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Socioeconomic Analysis of the Impact of Investments in Nature Conservation and Forest Biodiversity

Final report based on the FOEN report 'Flow of Funds, Recipients and Impact of Investments in Nature Conservation and Forest Biodiversity. Cantonal Survey 2019.'



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Contents

Glossary	4
1 Summary	6
2 Introduction	9
2.1 Background	9
2.2 Objectives and content of the study	9
3 Procedure and method	10
3.1 Steps in drawing up the study	10
3.2 Selection of the case studies	10
3.3 Impact model	11
3.4 Interpretation of the effects	17
3.5 Questions for the literature analysis	17
4 Case studies	18
4.1 Canton of Neuchâtel: Revitalising the Marais-Rouge (Vallée des Ponts-de-Martel)	18
4.2 Canton of Graubünden/Uri: Using free-ranging goats to graze dry pastures	20
4.3 Canton of Zug: Repairing a dry stone wall to help the smooth snake	24
4.4 Canton of Basel-Stadt: Measures to help redstarts	27
4.5 Canton of St. Gallen: Helping the capercaillie at the Amden forest reserve	30
4.6 Canton of Nidwalden: Habitat improvement at the Rieter Oberrickenbach fen	34
4.7 Summary of the case studies	36
5 Literature analysis: findings from Switzerland and abroad	38
5.1 Overview	38
5.2 Impact assessment methods	38
5.3 Impact of biodiversity-promoting measures on society and the economy	40
5.4 Funding of nature conservation and biodiversity	43
6 Effects of biodiversity-promoting measures on the economy and society	46
6.1 Desired effects	46
6.2 Undesired effects on the environment, the economy and society	50
6.3 Conflicting objectives and obstacles	51
7 Synopsis	52
7.1 Desired effects predominate	52
7.2 Taking advantage of opportunities for nature, the economy and society	53
8 Annexes	55
8.1 Literature	55
8.2 List of interview partners	58
8.3 List of participants at the expert workshops	59

Glossary

Term	Definition
Biodiversity	Biodiversity refers to the diversity of species, the genetic diversity within the various species, the diversity of habitats and the interactions within and between these levels.
Case study	Selection of implementation examples from the cantonal survey (FOEN 2019) which represent particularly successful examples of the investment of the funds in terms of ecological success or positive future impact on biodiversity.
Ecosystem service	The communities of species, which interact with one another and their abiotic environment (ecosystems) as a functional unit, provide essential services of great economic, social and ecological value, such as the supply of drinking water, food for humans and animals and raw materials, the ability to adapt to climate change, protection against natural disasters, natural pest control, the provision of active substances for pharmaceutical products and the importance of natural spaces for physical and mental recreation and recuperation and consequently for human health. These ecosystem services enable human existence and the performance of economic activities (Federal Council 2017).
Effect	The difference, originally attributable to an intervention, in a state compared to an uninfluenced state. ¹
Federal investments in nature conservation and forest biodiversity	General term for the ordinary transfer funds from federal government for the cantons and the transfer funds to finance immediate measures in the programme agreement period 2016–19 in the areas of nature conservation (based on the Nature and Cultural Heritage Act NCHA) and forest biodiversity (based on the Forest Act ForA). The programme objectives set out in the manual for programme agreements in the area of the environment 2016–19 form the basis for the funding of measures (FOEN 2015). The federal government has CHF 37 million a year in ordinary transfer funds available to compensate the cantons' implementation tasks in the areas of nature conservation (CHF 27 million, 'nature and landscape' transfer credit) and forest biodiversity (CHF 10 million, 'forest' transfer credit).
Full-time equivalent (FTE)	A full-time equivalent is a position with a 100% level of employment (e.g.: a 50% level of employment would equate to 0.5 FTE).
Impact	Impact refers to the indirect, longer-term effects of the projects on the environment, economy and society (or parts of them). ² It describes changes brought about by the projects for persons, groups and organisations or other results achieved via the direct target groups of the measure.

¹ Evaluation glossary (<https://www.bag.admin.ch/bag/en/home/das-bag/ressortforschung-evaluation/evaluation-im-bag/arbeitshilfen-fuer-das-evaluationsmanagement/checklisten-und-vorlagen-zum-evaluationsmanagement.html>) (consulted in Jan.-Feb. 2019)

² Based on the evaluation glossary <https://www.bag.admin.ch/bag/en/home/das-bag/ressortforschung-evaluation/evaluation-im-bag/arbeitshilfen-fuer-das-evaluationsmanagement/checklisten-und-vorlagen-zum-evaluationsmanagement.html> (consulted in Jan.-Feb. 2019)

Input-output tables (IOT)	Input-output tables show the flows of goods and the interconnections between the sectors within an economy. ³ On the production side, the interconnections show which goods are used in which sectors and, on the consumption side, which goods are used in which sectors or flow into final consumption.
National priority species (NPS)	National priority species are endangered species for whose survival Switzerland has an international responsibility.
Outcome	Changes in behaviour amongst the target groups achieved by projects. The outcomes refer to the direct, short to medium-term effects of the projects. ⁴
Output	Services and products that are provided or produced directly by a strategy, programme, project or other initiative and which are aimed at the target groups. ⁵
Policy evaluation	In the impact analysis we use the concepts of the theory of the evaluation of political measures (FOEN 2013).
Preliminary service	The value of goods and services used during the period under review to produce other goods and services. The preliminary services refer to the input (energy, materials, rent etc.) required for the production process. ⁶
Programme agreement (PA)	The programme agreement as a subsidy instrument is based on the strategic objectives of federal government and the federal government funds available for this purpose. Federal government and the cantons jointly set out how the common tasks will be performed and what federal government subsidies will be provided for this purpose. The programme objectives set out in the manual for programme agreements in the area of the environment 2016–19 form the basis for funding measures in the areas of nature conservation (based on NCHA) and forest biodiversity (based on ForA) – (FOEN 2015).
Value creation	Value creation refers to the increase in value of the goods resulting from the production process. In the national accounts it is calculated by deducting preliminary services from the production value balance. ⁷
Work productivity	The value creation (output) per work unit (input). ⁸ The work input is measured in full-time equivalents.

³ <https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/input-output.assetdetail.5453222.html> (consulted in Jan.-Feb. 2019)

⁴ Based on the evaluation glossary <https://www.bag.admin.ch/bag/en/home/das-bag/ressortforschung-evaluation/evaluation-im-bag/arbeitshilfen-fuer-das-evaluationsmanagement/checklisten-und-vorlagen-zum-evaluationsmanagement.html> (consulted in Jan.-Feb. 2019)

⁵ Based on the evaluation glossary (<https://www.bag.admin.ch/bag/en/home/das-bag/ressortforschung-evaluation/evaluation-im-bag/arbeitshilfen-fuer-das-evaluationsmanagement/checklisten-und-vorlagen-zum-evaluationsmanagement.html>) (consulted in Jan.-Feb. 2019)

⁶ <https://www.bfs.admin.ch/bfs/en/home/basics/definitions.html> (consulted in Jan.-Feb. 2019)

⁷ <https://www.bfs.admin.ch/bfs/en/home/basics/definitions.html> (consulted in Jan.-Feb. 2019)

⁸ <https://www.bfs.admin.ch/bfs/en/home/basics/definitions.html> (consulted in April 2020)

1 Summary

Investment in biodiversity means investment in our future: it enables the conservation of nature and its contribution to human wellbeing and creates many positive effects for the economy and society. The biodiversity-promoting measures also have great potential in terms of communication and awareness-raising. This means the wide range of opportunities that investment in biodiversity presents should be utilised. This analysis of the impact of federal and cantonal funds on nature conservation and forest biodiversity shows that the scalability and replicability of the funding measures and mechanisms – especially in terms of communication and awareness-raising – must be leveraged.

Funds for nature conservation and forest biodiversity

Various instruments are available to federal government for subsidising and funding measures and projects to promote biodiversity. A key instrument are the programme agreements in the area of the environment. Their financial flows generate additional positive effects on the economy and society beyond the objective of conserving and promoting biodiversity. These socioeconomic effects were evaluated in this analysis.

