canada is signatory to international agreements that have a direct bearing on how Canadians manage the forest, such as the Convention on Biological Diversity, Framework Convention on Climate Change, Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Kyoto Protocol. As well, Canada has signed other agreements that have some effect on forest management. These include trade agreements, the United Nations Conference on Environment and Development (UNCED) – Forest Principles, and the Montreal Process – Criteria and Indicators of Sustainable Management of Temperate and Boreal Forests.

In 1985, Canada's federal, provincial and territorial ministers responsible for forests formed the Canadian Council of Forest Ministers (CCFM). Through addressing national and international issues and stimulating joint initiatives, this voluntary organization coordinates and facilitates cooperative measures that have gradually shaped the overall direction for the sustainable management of Canada's forest. In doing so, the CCFM has built a legacy of consulting Canadians on the state of the forest and its future. For example, through public consultations, it led the development of three National Forest Strategies, including the creation of the National Forest Strategy Coalition – a collection of governmental and nongovernmental bodies – to oversee the implementation of the 1992 and 1998 Strategies.

The leadership for developing the fifth National Forest Strategy (2003-2008), however, came from within the National Forest Strategy Coalition. The broad forest community was once again engaged in dialogue – this time led by the Coalition. The 2003-2008 Strategy confirms Canada's collective commitment to continue to be a global leader in sustainable forest management. This Strategy proposes a vision and challenges all Canadians to implement the actions identified in it.

4 Canada's forest benefits

The forest plays a number of vital ecological roles. It is a biodiversity storehouse, reservoir of carbon, producer of oxygen, filter for clean air and water, moderator of climate and protector against soil erosion. The forest also provides recreational, aesthetic and environmental benefits for rural and urban Canadians. Canada's forest is home to a diversity of plants, animals and micro-organisms. About two-thirds of all species found in Canada live in the forest or depend on forest habitat.

As well, the forest provides socio-economic benefits to all Canadians. The forest is the economic backbone of many rural, remote and forest-based communities across the country. For Aboriginal Peoples across Canada, the forest is fundamental to their traditional cultural, spiritual and material well-being and future self-sufficiency. The wood and paper products industries are major contributors to Canada's standard of living. These industries employ over 350 000 Canadians directly and over 770 000 indirectly. They generate over $58 billion in total sales annually, making a net contribution of $34 billion – more than half of the country's annual trade surplus. Even though forest exports from other nations are rising, Canada continues to be the world's largest exporter of forest products.

Canada's forest also provides the required environment for sustainable resource use, such as timber production, as well as a wide range of internationally important non-timber products and activities such as recreation, tourism, hunting, fishing, trapping, Christmas trees, mushrooms, medicinal plants and maple products.

5 Themes of the national forest strategy

The National Forest Strategy (2003-2008) focuses on the following eight strategic directions:

1. Ecosystem-based Management
2. Sustainable Forest Communities
3. Rights and Participation of Aboriginal Peoples
4. Forest Products Benefits
5. Knowledge and Innovation for Competitiveness and Sustainability
6. The Urban Forest and Public Engagement in Sustainability
7. Private Woodlots' Contribution to Sustainability
8. Reporting and Accountability

5.1 Ecosystem-based management

The goal of this specific strategy is to manage Canada's natural forest using an ecosystem-based approach that maintains forest health, structure, functions, composition and biodiversity, and includes using integrated land-use planning, especially before tenure allocation, maintaining natural forested ecosystems, completing a system of representative protected areas. In addition, this strategy attempts to maintain carbon reservoirs and manage the forest to be a net carbon sink, on a national basis over the long term; and to conserve old-growth forests and threatened forest ecosystems.

The ecosystem-based approach to managing natural resources recognizes that the social and economic benefits the forest provides over the long term rests on the ecological integrity of the forest. Forest management policies in Canada are based on this philosophy, as are many forest-related international commitments. The United Nations Forum on Forests has identified the ecosystem-based approach to sustainable forest management as a priority.

Essential to an ecosystem-based approach is the establishment and management of protected areas. These contribute to the conservation of biological diversity. However, protected areas must be complemented by sound stewardship across the entire country, accompanied by particular attention to lands around protected areas.

Ecological functions and processes must be understood, maintained and restored where necessary. Maintaining productive capacity, resilience and biological diversity are key factors in ensuring a healthy forest ecosystem. In turn, a healthy ecosystem is essential for a healthy society and economy. Thus, an ecosystem-based approach needs to reflect the fundamental connection of people to the ecosystem.

Forest management considers all the benefits the forest can provide, whether these are direct benefits, such as wood, water, carbon sequestration, wildlife habitat, recreation, hunting, trapping, fish habitat, fishing or wildfoods, or indirect benefits, such as the beauty of the forest landscape or the satisfaction that society derives from its forest. Management also considers human and natural disturbances such as fire, insects and disease when making choices to optimize forest use over time. Managing the forest to encompass this wide spectrum of benefits is complex because they often conflict.

Ecosystem-based management, therefore, considers non-timber and timber benefits along with other social and economic benefits, while also incorporating the best available scientific and traditional knowledge.

In order to fully adopt this strategy, however, Canada needs to take specific steps. First, it ought to develop

guidelines for integrating watershed-based management and wildlife habitat conservation into forest management practices across Canada and measures for evaluating implementation. In addition, it must establish a process involving forest-based communities leading to the implementation of land-use management plans, which include all forest benefits. It should also implement systems and decision making that sets resource-use levels (for example, the Allowable Annual Cut – AAC) as an output of a planning process.

Despite better forestry practice in the industry, Canada needs to place an emphasis on reforesting areas that are cut for temporary uses and use afforestation, where feasible, to mitigate the permanent loss of forest, as well as learning from afforestation techniques that have proved effective elsewhere (i.e. Finland: Tahvanainen, et al. 1996)

Where pests are concerned, Canada needs to manage to avoid or mitigate the adverse impact of invasive species on its forest ecosystems, increase the use of pest management approaches to gradually reduce the use of synthetic, chemical pesticides in forest management, and redirect, where appropriate, harvesting into forest areas affected by forest fire, pests and disease damage to mitigate loss.

5.2 Sustainable forest communities

The goal of this strategy is to develop legislation and policies to improve the sustainability (social, environmental and economic) of forest-based communities by fostering participation and involvement in forest management decision making improving access to resources, sharing benefits, enhancing multiple benefits, and supporting community resilience and adaptive capacity.

In 2000, nearly 300 communities, described as being “heavily forest-dependent”, had at least 50 percent of their employment base in the industrial forest sector. As well, more than 800 Aboriginal communities are located within Canada’s productive forest. Many of these communities continue to depend on the forest for traditional, non-economic uses. All forest-dependent communities, however, rely on the forest not only for their economic well-being, but also for their environmental and social well-being – in some cases, even for their survival.

Traditionally, the forest industry’s processing facilities have been built in rural or remote areas close to the fibre source. This, however, is changing. Communities have been affected by a shift in the way forest resources are used. For example, expanded access to remote forest areas, efficient mechanized harvesting and transport and large tenure allocations have reduced the number of jobs per unit of wood harvested and concentrated forestry support services in larger and fewer regional centres.

The heavy dependency of forest-based communities on the forest as a source of employment and revenue has created economic challenges in many areas of Canada. Simple proximity to the forest and forest industry jobs does not necessarily lead to community sustainability and meaningful participation in the forest economy. The ability of forest-based communities to participate in resource and land management decision-making processes and in the development of new economic opportunities that will improve their future, is essential to ensure community sustainability.

Despite increasing community involvement in forest management planning in recent years, further community involvement in decision-making and implementation needs to be improved. This is especially important because the future of rural regions and Aboriginal Peoples is linked not only to a timber-based forest economy, but also to the use of non-timber forest products and other forest uses such as trapping, traditional uses, tourism and recreation.

To meet this need, Canada needs to develop and adapt forest legislation and policies to provide involvement of forest-based communities in sustainable forest management decision making and implementation. In addition, Canada ought to expand the area and use of community-based tenure systems and resource allocation models in remote, rural regions of Canada to increase benefits to Aboriginal Peoples and forest-based communities.

On the community level, the government ought to support capacity building in local communities so that they can effectively participate in processes that lead to community sustainability. Finally, Canada needs to develop assessment and decision-support systems to enhance the socio-economic health of forest-based communities.

5.3 Rights and participation of aboriginal peoples

This strategy attempts to accommodate Aboriginal and treaty rights in the sustainable use of the forest recognizing the historical and legal position of Aboriginal Peoples and their fundamental connection to ecosystems.

Aboriginal Peoples' involvement in sustainable forest management continues to increase, shaped by several concurrent factors, including various international commitments, court rulings on accommodating such rights, as well as policies and practices ensuring benefits to Aboriginal communities. These recognize the historical and fundamental connection of many Aboriginal Peoples to forest ecosystems. Land claims, treaty-making and treaty land entitlement are three ongoing processes through which Aboriginal interest in the land is acknowledged formally, resulting in an Aboriginal-controlled land base. Meaningful Aboriginal participation in forest management necessitates goodwill and foresight on the part of the entire forest community.

Although courts have provided direction on certain issues, Aboriginal Peoples and governments in Canada have different views on the scope and nature of Aboriginal and treaty rights and how they should be applied generally to forest management policies and practices. This difference in perspectives creates a sense of economic and legal uncertainty in the forest sector. A shared understanding of Aboriginal and treaty rights, how they can be accommodated in forest management and how this affects roles and responsibilities, is essential in order to achieve the clarity and relative stability sought by all parties in the forest sector.

In addition to the direction provided by Canadian courts, several international conventions, declarations and ongoing policy fora are directly relevant to the involvement of Aboriginal Peoples in sustainable forest management. These include, for example, the Convention on Biological Diversity, the United Nations Conference on Environment and Development (UNCED) – Forest Principles and the Draft United Nations Declaration on the Rights of Indigenous Peoples. Their spirit and intent will influence sustainable forest management policies and initiatives in Canada.

Aboriginal participation in the forest sector has generally increased in recent years. Opportunities for employment, contracting and business development are more abundant, with the forest industry willing to enter into various forms of partnership. However, the lack of technical, human and financial resources and the lack of appropriate policy frameworks make it difficult for Aboriginal Peoples to participate in forest management and forest-based economic activities. Effective participation also calls for innovative and bold institutional arrangements between governments and Aboriginal communities relating to forest management. To support more effective participation, forest management planning and decision-making processes need to include women and youth as well as Aboriginal cultural and traditional approaches to land use.

To effect this, Canada needs to initiate processes with Aboriginal Peoples and appropriate levels of government for establishing a shared and grounded understanding of Aboriginal rights, Aboriginal title and treaty rights, the roles and responsibilities of Aboriginal Peoples, governments and forest stakeholders; and, measures to fulfill governmental fiduciary responsibilities and the legal duty to consult. In addition, Canada should implement institutional arrangements between Aboriginal Peoples and governments that reflect a spirit of sharing responsibilities and benefits for the management, conservation and sustainable use of forest lands and resources, and give effect to land claim settlements, treaties and formal agreements on forest resource use and management.

Aboriginal Peoples play an important role. Canada should do its best to incorporate traditional knowledge in managing forest lands and resources in accordance with the Convention on Biological Diversity, as well

as direct federal and other available funding to support Aboriginal capacity building and participation in implementing the National Forest Strategy, through measures such as a renewed and expanded First Nation Forestry Program and the development of a parallel Métis forestry program, and in supporting Aboriginal participation in related local, regional and international meetings. Finally, Canada should provide for access to a fair share of benefits from the use of forest lands and resources, as well as provide for Aboriginal interests in the development of international trade agreements.

5.4 Forest products benefits

This strategy attempts to stimulate the diversification of markets, forest products and services and benefits (both timber and non-timber) by understanding current and emerging markets and developing new domestic and international markets, promoting value-added and best end-use through expanded research and design, and attracting manufacturers of finished products and promoting markets for forest environmental services.

In addition to ecological services, Canada's forest supports a wide range of benefits such as timber, recreation, numerous non-timber products and service-based industries that are important both nationally and internationally. Over the last decade, exports of non-timber products and value-added products (for example, engineered wood products or wood veneer panels) have increased more than have exports of traditional wood and paper products.

Canada is the world's largest forest products exporter, accounting for over 20 percent of the global market in 2001. Canada's future share of the international forest products market and the competitiveness of its forest industry will depend on its ability to adapt to changes in domestic and international markets at a time when the forest is increasingly expected to be managed for uses other than timber production.

