

Forests against Avalanches: Paying Protection, not Costs

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Annex: Standard Contract (in German)

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1. Introduction

1.1 About this Report

The management of forests in the European Alps has a history of continuous change. Over-exploitation in the 17th and 18th centuries led to floods, falling stones and avalanches. In contrast to other mountainous regions in the world, however, the Alps are relatively densely populated. The consequences of these natural catastrophes for the population were often devastating. This led, in the middle of the 19th century, to a wide-held consensus that forest management needed to be regulated and supervised by the state. The three most important instruments at the time were clearing prohibition, determining the maximum of wood volume yield per forest owner and national afforestation.

Growing international trade and a global surfeit of wood towards the end of the 20th century led to radical changes in the situation of forest management in central Europe. Owing to falling wood prices, exploitation in the alpine regions began to cease and wood reserves in mountain forests increased and, concomitantly, the risk of collapsing stands. Forests that now afforded only insufficient protection from natural catastrophes came to dominate socio-political agendas. This is why, especially in Switzerland, forest restoration projects carried out by the owners began to be supported with state subsidies. These subsidies, however, led to new problems.

This report is an attempt to analyze Switzerland's subsidy policy from an economic point of view by evaluating new instruments for the buying-in by the state of protection afforded by the forest in order to develop a concrete proposal for a contract that the state can use to ensure the required level of protection. The report and the contract (appended) resulted within the framework of the project «Paying Protection, Not Costs». The project was carried out at the Property & Environment Research Center (PERC) in Bozeman (MT, USA) and generously funded by the Kinship Conservation Institute and Tensor Consulting (Berne, CH). Following people or institutions contributed to the success of the project: Holly Lipke Fretwell (Bozeman), Peter Greminger (Berne), Brächt Wasser (Thun, CH), Marc Wyer (Turtmann, CH), Rudolf Zumstein (Interlaken, CH) and an audience of distinguished economists and professional colleagues on June 25th, 2004 in Bozeman.

What the project does not include are problems that could arise from the endemic federalist partition of responsibilities between the federal state and the Cantons.

1.2 Goal

The project is aimed at creating a standard contract, valid over a number of years, between the state and forest owners to ensure the provision of protection from avalanches. The contract rewards the amount of protection achieved and is based in the main part on criteria directed at effectiveness. It improves incentive structures for forest owners to such an extent that forest management becomes profitable for them.

2. Forestry in the Swiss Alps

2.1 Overview

Much of the alpine forest protects the population and important infrastructural elements, such as roads and railway lines, from avalanches (so-called protection forests). Over a period of 150 years most of these forests were subject to intense exploitation, which has ceased in many locations in the past 30 years because it is no longer economically interesting. It is to be expected that this development will continue in the coming years.

For ecological or anthropogenic reasons, parts of the protection forests that are no longer exploited are unstable. In order for them to continue to fulfill their extremely important function they have to be tended periodically. Tending measures are generally limited to the introduction and speeding up of regeneration processes in the forest. In dry years or following strong storms or hurricanes, large populations of bark beetle appear, which also have to be dealt with.

Looking after protective alpine forests is a public service today. It is undertaken by way of tending and regeneration projects carried out by the forest owners. Between 90 and 120% of the costs of these projects are reimbursed by way of state subsidies. Forest owners receive their actual or planned costs. This has led to the present situation where forest owners have often no incentive to rationalize the service they provide. In keeping with this it is rare to find mechanized harvesting techniques being used. Subsidies have the effect of maintaining the status quo and have led to forest management in the Alps becoming ever more dependent on subsidies.

A few key statistics serve to illustrate the case in point. In the Swiss Alps over the past ten years the annual management costs of public forest enterprises has averaged out at around 160 USD/acres.¹ These costs are covered by 65 USD wood yield, approx. 5 USD sundry profits, 75 USD subsidy for «public goods» and 15 USD from the liquidation of enterprises' own reserves and deficit coverage by public communities.

2.2 Description of typical contractual relations

Forest owners in Switzerland are not subject to any general management duties. The Cantons are responsible for the tending of protection forests, and have the power, if necessary, to expropriate forest management. Cantonal Forest Laws, however, often have the possibility to compel owners to clear and tidy their forests when bark beetle (IPS TYPOGRAPHUS) infestations occur, whereby the Canton – entirely or partially – covers the costs.