During the 2016–19 programme agreement period in the area of the environment, federal government and the cantons jointly invested around CHF 420 million in the preservation and promotion of biodiversity in the areas of nature conservation and forest biodiversity. In a survey conducted by FOEN amongst the cantons, on which this study is based, the cantons reported that the first successes of this investment are already evident in nature (FOEN 2019). However, with farmers, forest owners and many other actors receiving and implementing these funds, the regional economy also benefits and people enjoy the enhanced landscapes. Not enough research has yet been conducted into the wide range of such socioeconomic effects on the economy and society. This analysis therefore aims to outline the effects of this investment on the economy and society and to achieve a better understanding of the areas of impact. The objectives to be met to achieve the conservation and promotion of biodiversity are set out in the 2016–19 programme agreements between federal government and the cantons and were monitored by the cantons as part of their implementation of environmental policy with relevant measures. The effects of these measures are analysed within the individual programmes and are not covered further in this report.

This analysis is based on an impact model which enables the specific services implemented (output), the desired effects (outcome) and additional effects (impact) in the areas of the environment, economy and society to be presented. Direct, indirect and induced effects (outcome) as well as demand-side effects (impact) are analysed in relation to impact on the economy. This impact model is applied to case studies selected from the previous cantonal survey (FOEN 2019). This analysis is supplemented by interviews and discussions with actors from the case studies (annex 8.2), by the evaluation of literature on the impact research and funding mechanisms and two expert workshops (annex 8.3).

Six **case studies** were analysed – the first four in the area of nature conservation and the other two in the area of forest biodiversity. The main effects are therefore broken down into the three areas of environment (EN), economy (EC) and society (S).

- **Revitalising the Marais-Rouge (canton of Neuchâtel)**
An increase in the diversity of species (EN) was observed as a positive impact of the revitalisation. The project generated direct value creation for the local construction and forestry sectors as well as a sawmill. The revitalised part of the raised bog is not being used for tourist purposes. A museum and educational centre are being built on the extended part of the Marais-Rouge raised bog the effects of which cannot yet be quantified (EC). Tours could provide special interest groups with access to the raised bog and information about the revitalisation project and its benefits in terms of biodiversity (S).
- **Using free-ranging goats to graze dry pastures (cantons of Graubünden and Uri)**
Steep and difficult to access but ecologically valuable habitats are increasingly becoming overgrown in mountain areas. To counteract this development, a team of shepherds are leading around 200 free-ranging goats over dry pastures and meadows of national importance between the Chur Rhine Valley and the Urserental. By grazing on shrubs, bushes, young trees and old grass, the animals create space for rare species that like light and warmth (EN). The project resulted in direct value creation for the shepherds and a consulting office which carried out the project management, project communication and marketing of the products as well as the monitoring of the success of the measures (inspection of the pastures before and after measures). Sausage production under Coop's Pro-Montagna label is also generating revenues for a local butcher's shop. Livestock farming in Urserental is benefitting thanks to the improved quality and increased size of pasture for cows (EC). The project also contributed to creating a very positive image of the concept and the region and to raising awareness about traditional crafts (S).
- **Repairing a dry stone wall to help the smooth snake (canton of Zug)**
The measure provides a habitat and refuge for the smooth snake and many other species (EN). The project generated direct value creation for the construction, transport and waste disposal sectors and for a local surveying office (EC). The training of farmers on maintaining and managing dry stone walls indirectly contributes to the preservation of cultural and historical values. The dry stone wall – with its fragmenting element – is also part of the typical local landscape (S).
- **Measures to help redstarts (canton of Basel-Stadt)**
The project is resulting in the reintroduction of redstarts and many other species as well as an improved corridor function for many animal and plant species (EN). Direct value creation was generated for local businesses, in particular gardening and environmental consulting firms and communications agencies (EC). The project aims to encourage garden owners to grow and purchase suitable plants. It is raising the local population's awareness of the issue, is creating meeting places and is involving social organisations (building of nesting boxes). The high and positive level of media coverage is contributing to the project's approval rating (S).
- **Helping the capercaillie at the Amden forest reserve (canton of St.Gallen)**
Various species are being preserved, their habitats improved and fen management optimised thanks to the thinning measures and creation of dead wood zones (EN). Value creation is being generated by forest management and by the timber harvest for the local forestry enterprise. The special forest reserve is increasing the region's appeal and may attract tourists. Various expert meetings and training events were also held in Amden (EC). The forest reserve is primarily being used for environmental education (info panels, training room). The light forests are creating an attractive landscape and strengthening the population's local identification with 'their' forest (S).

– **Habitat improvement at the Rieter Oberrickenbach fen (canton of Nidwalden)**

The habitat improvement and the thinning measures are stabilising and increasing the diversity of species, in particular butterflies. The fen is also making a contribution to climate protection as a carbon sink (EN). Value creation was generated for a local forestry engineering studio and a forestry company and the timber is being supplied to a local sawmill. Agricultural management of the fen is now easier and more effective (EC). The landscape has only been indirectly improved and the area is not being marketed for tourism or environmental education and should be a quiet place of refuge for nature (S).

The six case studies illustrate, on one hand, the diversity of the measures implemented (objectives, financial scope, implementation partners, appeal/profile etc.), and, on the other, the diversity of the effects that the investment in nature conservation and forest biodiversity are having in the three areas of environment, economy and society. Although the environmental objective – i.e. the preservation and promotion of biodiversity – is the main goal of all the measures, additional, usually positive, effects on the economy and society are also being achieved.

The **literature analysis** shows that various methods can be used to assess the impact of the contribution of nature (biodiversity, nature conservation, resource preservation) on human wellbeing. The established methods include contingent evaluation methods (willingness to pay), the travel or transport cost method or increasingly also qualitative descriptions of the socio-cultural values and sensory perceptions of nature. The assessment of the economic effects of biodiversity-promoting measures almost always focus on value creation effects.

The literature also includes a wide range of studies that assess the impact of biodiversity measures in different areas (environment, economy, society): the impact of biodiversity on physical and mental health and on recreation, social cohesion, learning and acquisition of knowledge and the contribution to preserving (indigenous) cultures. There are some value creation studies specifically relating to Switzerland that focus on nature parks (national park, parks of national importance). These studies refer back to the Swiss Parks Ordinance of 7 November 2007⁹ (ParkO) which explicitly provides for the strengthening of the regional economy for nature parks as well as the conservation of nature and the landscape.

A comparison with other OECD¹⁰ countries shows that in Switzerland it is primarily taxation – and almost no other income generation instruments – which is available for the funding of biodiversity objectives. In contrast, various other countries have fees or licences (e.g. park fees, hunting permits, water charges, penalty payments), fees for the use of ecosystem services, the taxation of products (e.g. pesticides, timber) or tradeable certificate exchanges (e.g. cap-and-trade approach) to generate funds to promote biodiversity. In addition to the wide range of such funding instruments, which are usually embedded in the local context or are country-specific, the literature also shows ways of supplementing public funding with private third-party funds to generate synergy effects. The Swiss solution of generating funds to finance biodiversity objectives via tax revenues takes account of biodiversity's status as a public asset. The instrument of the programme agreements between federal government and the cantons is well established. Supplements from private third-party funds (e.g. voluntary contributions, such as donations or support from foundations) or the levying of fees for biodiversity services (e.g. park admission fees) may represent further options for funding biodiversity measures (e.g. OECD 2017).

⁹ CC 451.36

¹⁰ Organisation for Economic Co-operation and Development (OECD)

2 Introduction

2.1 Background

The wellbeing and prosperity of the economy and society depend directly on biodiversity and its services for people (section 3.3.3, excursus on ecosystem services). This suggests investment in biodiversity is in everyone's interests.

The Swiss Federal Constitution obliges federal government and the cantons to ensure the long-term preservation of natural resources and to protect the natural environment of the population against damage or nuisance (art. 2 and 74 Federal Constitution, Cst.). The conservation of biodiversity is enshrined in the Federal Constitution (art. 77 to 79 Cst.) as a joint responsibility. This is based on the strategic objectives of federal government in the area of the environment. Within the scope of the programme agreements, federal government and the cantons jointly determine, every four years¹¹, which services a canton will provide to achieve federal government's strategic objectives (FOEN 2015). Federal government also undertakes to support the cantons financially with the operational implementation of the measures undertaken. Transfer funds are available to federal government which are distributed according to the relevant legal bases. The programme agreements have been the main instrument of partnership-based implementation of Swiss environmental policy between federal government and the cantons since 2008. In view of the existing implementation deficits in the areas of nature conservation and forest biodiversity, in May 2016 the Federal Council decided to increase the existing ordinary transfer funds for these two areas for a limited period. Federal government provided the cantons with a total of CHF 135 million to finance immediate measures in the areas of nature conservation and forest biodiversity for the period 2017–20. The Federal Council decided to distribute this federal funding to the cantons – as part of the programme agreements in the area of the environment between federal government and the cantons – in tranches¹² and that they should be supplemented by the cantons (basis: Nature and Cultural Heritage Act NCHA and the Forest Act ForA).