Canada's success in producing and marketing forest products and its closeness to the U.S. market have provided excellent economic opportunities. However, regulatory barriers and new global competition from lower-cost fibre sources present new challenges for the forest industry. Addressing these challenges requires continuous improvements in new product development, market diversification, cost competitiveness, quality enhancement, worker retraining and public reporting. Opportunities, nevertheless, exist to increase products and services while using less wood and less land.

Changing values have underlined the need to collaborate in communicating information about Canadian forest practices. The industry's commitment to sustainable forest management must be demonstrated to both Canadian and international communities.

Accordingly, Canada ought to create and maintain policies and programs that encourage human capacity, investment, productivity, innovation and competitiveness in existing and potential primary and value-added timber industries, non-timber and service-based industries, such as tourism and recreation, hunting and fishing, trapping and wildfoods, and specialty forest products and services such as medicinal plants, ethno-botanicals, carbon sinks, water regeneration, and bioplastics.

In addition, Canada must create and maintain policies and programs that encourage, develop and maintain access to markets for primary and value-added timber and non-timber based industries. As an example, Canada should promote its forest products and practices at home and abroad through public events, market initiatives, world-class environmental programs and community activities.

In terms of development, Canada needs to develop value-added industries and programs to support innovation, such as financial investment in intermediate and final product manufacturing, and collect statistics to monitor their development, as well as providing for the removal of policy barriers, thereby encouraging the greater use of renewable forest products to improve resource and energy efficiency.

5.5 Knowledge and innovation for competitiveness and sustainability

This strategy seeks as its goal to maintain and enhance the skills and knowledge of forest practitioners and mobilize the broader Canadian knowledge community to establish a new forest innovation agenda for Canada by developing "clusters" of forest sector cooperation, both nationally and regionally, to use available science and technology resources more efficiently and effectively In addition, it seeks to support innovative post-secondary education institutions, continuing education and technology transfer to ensure that the principles of adaptive management improve the management of resources, and improve the processes for bringing new and traditional knowledge and ideas to policy evolution, decision making and field practices.

The Canadian forest sector has an impressive history of using innovative practices and new technologies that have advanced many aspects of forest management and captured a significant share of the global forest product market. Future success lies in embracing a more knowledge-centred, innovation-based approach that encompasses forest tree genetics to forest products markets. Research is increasingly structured so that experts from diverse disciplines can work together. There is also a growing appreciation for the importance and value of traditional scientific knowledge found in Aboriginal and local communities, and for the need to integrate this with current scientific knowledge. Canada's progress in sustainable forest management requires integrated approaches and multidisciplinary research partnerships and networks that incorporate the natural and social sciences and traditional knowledge.

Achieving the National Forest Strategy's objectives requires understanding how knowledge, from tree seed to markets, is generated and translated into new products, processes and services. Technology, public awareness, social responsibility and environmental standards have changed considerably in the last ten years. Canada's workforce (from field personnel to policy makers) is responsible for Canada's leading presence in global markets. The workforce must be equipped with the knowledge and the ability to adapt to change by fostering a culture of innovation, learning and knowledge management. This requires a continuing commitment and stable funding for research and development by all partners and to applying the best available knowledge to decision making. To remain competitive and to meet the evolving expectations of forest stewardship, the forest community needs to quicken the pace of innovation.

To meet this objective, Canada must develop a framework to use traditional knowledge along with current scientific knowledge and to protect the intellectual property rights of Aboriginal Peoples, and develop strategies for improving the forest sector's success in competing for funding to support leading-edge science and technology programs, using research and development, tax credits, research extension and education.

In addition Canada ought to develop and implement more focussed education and training for practitioners involved in growing, harvesting and producing specialty wood products through enriched secondary and post-secondary education curricula, extension services, adaptive management, demonstration projects and outdoor classrooms, and continuing education.

5.6 The urban forest and public engagement in sustainability

The primary goal of this strategy is to actively engage Canadians in sustaining the diversity of benefits underlying the importance of Canada's forest by establishing mechanisms to advance the planning, maintenance and management of urban forests based on an ecosystem-based approach and enhancing communication and outreach programs.

For the vast majority of Canadians living in large urban areas, the urban forest is their contact to the forest's benefits and values. The urban forest provides many tangible and intangible social, spiritual, cultural, environmental and economic benefits. In many cases, it defines communities, neighbourhoods and cities. Trees can increase residential property values, can attract industry and tourists, provide wildlife habitat and provide jobs for city foresters, technicians, planners, arborists and others.

The forest in rural areas affects people living in towns and cities because of its contribution to the economy, its environmental functions (i.e. cleansing groundwater and regulating water flows) and its recreational opportunities. All the while, people living in urban areas are increasingly shaping forest policies by their participation in decision making at local, regional and national levels.

A key element in fostering educated debates and making sound decisions is credible information. Canadians need to be informed about the state of the forest and the social and spiritual well-being, environmental health and economic wealth that results from both forest use and conservation. Whether living in an urban centre or a rural forest-based community, Canadians benefit from greater access to, and availability of, accurate, timely information on the forest. Sharing information in an open and transparent manner is a critical part of generating trust and understanding between the public and the various interests that compose the forest community. Engaging young people, in particular, and encouraging the exchange of perspectives on the forest in various public meetings is important.

To effectively engage the public on these issues, Canada needs to develop and implement a national urban forestry strategy, as well as guidelines and support tools to help municipalities maintain and enhance their urban forest, to protect the surrounding forest and watersheds from urban pollution, to inform the public about how the forest contributes to their quality of life. To engage young people, Canada needs to develop educational initiatives and programs that will inform youth about forest stewardship and engage them in local forest stewardship programs.

5.7 Private woodlots' contribution to sustainability

This objective seeks to increase the economic, social and environmental contribution by Canadian woodlot owners to Canadian society through a concerted effort by stakeholders to strengthen policies and services that encourage and support viable woodlot businesses.

Six percent of Canada's forest is owned by 425 000 woodlot-owning families. Woodlots are often the forest most Canadians see, because they are a common feature on the southern Canadian landscape. Woodlots are also an important source of raw material for the forest industry. The income generated from producing pulpwood, sawlogs and other forest products is an important source of economic stability for many rural communities. As well as economic benefits, woodlots provide recreational opportunities, wildlife habitat and biodiversity, clean water and pleasant roadside scenery across rural Canada. In some areas, woodlots may be all that is left of the original forested ecosystem.

The multi-faceted contribution of private woodlots to Canadian society is the result of good stewardship carried down through generations of many woodlot-owning families. These families have been guided by their own "land-ethic", by market opportunities and by supportive government policies and programs, including forest extension services. However, a delicate balance exists between sustainable management of woodlots and the short-term financial viability of woodlot-based family businesses. Financial pressures sometimes build to a point where poor forestry practices result, such as over harvesting and deforestation. These problems have been increasing in parts of Canada in recent years. At the same time, Canadians have rising expectations about acceptable management practices. Indeed, woodlot owners are subject to an accelerating pace of change in markets, production technology, management practices and obligations to society. There is a growing need for reliable information and educational services, both of which are vital tools for coping in an environment of constant change.

With appropriate incentives, these problems can be overcome. More owners will be encouraged to strengthen their commitment to good stewardship, which in turn will increase the flow of products and services from woodlots. The challenge for Canadian society is to ensure that a comprehensive framework of policies and services is in place and is available to all owners.

The framework would include conventional incentives through the marketplace, the tax system and silviculture assistance programs. Fair access to markets is needed as are government policies that could help offset

market pressures. Adequate funding is needed for silviculture programs. Positive incentives in the tax system need to replace disincentives to sustainable forest management. The framework would also include new forms of incentives to compensate for the cost of providing environmental services, such as maintaining watershed health and clean water, wildlife habitat and other services. Another component of the framework would include educational services. They are vitally important in ensuring that owners have access to the information, skills, technology and the assistance with planning needed to take full advantage of available financial incentives. As woodlot owners begin to respond to the challenge of forest certification, the importance of these services increases.

Stronger partnerships among woodlot owners, their associations, governments, industry and other agencies are instrumental in making progress toward these goals. To strengthen these partnerships, Canada must identify and remove obstacles hindering sustainable development with particular attention to market incentives, silvicultural programs and tax policies, increase the capacity of private woodlot owners by expanding extension programs, and develop and implement incentives for the provision of environmental services from private woodlots.

In addition, Canada should consider organizing a national forum for private woodlot owners to review progress across the country in the design and implementation of policies, incentives and programs to support private woodlot owners in areas such as extension, training and technology transfer, taxation (income and property), forest renewal, environmental services, natural disasters, certification, fairness in access to markets and stumpage policies, and carbon pooling.

5.8 Reporting and accountability

The main goal of this strategy is to create a comprehensive national forest reporting system that consolidates data, information and knowledge for all valued features of the forest, both urban and rural.

Sound, credible information is essential not only for knowledgeable decision making, but also for reporting at all levels. However, reporting and accountability are significantly challenged by the ability of any one organization to efficiently collect, compile, analyse, synthesize and publish information, and by the speed with which both forest-related information and public expectations have expanded. From an information perspective, tremendous changes in technology such as better remote sensing material and improved computerized tools have taken place in the last ten years. At the same time, the evolution of more powerful computers, farther-reaching information networks and the internationalization of the debate on the forest have rapidly increased the number and range of reporting requirements that Canada must comply with. Forest data and information are currently generated from a vast range of sources. The resulting information often varies in scope, nature, format and volume.

Canada needs a standardized national system that provides information on the current state of its forest and forest change over time. Improved databases and availability of information will help influence the quality of reporting, communicate the value of the forest and promote the accountability of all those involved in the forest sector.

To increase its accountability Canada must attempt to establish the capacity for credible and authoritative reporting to the public on important topics such as legal reporting requirements, how management practices incorporate multiple values, criteria and indicators of sustainable forest management, Aboriginal involvement in the forest sector, honouring international commitments such as those under the Convention on Biological Diversity, and actions pursuant to recommendations of the Intergovernmental Panel on Forests and the United Nations Forum on Forests and other forest-related international meetings.

In addition, Canada needs to assess socio-economic and environmental impact analysis of policy and management options, institute forest data standards for forest inventories, including monitoring protocols, to create a publicly accessible forest information system that provides high-quality information on the status of the forest, and enhance programs to monitor and inform the public about invasive species.

Finally, Canada must establish a consolidated reporting system that satisfies its objectives and obligations related to conventions and policy initiatives such as the Convention on Biological Diversity, the United Nations Forum on Forests and those related to the CCFM Criteria and Indicators Framework, as well as the National Forest Strategy.

6 Conclusion

This National Forest Strategy provides an overview of the vision and the goals that Canadians have for their forest over the next five years. While it confirms Canada's collective commitment to continue to be a global leader in sustainable forest management, it must also develop the appropriate frameworks to actually reach these goals. As the Strategy goals are voluntary, Canada must balance the realities of a strategy that is largely unenforceable, while still meeting obligations it has committed to nationally and internationally.

While there are significant challenges still facing Canada's forest policy, Canada's experiment has shown that it is possible to develop a strong national policy on safeguarding forest biodiversity that brings together diverse values and that ensures environmental health, social and cultural well-being and economic growth. By encouraging active national participation, the level of commitment to the strategy by each of those involved in the industry has shown that sustainability can be achieved through a voluntary system. While some problems still remain, the experiment has effectively been a successful one.

Other papers

Property rights for biodiversity conservation and development: an analysis of extractive reserves in the Brazilian Amazon

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Abstract

The economic literature of property rights has been assessing the impact of different community based arrangements on the efficiency of natural resource management of specific areas. Differently, other strands of development economics and policy-oriented research have been concerned with issues such as poverty alleviation, technological progress and the capability to compete in market economies, which go beyond the local areas where traditional communities live and include the wider economy. The extractive reserves in the Brazilian Amazon offer perhaps one of the most interesting cases for investigating the connections between these two approaches in the context of tropical forests. It is based on the idea that the combination of public property with collective use in particular forest areas can generate competitive and, at the same time, sustainable exploitation of its natural resources. This paper aims to analyse whether the existing property rights support the joint objective of conservation and development. Our main result is that current property rights systems are efficient only with respect to competition in markets for existing extractive products. This finding points out to a fundamental contradiction between the static structure of the property rights systems and the dynamic nature of two most promising development paths, namely the discovery of new products and the supply of biological inputs for plantations. The current model of extractive reserves based on the design of internal property rights fails to taken into account the broader economic context where the reserves must generate a viable revenue stream. We conclude therefore that under the current set of institutions, the development objectives inherent in the extractive reserves model are likely to face probably considerable challenges to be accomplished in the future.