Based on the Federal Forest Law (WaG) of 4th October 1991² and Cantonal Forest Laws, forest owners in the Alps are entitled to subsidies. Apart from the subsidy to support inter-

¹ 1 ha = 10.000 m² = 2.47 acres. 1 CHF = 0.80 USD.

² SR 921.0.

ventions to combat the bark beetle there are about ten further types of subsidies. For the tending of protection forest subsidies are typically granted within the framework of forest restoration projects (table 1). Three different kinds of projects exist, called Co, Cn and E. Type Cn is the norm, type Co was practiced until a few years ago. Type E is a new kind of project, destined to replace Cn in 2008. The contractual situation and subsidy mechanism are also given in table 1. The Cantons will only carry out forest restoration projects that run over a number of years with the agreement of the owner, whereby, for practical reasons, the management of publicly owned forest will be given preference.

Name	Type	Contractual relation	Basis	Indicator	Restrictions
Co project	Subsidy	Decree to owner	Authorized project	Real costs (cost-plus)	1. Important project decisions are taken by forest authority.
Cn project	Subsidy	Decree to owner	Authorized project	Projected costs	1. Administrative project cost estimation by forest authority; 2. important project decisions are taken by forest authority; 3. project execution roughly controlled by forest authority.
E project	Subsidy	Contract with owner	Authorized project	Tended area	1. Administrative area cost estimation by forest authority; 2. guidelines for quality management; 3. project execution controlled by forest authority.

Table 1: Current types of subsidy for the care of the protection forest (forest restoration projects). Subsidies are paid by the shown indicator. Approximately between 90% and 120% of the costs are reimbursed by subsidies.³

2.3 Description of the organization of forest owners

Private Forest Owners

Around a third of forest owners are farmers who manage their forests themselves. The remainder often do not manage their forests at all or commission a farmer, a private company or the county to do so (figures 1 and 2).

Publicly owned Forest

Most publicly owned forest is supervised by a communal forester, who organizes its management⁴. Many of the communities with publicly owned forest employ forest workers to manage the forest. For the following considerations we differentiate between four organi-

³ Forest owners have to carry between 5% and 10% of the costs. Usually, however, forest owners are able to increase accepted costs by „clever accounting“.

⁴ County foresters are partially paid by the Canton, because they oversee private forest owners and themselves in an official function.

zational models (Figures 3 and 4): Communities with or without their own forest employees and communities with or without powers of taxation.



Figure 1: Organization of private forest owners (farmer).

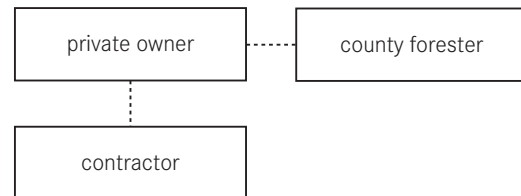


Figure 2: Organization of private forest owners (non-farmer).

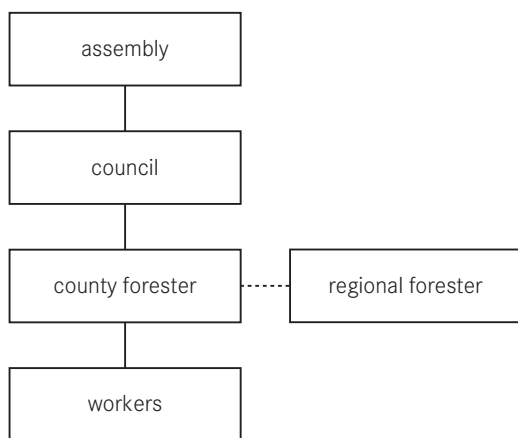


Figure 3: Organization of public forest owners with public employees.

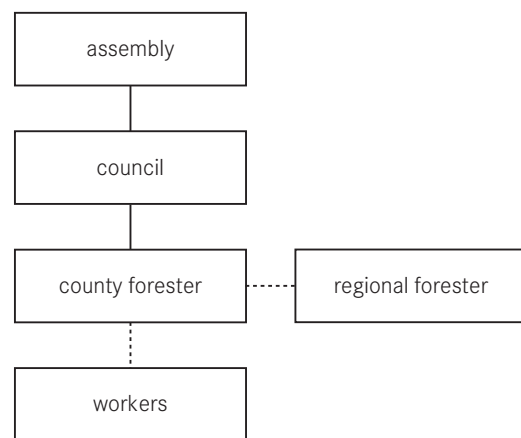


Figure 4: Organization of public forest owners with no public employees.