As part of the 2016–19 programme agreement period in the area of the environment, federal government and the cantons jointly invested around CHF 420 million to conserve and promote biodiversity in the areas of nature conservation (around CHF 300 million, basis: NCHA) and forest biodiversity (around CHF 120 million, basis: ForA; fig. 4).¹³ These investments include the ordinary transfer funds of federal government in these areas, the transfer funds to finance immediate measures for 2017–19 and the supplementary amounts from the cantons. Federal government and the cantons shared the costs for the measures in favour of biodiversity based on NCHA and ForA almost equally. The investments by federal government and the cantons and any other funds, such as from communes as part of 'investment in nature conservation and forest biodiversity', are summarised below.

2.2 Objectives and content of the study

There were previously no in-depth findings on the effects of investment by federal government and the cantons in the areas of nature conservation and forest biodiversity on the economy and society. This socioeconomic analysis aims to analyse and outline these effects and to show how better use can be made of the wide-ranging opportunities presented by investment in biodiversity for the economy and society. This study is based on a survey conducted by FOEN amongst the cantons on the flows of funds, the recipients and the impact of the investments made in nature conservation and forest biodiversity as part of the programme agreements (FOEN 2019, subsequently abbreviated as 'cantonal survey').

This report

¹¹ The 4th programme agreement period (2020–24) lasts five years instead of four as the budget process was brought into line with federal government's legislative funding planning as part of the programme agreements in the area of the environment.

¹² 2017: CHF 20 million, 2018: CHF 35 million, 2019 and 2020: CHF 40 million each

¹³ Estimated based on FOEN (2019). Definitive calculations on the programme agreement period 2016–19 will be available in mid-2021.

- explains the procedure and the methodological approaches to producing this socioeconomic analysis (section 3).
- assesses, for six of the 25 examples of projects implemented that are described in the cantonal survey, which socioeconomic effects the flows of funds have generated for the areas of nature conservation and forest biodiversity or which effects are still anticipated (section 4).
- based on a literature analysis of methods of impact assessment (section 5.2), evaluates the effects of nature conservation and forest biodiversity on the economy and society in general (section 5.3) and possible models for funding biodiversity measures in Switzerland and abroad (section 5.4).
- provides a synopsis based on the case studies, literature analysis and expert workshops (section 6).
- highlights possible areas of action with the aim of improving transparency and efficiency of the subsidy system in the area of biodiversity (section 7).

3 Procedure and method

3.1 Steps in drawing up the study

1. *Case studies*: selection from the examples of projects implemented in the cantonal survey.
2. *Impact model*: creation of a three-tier model (output, outcome, impact) used to document the effects in the areas of environment, economy and society in this report in a well-structured and uniform way.
3. *First expert workshop*¹⁴: updating and definitive selection of the case studies, definition of the impact model.
4. *Literature analysis*: setting the question in the current national and international context, provision of relevant bases for the analysis of the case studies.
5. *Analysis of the case studies*: description of the content and evaluation of the effects in the areas of the environment, economy and society.
6. *Second expert workshop*: discussion of the results from the literature analysis and the case studies and updating of the summary of the desired and undesired effects in the areas of the economy and society, the information on institutional barriers and conflicting objectives with other sectors. Discussion on possible measures to improve transparency of investment in biodiversity measures.
7. *Synopsis*: summary of the findings from the case studies, the literature analysis and expert workshops.

3.2 Selection of the case studies

The internal FOEN advisory group selected six case studies (nature conservation: four case studies; forest biodiversity: two case studies) for socioeconomic analysis from the examples of projects implemented that are described in the cantonal survey from the 2016–19 programme agreements. The selection was based on the following criteria (tab. 15):

1. Meeting the programme objectives according to the manual for programme agreements (FOEN 2015; tab. 1): A case study was selected for every programme objective (PO) in the areas of nature conservation and forest biodiversity except for PO4. As no case study was available for the analysis of PO4 in the area of nature conservation, the internal FOEN advisory group selected a second project for PO1.
2. Ecological success or future positive effects of the project on biodiversity
3. At least one project that is implemented in a large area
4. At least one project taking place in an urban area and with a strong connection to the population
5. At least one project from French-speaking or Italian-speaking Switzerland
6. At least one project that spans habitats

¹⁴ Annex 8.3 List of participants at the expert workshops

The following six case studies from seven cantons were analysed:

Area of nature conservation:

- PO1: Canton of Neuchâtel: revitalising the Marais-Rouge (section 4.1)
- PO1/PO5: Canton of Graubünden/Uri: using free-ranging goats to graze dry pastures (section 4.2)
- PO2: Canton of Zug: repairing a dry stone wall to help the smooth snake (section 4.3)
- PO3: Canton of Basel-Stadt: measures to help redstarts (section 4.4)

Area of forest biodiversity:

- PO1: Canton of St.Gallen: helping the capercaillie at the Amden forest reserve (section 4.5)
- PO2: Canton of Nidwalden: habitat improvement at the Rieter Oberrickenbach fen (section 4.6)

Table 1. Programme objectives in the areas of nature conservation and forest biodiversity according to the manual for programme agreements in the area of the environment 2016–19.

Area	Programme objective (PO)
Nature conservation	<p>PO1: Protection, maintenance and improvement of biotopes, habitats and mire landscapes of national importance to ensure the functionality of the ecological infrastructure</p> <p>PO2: Protection, maintenance and improvement of biotopes, habitats and mire landscapes of regional importance to ensure the functionality of the ecological infrastructure</p> <p>PO3: Implementation of action plans for national priority species (NPS) and control of invasive alien species</p> <p>PO4: Habitat connectivity</p> <p>PO5: Innovations/opportunities</p>
Forest biodiversity	<p>PO1: Long-term conservation of forest areas and trees of special natural value</p> <p>PO2: Habitat and species promotion (forest edges, ecological connection elements, improved habitats and wetlands, forms of use)</p>

3.3 Impact model

3.3.1 Levels of the impact model

The impact model describes the services of the project and the related effects on the environment, economy and society. In this context, we talk about 'effects' and not 'benefits' as the main targeted benefits of the measures exist in the form of improvements in the area of nature conservation and forest biodiversity (e.g. greater diversity of species).

The model takes account of three levels – in line with the logic of the policy evaluation (fig. 1 and glossary):

Output

The services at the output level concern the measures implemented as part of the project, e.g. the building of a dry stone wall or shepherding a herd of goats on alpine pastures.