Keywords: *Property Rights, Extractive Reserves, Environment and Development* (JEL Classification: O13, Q23)

1 Introduction

Since the seminal work by Hardin (1968), the role of property rights for balancing the conservation-development trade-off has been discussed in the economic literature. The research on property rights has been mainly concerned with the assessment of different community based arrangements in promoting efficient management of natural resources. In several studies a particular emphasis has been placed on property rights internal to the study area or the theoretically conceived community area (Baland and Platteau, 1996; Bardhan, 1993; Seabright, 1993; Ostrom, 1990).

However, economic theory and empirical evidence provide mixed insights regarding the adequacy of choosing between private property, public ownership or communal property as optimal resource management systems (Baland and Plateau, 1996; Seabright, 1993). Indeed both approaches show that it is not possible to rule out situations where none of the single alternatives individually provides a viable solution. A natural response to the difficulty of choosing a single property right regime can be found in combinations of 'pure' categories, i.e. by building the so-called co-managed systems. It can be argued that in particular, the combination of state-based with community-based modes of regulation might be effective in reducing informational asymmetries and monitoring costs (Baland and Plateau, 1996). An added benefit is that the government can provide legal frameworks enabling rural organizations to claim their rights against external intruders. Finally, co-management systems can avoid resistance from the communities with respect to regulations coming from the central government.

While the property rights literature has been mainly focused on optimal resource management within specific areas, other strands of development economics and policy-oriented research have been concerned with broader development issues (see Sadoulet and de Janvry, 1995 and Bardhan and Udry, 1999 for an introduction). For the latter, questions regarding poverty alleviation, technological progress and the capability to compete in market economies pose challenges that go beyond the local areas where traditional communities live and include the wider economy (Angelsen, 1999; Lipton and Ravallion, 1995; Aghion and Bolton, 1997; Foster and Rosenzweig, 1995; Keller, 1996; Rodriguez-Clare, 1996). The interface of these two bodies of research becomes important when traditional communities managing complex natural resources interact to the outside world by trading products. The need to remain competitive in a market economy where heterogeneous players operate with different production systems creates an inexorable link between internal property rights and wider development processes. Traditional communities must be able not only to manage their resources optimally but also to improve their production systems and technologies, offering products at competitive prices and deriving comparative advantages.

The extractive reserves in the Brazilian Amazon offer perhaps one of the most interesting cases for investigating the interface between property rights and development in the context of tropical forests. In these reserves, the combination of public property, community management and private resource use of designated forest areas are expected to generate competitive and, at the same time, sustainable extraction of non-wood forest products (NWFP) [1]. Therefore, not only the internal property rights assigned to the reserve matter but also the broad set of property rights upon the wider economy is structured.

In their first 10 years of existence the extractive reserves have been attracted the attention and investments of a number of institutions and have been considered by some as an important element for a development strategy to the region (Allegretti, 1990, 1994; Menezes, 1994). Nevertheless, the economic reality of these reserves poses serious doubts and motivates scepticism about their capacity to fulfil its economic development objectives (Southgate, 1998; Brown and Rosendo, 2000; Assies, 1997; Almeida, 1994; Homma, 1992; Goeschl and Igliori, 2003). Only a very limited number of products are commercially exploited so far and the majority of their population remains poor. The threat posed by cultivated substitutes is eminent and the extraction of NWFP still depends on external support.

Building on previous research on the spatial economics of extractive reserves (Goeschl and Igliori 2003), this paper investigates the relationship between property right regimes and the development perspectives of

extractive reserves to contribute to the bodies of literature above-mentioned. To do so, we first explore three possible development pathways that the extractive reserves production system can pursue. We then confront these pathways with the property rights in place both within and outside the reserves in order to assess the capacity of these property rights to support each of the development pathways.

Our main result is a negative one: The current system of property rights properly supports only one of three principal development pathways, namely the extraction of established NWFP. We argue that this development pathway has very limited capacity to serve as a growth engine for the communities living in extractive reserves. On the other hand, the current property rights structure generates no or very limited rents for the inputs required to access the other two pathways, diversification into newly discovered NWFP and supply of biological inputs into the intensive production of NWFP.

These findings point to a fundamental tension between the static structure of the internal property rights system and the dynamic nature of the two more promising development paths. The current model of extractive reserves, based on the design of internal property rights, fails to take into account the broader economic context where the reserves must generate a viable revenue stream. We conclude therefore that under the current set of institutions, the development objectives inherent in the extractive reserves model are likely to face probably insurmountable challenges.

This problematic conclusion has implications for policy-making and provides material for further research. On the one hand our analysis suggests that policies aiming to enable indigenous communities to develop viably should go beyond the design of internal property rights and address the issues regarding the ways these communities interact economically with the outside world. On the other, the results also indicate that there is a clear need for further research exploring in greater detail the link between internal property right systems and broader development strategies rather than merely the optimal management of a given resource.

The paper is structured in four sections. The following section characterises the NWFP production and explores the long run perspectives of extractive reserves through its alternative development pathways. The analysis of property rights internal and external to extractive reserves is the topic of the third section. The fourth section discusses to what extent these property rights are conducive to alternative development pathways. We then summarise and conclude.

2 NWFP production and development pathways

2.1 Capital stock and cost dynamics

In this section we characterize the main features of NWFP production systems. To capture the peculiarities of the NWFP production, Goeschl and Igliori (2003) developed a dynamic model of spatial competition between an extractive reserve and a plantation. Here we discuss the motivations underlining the model and its main results without going into the mathematical set up and propositions.

The production of NWFP involves the harvesting of products generated by trees or shrubs. This makes clear that the production process relies on an underlying stock of biological capital. This capital stock differs from the standard physical capital used in conventional production systems in that the composition and size of the capital stock are directly linked to the rate of capital depreciation. Take the rubber tree as an example. Prior to the development of rubber plantations in Brazil, incidence of leaf blight was limited due to genetic variability in natural tree populations from which rubber was extracted. Early rubber plantations using intensive methods were devastated by the impact of leaf blight epidemics that made Brazilian rubber permanently uncompetitive on world markets while South-East Asian plantations evaded the disease through mere serendipity at the time when rubber saplings were smuggle out of South America (Kloppenburg, 1988). In all, there are about 90 species of fungi known to attack *Hevea* trees, two species of bacteria, and various nematode and insect

pests (Duke, 1983). These pathogens seriously impact on the costs of intensive production development since they require continuous investment into the protection of the biological capital base, mostly significantly through breeding (Goncalves, 2002; IRRDB, 1998; Rubber Board, 2002). On the other hand, intensive production in plantations benefits in a static sense from lower harvesting costs and in a dynamic sense from productivity gains in complementary inputs (physical capital, human capital) driven by technological progress and knowledge (FAO, 1995).

The general dynamics of an industry dependent on a biological resource stock imply that production costs of a NWFP producing enterprise will vary over time depending on the productivity of its capital stock: The productivity of the biological capital stock will be negatively affected by increases in the size of production that can be mitigated through simultaneous investments in biological resources. A conventional enterprise will be able to optimally choose price and output as well as the path of its production technology.

By contrast, extractive reserves combine a severe restriction with regard to the choice of production technology with an abundance of biological capital. With respect to NWFP production, extractive reserves are peculiar because not the community, but the government is the owner of the biological capital stock. It grants the community free use of that stock subject to that stock not being depreciated. Implicit in this use condition is also a restriction of the production technology that limits the marginal productivity of physical capital (Browder, 1992). These restrictions together with the intrinsic difficulties in operating within the forest, low capital intensity, little access to capital and the persistence of traditional methods suggest that the depreciation of the biological capital stock in NWFP production in reserves is negligible. Conversely, the rate of cost reduction driven an existing physical capital stock will be extremely low in the reserves because labour intensive production involves little physical capital. With this configuration, the cost dynamics are not relevant to the intertemporal management of an extractive reserve. What will matter for the profitability of NWFP production, however, is that the level of unit costs will be at a level commensurate with the constrained production conditions in the reserve.

While constrained in the choice of technology, the abundance of biological capital means that extractive reserves have direct and inexpensive access to a critical input in the NWFP production process. This stock potentially allows a diversification of NWFP production into the various extractive activities (rubber, nuts, fruits, oils, fibres) thus reducing the reliance on each individual product. It also opens up the interesting perspective of extractive reserve potentially benefiting from the demand for biological inputs from other NWFP producing enterprises subject to cost dynamics. This demand could be met in accordance with the use restrictions as long as the reserve can supply these inputs at a price lower than the cost of bioprospecting to the enterprises.

The peculiar production conditions in the extractive reserves present both a set of constraints for each NWFP production process by virtue of not being able to choose the first-best technology and a set of opportunities through the free access to an abundant biological capital stock that allows both diversification of output and sale of biological inputs. In terms of biodiversity conservation, these production conditions have clear benefits as they secure land use rights for activities that do not rely on land conversion. Economically, these conditions represent a significant improvement in terms of social equity compared to the traditional 'aviamento' system of rubber 'barons' and quasi-indentured labour[2]. However, it is less clear whether this constrained production system offers viable pathways to development through sustainable income flows for their populations.

2.2 Markets for existing NWFP

NWFP enterprises generate revenue through sale of their products on markets where they interact with other producers of NWFP. Following Goeschl and Igliori (2003) we focus on two peculiar features of this market for NWFP: The first is the spatial structure of enterprise location in the NWFP sector. Due to the considerable distance involved in the domestic market and resultant transportation costs, space is an important determinant of the profitability of operations. At the same time, production depends on peculiar local characteristics that are not present everywhere, thus limiting the choice of production sites. The second peculiar feature is the

heterogeneity of enterprises competing on the market. What is expected of extractive reserves is that they are able to generate revenue on output markets where they will be competing with other producers that are operating using different technological choices and resource bases.

The combination of spatial considerations and producer heterogeneity is not only analytically interesting, it is also empirically relevant: Extractive reserves and potential plantations are usually localised in different parts of the country (in rubber production most of the plantations are localised in the South East of the country). Wunder (1999) shows that NWFP production outside extractive reserves is very concentrated and 18 municipalities account for 25 per cent of the total extraction values.[3] These product belts are mostly characterised by proximity to market areas and by previous intervention or degradation in current sites of extraction. These environments are now dominated by the commercial species, sometimes up to the point of forming 'quasi-plantations', as a consequence of natural re-growth combined with management practices to deliberately eliminate competitive vegetation (Wunder 1999).

Goeschl and Igliori (2003) show that, given the constrained production conditions, the development of the market share for extractive reserves even under most favourable assumptions, is likely to lead to a declining revenue stream. This is on account of the unconstrained producer being able to reduce costs through investment. This investment is justified because it allows the producer to capture a higher market share from the reserve in the spatially differentiated market. If eventually the cost difference reaches a threshold the low cost firm takes over the whole market. This implies that there is only a limited time period over which production of a NWFP will generate significant revenues for the reserve. This limitation is exacerbated by the fact that the more revenue potential that product has, the greater are the incentives for the unconstrained producer to reduce costs quickly, and consequently the shorter the time period of profitable operation for the reserve.[4]

This rather pessimistic view regarding the revenue prospects in established markets for NWFP is supported by various empirical observations. Homma (1992), analysing the historical development of extractive activities in the Amazon, characterises the dynamics of NWFP as an economic cycle composed by 4 phases: expansion, stabilisation, and decline of the extraction, followed by cultivated plantations. The expansion phase is characterised by the existence of large reserves of resource and by the monopolistic position of the extraction region in the product market. The stabilisation occurs when the market tends to equilibrium close to the maximum capacity of extraction. The decline starts with the reduction of the resource base and with the increase in the extraction costs. Finally, the domestication phase begins during the stabilisation phase as long as technological and substitution constraints are not high enough and the demand remains reasonably stable. This theory of a revenue cycle is also supported by more recent empirical evidence for current NWFP produced in extractive reserves, most strikingly in the case of rubber over the last ten years. Although rubber is still the main product of extractive reserves, its production has been constantly declining since their creation. The rubber production in Brazil started the 1990s with almost 25 000 tons a year and finished the decade with less than 6 000 tons, facing a decline of more than 75 per cent (IBAMA, 2001). In addition, rubber plantations are increasing in other regions of Brazil, particularly in the state of Sao Paulo. Similar developments have been observed for nuts and other NWFP.