3. Instruments

3.1 Possible instruments for buying in protection from avalanches

In addition to the three current types of subsidy (table 1) we examine four other protection forest instruments (table 2). The first of these is a general product subsidy, where a sum is paid for every exploited cubic meter of wood. Two of the instruments deal with forest restoration projects in which a canton carries out the project, either with a private company or its own employees. The fourth instrument pays the forest owner for the current and future level of protection his forests can deliver. This instrument takes a new approach, namely one that uses no public funds, either for the exploitation of wood or to carry out forest restoration. Rather it is aimed at compensation for the effective amount of protection the forest affords or will probably afford in future.

Name	Type	Legal basis	Basis	Indicator	Conditions
Paying timber	Subsidy	Laws	Perimeter	Cubic meter timber	1. Long-term sustained yield; 2. timber volume controlled by forest authority.
Project P	Procurement	Contract with private firm	Administrative project	Offer (fixed price or cost-plus)	1. Partial expropriation of owner; 2. project execution mandated by forest authority; 3. competitive bidding.
Project A	Administrative	–	Administrative project	Administrative budget	1. Partial or total expropriation of owner; 2. project execution by forest authority.
Paying protection	Compensation	Contract with owner or law	Perimeter	risk reduction (state of forest, risks)	1. Long-term sustained yield; 2. state of forest measured by forest authority.

Table 2: Four other instruments for improving avalanche protection forests. Subsidies are paid out by the indicator.

3.2 Assessment of these instruments from an economic point of view

Incentives

Principal-agent relationships – like those shown in chapter 2.3 – can lead to relevant differences in incentives between principal and agent. We examined the question of incentives for the major actors (table 3 to 5). For the publicly owned forest we differentiate between communities with or without the right to tax, i.e. with stronger or weaker budget restrictions. No analysis is given for county councils, though it should be assumed that their incentives lie somewhere between those of the county forester and the county assembly.

Name	Incentives
Paying timber	1. Increasing timber production in forests with low harvesting costs.
Project Co	1. Increasing project costs by keeping productivity low; 2. planned and actual harvest in forests with high harvesting costs; 3. general neglect of forests.
Project CN	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. general neglect of forests.
Project E	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. general neglect of forests.
Paying protection	1. No or optimal tending of protection forests in forests with high protection levels (according to discount rate); 2. optimal tending of forests affording sufficient levels of protection; 3. neglect of forests affording insufficient levels of protection.

Table 3: Incentives for private forest owners (strong budget restrictions) and for county assemblies (public forest with weak or strong budget restrictions). The county assembly has to be looked on as the true forest owner. Hence private forest owners and county assemblies face more or less the same incentives.

name	incentives	
	weak budget restrictions	strong budget restrictions
Paying timber	1. Favoring status quo regime (tending all forest alike).	1. Increasing timber production in forests with low harvesting costs.
Project Co	1. Increasing project costs by keeping productivity low; 2. planned and actual harvest in forests with high harvesting costs; 3. favoring status quo regime.	1. Increasing project costs by keeping productivity low; 2. planned and actual harvest in forests with high harvesting costs; 3. some neglect of forests.
Project CN	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. favoring status quo regime.	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. some neglect of forests.
Project E	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. favoring status quo regime.	1. Planned harvest in forests with high harvesting costs; 2. actual harvest in forests with low harvesting costs; 3. some neglect of forests.
Paying protection	1. Favoring status quo regime (tending all forest alike).	1. No or optimal tending of protection forests in forests with high protection levels (according to discount rate); 2. optimal tending of forests affording sufficient levels of protection; 3. neglect of forests affording insufficient levels of protection.

Table 4: Incentives for county foresters (public forest). Asymmetric information often enables county foresters to maximize their profit. Consequently they can augment costs or maintain high costs, which are paid for by means of higher state subsidies or lower profits for the forest owner. Counties with strong budget restrictions (no right to tax) will try to improve their information and better monitor their forester. Otherwise they risk bankruptcy. Counties with weak budget restrictions (right to tax) do not have the same urgency to monitor, because their financial basis is more or less solid. Confronted with high deficits they are always able to raise the tax rate and balance the county budget.