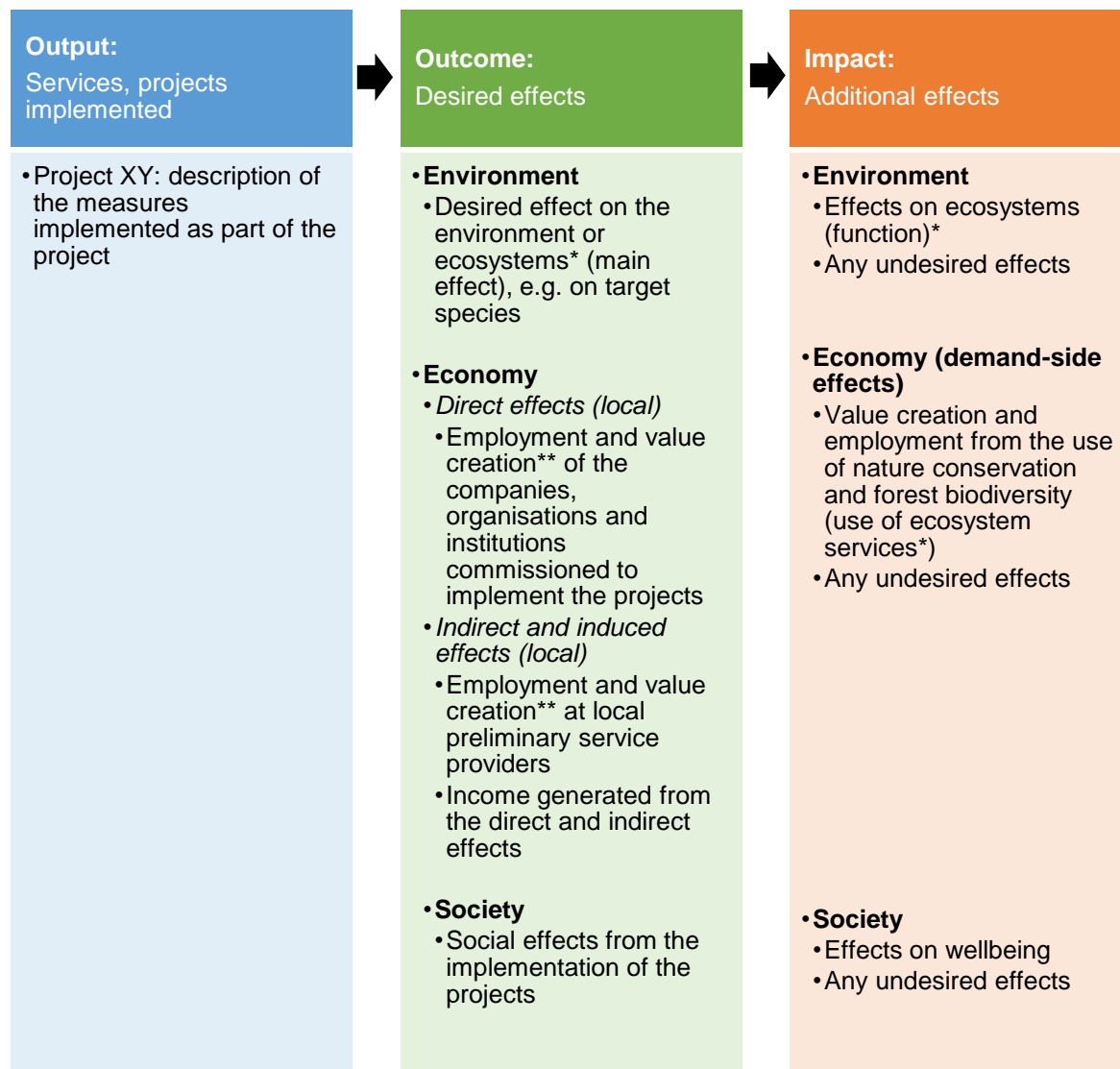
Outcome

The outcome level concerns the desired and undesired short to medium-term effects of the project or of the measure implemented on the environment, economy (sectors) and society. Example of effects on the environment: change in the number of species over a period of time. Example of effects on the economy: value creation and employment effects on actors directly commissioned with the implementation of the projects (e.g. forestry company).

Impact

The additional long-term desired and undesired effects on the environment, the economy as a whole and society are shown on the impact level. Example of additional effect on society: the local population and tourists enjoy the greater biodiversity and more diverse landscape. Example of additional effect on the economy: restaurant benefits from an increase in tourists visiting the area concerned.

Figure 1. Impact model for the analysis of the desired and undesired effects in the areas of the environment, economy and society.



For further explanations on the levels of the impact model see section 3.3.2/3.3.3.

*) See section 3.3.3 Excursus on ecosystem services

**) See glossary

3.3.2 Desired effects of the measures (outcome)

Environment

The effects of the case studies analysed on the environment are the main effects of the projects on biodiversity, especially on the target species. Information on the extent of the effects (e.g. increased prevalence of a target species) is based on the cantonal survey (FOEN 2019) and information from the expert interviews.

Economy

The investments analysed in the areas of nature conservation and forest biodiversity constitute, in economic terms, a state mandate to protect a public asset (biodiversity). The companies commissioned carry out work that would not be performed without a state mandate.

From an economic perspective, the spending of federal government and the cantons on measures to promote nature conservation and forest biodiversity are economic costs, i.e. the use of resources necessary to achieve the targeted ecological effects in the areas of nature conservation and forest biodiversity.

In addition to the economic costs, the measures undertaken can also generate value creation and employment effects which have a positive impact on the local/regional economy if they contribute to the utilisation or expansion of the production capacities available in a region. In this regard, the economic costs may be deemed positive in economic terms. For example, the cantonal survey indicates that the measures contribute to improving the employment situation for small and medium-sized companies, such as forestry companies in peripheral regions (FOEN 2019).

The examples evaluated have the following parameters:

- **Local value creation:** the total of direct and indirect value creation at local level. It includes value creation that occurs at the local companies commissioned to implement the projects and the value creation of the local upstream suppliers of these companies.
- **External value creation:** the total of direct and indirect value creation at external companies.
- **Preliminary services from Switzerland and abroad:** goods and services procured by the companies commissioned with implementation and their upstream suppliers from Switzerland and abroad.
- **Employment:** employment can be calculated from the value creation and work productivity of a sector¹⁵ and is indicated in terms of full-time equivalents (FTE). The work productivity is the value creation per work input. Sector-specific work productivity from the Federal Statistical Office's statistics are used in this study.¹⁶

Economic effects can be identified at the outcome and impact level of the impact model: effects due to the implementation of the measures occur at the outcome level. They are value creation and employment effects for the actors commissioned with the implementation of the projects (e.g. forestry companies) and their upstream suppliers. Effects arising from improved nature conservation and increased forest biodiversity are shown on the impact level (section 3.3.3).

The value creation and employment effects arising on the outcome level can be sub-divided into direct, indirect and induced effects (tab. 2):

- **Direct effects:** Value creation and employment at the authorities (cantons) commissioned with the implementation of the measure and additional third parties commissioned by the canton, such as communes, environmental organisations or local and external companies and businesses (construction companies, forestry companies, farmers, planning/consulting offices etc.). The local perimeter described in the report generally refers to the communes in the location of the project and the surrounding communes. The value creation effect mainly consists of the wage income generated. The value creation generally also includes depreciation for investments, dividends etc. As these play a minor role in the case studies, they are excluded in the presentation of the effects.

¹⁵ Value creation of a sector divided by sector-specific work productivity (value creation per FTE) = FTE.

¹⁶ Work productivity by sector at current prices (50 sectors), T 04.07.04.03, <https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/tables.assetdetail.9546235.html>

- **Indirect effects:** Value creation and employment at the providers of preliminary services required by the companies and businesses commissioned (e.g. gravel extraction). These providers of preliminary services in turn also require preliminary services. They can come from Switzerland or abroad (referred to as 'preliminary services from Switzerland/abroad' in the case studies). We estimated the local/regional share of preliminary services based on the Swiss input-output table 2014¹⁷ (IOT). The preliminary services from abroad are not indicated separately in the case studies and the same percentage share was assumed in all case studies to simplify the analysis (based on the average share of preliminary services from abroad according to IOT).
- **Induced effects:** Value creation and employment created due to the employees of the companies of the direct and indirect effect spending their income (multiplier effect). The relevant local/regional income is given by – in simplified terms – the total of local/regional value creation due to the direct and indirect effect. As the estimation of the relevant local/regional income entails a degree of uncertainty, we decided against calculating the induced value creation and employment effects. We have restricted ourselves to indicating the relevant local/regional income to illustrate the case studies.

Table 2. Calculation of the effects in the area of the economy. The services of cantonal authorities and private organisations are taken into account as salary income in the value creation.

Effect	Parameters determined	Calculation	Benchmarks and sources
Direct	Local value creation effect	= Local revenue minus preliminary services	Local revenue = amounts paid to local implementing actors; revenue share of preliminary services: sector-specific value from the IOT
	Local employment effect	= Value creation (VC) divided by the average sector-specific VC per FTE	Average VC per FTE: sector-specific value from FSO statistics on work productivity
Indirect	Value creation effect	Local revenue at upstream providers = preliminary services from the direct effect minus the share of preliminary services from abroad and the rest of Switzerland Local value creation effect = local revenues minus preliminary services	- Share of preliminary services from abroad: value from IOT table - Share of preliminary services from the rest of Switzerland: own estimate based on IOT - Revenue share of preliminary services: average value across all sectors from IOT
	Employment	= Value creation (VC) divided by average Switzerland-wide VC per FTE	Average VC per FTE: Switzerland-wide value from FSO statistics on work productivity
Induced	Income	= Total of direct and indirect value creation ¹⁸	For the sake of simplicity, we refrained from calculating the value creation and employment related to the use of income.