Both the industrial analysis and the empirical evidence suggest that over a longer time horizon, extractive reserves are able to compete with plantations in the NFWP markets only under very restrictive conditions. According to Goeschl and Igliori (2003), these arise when (1) technology-induced cost savings in the NWFP industry are limited, (2) biological inputs are sufficiently expensive, and (3) there is spatial differentiation.

2.3 Markets for new NWFP

While the probability that extractive reserves can generate a long-run revenue stream in existing NWFP markets is limited, the empirical evidence points to temporary monopolies for extractive reserves in early stages of the market. Particularly in rubber[5], but also more recently in various nuts, fruits and oils, it has been observed that the initial phases of the NWFP market generate significant profits (Homma, 1992). There are various reasons to believe that such transitory periods of abnormal profits will generally exist: (1) Competitors

face fixed costs of market entry; (2) initial production costs for competitors may be higher while cost reduction will not occur instantaneously, and (3) the demand for products may be partly endogenous and hence initially clustered around the reserve where it enjoys a location advantage over competitors even when its unit costs are higher.

This potential of a temporary monopoly in a specific NWFP market raises the possibility of a development pathway for extractive reserves that builds on the abundant biological capital available therein. If reserves are in a position to generate a sequence of novel NWFP, they are rewarded for this activity with a sequence of temporary monopolies in the markets for these new products. Whether this strategy is economically feasible depends on the returns to product search activities carried out in the reserve. Two factors need to be considered: One is the cost of product search carried out in the expectation of discovering a new NWFP with market potential; the other is the pool of potential products over which this search can be conducted. These factors will determine the returns to the search activity.

2.4 Markets for biological inputs

Additional to pursuing a strategy of product discovery, the inexpensive access to a biological capital allows for a third strategy available for extractive reserves. This is to supply the biological inputs that its plantation competitors will be demanding in order to control the cost function dynamics.

A key variable is the price of biological capital. The plantation has a reservation price, which corresponds to the cost associated with setting up an enterprise to collect natural resources in the Amazon region. However the plantation can alternatively pay the price charged by the reserve to supply biological resources. If the latter is lower than the former, there are incentives for the plantation to buy biological inputs from the reserve. It is not unreasonable to assume that this inequality will be fulfilled given the labour-intensive production methods in the reserves. The methods allow those involved in the extractive activities to observe the traits of various tree varieties with respect to yield, disease resistance, quality of output etc. It is plausible, therefore, that extractive reserves will be able to identify characteristics valuable to plantations at a lower cost than a search process not relying on this prior information.

From the reserve's point of view, the most attractive feature of the supply of biological inputs to competitors is that it establishes a negative link between the development of the reserve's share of the market for NWFP and the revenue generated by the sale of inputs into NWFP production. Goeschl and Igliori (2003) show that to the extent that reserves can supply these biological inputs, some mitigating compensation for the revenue loss on the NWFP market is available.

3 Property rights

3.1 Property rights within the reserve

Extractive reserves have an innovative and idiosyncratic internal property rights regime. It has a triple structure and can be seen as a co-management system involving the government, the community, and the individuals:

a. The state owns the land and regulates the exploitation of the resources, giving the concessions to the communities and approving a use plan, and monitoring its compliance.
b. The communities write the use plan, receive the long-term use concession of the natural resources, and are responsible for the full application and respect of the use-plan. Communities also negotiate with the government the construction and management of health and education facilities in the reserves.
c. The exploitation of the resources is made within individual land plots ('colocações'). Each household

organizes his/her extraction activities and cultivation of subsistence crops. Co-operation between households is more or less frequent depending on the particular case, but the results are privately appropriated.

The external property right structure includes only the NWFP. The households can sell and fully appropriate the value of their production of extractive products. They cannot sell neither the land nor the use of exploiting the land. Diagram 1 illustrates the property rights structure in a typical extractive reserve.

Rather than been a top-down measure elaborated within government's offices the creation of the extractive reserves were originally proposed by the rubber tappers themselves. Potentially, this fact contributes to the compliance with respect to the constraints in resource exploitation prescribed by the use plan. Boundary definition also contributes to avoid conflicts, as they are determined in accordance with the already established exploitation methods and geographic coverage. The communal design of the reserve boundary preserve access to all members of the community to natural resources such as rivers and lakes, and avoids cost with fencing. Communal facilities for storing and processing products can also be built without promoting disputes regarding land allocation.

As mentioned above the ultimate economic incentive is allocated to the individual who will be benefiting from his/her own production. Thus, it is possible to say that the standard efficiency mechanisms associated with private property structures are present in the property design of the extractive reserves. Since members have no rights over the other members' production there is no possibility for free riding and consumption possibilities are connected with individual efforts. One the other hand the households can benefit from collective initiatives to store, process, and market the products.

In order to assess the possibilities of a community to cope with the challenges of managing local natural resources based on collective action, Ostrom (1990) has elaborated seven 'design principles' that characterize robust institutions, present in several cases of common property resources she studied. By 'design principle' she means 'an essential element or condition that helps to account for the success of these institutions in sustaining common property resources and gaining the compliance of generation after generation of appropriators of the rules in use' (Ostrom, 1990, p.90). Table 1 presents the Ostrom's principles.

In principle, extractive reserves have most of the necessary institutional characteristics, proposed by Ostrom in her design principles, to enhance the chances of a successful management of natural resource with an

Table 1. Design principles illustrated by long-enduring CPR institutions.

1. Clearly defined boundaries. Individuals or households who have rights to withdraw resource units from CPR must be clearly defined, as must the boundaries of the CPR itself.
2. Congruence between appropriation and provision rules and local conditions. Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labour, material, and/or money.
3. Collective choice arrangements. Most individuals affected by the operational rules can participate in modifying the operational rules.
4. Monitoring. Monitors, who actively audit CPR conditions and appropriator behaviour, are accountable to appropriators or are the appropriators.
5. Graduated sanctions. Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offence) by other appropriators, by officials accountable to these appropriators, or both.
6. Conflict-resolution mechanisms. Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7. Minimal recognition of rights to organize. The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

Source: Ostrom (1990, p.90)

active role for the rural community:

a. Boundaries and population with use rights are clearly defined;
b. Although approved by the government, everyone involved in the community designs operational rules;
c. Monitors are the appropriators themselves;
d. There is an association, which is a local forum for conflict resolution. For more serious or complex problems there is also the National Council of Rubber Tappers, which congregates the associations of all reserves. The government also provides a institution structure which represents the communities called the National Centre for the Sustainable Development of Traditional Populations (CNPT) based on the Ministry of the Environment;
e. Governmental authorities do not challenge autonomous institutional building. On the contrary there is a number of initiatives, sponsored by the government and NGOs focused on governance and institution building within the extractive reserves.

Overall therefore, the structure of property rights within reserves creates incentives that are compatible with a conservative use of the biological capital base and provides incentives for the extraction of a defined set of NWFP in the extractive reserves. This structure ensures that contributions from members of the community to the specific extractive activities in the reserves will be rewarded in congruence with the local production conditions.

How well does this structure works with respect to contributions of members that are not related to the pre-defined set of NWFP? There is little evidence that the appropriation and provision rules reward two critical inputs required to access the development pathways of diversification and biological input supply. The critical input into accessing the pathway of diversification is search activity directed towards the discovery of new NWFP with revenue potential. However, as individuals in the reserves cannot exclude others within the reserve from benefiting potential discoveries, there are few incentives for putting efforts in research and development activities. In addition, the human capital base formed by the traditional populations not necessarily aggregates the necessary expertise to carry out systematic research and product development.

The critical input into biological input supply is knowledge about production-relevant characteristics of the local biological capital stock. However, there is currently no mechanism to reward the information an individual has with respect to the biological characteristics, productive properties and resistance to diseases, the different varieties might have. Neither one of these inputs is therefore considered under the use plan or included in the quasi-contractual relationships between households and the wider community such as the ones that govern the benefit sharing over revenues from the marketing of NWFP.

3.2 Property rights in the wider economy

A related, but separate issue is the property rights structure over the commercial outputs generated by the extractive reserve in the wider economy. One factor that supports the functioning of the property rights regimes within the reserve with respect to existing NWFP is the fact that the property rights over the output of the production system can be easily defined and are well established both within and outside the reserve. The reason is that the existing NWFP produced such as rubber and nuts have the classical characteristics of private goods: They are both excludable and rivalrous in consumption and protected by adequate legal titles.

This rights structure over NWFP in the wider economy facilitates the definition of boundaries and helps ensure congruence between input provision and share of benefits from the output within the reserve. However, with respect to the discovery of new marketable NWFP and the supply of biological inputs, the property rights structure in the wider economy is less supportive. In the case of discovery, since the search procedure does not involve the 'creation' of a novel product, extractive reserves are not protected from imitating companies. However, the property rights in the new NWFP itself are again compatible with rewarding inputs. This contrasts with the case of biological inputs. Although the Convention of Biological Diversity has motivated systematic discussions about legislative proposals aiming to protect indigenous rights related to biological diversity, the property rights over biological inputs and most importantly over genetic resources are currently

in the public domain[6]. This means that no property rights in the local biological capital are assigned to the community living in the reserve. The obvious consequence is that the supply of biological inputs in a narrow sense cannot generate economic rents for the reserve under the current set of property rights.

4 Discussion

Theoretical and empirical studies indicate that pure property rights arrangements (open space, common property, private property, public property) cannot generally guarantee efficient management of natural resources. Therefore they call the attention for case-by case analysis and suggests that co-managed structures might offer alternatives for balancing the development-conservation trade-off.

Extractive reserves combines public, common and private property rights with the aim of providing incentives for achieving the joint objective of biodiversity conservation and economic development for populations selling NWFP in a market economy without converting the designated forested areas. The analysis presented in this paper suggests that the current set of property rights in extractive reserves is primarily based around the continued extraction of established NWFP. Within this narrow domain, the property rights structure represents a very effective response to the competing objectives of conservation and income generation.

However, considering a wider choice of development pathways, the adequacy of the current property rights structure is less apparent: Rewarding contributions to an expansion of products that the community markets is conducive to a pathway directed towards diversification. Likewise, rewarding the supply of biological inputs and knowledge about the characteristics of these inputs contributes to a development process built around biological input supply. The current property structure both within and outside the reserves presents considerable deficiencies to provide incentives for these two possibilities of turning the extractive reserves economically viable. Table 2 summarises the contribution of the property right structures within the reserve and external to the reserve with respect to the three development pathways discussed in the paper.

We can see that only the currently pursued development pathway, which relies on the extraction of existing NWFP, is fully supported by the property rights, both internally and externally. A strategy involving diversification is discouraged by a lack of rewards for the input supporting that strategy, specifically the activity of product search, but has partial support in that the new NWFP themselves are covered by the current property rights over outputs. Lastly, the pathway involving the supply of biological inputs is supported neither by rights over input nor over outputs.

Property rights:	Existing NWFP	Development pathways: Diversification	Biological input supply
Internal	Effective	Deficient	Deficient
External	Effective	Effective/Deficient	Deficient

This finding is problematic when set into the context of section 2: The current property rights structure encourages the reliance on only one of the three possible pathways. This limits the width of the revenue base at any given point in time on which economic development of the extractive reserve could be based. Over time, this limitation is even more problematic since the analytical and empirical evidence suggest that revenues from existing NWFP production will be maintained only under very restricted conditions. The current property rights regime also contains features that in themselves undermine the development objective of the extractive reserves. One example is that because no functioning property rights exist for biological inputs at the same time as the government conserves biological capital on public land (notably extractive reserves), plantations benefit from an inexpensive supply of these essential inputs into NWFP production. This reduces plantations'

expenses for inputs, enabling them to compete even more effectively with extractive reserves on the NWFP markets that are supposed to generate the revenues to develop reserves economically. In such cases, the conservation and development objectives are clearly in conflict and require adjustment.

These rather discouraging conclusions raise questions regarding the challenges ahead the extractive reserves. Firstly, as the difficulties regarding the establishment of property rights over biological capital evidenced by the discussions in the Brazilian congress might suggest, it is not clear whether property rights can be changed to enhance the chances of extractive reserves to survive in the long run. Moreover, confronting previous studies with the case of extractive reserves we see the limitations of assigning property rights for solving efficiency problems of natural resources management. Particularly, when communities operating a constrained production system must compete with unconstrained firms in a market economy. Then, the dynamic processes of product discovery and the creation of markets for biological inputs set in a broader context must be taken into account, which go beyond the static context of mixed property rights assigned to extractive reserves. These questions conform a fundamental contradiction posed by the static nature of property rights in the reserve as opposed to the economic dynamics of competition to the outside world. As the property rights structure in extractive reserves was based on the previously established extraction system exploited by the rubber tappers, it not contemplate the necessary features the two other more dynamic development pathways would require to be accomplished.