Name	Incentives
Paying timber	1. Heavy loss of influence, therefore no interest in this instrument.
Project Co	1. Increasing number and size of projects.*
Project CN	1. Increasing administrative prices for cost estimation;* 2. increasing number and size of projects.*
Project E	1. Increasing administrative prices for cost estimation;* 2. increasing number and size of projects.*
Project P	1. Increasing number and size of projects.*
Project A	1. Increasing number, size and costs of projects.
Paying protection	1. Heavy loss of influence, therefore – at least for the moment – no outstanding interest in this instrument.

Table 5: Incentives for forest authorities. *: Weak incentive, because the forest authority does not profit directly.

Evaluation

We examined the advantages and disadvantages of the seven analyzed instruments in a more general way (table 6).

Name	Advantages	Disadvantages
paying timber	–	1. Subsidized forest area much too large; 2. costly to measure timber volume; 3. correlation between timber production and afforded protection weak; 4. political economy leads to difficult implementation (influential forest authority).
project Co	1. Planned and actual measures are identical.	1. Strong incentive not to increase labor productivity or capital intensity; 2. harvest in forests with high harvesting costs (only weak link to regional priorities); 3. general neglect of forests.
project CN	1. Incentives to increase productivity if strong budget restrictions apply.	1. Planned and actual measures are not identical; 2. harvest in forests with low harvesting costs (only weak link to regional priorities); 3. general neglect of forests.
project E	1. Incentives to increase productivity if strong budget restrictions apply.	1. Planned and actual measures are not identical; 2. harvest in forests with low harvesting costs (only weak link to regional priorities); 3. general neglect of forests.
project P	1. Planned and actual measures are identical; 2. bidding competition improves productivity constantly.	1. Partial expropriation of forest owner.
project A	1. Planned and actual measures are identical.	1. Partial expropriation of forest owner; 2. low productivity or high costs; 3. affording high protection levels hardly at the center of the bureau's effort.
paying protection	1. Goal oriented (optimal tending of forests, neglect of timber production); 2. owners with low discount rates will also tend some forests with insufficient levels of protection; 3. forest owners get paid for an environmental service actually provided (encouragement of free market environmentalism); 4. well suited to future economic environment in European forest industries.	1. Neglect of forests affording insufficient levels of protection; 2. owners with high discount rate will neglect forests with high protection level; 3. political economy leads to difficult implementation (influential forest authority).

Table 6: Evaluation of analyzed instruments for improving avalanche protection forests.

3.3 Choice of the most appropriate instruments

All assessed instruments have both advantages and disadvantages. They do, however, differ quite clearly in their approach:

- In the sense of a «joint production» the instrument we call «paying timber» is an indirect approach. The production of timber leads to an increase in both the stability and the regeneration of stands and thus to a better level of protection. The indirect approach, however, means that there is only a loosely targeted use of resources.
- The five project-oriented instruments represent possibilities of state intervention to improve the condition of the forest. The strength of these instruments is that proceedings can be locally targeted but they are less suitable for application over wide areas. Competitive bidding in particular – a central feature of the newly proposed instrument project P – enhances efficient allocation of public funds.

- The instrument called «paying protection» compensates forest owners for the level of protection afforded by the forest under their care. It also acts as a simultaneous incentive to ensure long-term protection and can generally increase the amount of care expended on protection forest in any given region. On the downside it must be said that it is hardly to be expected that urgently needed forest restoration can be realized with this instrument.

This brief synopsis clearly illustrates that a **rational forest policy** must be based on a combination of instruments because no single approach can provide a satisfactory solution. Moreover, any new approach must take into account that, for economical reasons, timber production in mountainous regions is increasingly being discontinued and that sooner or later forests in alpine areas will cease to be managed at all.

4. Outline for a new forest policy

4.1 Instrument combination

In the future the protection of the population from avalanches will be assured by two different instruments:

- **Paying protection:** Forest owners will be rewarded for the level of protection their forests provide. The compensation payment includes present and future components and is paid by the Canton.
- **Procurement of restoration projects:** In forests where strong restoration measures are required forest owners will be materially expropriated for limited time periods. Cantonal forest restoration projects will be put out to tender and carried out by suitable contractors.