¹⁷ Glossary and <https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/input-output.html> (consulted on 21 August 2019)

¹⁸ Assumption: Value creation = income. Other value creation components, such as depreciation, interest and taxes etc. are excluded.

Society

Social effects mainly occur when the biodiversity measures are used for training/education and awareness-raising purposes. For example, information panels, brochures or media articles provide information about the biodiversity project. Tours and training events are sometimes also carried out locally for various target groups, e.g. for schools and other educational institutions, the local population and tourists. The employees of social organisations are also sometimes used for the implementation of measures in some projects (e.g. in the form of integration projects). These persons benefit from the social structures created through participation in the project.

3.3.3 Additional effects on the environment, economy and society (impact)

Environment

Biodiversity is the basis of the ecosystem services which are essential for human wellbeing (Federal Council 2012). Additional effects on the environment result from the fact that measures aimed at the conservation and promotion of biodiversity (outcome level) contribute towards ensuring the functionality of ecosystems and thus preserving ecosystem services (impact level). However, there can also be negative additional effects on the environment, for example if the number of people seeking recreation in nature conservation areas increases due to the measures (such as improvements), causing disturbance.

Economy and society

The additional effects on the economy and society result from the 'usage' of nature conservation and forest biodiversity. They are the demand-side effects that can trigger economically relevant effects for the actors. They are described qualitatively in this study.

Examples of potential positive and negative effects on the economy are:

- The regeneration of fenland contributes to climate protection (fenland as a carbon sink).
- The project results in the enhancement of fenland landscape. Restaurants close to the fenland landscape benefit from more visitors (e.g. hikers), enabling them to increase their revenues, value creation and employment.
- Farmers achieve greater yields because fewer neophytes are found in their fields.
- Farmers suffer a loss in yield because they can no longer use some areas intensively.
- The value creation generated (jobs) prevents some outward migration e.g. in peripheral regions.
- The improved quality of life increases the attractiveness of the location.

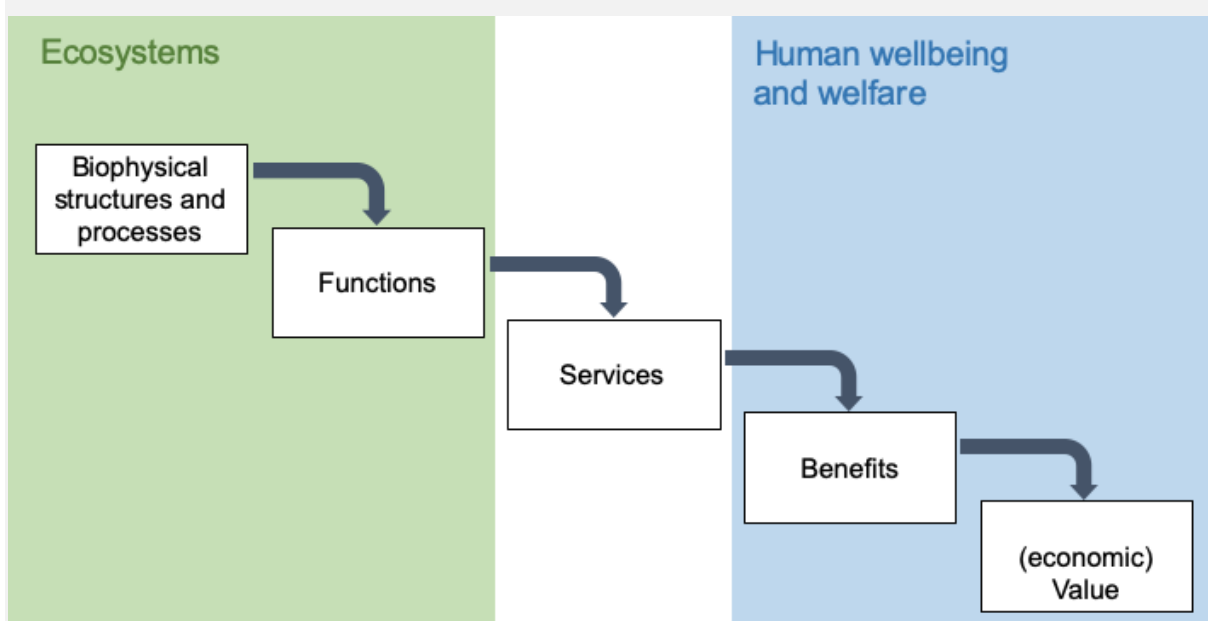
For example, the following positive and negative effects on society are conceivable:

- Day-trip tourists or hikers benefit from the implementation of the biodiversity measure because it increases the leisure and recreational value of the natural environment or the beauty of nature improves the mental wellbeing of people seeking recuperation.
- Residents benefit from a higher local or regional quality of life and living space.

Excursus: ecosystem services

The concept of ecosystem services creates a direct relationship between the functions of nature and ecosystems and people and their wellbeing and social welfare. It shows which services or contributions nature makes or provides directly or indirectly for the economy, society or individuals. The communities of plants, animals, fungi and microorganisms, which interact with one another as a functional unit, and their abiotic environment (ecosystems) provide vital services of great economic, social and ecological value, such as the provision of drinking water, food for people and animals and raw materials, the ability to adapt to climate change, protection against natural disasters, natural pest control, the provision of active substances for pharmaceutical products or the importance of natural spaces for physical and mental recreation and recuperation and, consequently, for human health. These ecosystem services enable human existence and the performance of economic activities (Federal Council 2012).

The figure below shows the logic of the ecosystem services as a cascade model at the interface between ecosystems (nature) and human wellbeing.



According to Keller 2017 (based on Haines-Young and Potschin 2010)

The concept of ecosystem services has become increasingly well established after the publication of the 'Millennium Ecosystem Assessment' (MEA 2005) report and the concept of 'Nature's contributions to people'¹⁹. The Millennium Ecosystem Assessment divides ecosystem services into the following types (Staub 2011):

- Basic services (e.g. soil formation, preservation of nutrient cycles)
- Supply services (e.g. food and animal fodder, drinking water, pharmaceuticals)
- Regulatory services (e.g. climate regulation, erosion protection, soil fertility)
- Cultural services (e.g. recreation, tourism, general wellbeing)

Biodiversity is regarded as an 'essential basis for the functioning of ecosystems' and therefore a 'pre-requirement for ecosystem services' (e.g. Naturkapital Deutschland – TEEB DE, 2018).

¹⁹ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES): 'Global Assessment on Biodiversity and Ecosystem Services' report being drawn up, drafts available at <https://ipbes.net/global-assessment> (last consulted on 21 April 2020)

3.4 Interpretation of the effects

The following aspects should be taken into account when interpreting these effects:

- The effects do not take account of displacement effects which occur when the funding of the measures results in negative value creation and employment effects in other places because financial resources are withdrawn to fund the measures.
- An assessment as to whether the indicated value creation and employment effects from the implementation of the projects occur for a region²⁰ in addition to pre-existing effects can be carried out qualitatively if necessary on the basis of assessments of local or regional experts on the situation. Three questions should be answered in particular:
 - What work can be carried out locally or regionally on the implementation of the projects? How high is the share of the external work?
 - What is the level of production capacity utilisation (workforce, machinery) in the region? Will the implementation of the projects result in better capacity utilisation or even in an (desired) expansion of capacity? Dynamic effects due to the strengthening of the resource potential in a region (human resources as well as capital and environmental resources) must also be taken into account here.
 - How much of the funds (federal government investments, other funding, in particular the cantons) will the region receive additionally? What share of the funding is no longer available for other economic activities in the region due to the funding of the nature conservation and forest biodiversity measures?

Overall, the quantification of the economically relevant effects enables statements to be made on which value creation and employment effects are linked with the economic activities triggered by the federal investments. The extent to which these effects are significant for the regional economy was assessed qualitatively in this report based on expert assessments.

3.5 Questions for the literature analysis

The literature analysis in section 5 assesses whether results exist for the following questions:

- Which **methods** can be used to assess the impact of biodiversity-promoting measures for the economy and society?
- What are the known (qualitative and quantitative) **effects** of biodiversity-promoting measures for the economy and society? And what favourable or inhibiting factors influence these effects?
- What **funding models** are used for biodiversity-promoting measures in other countries?