5 Conclusion

The instrument of extractive reserves has been advertised as a novel approach to reconciling biodiversity conservation and economic development. It is on the basis of this claim that their number and size is currently undergoing expansion in the Brazilian Amazon.

In this paper, we characterise the peculiar production conditions for NWFP that exist in extractive reserves and assess the development pathways that these conditions offer to the communities living there. These pathways are the marketing of existing NWFP, the diversification into new NWFP and supply of biological inputs to other NWFP producing companies. The pathways are then set against the current property rights structure within the reserves and in the wider economy. The extractive reserves in the Brazilian Amazon have an innovative structure of property rights combining elements of public, communal and private ownership and use rights. As the literature on property rights indicates, this idiosyncratic combination seems to produce the appropriate incentives for efficient conservation and economic exploitation of existing NWFP. However, the analytical and empirical evidence suggests that the revenue potential in existing NWFP is very limited. On the other hand, the existing property rights structure does not facilitate accessing the remaining two development pathways. The difficulties involving significant changes in the current set of property rights particularly with regards to the wider economy anticipate considerable challenges for fulfilling the development objectives of extractive reserves in the future. This problematic conclusion points out that policies aiming to enable traditional communities to undertake long-run development must take into account the relationship they ultimately have with competitors outside they internal remit. It also indicates the need for further research on the links between optimal property right design and broader development policy.

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Footnotes

[1] For a discussion on the creation of the extractive reserves, see Allegretti (1990). For a description of the main features of extractive reserves and their current status see Brown and Rosendo (2000), and Goeschl and Igliori (2003).
[2] See Allegretti 1994 and Brwon and Rosendo for a discussion of this tradional system.
[3] These municipalities form the so-called “assai belt” (Para state) and “babassu belt” (mainly Maranhao state).
[4] Apart from the threat of domestication in plantations, revenues from NWFP produced in reserves are limited by the availability of substitutes. The substitution of natural products by synthetic ones can be triggered either by a shortage of supply or by technological advance.
[5] It is sufficient here to mention the rubber boom in the late 19th and early 20th century.
[6] See Dutfield (2000) and Arcanjo (2000).

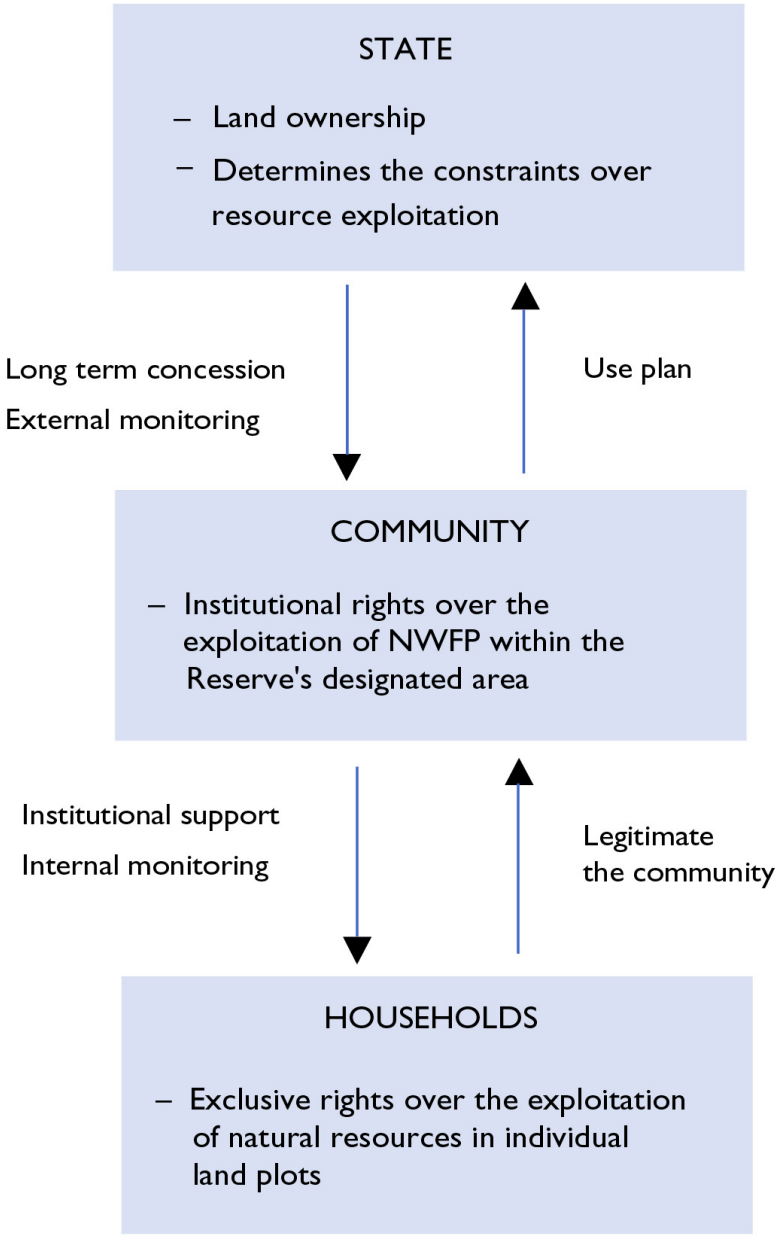

Figure 1. Property right structure in a typical extractive reserve.

Biodiversity law*

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1 Introduction

This article examines the safeguarding of biodiversity as a three dimensional legal concept. The dimensions are based on ecological facts, core values and legal norms[1]. The facts and values form together a background for the systematization of legal norms in order to safeguard biodiversity. Thus, the main purpose of this article is to introduce a new system of law for safeguarding biodiversity, so-called biodiversity law[2]. Also, in this new approach law has two tasks: 1) as an institution and 2) as a policy instrument[3]. This article takes mainly an instrumental approach to biodiversity law.

The traditional legal system acting between legal subjects, e.g. individuals, state and companies, offers no solution on how to protect biodiversity. Ecological and ecophilosophical studies have shown that biodiversity is a complex dynamic system as well as a target of diverse values. Thus, it is necessary to establish a new branch of law, biodiversity law, based on novel legal principles and mechanisms. The objectives of the Convention on Biological Diversity (the CBD) cannot be achieved by means of traditional legal solutions[4].

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2 Biodiversity as an ecological and legal fact

When biodiversity is safeguarded as an ecological fact, the general target of protection is the whole biosphere with all its life forms. The biosphere covers about a half billion square kilometers on the earth's surface and comprises approximately one kilometer-thick layer of soil, water and air.[5] Biodiversity comprises three conceptual levels: 1) species diversity, 2) genetic diversity and 3) ecosystem diversity.

Biological *species* form the basic units of biodiversity although the concept of species itself is ambiguous. In a biological sense the species are comprised of populations whose members are able to interbreed freely under natural conditions. Thus, in principle the species can be understood as closed packages of genes. A diversity of species emerge when the populations of certain species have diverged from each other for some reason (e.g. when a body of water forms many separate lakes after the water level has permanently lowered) and when the isolated populations constitute a new species whose members are not able to mate or reproduce any longer with the members of the original populations.[6]

A fundamental evolutionary event is a change in the frequency of genes and chromosome configurations in a population. Evolution proceeds from the idea of natural selection, which is based on variation as a result of mutations, i. e. the random changes in the chemical composition of the genes, in the positions of the genes on the chromosomes, and in the numbers of chromosomes themselves. Without forgetting the role of the surroundings in natural selection, *genes* are within species the ultimate sources of diversity.[7]

The third important level of biological diversity is based on the concept of *ecosystems*. According to article 2 of the CBD an ecosystem means a dynamic complex of plant, animal, and micro-organism communities and their non living environment interacting as a functional unit. The concept of the ecosystem connects biodiversity to nature as whole, not only to living nature. In an ecosystem the functions of life forms are mainly internal. The individuals of different species bind each other to closely interdependent communities. However, the significance of a species varies with respect to the communities as a whole: The removal of a key species causes a substantial part of the community to change drastically. Some other species may not have such an important role in the community. Despite this fact, it is uncertain which of the species is ultimately vital to the ecosystem. Thus, the starting point for safeguarding biodiversity is that all species are important for the ecosystem.[8]

When biodiversity is safeguarded in a legal context, species, genes and ecosystems underlying diversity are also the targets of legal protection. In order to fulfil the safeguarding aim in legislation, legally relevant ecological facts are described in regulations as legal facts. The regulations may, for example, concern legal facts about the protection of endangered species or certain habitats and the establishment of conservation areas. Sometimes originally ecological terms are given an unusual meaning in a legal text. In legal decision making it is impossible to safeguard biodiversity as a whole. Thus, ecological facts are limited in social interactions and with functional legal facts to legal decisions. The social qualifications are made 1) when the legal drafts are passed 2) when legal facts within regulations are interpreted and 3) when proposition for norms about regulations are presented.[9]

Legal decisions are based on more or less incomplete information about nature. The relevant facts linked up to biodiversity law include complex information not only about life forms, but also about relations within nature and between nature and human beings. Furthermore, many social facts have an influence on legal decision making, which concerns biodiversity. Legal decision makers also deal with risks and with the law of averages, especially, when they are trying to find precautionary approaches for safeguarding biodiversity.[10]

Biodiversity law includes not only horizontal (present), but also vertical time dimensions (past and future) in legal facts. One the one hand, biodiversity law is connected to legal tradition, together with the interpretation of legal norms. On the other hand, biodiversity law extends to the living conditions of prospective human generations in order to achieve sustainable development.[11]

3 Safeguarding biodiversity as a core value

The legislative reform concerning fundamental rights that took place in Finland in the 1990s recognised that there are values associated with conserving nature that can no longer be recast as rights for individuals[12]. More precisely, this relates to the insights gained in ecophilosophy on the intrinsic value of nature, which question the perception of nature as a resource – a concept inherited from the Age of Enlightenment[13]. Today, efforts are being made to conserve nature not merely for the benefit of mankind, but for the sake of nature itself[14]. Biological diversity is acknowledged in the international community as possessing an intrinsic value alongside other values. From this viewpoint, the components of biodiversity, such as living organisms and their habitats, cannot be considered a freely exploitable natural resource, but should instead be seen as no more from conservation than objects for sustainable and sparing use. If the intrinsic value of nature is reincorporated into respect for life and for the self-realisation of living organisms, it will be the safeguarding of biodiversity, not its free exploitation, that will constitute the underlying objective or principle.[15]

Notion about the free exploitation is also challenged by our awareness of the ecological limitations on the perpetuation of the human species, as well as by our sense of responsibility for the living conditions of future generations[16]. Concerns about the use of natural resources are not focused exclusively on the destruction of the natural environment – after all, nature will continue to exist in one form or another – but also on the degradation of the living conditions of existing and future generations of human beings[17]. It is, in fact, nothing less than a question of human culture being ultimately dependent on nature and its ecosystems. Our use of natural resources today emphasises our collective responsibility for nature and its diversity, as well as the principle of sustainable development (especially, ecological sustainability).

Safeguarding biological diversity can also be defended in terms of other value criteria, such as instrumental values: biological diversity includes an unknown quantity of as-yet undiscovered raw material reserves important for mankind, for instance, various medicinal substances[18]. Biodiversity could be viewed even as the most valuable natural resource of all[19]. It is essential, however, to recognise from these arguments that human societies have evolved to a point where they are now aware of the importance of safeguarding diversity in nature and at the same time they are aware of the limitations of approaches that revert to interpersonal legal relationships[20]. To achieve the safeguarding objective, it is not necessary that the constituents of nature should be granted legal entity status in accordance with medieval concepts. On the other hand, neither can biodiversity and its component parts any longer be a freely exploitable natural resource corresponding to the notion developed in the Age of the Enlightenment. A legal paradigm is required in which biodiversity, as an object worthy of safeguarding, is awarded different degrees of legal and other protection in order to survive amidst the pressures of consumer culture. Thus, a new challenge facing our legal culture is how human behaviour can be regulated to ensure that biodiversity is maintained for present and future generations as well as for the sake of nature itself[21].