The new approach offers forest owners the chance to market environmental care. It rewards owners who, in the past, have tended their forest in an appropriate manner or those who own forests where the circumstances are naturally good.⁵ At the same time the new approach creates a strong incentive to continue to adequately tend the forests that provide good or sufficient protection. It should, quite coincidentally, help to overcome the existing splintered forest ownership structures and encourage forest owners to manage protection forests by co-operating amongst themselves. For this reason owners should not be compensated by law but only based on a contractual agreement with a private company.

⁵ A fundamentally new approach would be to make forest owners responsible for damages caused by natural disasters. Following COASE, however, we would be forced to conclude that the cause of the problem lies in this case solely and exclusively in the neighbouring land's exposition to natural disaster and that it would therefore be better to involve the beneficiary of protection in any solution. Moreover, the passing over of responsibility to the forest owner would rapidly lead to a situation where the greater part of the forest would belong to the state.

The ideal situation would be where the same company managed the forests of an entire region on behalf of the individual owners.

In addition, in those forests that have a very high importance as protection forests but that are in poor condition and do not – or only inadequately – fulfill this vital function for the population the Cantons could take the initiative and improve the situation within the framework of restoration projects. Restoration projects are put out to tender. The advantage of this solution lies in the clear lines of responsibility it creates within the management of the project – clear demarcation of responsibility regarding results – and the creation of competition for the execution of the projects.

4.2 Details about the new policy

Fundamentals

Avalanche protection forests are to be identified by the means of risk analysis. Analysis is based on the probability of an avalanche coming down in locations where the state of the forest is deemed unsatisfactory and on the potential damage that it could cause. Generally speaking, avalanche or other protection forest is to be dedicated in such a way as to take into account small topographical structures. The Canton decides on such dedication by the issue of a decree with the right of appeal. Criteria to be applied in the risk analyses are determined by the federal authorities.

Paying protection

The Cantons ascertain the level of protection afforded by the forests every twenty years. Protection level is determined in the field, assigned to one of three categories – good, sufficient or insufficient – and entered on a map. Both the current protection level is judged (present component) and the probable protection effectiveness in 50 years time (future component). The owner is notified of the ascertained level of protection the forest provides by means of a decree with the right of appeal.

Compensation is only paid to those owners whose forest is tended by a mutual professional company, which has signed a contractual agreement with the Canton (cf. chapter 5). Single requirement for the professional company would be to represent a minimal forest area (e.g. 5.000 ha).

Owners are compensated with a lump sum per area on an annual basis. The level of compensation is determined by the Canton and is the same for all forest owners. Differences in topographical or other conditions are not taken into account. Calculation of compensation reflects the levels of ascertained current and expected future protection, whereby both components are weighted with fifty per cent.

- **Good level of protection:** Compensation is calculated in order to cover the costs of specialist tending of the protection forest and so that a substantial profit remains. Management is not compulsory.
- **Sufficient level of protection:** Compensation is calculated in order to manage the protection forest in a cost-neutral way and improve the effectiveness of future protection. Management is not compulsory.
- **Insufficient level of protection:** A small compensation is paid in cases where the contractor can prove that silvicultural measures have been undertaken in the protection forest in question to improve future level of protection. The measures have to be taken according to the federal NaiS-guidelines.

The present report does not enter into more detail on the ascertainment of the level of protection. However, discussions with the relevant specialists show that it is feasible with regard to both expertise and financing. Important characteristics of the assessment are canopy cover, structural heterogeneity, existing regeneration and pre-conditions for forest regeneration.

Procurement of restoration projects

Based on the results of the risk analysis, the ascertained level of protection and the available budget the Cantons carry out restoration projects in avalanche protection forests that manifest insufficient levels of protection. In order that this can be done owners of the forest in question are expropriated for the duration of the project if they do not relinquish their right of usufruct of their own free will (cf. chapter 5).

The Cantons commission private companies to develop the projects, which are put out to tender. During the project execution the Canton limits itself to its function as mandator, as with public underground and surface engineering. After a stipulated period the restored forests are returned to the owner together with the right of usufruct. After a certain transition period the owners will be paid again according to the protection they provide.