The selection of the literature is geographically limited and primarily includes studies from Switzerland, a few from Germany as well as several international studies (e.g. OECD, IPBES). In terms of content, the studies focus on the statements on the effect or type of effect of nature conservation and forest biodiversity on the economy and society.

²⁰ A region includes the communes in the location and the surrounding communes.

4 Case studies

4.1 Canton of Neuchâtel: Revitalising the Marais-Rouge (Vallée des Ponts-de-Martel)

4.1.1 Description (output)

The Marais-Rouge is a raised bog in the canton of Neuchâtel which was the site of peat extraction for use in horticulture until 1987. From 2009 revitalisation work was carried out to restore the bog's hydrological balance. During the assessment of the measures, it was observed that the water table in the area was very low and, as a result, only low-lying areas could be revitalised as planned. In 2018, work was carried out to minimise the sloping topography caused by soil erosion and to bring the surface nearer to the water table. This measure is analysed below.

The project received two contributions as part of federal investments. The first contribution in 2009 was part of the first project agreement 2008–11. A second contribution was made in 2018. The overall project lasted from 2009 to 2018 while monitoring will continue beyond the end of the project (tab. 3).

Table 3. Summary of the 'Revitalising Marais-Rouge' case study.

Name	Description
Canton	Neuchâtel
Title	Revitalising Marais-Rouge (Vallée des Ponts-de-Martel)
Cantonal survey reference	Section 5.13 (FOEN 2019)
Measures	Work carried out to minimise the sloping topography caused by soil erosion and bring the surface nearer to the water table
Implementation area	Commune of Les Ponts-de-Martel in the canton of Neuchâtel
Project type	Cantonal
Project management and partners	Office for Fauna, Forestry and Nature of the canton of Neuchâtel
Duration	2009–18
Total volume	2009: CHF 250,000 2018: CHF 100,000
Funding	<ul style="list-style-type: none"> Federal government contribution (as part of programme agreement): CHF 227,500 (65%) Contribution from the canton of Neuchâtel (as part of the programme agreement): CHF 122,500 Contributions from communes: nil Contributions from third parties: nil Canton's own resources: CHF 42,000
Use of funds	<ul style="list-style-type: none"> Construction company (local): around CHF 287,500 (of which CHF 187,500 in 2009 and CHF 100,000 in 2018) for the work to minimise soil erosion in 2009 and 2018. Forestry companies (local): approx. CHF 37,500 for the forestry work in 2009 (one-off). Sawmill (local): approx. CHF 25,000 in 2018 for the processing of the timber and the provision of timber for the revitalisation work (one-off).

4.1.2 Desired effects (outcome)

Environment

The most important effect of the revitalisation of the Marais-Rouge raised bog on the environment is the increase in the diversity of species shown by the monitoring of the two measures (2009 and 2018). For example, the increase in the amount of peat moss and the return to the area of two national priority dragonfly species (NPS), the large white-faced darter and the dark whiteface (FOEN 2019).

Economy

Implementation/project coordination: the canton of Neuchâtel managed the project. The Office for Fauna, Forestry and Nature (Service de la faune, des forêts et de la nature, SFFN) coordinated the project, concluded contracts with the implementing companies, supervised the work and carried out monitoring. Monitoring is still being carried out.

Implementing actors: the SFFN used the funds provided for the project as follows:

- A local construction company was commissioned to carry out the work on the elevated bog to minimise the sloping topography caused by soil erosion (FOEN 2019).
- Local forestry companies were also commissioned to carry out forestry work as part of the revitalisation.
- A sawmill from the region processed timber for its own products, on one hand, and also provided timber for the revitalisation work on the other.

Value creation and employment effects: In total, the funding for the project amounts to around CHF 392,000 (tab. 4). The project enabled value creation of around CHF 194,000 to be generated at local level over the project term of ten years. It created around two full-time equivalent (FTE) positions at local companies. A further CHF 73,000 in value creation is accounted for by external companies and the remaining CHF 125,000 was spent on preliminary services in Switzerland and abroad. Local value creation is the income received as salary by employees of the local companies involved in the project. By spending this income, the employees in turn generate value creation and employment.

Table 4. Overview of the funding of the measures and the use of funds (CHF) in the 'Revitalising Marais-Rouge' case study.

Funding [CHF]		Usage [CHF]	
Federal government	227,500	Local value creation	194,000
Cantons	122,500	External value creation	73,000
Communes	0	Preliminary services from Switzerland/abroad	125,000
Third parties	0		
Canton's own resources	42,000		
Total amount of funding	392,000	Total amount used	392,000

Society

The revitalised part of the raised bog will not initially be used for recreational or tourist purposes²¹ and will therefore have no direct effects on society (e.g. contribution to education). The implementation of the measure by the actors involved (construction company etc.) does not have any direct effects on society either, for example, as would have been the case through the employment of unemployed persons or persons on civilian service. Additional effects are described in the following section.

²¹ Information from the canton of Neuchâtel

4.1.3 Additional effects (impact)

Environment

The project maintains and increases biodiversity in the Marais-Rouge raised bog. Biodiversity is the basis for ecosystem services – in particular supply services such as the natural supply of drinking water²² – it enables a cooling microclimate and acts as a flood reservoir and as an environmental archive²³. Various studies show that the revitalisation of raised bogs also contributes to climate protection (fens as a carbon sink, e.g. Gubler 2017). The renaturation of a fen can be used for CO₂ compensation, generating income for the region. According to Gubler (2017), the price for the compensation of a tonne of CO₂ with a fen renaturation project in Switzerland is around CHF 76. This could contribute towards partly covering the high costs of the improvement measures. A study from 2017 shows that the funds of federal government and the cantons fall well short of what is required to finance the remediation of the biotope of national importance (Martin et al. 2017).

Economy

The revitalised part of the raised bog is not a local recreational area and nor is it used for touristic purposes. However, a museum and an educational centre are to be built in the extended part of the Marais-Rouge raised bog. The 'Peat bog of Les Ponts-de-Martel' foundation and the 'Maison de la Tourbière' were founded for this purpose²⁴. The impact that the revitalisation or the museum and educational centre will have on visitor numbers cannot be estimated at this stage. It is conceivable that guided group tours of the revitalised part of the bog could be provided in future from the educational centre. According to Knaus (2018) in the case of nature parks, such services have great potential for triggering further economically relevant regional knock-on effects and thus generating value creation.

Society

As the revitalised part of the raised bog will not initially be used for recreational or touristic purposes, the revitalisation will have no specific effects on society. However, in future tours from the planned museum, including an educational centre, could provide special interest groups with access to the raised bog and information about the revitalisation project and its benefits for biodiversity²⁵. Initial work is already under way. These awareness-raising measures could contribute to enabling visitors to gain a better understanding of biodiversity, ecosystems and fens, thereby having a social impact.

4.2 Canton of Graubünden/Uri: Using free-ranging goats to graze dry pastures

4.2.1 Description (output)

There are lots of overgrown dry pastures and meadows, especially in mountain areas. They are no longer used and maintained because they are often very steep and difficult to access. As a result, ecologically valuable habitats are disappearing. The 'free-ranging goats' project aims to counteract such shrub encroachment. A three-strong team of shepherds is leading a herd of around 200 free-ranging goats over dry meadows and pastures of national importance from the Chur Rhine valley in the canton of Graubünden to the Urserental in the canton of Uri and back again during the entire vegetation period. The shepherds bring the goats back to their owners before the onset of winter.

The project received a one-off contribution in 2018 as part of federal government's transfer funds for the programme agreements in the area of the environment. An application was made for another contribution in 2019 (tab. 5). Continuation as part of regional projects is planned for 2020. In 2020, the project with regional character is to be continued at several smaller locations in the cantons of Graubünden and Uri. The plan is to hand the project over to a farming association and to finance it over the long-term using income from meat sales and the direct payments.

²² See concept of ecosystem services (MEA 2005)

²³ <http://kbnl.ch/2017/09/06/klimaschutz-durch-hochmoorrenaturierung/>. (consulted in Jan.-Jun. 2019)

²⁴ <https://www.maisondelatourbiere.ch/en/> (consulted in Jan.-Jun. 2019)

²⁵ e.g. tours are provided by <https://www.torby.ch/>. Upon request for further information, the Torby association referred to the cantonal administration.