4 Safeguarding biodiversity as a legal objective

The main objective of biodiversity law is to safeguard the living natural world and its variety; in other words, to safeguard biological diversity. This involves due consideration of the relevant norms and facts and the above-mentioned values. The *safeguarding objective* can be expressed in terms of 1) conservation, 2) sustainable use and 3) non-degradation of biodiversity and its component parts. These sub-objectives are, in fact, interconnected in many ways.[22] For instance, the stated aims of the Nature Conservation Act include both maintaining the diversity of nature and promoting the sustainable use of natural resources and the natural environment. Both aims may be juxtaposed with one another in practice, too, for example, in the environmental impact assessment of projects and plans associated with the Natura 2000 areas.

An important distinction must be made between the objective of safeguarding biodiversity and purely anthropocentric objectives, for instance, the objective of fair and equal distribution of the benefits derived from biological natural resources. The latter objective focuses on the legal relationships (rights and duties) between people (legal entities) with regard to natural resources and knowledge inherited from previous generations. The safeguarding objective, on the other hand, focuses on the safeguarding relationship between people (legal entities) and nature (object) in a way that is legally relevant.[23]

5 The safeguarding relationship

Conferring legal status on the objective of safeguarding biodiversity gives rise to two kinds of relations in legal protection: *1) biodiversity versus the individual, and 2) biodiversity versus government* (as represented by public authorities). A corporation may also take the place of the individual. (See Figure 1.) Acknowledging the existence of these two relationships means that the objectives of safeguarding biodiversity can be assigned to safeguarding relationships, so that the objectives can be achieved by employing legal means to steer private individuals and public authorities (legal entities) towards acting responsibly in support of biodiversity. The existence of safeguarding relationships will strengthen and complement the provisions of section 20(1) of the Finnish Constitution (731/1999) on responsibility for the environment.

In a safeguarding relationship, biodiversity cannot be on an equal level with the other participants in the same way as is generally the case in relationships between legal entities. Both public authorities (e.g. regional environment centres) and private individuals (e.g. landowners and conservation bodies) have the right, under conditions laid down by law, to be heard in defence of the various constituents of nature. By increasing the awareness of safeguarding relations and by adopting them, it is possible to ensure that broader consideration can be given to the objectives of biodiversity law and that these objectives can be implemented where necessary, for instance, in legal situations where different interests are being compared.[24]

The importance of different safeguarding relationships will grow as threats to biodiversity increase. Chapter 2 of the Environmental Impact Assessment Procedure Act (468/1994), for example, allows extensive participation, in which the parties (general public, experts, authorities), who can potentially safeguard the constituents of nature, can present their views and provide statements on such matters as the deleterious effects on nature of the proposed project. On the other hand, the granting of an individual exemption to species protection under section 48(2) of the Nature Conservation Act does not necessarily require any

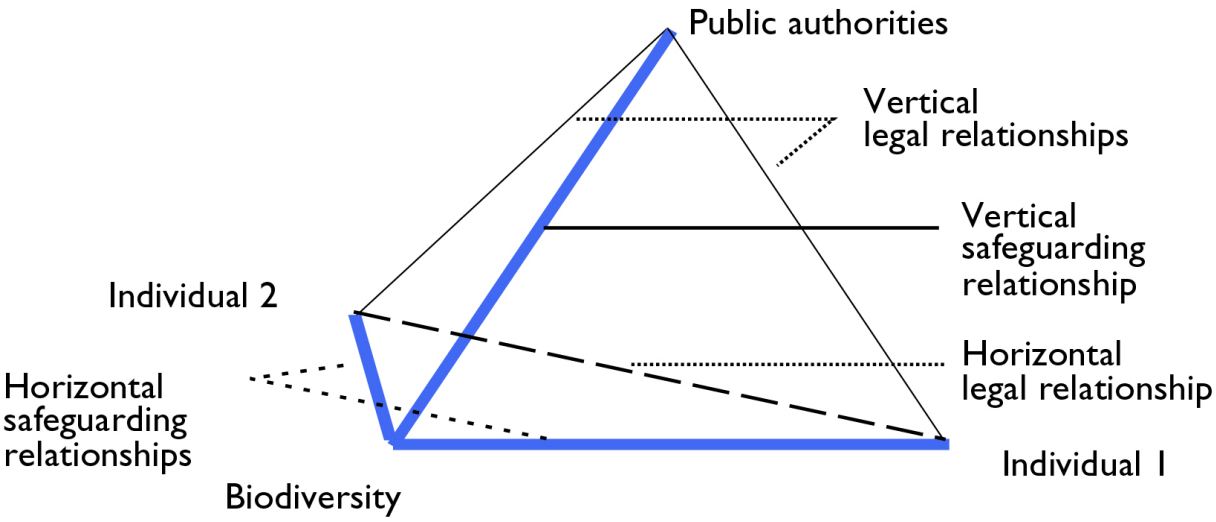

Figure 1. Relations in biodiversity law.

public participation at all; instead, the law prescribes that safeguarding the species in question is the responsibility of the authorities that grant these exemptions, that is to say, the regional environment centres.[25]

A further reason for building safeguarding relationships is that in practice a public authority or other body can find itself playing a dual role, for instance, as both user and protector of biological natural resources. In these cases, the authority or body should aim to safeguard biodiversity by paying special attention to both the sustainability of use and to conservation viewpoints. In malfeasance situations associated with the dual role of public authorities or in other potential malpractices, the opportunity for individuals or corporations to use their right to be heard in defence of biodiversity will be a useful addition to the safeguarding afforded by the nation's environmental administration. The creation of a biodiversity-safeguarding relationship between, on the one hand, the different sections of society and, on the other, the diverse constituents of nature is therefore not only possible but also essential.[26]

A safeguarding relationship will, through specified principles, for example, ensure that the sub-objectives for safeguarding biodiversity are firmly integrated into the legal sphere and will help in recognising conflicts of interest concerning biodiversity in the decision-making process. The safeguarding relationship can be consciously incorporated into existing legal instruments, such as licensing systems, alongside norms that define legal relationships and legal protection of traditional legal entities. Through greater awareness of the safeguarding relationship, other mechanisms aimed at safeguarding biodiversity can also be developed, such as strategies and standards (see Figure 2).[27] The principles concerning the safeguarding of biodiversity are discussed in more detail below, followed by an examination of the safeguarding mechanisms.

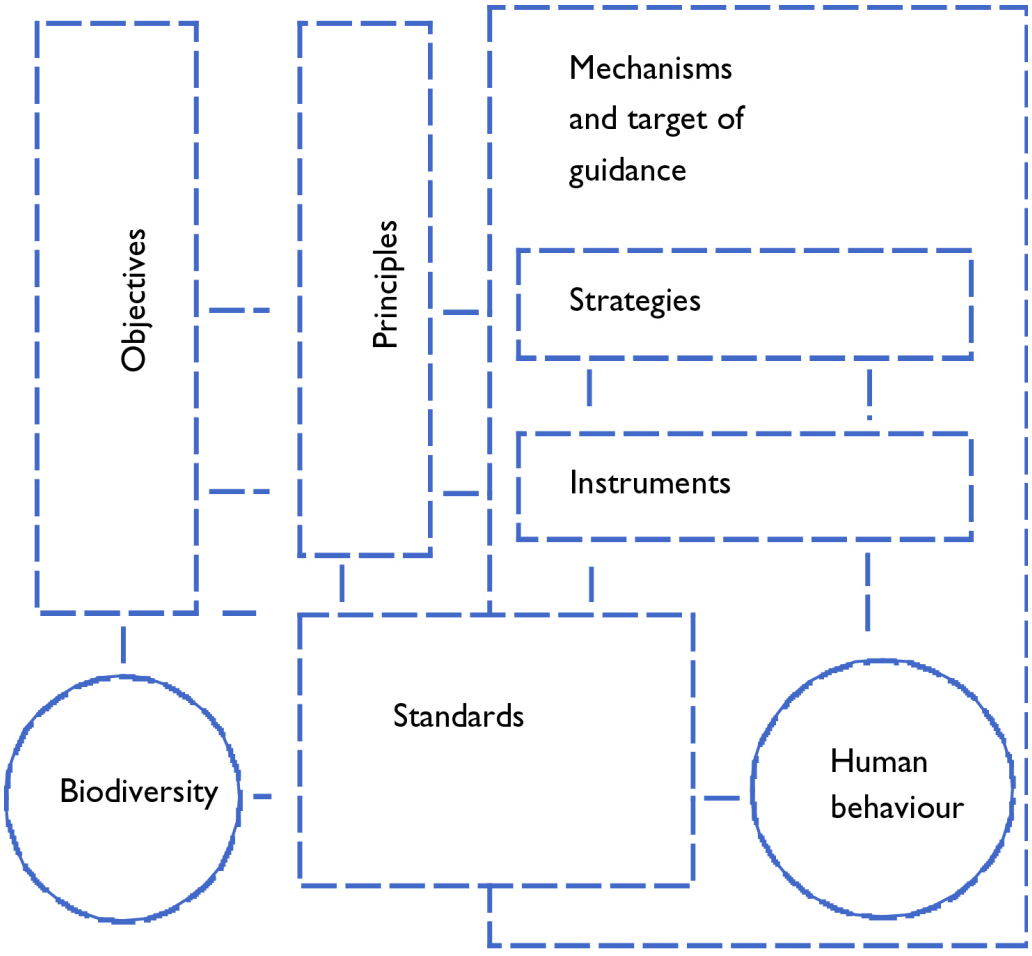

Figure 2. Legal guidance in biodiversity law.

Table 1. Interpretation of environmental law principles in biodiversity law.[32]

Principles	Content
Safeguarding the biodiversity principle	- any adverse (irrevocable) effect on biodiversity shall be avoided - to sustainable use, non-degradation and conservation of biodiversity shall be encouraged according to the integration principle in all actions
Sustainable development principle	- development shall take biodiversity into account and shall be ecologically sustainable, so that the needs and aspirations of present and future generations are met
Sustainable use principle	- biological resources shall be used in a sustainable way within the limits of renewal to meet the needs and aspirations of present and future generations
Non-degradation principle	- biodiversity shall not be irreversibly degraded and shall be maintained within the limits of renewal
Precautionary principle	- lack of complete scientific certainty shall not be used as a reason for postponing precautionary measures - preventive measures shall be taken in order to avoid any risk or danger to biodiversity - the legitimate needs of different interest groups linked to the components of biodiversity should be taken into consideration in advance
Preventive principle	- significant harmful effects on biodiversity shall be assessed and prevented or minimized in advance
Source principle	- the causes of significant reduction or loss of biodiversity shall be anticipated, prevented and attacked at the source
Shelter principle	- any activities shall be practised within the quality limits of biodiversity (within the limits of environmental tolerance)
Polluter pays principle	- anyone whose activities cause or are likely to cause damage to biodiversity shall bear the costs of full preventive or restorative measures

6 Safeguarding principles

Safeguarding principles are needed in order to achieve the objectives of biodiversity law. These principles aim to influence human behaviour in the same way as other guiding principles of environmental law. However, the principles of safeguarding biodiversity focus above all on the safeguarding relationship and not on the arrangement of legal relationships between legal entities. Depending on their regulatory status, safeguarding principles will be existing or newly established legal principles that can be used to develop legislation and to guide decision-making based on flexible provisions. Before they are approved and become established, the safeguarding principles could serve as moral guidance, but only when they become legal principles can they be conferred a meaning that is binding in the sense of a legal norm.[28]

The principle in article 3 of the CBD defines the rights of states to use their own biological resources[29]. According to this principle, the states have a sovereign right to exploit these resources (sovereignty principle). At the same time the states have a responsibility to safeguard ("ensure...do not cause damage") environment,

including biological diversity not only for other States or areas beyond the limits of national jurisdiction, but also within the limits of their own jurisdiction[30]. The right to exploit and the responsibility to safeguard biodiversity especially in relations to other states must be fulfilled with respect to the Charter of the United Nations and the principles of international law.

Many of those international principles have connections for safeguarding biodiversity. Conversely, once international and national guiding principles of environmental law have been amended and supplemented to transform themselves into safeguarding principles of biodiversity law, the objectives of biodiversity law will form a basis for interpretation. The principle of sustainable development, for example, can be reshaped under such an interpretation as follows: Development must take biodiversity into account and must be ecologically sustainable, so that due consideration is given not only to the needs and hopes of present generations but also future generations.[31] (See Table 1.)