5. Contractual Implementation

The specimen contract (cf. appendix) sets out the details of the agreement entered into by the Canton and the individual enterprise. Levels of compensation are based on a risk analysis, the maps of protection afforded by the avalanche protection forest and in accordance with established flat compensation rates. The flat rates are calculated with a simple model, which, like the flat rates themselves are legally defined.⁶

⁶ The measurement model, which we shall not investigate in detail here, would probably need to be based on the likelihood of a natural disaster (e.g. into one of three categories), on the one hand, and the potential level

6. Conclusions

6.1 Advantages of the new forest policy

Under the current regulation great sums of money flow into the management of Switzerland's protection forests. The bad allocation of these monies with regard to obtaining a reduction of risk, as well as the friction involved in the distribution of the monies caused by agency costs, leads to a poor use of taxpayers money. The policies for protection forests described here are aimed at eliminating these failings using a new approach:

1. Public funding is employed where the greatest reduction of risk is achieved.
2. As a rule, resources are unconditionally employed where avalanche protection is provided or will probably be provided in the future.
3. A small part of the funding is used to remunerate forest owners who are voluntarily prepared to raise the protection value of their forest to a sufficient level.
4. Direct intervention by the state is reserved for those forests that provide inadequate protection where risk is high, and the owners neglect to take measures themselves.

The two greatest advantages of the proposed solution lie, therefore, in a more efficient use of resources, on the one hand, and in the restriction of direct state intervention to cogent matters, on the other. There are, moreover, a number of further advantages that speak for the proposed approach. One is the almost total renunciation of taking the yield from wood sales into account in the calculation of compensation. Another lies in the withdrawal of forest authorities from the organization and supervision of general silvicultural tending activities and the execution of renovation projects by the forest authorities under the laws governing public tender. The difficulty of evaluating and supervising the effectiveness of forestry measures also becomes more or less redundant. The final advantage of the proposal is that, should there be a strong increase of protection forests that are no longer tended, the provision of the public good «Protection from Natural Disasters» can still be mastered. It cannot be discounted that with a strong reduction of forest management in mountainous regions – to be feared with the expected low wood prices – current promotion politics will quickly reach their administrative limits.⁷

6.2 Consequences of the new forest policy

Three consequences of the implementation of the new forest policy can be directly inferred from the deliberations set out so far. The first is that a risk analysis must be carried

of damage (loss of human life and material damage, e.g., in four categories) and, on the other, on one of three categories of the level of protection afforded (good, sufficient, insufficient). This would mean a maximum of 36 flat rates of compensation.

⁷ Both the federal government's NaiS project and the pilot project «Innsbruck Compensation Model» indicate that similar reflections already abound in other places.

out for every canton based on guidelines set up by the federal government.⁸ Secondly, each canton would have to verify, every twenty years, the effectiveness of protection provided by its forest. Thirdly, public and private forest owners would have to organize themselves in such a way as to ensure that each unit represents a given minimal area of forest.

Naturally, the new forest policy calls for changes to the Cantonal Forest Laws currently in force. It is important to note that, in the short term, the new policy would cost more but that in the long run this investment should pay for itself.

6.3 Open questions regarding the new forest policy

The proposal raises a number of new questions:

- How can the considerations for an avalanche protection forest be extended to protection forest as a whole, and how can we include the natural disasters «falling stones» and «mudslides, erosion, landslips»?
- How can private and public beneficiaries of protective measures be better involved in the participation of financing the tending of protection forest?⁹
- How can the proposed solutions be extended to include the prevention and removal of damaged forest (art. 26 WaG)?
- How is the effectiveness of protection to be ascertained case by case and how is it to be categorized?
- How are the flat rates to be measured and graduated in order for them to function as financial incentives?
- What future level of public funding can be expected for tending protection forests and how do the opportunity costs of public funding compare with other state activities providing amenities?
- How can the Canton ensure its long-term commitment for paying protection?¹⁰
- How can forest authorities be convinced of the value of the new forest policy despite the fact that they would have less direct influence under the new regime?

⁸ Steps were recently introduced in this direction with the project «SilvaProtect-CH» set up by the Federal Forest Service.

⁹ Following MANCUR OLSON one solution could be to limit the protection paid by the Canton to a certain, rather low level. Subsequently private and public beneficiaries would have to complement payments to forest owners according to their preferences for protection. See OLSON, M. (1969): The principle of „fiscal equivalence“: the division of responsibilities among different levels of government. *Am. Econ. Rev.* 59, 2 (Papers & Proc.): 479–487.

¹⁰ Insufficient commitment by the Canton will tempt forest owners to underinvest. See also KYDLAND, F.E., PRESCOTT, E.C. (1977): Rules rather than discretion: the inconsistency of optimal plans. *J. Pol. Econ.* 85, 3: 473–492.