Table 5. Summary of the 'free-ranging goats' project case study.

Name	Description
Cantons	Graubünden and Uri
Title	Using free-ranging goats to graze dry pastures
Cantonal survey reference	Section 5.9 (FOEN 2019)
Measures	A team of shepherds leads around 200 goats over overgrown dry pastures
Implementation area	Chur Rhine valley to Urserental, approx. 70 hectares of dry pastures
Project type	Cantons with support from environmental organisation
Project management	Private consultancy
Project partners	Cantons of Graubünden and Uri, Pro Natura (project coordination)
Duration	2018, renewed in 2019 Continuation in 2020 planned
Total volume	2018: CHF 165,000 2019: CHF 69,247 (only federal government) ²⁶
Funding (2018)	<ul style="list-style-type: none"> • Federal government contribution (as part of programme agreement): CHF 99,000 • Contribution from the canton of Graubünden (as part of programme agreement): CHF 44,550, additional contribution from canton's own resources of CHF 14,000 • Contribution from the canton of Uri (as part of programme agreement): CHF 21,450 • Contributions from communes: nil • Summer grazing contributions, contributions from goat owners: CHF 36,000 • Proceeds from sale of goat-meat sausages: CHF 10,000 • Pro Natura contributions: organisation's own contributions for project coordination (approx. CHF 58,500), funds to cover deficit CHF 3,500
Use of funds	<ul style="list-style-type: none"> • Team of shepherds: total of CHF 108,300 (one-off), of which CHF 72,600 for personnel costs and CHF 35,700 for materials etc. (operating costs) • Consultancy: total of CHF 106,300 (one-off), of which 16,200 for marketing, CHF 62,500 for project management and CHF 27,600 for project monitoring

4.2.2 Desired effects (outcome)

Environment

The effects on the environment are positive. According to the consulting office oekoskop, the comparison of photographs of the individual pastures clearly shows that the goats made a significant contribution to combatting shrub encroachment and conserving and promoting the dry pastures and meadows. Environmental experts consider the 'free-ranging goats' project to be an efficient measure for counteracting shrub encroachment. By grazing on shrubs, bushes, young trees and old grass, the animals create space for rare species that like light and warmth. The 'free-ranging goats' project also promotes the following target species: Mountain Pasque Flower (*Pulsatilla montana*), Owlly Sulphur (*Libelloides coccajus*), Yellow Bluestem (*Bothriochloa ischaemum*), Woodland Pink (*Dianthus sylvestris*), St Bruno's Lily (*Paradisea liliastrum*), Six-spot Burnet (*Zygaena filipendulae*), Mountain Apollo (*Parnassius apollo*) and Baton Blue (*Pseudophilotes baton*). In total, over 70 hectares of dry meadows and pastures are being grazed with the herd of goats. The report by 'Info Habitat' on the management of

²⁶ Not taken into account in determining the value creation and employment effects.

biodiverse goat pastures also observed a positive impact. Using six case studies, the report shows that dry pastures and meadows can also be maintained by grazing with goats over the longer term under suitable conditions.

Economy

Implementation/project coordination: the nature conservation organisation Pro Natura managed project coordination, using its own resources to perform this task. The canton of Graubünden performed the following tasks using its own resources: payment of the federal government and cantonal contributions, monitoring of the areas, meetings on promoting and marketing of goat-meat sausages (in cooperation with the Federal Office for Agriculture). The costs for these expenses were incurred in addition to the cantonal contribution and mainly in the form of salary expenses. The Office for Nature and the Environment of the canton of Graubünden estimates that this contribution from its own resources amounts to around CHF 14,000.

Implementing actors: the available funds were distributed as follows:

A planning and consulting office received around CHF 106,000 which funded the following tasks:

- Project management
- Communication and marketing, including meetings with media professionals, Coop and butcher's shops as product purchasers
- Monitoring of success (visits to the pastures before and after implementation of the measure)

Local shepherds who tended the free-ranging goats received around CHF 108,000. The contribution covered personnel and operational costs (materials etc.). The team of shepherds erected and dismantled fences, protected the herd and took care of sick or injured animals. The expenditure on consulting services is generally reduced if the project is repeated or extended to other regions which would mean that the team of shepherds and other actors (e.g. sausage production) would then account for a higher proportion of the direct economic effects.

Value creation and employment effects: The total amount of funding for the project amounts to around CHF 287,000 (tab. 6). The project enabled value creation of around CHF 95,000 to be generated at local level over the project duration of a year. This includes around two full-time equivalent (FTE) positions at local companies. A further CHF 125,500 in value creation is accounted for by external companies with the remaining CHF 66,500 being spent on preliminary services in Switzerland and abroad. The local value creation is the income available to employees of local companies involved in the project. By spending this income, these employees in turn generate value creation and employment.

Table 6. Overview of the funding of the measures and the use of funds (CHF) in the 'free-ranging goats project' case study.

Funding [CHF]		Usage [CHF]	
Federal government	99,000	Local value creation	95,000
Cantons	66,000	External value creation	125,500
Communes	0	Preliminary services from Switzerland/abroad	66,500
Third parties	0		
Canton's and third parties' own resources	76,000		
Additional income (summer grazing contributions, goat owners contributions, revenues from sale of goat-meat sausages)	46,000		
Total amount of funding	287,000	Total amount used	287,000

4.2.3 Additional effects (impact)

Environment

Biodiversity, particularly the dry pastures and meadows, benefits from the project. Neglected dry areas get their typical vegetation back and the wealth of structures and species of underused pastures and meadows is improved.

Economy

The she-goats overwinter with local livestock owners. The young animals are slaughtered in the autumn. A local butcher's shop turns the meat into goat sausages, generating revenues as a result. Coop sells the goat-meat sausages under the Pro Montagna label as 'biodiversity-promoting sausages'. Thanks to the biodiversity label, Coop generates a higher margin than with ordinary sausages and all the additional revenues generated in 2018 of CHF 10,000 were contributed to the funding of the project. The final report on the pilot project proposes not selling the product under the Pro Montagna label but instead as the brand of the butcher's shop – this would make the sausage cheaper and enable it to be sold via various channels.

The success of the 'free-ranging goats' project and the associated marketing of the goat-meat sausages resembles the successful valorisation of the products generated by the parks of national importance. Here the regional value creation (e.g. through the production and marketing of regional products), which extends well beyond purely tourism-induced value creation, makes up a relevant part of the revenues (Swiss Academies of Arts and Sciences 2014, section 5).

The feedback from the livestock owners was mainly positive. Additional livestock owners are interested in allowing their goats to participate in the free-range grazing. Various efforts are being made to replicate the project in other regions (Jura, Entlebuch etc.).

The consulting office responsible for project management identified another positive effect for livestock farming in the canton of Uri. Shrub encroachment of pastures presents a major problem for local livestock farming in Urserental. Thanks to the grazing by the free-ranging goats, the project contributed to the quality and size of cow pastures. According to the project management, it is still too early to observe additional effects, such as on tourism.

Society

The consulting office oekoskop and Pro Natura indicated that there had been an overwhelming and very positive response to the project, oekoskop (2018):

- There were many media enquiries, including news items on Romansch television.²⁷
- The project met with a great deal of approval amongst the local and external population, also because it also revived the tradition of keeping free-ranging goats.
- More and more people registered an interest in shepherding or helping.

²⁷ e.g. <https://www.suedostschweiz.ch/politik/2018-06-12/200-wanderziegen-grasen-fuer-biodiversitaet-im-alpenraum>, <https://www.coop.ch/de/ueber-uns/medien/medienmitteilungen/2018/von-hoch-oben-ziegenwuerste-von-pro-montagna.html> (consulted in Jan.-Jun. 2019)

4.3 Canton of Zug: Repairing a dry stone wall to help the smooth snake

4.3.1 Description (output)

The smooth snake is the most widespread species of snake in Switzerland. However, the smooth snake has almost been eradicated in the Swiss Plateau. With high expectations in terms of habitat, it lives hidden and prefers warm and dry biotopes, such as waste disposal sites, rocky terrain and steppes, pebbly shores and similar areas but also quarries, vineyards, dams and embankments. The smooth snake is a national priority species (NPS). The improvement and creation of habitats is one of the most important measures for NPS.