The principles of biodiversity law can be used to direct decision-making by public authorities at the same time as the principles of administrative law, because the respective objects of safeguarding in each case are rooted in *different relations* (see Figure 3). While the principles of biodiversity law safeguard biological diversity from the harmful activities of public authorities and individuals, the principles of administrative law protect the private individual from malfeasance by public authorities. In general terms, conflicts should not then occur between these sets of principles. Some decision-making criteria would, however, change

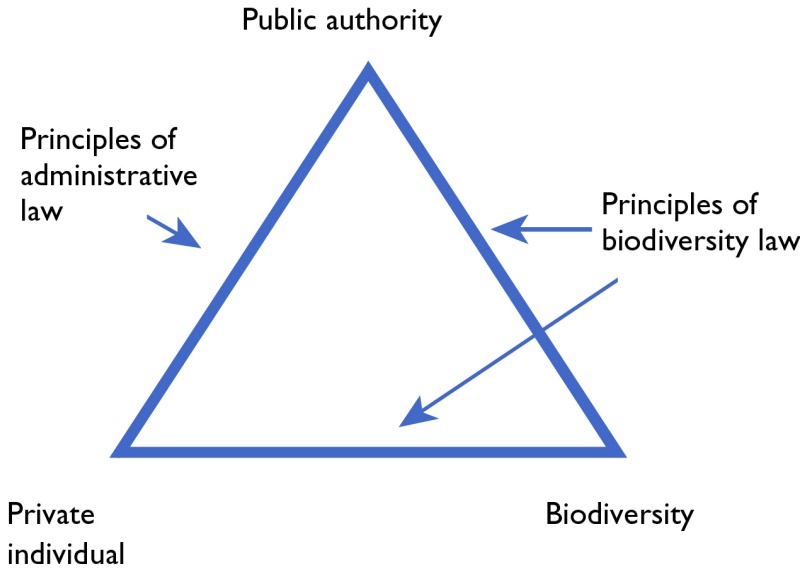

Figure 3. Safeguarding principles in relation to principles of administrative law.

from their present form if and when safeguarding principles start to be applied simultaneously with administrative law principles. Principles safeguarding biodiversity could be used in decision-making 1) for interpreting flexible norms and 2) as 'analogy keys' for filling normative gaps. In the latter case, caution would need to be observed, because the intention is not to regulate every single shortcoming.[33]

7 Safeguarding mechanisms

Mechanisms for safeguarding biodiversity can be divided into strategies, instruments and standards. In practice, these mechanisms are interconnected in different ways. In the theoretical model, each has a distinct function of its own.

Strategies are programmes for drafting or interpreting legislation for the purpose of adopting certain environmental, economic and other policy requirements to become part of the legal system. As tools for implementing policy, strategies set a 'framework' for legal guidance. Strategies are used to operationalise the objectives, in this case for safeguarding biodiversity in different activities. Strategies will not normally include legal norms whose application could force another goal-oriented body into engaging in actions that accord with those norms or with the socially desirable state of affairs underlying them. Therefore, in addition to the strategies, what is necessary for their implementation are instruments containing flexible legal provisions and, for instance, standards that transform these provisions into something concrete.[34]

Legal *instruments* for safeguarding biodiversity are more multiple mechanisms than the standards. They are used to guide human behaviour in a direction consistent with the objectives established in the strategies. They can also be very neutral mechanisms for harmonising different interests. Common to the instruments examined, they are legal instruments, or at least are anchored in legislation in various ways. Instruments can, in fact, be described as clusters of norms that include in approximate terms both procedural and substantive norms. Instruments are not, however, composed only of norms; instead, non-judicial elements connected with an instrument may also be used in the associated decision-making or at an earlier stage (see Figure 4). Instruments can be classified in various ways. The classification used in the study is as follows: 1) informative instruments, 2) administrative instruments, 3) financial instruments, 4) agreements as instruments and 5) combinations of these.[35]

Standards are an inseparable part of the guidance for biodiversity law. Standards traditionally include binding regulations that can be both numeric and verbal, and they add details to the flexible, instrument-based guidance on decision-making or other actions. Using such standards, decision-making could actually be made more consistent and its predictability improved, because efforts would be made in individual cases to implement the objectives of biodiversity law and private legal protection. The degradation of biodiversity could also be prevented by using traditional standards of environmental protection law and related target and guideline values.[36]

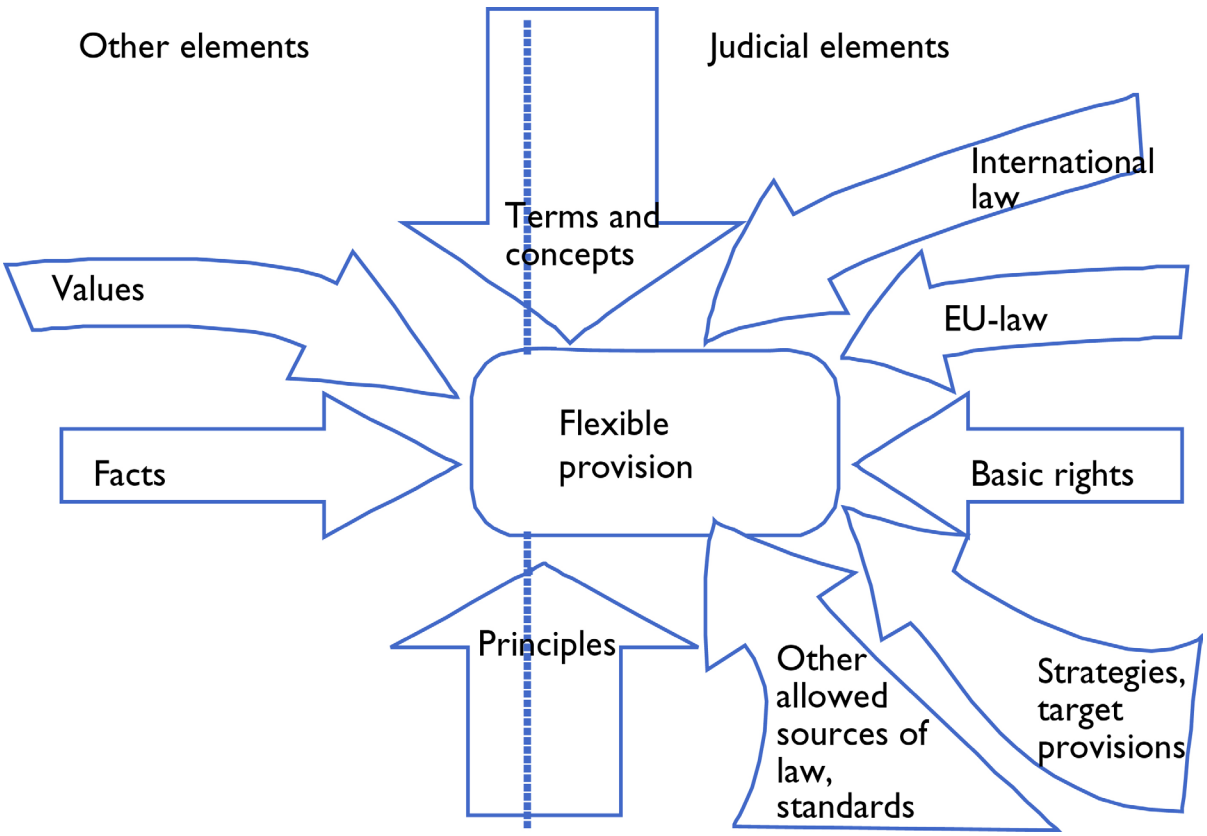

Figure 4. Elements of interpretation of flexible provisions.

Standards can also be used in biodiversity conservation or, more precisely, conservation of biological natural resources, as well as in their sustainable use. However, nature would first need to be standardised so that standard values could be used to guide decision-making on biodiversity. These values would have to be scientifically researched and based on environmental evidences. In practice, standardisation could occur with the aid of, for example, the concept of the favourable conservation status of a species.[37] In practise, the favourable conservation status of a species is already used as such as a navigation standard in the Nature Conservation Act and in the Hunting Decree (666/1993).[38]

Biodiversity law must be implemented in an effective way. During the implementation period losses always occur when the goals of biodiversity law are translated into legal guidance principles and mechanisms and finally concrete human actions. These implementation losses should be taken into consideration when regulations are drafted for safeguarding biodiversity. Furthermore, the internal collisions of mechanisms should be avoided in order to implement the objectives of biodiversity law effectively.[39]

8 Finally - an example of the ecologically unsustainable development of legal order

A legal system that safeguards biodiversity would not simply focus on interpersonal legal relationships, but would also take the living natural world (and its ecosystems) into consideration as objects for legal protection. This would give rise to different safeguarding relationships between legal entities and the various constituents of nature. The successful functioning of safeguarding relationships should not, however, be dependent on the personal interests of any legal entity in any particular situation.

Safeguarding nature and its diversity is generally perceived as being in the public interest and something which public authorities defend by using their right to be heard. Indirectly, however, the different constituents of the living natural world can also be protected in connection with private interests. For example, a neighbour may oppose a project on the grounds of nature conservation values, although his real interest might be in protecting his land and property from any harm or disturbance caused by the proposed project. However, this *dichotomy of interest* must not be allowed to hinder the safeguarding of biodiversity. Furthermore, in situations in which a private individual sincerely wishes to promote nature conservation, he should be given the chance to present his views on a project that would be considerably damaging to nature, regardless of his private interest in the matter. Only in this way can biodiversity be afforded sufficient protection in situations where a public authority does not, for one reason or another, pursue nature conservation interests (as part of its duties in the public interest under the traditional dichotomy).[40] The needs for erosion of the dichotomy of interest is discussed below in the light of an example of interpretation concerning the new Act on Administration and Governance (434/2003)[41], which entered into force at the start of 2004 in Finland.

Recognition of the safeguarding relationship opens up a new interpretation of section 41(1) of the Act on Administration and Governance concerning the reserving of opportunities to participate. The provision in question states: “If the decision on a matter may have a significant effect on the living environment, work or other conditions of parties other than the interested parties, the authorities shall reserve such persons the opportunity to obtain information on the background of the consideration of the matter and the objectives, and to state their views on the matter.” It was not the intention of this provision to weaken any of the criteria for submitting notification on pendency under section 13(1) of the Administrative Procedure Act (598/1982): “If the decision on a matter may have a considerable effect over a wide area or on the circumstances of a large number of people, the pending nature of the matter must be publicly declared.”

The first of the discretionary criteria in section 13(1) referred to above, namely “the decision on a matter may have a considerable effect over a wide area”, enables the biodiversity-safeguarding relationship to be taken into account without any connection to potential “interested parties” (asianosainen) or even the above-mentioned “parties other than the interested parties” (osallinen) insofar as the effects are understood to represent a significant environmental impact across a broad area. On this basis, the various parties should be

able to present their views on the matter in the area of probable environmental impact, regardless of how the decision would affect the conditions or circumstances of the parties in question and regardless of any private interest in the matter.

The wording of section 41(1) of the Act on Administration and Governance may prove to be problematic in situations where reserving the opportunity to participate is necessary purely on the grounds of a significant environmental impact and, above all, for safeguarding biodiversity. Any problems may be resolved only by abandoning the dichotomy of interest or, more precisely, by interpreting the provision in question 1) in accordance with section 20(2) of the Finnish Constitution, that is, taking into account everyone's opportunity as a citizen or as non-governmental organisations to influence decision-making that concerns their living environment, and 2) especially when, in these cases, the decision on a matter could have a marked environmental impact across a broad area, regardless of whether or not the citizen or non-governmental organisation concerned has a formal private interest in the matter. Otherwise, no relationship can be established between biodiversity and these parties that would safeguard nature for its own sake or for future generations (or merely in the public interest, under the traditional dichotomy).

Acceptance of the safeguarding relationship should not mean discarding people's traditional fundamental rights or legal protection viewpoints, but instead creation mechanisms for safeguarding biodiversity that complement these. The development of a legal system that is ecologically more sustainable than the present one will require the re-evaluation of legal principles and mechanisms, as well as considerable development work requiring more than a single study. It is nevertheless reassuring to know that biological diversity can – if the will exists – be safeguarded through legal principles and mechanisms.

Footnotes

[1] See also Tapio Määttä, *Maanomistusoikeus* (Suomalainen Lakimiesyhdistys 1999) p. 67, Hannu Tolonen, *Mitä oikeus on?* (Oikeus 2/1997) pp. 110–111, Laakso, Seppo, *Juridinen maailmankuva* (Oikeus 1/1978) p. 17.

[2] Biodiversity law includes new terms that are not yet well established in a legal context. Many of the terms are listed in *the Convention on Biological Diversity* (the CBD, Rio de Janeiro 1992). In addition, *the Bird* (79/409/EEC) and *Habitat Directives* (92/43/EEC), *the Forest Act* (1093/1996) and *the Nature Conservation Act* (1096/1996) in Finland contain special terms in order to safeguard biodiversity. The key term, of course, is biological diversity or biodiversity, which means the variability among living organisms, including variation within species, between species as well as the variation of ecosystems.

[3] See more about the law as an institution and as a policy instrument, Jürgen Habermas, *Theorie des kommunikativen Handelns* (Frankfurt am Main, Suhrkamp 1981, volume 2) p. 536, Kaarlo Tuori, *Kriittinen oikeuspositivismi* (Werner Söderström 2000) p. 241, Mathieu Deflem *Introduction: Law in Habermas's Theory of Communicative Action*, Habermas, Modernity and Law (London, Sage1996) p. 11.

[4] See article 1 of the CBD. See also V.H. Heywood (edit.) *Global Biodiversity Assessment* (United Nations Environmental Programme, UNEP1995) p. 763.

[5] Edward O. Wilson, *The Diversity of Life* (London, The Penguin Books1994) p. 33 and Ilkka Hanski – Jan Lindström – Jari Niemelä – Hannu Pietiäinen – Esa Ranta, *Ekologia* (WSOY 1998) p. 52.

[6] See Heywood 1995 pp. 41–43, Wilson 1994 pp. 37–46, 53–58 and Hanski et al.1998 p. 29.

[7] See Wilson 1994 pp. 69–70, Heywood 1995 pp. 57–63 and Hanski et al. 1998 pp. 118–121.

[8] See Lyle Glowka – Françoise Burhenne-Guilmin – Huge Synge – Jeffrey A. McNeely – Lothar Gündling, *A Guide to the Convention on Biological Diversity* (IUCN – The World Conservation Union 1994) pp. 20–21, Heywood 1995 pp. 93, 285–298, Wilson 1994 p. 154, Hanski at al. 1998 pp. 404–409 and Jari Niemelä, *Luonnon ekologiset arvot*, Arvot ja luonnon arvottaminen (Gaudeamus 2000. edit. Hiedanpää J. – Haila Y.) p. 221.

[9] See Kokko 2003 p. 25 and 27. See also Hannu Tapani Klami, *Finalistinen oikeusteoria* (Turun yliopiston yksityisoikeuden laitos 1979) p. 174 and Kari Kuusiniemi, *Ympäristönsuojelu ja immissioajattelu* (Lakimiesliiton kustannus 1992) p. 131.

[10] See Kokko 2003 pp. 26–27, Määttä 1999 p. 68, preamble of the CBD and Glowka et al. 1994 p. 10.

[11] See Kokko 2003 p. 27 and Staffan Westerlund, *En hållbar rättsordning – rättsvetenskapliga paradigm och tankevändor* (Uppsala, Iustus förlag 1997) pp. 37–38.

[12] See *Government Proposals* (1/1998) and (309/1993) linking up to section 20.1 of *the Constitution of Finland* (731/1999) and Kari Kuusiniemi, *Luonnon oikeudet vai tulevien sukupolvien suojeleminen?*, Juhlakirja Erkki Johannes Hollo (Lakimiesliiton kustannus 2000) p. 149.

[13] See, for example, John O'Neill, *The Varieties of Intrinsic Value*, (The Monist 75/1992) pp. 119–137.

[14] See concerning the argumentation, e.g. Juhani Pietarinen, *Ihmislähtöiset luontoarvot ja luonnon omat arvot,* Arvot ja luonnon arvottaminen (edit. Arto Haapala – Markku Oksanen, Helsinki, Gaudeamus 2000) p. 53 and Paul Taylor, *The Ethics of Respect for Nature* (Environmental Ethics 3/1981) pp. 197–218.

[15] See Freya Matthews, *Ecological Self* (Cornwall 1994) pp. 98-103, Georg Henrik von Wright, *The Varieties of Goodness* (Thoemmes Press 1996) p. 50, Alexander Gillespie, *International Environmental Law Policy and Ethics* (Sommerset 1997) pp. 107–136, the preamble of the CBD and Glowka et al. 1994 p. 9. On the intrinsic value of nature and its relationship to environmental law, Christopher D. Stone has written an original article "*Should Trees Have Standing**?"*(1972) (Los altos William Kaufmann INC 1974). In Finland Erkki Hollo, for example, has considered this question in his text book *Johdatus ympäristöoikeuteen* (Helsinki Lakimiesliiton kustannus 1998) p. 10 and Anne Kumpula in an article entitled *Vastuu luonnosta ja sen monimuotoisuudesta,* Juhlajulkaisu Leena Kartio, (Turun yliopisto 1998).

[16] See Westerlund 1997 p. 161 and Edith Brown Weiss, *Our Rights and Obligations to Future Generations for the Environment*, (American Journal of Environmental Law, volume 84, 1990) p. 199.

[17] See Yrjö Haila, *Biodiversiteetti ja luonnonsuojelu*, Biodiversiteetti ja tuotantoelämä (Satakunnan ympäristöntutkimuskeskus, SYKE : Porin koulutus- ja tutkimuskeskus, PKTK, 1994) p. 29.

[18] See the preamble of the CBD and Michael Bowman, *The nature, development and philosophical foundations of the biodiversity concept in international law*, in publication International law ant the conservation of biological diversity (Kluwer Law International 1996) pp. 15 and 21–22.

[19] See Wilson 1994 pp. 269–296.

[20] See, about the limitations, for example, Juha Pöyhönen, *Uusi varallisuusoikeus* (Jyväskylä 2000) pp. 21–22.

[21] See, concerning the above-mentioned discussion, Westerlund's (1997) publication "*En Hållbar Rättsordning*", "A sustainable legal order" and Anne Bahr Christophersen's publication "*På vei mot grønn rett?*" (Oslo 1997), "On the road towards green law?" See also Kuusiniemi 2000 pp.149–169 and Määttä 1999 pp. 6–20.

[22] See, for example, Kokko 2003 pp. 35–49, articles 1 and 14 of the CBD and article 15 of *Convention on the Protection of the Marine Environment of the Baltic Sea Area*, 1992 (entered into force on 17 January 2000).

[23] See Kokko 2003 p. 49 and pp. 74–75. See also Pöyhönen 2000 p. 63 and Erkki Hollo, *Ympäristöoikeus* (Lakimiesliiton kustannus 1991) p. 25. See, concerning legal relationships, Pekka Vihervuori, *Hallitusmuodon 14 a § ja horisontaalisuhteet*, Perusoikeuspuheenvuoroja (edit. Pekka Länsineva and Veli-Pekka Viljanen, Turun yliopisto 1998) pp. 237–238.

[24] See Kokko 2003 p. 77.

[25] See Kokko 2003 p. 78.

[26] See Kokko 2003 pp. 78–79

[27] See Kokko 2003 p. 83.

[28] See, concerning the national guiding principles of environmental law, e.g. Kari Kuusiniemi – Ari Ekroos – Anne, Kumpula – Pekka Vihervuori, *Ympäristöoikeus* (WSOY lakitieto 2001) p. 72. See concerning the international guiding principles of environmental law, e.g. Philippe Sands, *Principles of International Environmental Law, Frameworks, Standards and Implementation* (Manchester University Press 1995) p. 183. Ronald Dworkin, A *Matter of Principle* (Clarendon Press 1986) pp. 2–3, has mentioned the difference between objectives and principles as follows: "Arguments of policy try to show that the community would be better off, on the whole, if a particular program were pursued. They are, in that special sense, goal-based arguments. Arguments of principle claim on the

contrary that particular programs must be carried out or abandoned because of impact on particular people, even if the community as a whole is in some way worse off in consequence. Arguments of principle are right-based." Safeguarding principles are right-based because of 1) the present and future generations have rights to clean and diverse nature and 2) present generation has responsibility to safeguard biodiversity. However, this safeguarding ground does not mean that the legal rights should give to nature as a legal entity. See concerning the generalization demand of principles, Hannu Tolonen, *Säännöt, periaatteet ja tavoitteet: Oikeuden moraalin ja politiikan suhteesta* (Oikeustiede – Jurisprudentia 1989) pp. 364 - 365.

[29] Article 3 of the CBD: "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction." See also article 15 of the CBD.

[30] International responsibility is mentioned in article 3 of the CBD. However, national responsibility can be concluded from the preamble of the CBD: "The Contracting Parties,...Affirming that the conservation of biological diversity is a common concern of humankind, Reaffirming that States have sovereign rights over their own biological resources, Reaffirming also that States are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner...". In Finland according to section 20 of the Constitution (731/1999) nature and biodiversity are the responsibility of everyone. See also e.g. Simone, Bilderbeek (edit.), *Biodiversity and International Law* (Amsterdam 1992) p. 82 and 87, Anu Mutanen, *Valtion suvereniteetti ja biodiversiteetti* (Lakimies 3/2002) pp. 414–416 and Jukka Pekka Tolvanen, *Maankäytön luonnonsuojelullinen sääntely* (Kauppakaari 1998) pp. 12–13.

[31] See further Kokko 2003 pp. 95–112 and 281–283.

[32] The principles are formed from principles introduced in one form or another in international, national or EU law. Because the interpretational contents of the principles vary in different countries and in different contexts, the table is meant to be more or less as an idea bank for international readers.

[33] See Kokko 2003 p. 112–121 and 283. See also Kari Kuusiniemi, *Biodiversiteetin suojelu ja oikeusjärjestyksen ristiriidat* (Oikeustiede – Jurisprudentia 2001), pp. 218-219 and 221–233, Staffan Westerlund, *Proportionalitetsprincipen - verklighet, missförstånd eller nydaning?*(Miljörettslig tidskrift 2/1996) p. 254–256, 284. See also, concerning legal principles in decision making, Jenny Steel – Tim Jewell, *Law in Environmental Decision Making* (Oxford 1998) p. 8.

[34] See Kokko 2003 p. 93, pp. 122–124, Rauno Sairinen, *Regulatory Reform of Finnish Environmental Policy* (Espoo, Center for Urban and Regional Studies Publications A 27/2000) p. 55 and pp. 70–83. See also Hollo 1991 p. 38 and Heywood 1995 p. 927.

[35] See Kokko 2003 pp. 124–147. See in general, concerning policy instruments in Finland, for example, Kuusiniemi et al. 2001 pp. 97–113. See also Heywood 1995 pp. 1044-1045 and Gabriel Michanek, *Rättslig skydd för biologisk mångfald* (Miljörättslig tidskrift 2/1994) p. 169.

[36] See Kokko 2003 pp. 147–148, Pekka Vihervuori, *Standardit ja normit ympäristöoikeudessa*, Korkein hallintooikeus 80 vuotta (Vammala 1998) pp. 220, 222–229, Westerlund 1997 pp. 44–45, Kuusiniemi et al. 2001 pp. 65, 67, 1149–1163 and Gerd Winter, *Standard Setting in Environmental Law*, European Environmental Law – a Comparative Perspective (Aldershot, Darthmouth 1996) p. 112.

[37] See Kokko 2003 pp. 149–150, 154–163 and Pasi Kallio, *Suotuisa suojelutaso luonnonsuojeluoikeudessa* (Edita, Helsinki 2001) pp. 86–89. See also Kuusiniemi et al. 2001 p. 67 and Westerlund 1997 pp. 43–46.

[38] See concerning the navigation function Kokko 2003 pp. 151–154 and Lena Gipperth, *Miljökvalitetsnormer - En rättsvetenskaplig studie i regelteknik för operationalsering av miljömål* (University of Uppsala 1999) pp. 259–260 and 266–267.

[39] See Kokko 2003 pp. 163–165, Westerlund 1997 pp. 52–59 and Kallio 2001 pp. 90–93.

[40] See further critics of the dichotomy of interests in environmental law Roberth Nordh, *Talerätt i Miljömål*, (Iustus Förlag 1999) pp. 547–562, Leila Suvantola, *Valitusoikeus natura 2000- verkoston suojelun valvontakeinona* (University of Joensuu Publications in Law 2003) pp. 186–187 and Kai Kokko, *Osallistuminen ja kaavoitus - erityisesti eräiden uusien kansainvälisten sitoumusten valossa* (Ympäristöjuridiikka 4/2003) p. 41.

[41] Sometimes this new statute "Hallintolaki" is also translated as the Administrative Procedure Act.