The canton of Zug had an existing, 100-year-old dry stone wall repaired to create additional habitat for smooth snakes. This dry stone wall is located in the commune of Walchwil, surrounded by farmland and close to forestry. Federal government and the canton each contributed half to the total project costs of CHF 65,000 (tab. 7). The project was coordinated entirely by the canton of Zug.

4.3.2 Desired effects (outcome)

Environment

The repair of the dry stone wall in Walchwil created a valuable habitat and refuge for the smooth snake (FOEN 2019). It also provides a good habitat and refuge for other reptiles (e.g. lizards) and amphibians (e.g. salamander species), many insects and plants. Dry stone walls also provide nutrition, resting places and breeding sites for small mammals and various bird species. These are often typical of the specific environment of dry stone walls and are therefore useful indicator species for monitoring success. In general, dry stone walls, with their gaps and cavities, provide very special habitats for sometimes rare animal and plant species. There are dry and warm conditions on the surface and also special microclimatic conditions in the interior on which certain plant species are dependent. The vegetation found in crevices includes Wall-Rue (*Asplenium ruta-muraria*), Yellow Corydalis (*Corydalis lutea*), Aaron's Beard (*Cymbalaria muralis*), Cypress Spurge (*Euphorbia cyparissias*), types of the Viper's Bugloss species (*Echium* sp.) and various types of the Stonecrop species (e.g. *Sedum acre*) (FLS 2019). Well-positioned dry stone walls also perform an important ecological function as a connecting element which – as part of the ecological infrastructure²⁸ – serves the web of life in Switzerland as well as the mobility and propagation of species.

Economy

Implementation/project coordination: The canton of Zug managed project coordination. The project lasted just under a year from planning stage to conclusion and the maintenance work was carried out within a few weeks. Thus project implementation was very 'streamlined' and, according to the canton, is a good example of an uncomplicated and problem-free biodiversity-promoting measure.

Implementing actors: The local companies involved include a local planning office, two local construction companies for the masonry work and another external company which supplied the materials and disposed of unrequired materials appropriately. An engineering studio was also used for the official surveying. *Value creation and employment effects:* Total funding for the project amounted to around CHF 71,000 (tab. 8). The project enabled value creation of around CHF 34,000 to be generated at local level over the project duration of a year. This includes around 0.3 FTE at a local company. A further CHF 14,000 in value creation is accounted for by external companies with the remaining CHF 23,000 being spent on preliminary services in Switzerland and abroad. The local value creation is represented by the income that employees of the local companies involved in the project have available. By spending this income, these employees in turn generate value creation and employment.

²⁸ As a web of life for Switzerland, the ecological infrastructure makes a significant contribution to securing the key ecosystem services for society and the economy. It consists of core and habitat connectivity areas – distributed across the area in sufficient quality, quantity and with a suitable structure – that are connected to one another and to valuable areas of neighbouring countries abroad. It takes account of the development and mobility requirements of the species in its dispersal area, including under changing general conditions, such as climate change. Over the long term, it ensures habitats can function and regenerate and – together with responsible use of the natural resources in the entire area – constitutes the basis for rich biodiversity capable of responding to changes.

Table 7. Summary of the 'Repairing a dry stone wall to help the smooth snake' case study.

Name	Description
Canton	Zug
Title	Repairing a dry stone wall to help the smooth snake
Cantonal survey reference	Section 5.24 (FOEN 2019)
Measures	Repairing an existing 100-year-old dry stone wall
Implementation area	Commune of Walchwil
Project type	Cantonal
Project partners	Canton of Zug
Duration	2017 to 2018
Total volume	CHF 65,000 (one-off)
Funding	<ul style="list-style-type: none"> • Federal government contribution (as part of programme agreement): CHF 32,500 (share of 50%) • Contribution from the canton of Zug (as part of programme agreement): CHF 32,500 (share of 50%) • Contributions from communes: nil • Third-party contributions: nil • Canton's own resources: approx. CHF 6,000
Use of funds	<ul style="list-style-type: none"> • Planning office (outside of canton): approx. CHF 800 (one-off) for the planning of the repair of the wall. No planning permission was required. The further planning work was carried out by the canton (estimated at two weeks of work, canton's own resources) • Construction companies used for installations, masonry work, disposal of materials: <ul style="list-style-type: none"> ○ CHF 25,000 for dismantling and construction of installations (one-time, local company from the commune) ○ CHF 33,400 for the construction of the wall (cantonal enterprise) • Material costs (procurement outside of canton): approx. CHF 5,000 (one-off) • Official surveying: CHF 600 (one-off, cantonal engineering office) • Commune of Walchwil: CHF 250 in fees (one-off) • No maintenance costs for the wall. The maintenance of the pastures and hedgerows are covered by direct agricultural payments (the dry stone wall is located in an agricultural zone)

Table 8. Overview of the funding of the measures and the use of funds (CHF) in the 'Repairing a dry stone wall to help the smooth snake' case study.

Funding [CHF]		Usage [CHF]	
Federal government	32,500	Local value creation	34,000
Cantons	32,500	External value creation	14,000
Communes	0	Preliminary services from Switzerland/abroad	23,000
Third parties	0		
Canton's own resources	6,000		
Total amount of funding	71,000	Total amount used	71,000

Society

In Switzerland, dry stone walls are sometimes repaired or built by persons on civilian service, unemployed persons participating in employment schemes or volunteers (young people and adults). The local construction sector and local farmers are also sometimes trained in how to build dry stone walls, enabling these farmers to generate additional income.

A company specialised in dry stone walls was used to repair the dry stone wall in Walchwil (no use of volunteers or employment schemes). As a result, this project achieved less of a social impact than other dry stone wall projects.

4.3.3 Additional effects (impact)

Environment

Dry stone walls contribute towards the preservation of biodiversity and the structural diversity of a landscape. As support walls, they divide steep slopes, creating varied terraced landscapes. In this way they help to connect ecologically valuable habitats and to divide the landscapes into small parcels of land.

Through their ecological impact – in other words, the general benefits for preserving and promoting biodiversity – they safeguard other ecosystem services. For example, the creation of habitats for insects results in better pollination for neighbouring agricultural areas and contributes towards protection of the gene pool of agricultural crops.

Economy

The training of local construction companies and farmers contributes towards the long-term preservation of traditional crafts (also see the next section 'Society') but also enables additional income, albeit relatively modest, to be generated which improves farmers' budgets. In some places dry stone walls also provide protection against landslides, rockfall, avalanches and flooding (FLS 2019). The inclusion of the traditional craft of dry stone wall building in the UNESCO list of intangible cultural heritage recognised the importance of dry stone wall building. This may have a positive impact on the tourism sector where dry stone walls or entire cultural landscapes can be marketed in a new or improved way for tourism or regional economic purposes.

Society

The dry stone wall in Walchwil contributes to a varied landscape and to its aesthetic value. This positive perception was empirically proven by Home et al. (2014): amongst the persons surveyed who expressed a preference for a landscape, around half prefer landscapes with connecting landscape elements, such as those containing dry stone walls. The dry stone wall also has cultural value for the local population. The historic dry stone wall was 100 years old and was close to collapse. Recognising and maintaining the cultural landscape strengthens the local population's identification with the landscape. There has been lots of positive feedback from the village of Walchwil, especially from older people, who expressed their delight at the traditional craftsmanship. According to the Swiss Landscape Fund (FLS, 2019), the dry stone wall is a living expression of a culture – a way of life and economic activity rich in tradition – that has left its mark on the landscape.

4.4 Canton of Basel-Stadt: Measures to help redstarts

4.4.1 Description (output)

A 'Canton of Basel-Stadt Redstarts' action plan was drawn up in the canton of Basel-Stadt in 2011. The action plan aims to stabilise the redstart population in the canton and to increase it over the medium term. To achieve this goal, measures were implemented up to 2020 in areas where redstart populations are currently found or could potentially exist. In 2017 and 2018, the measures focused on enhancing allotment areas. In all, the canton of Basel-Stadt's nature conservation agency has upgraded ten allotments as 'stepping stone' biotopes and habitats for redstarts (tab. 9). The measures include the provision of nesting boxes, the creation of suitable plots of land, the development of extensive, insect-rich structures, the modification of the mowing system (incl. leaving sub-plots untouched), leaving old grass untouched, the extensification of meadow areas, the creation of piles of branches, leaving dead wood untouched, the conservation of hedges and the planting of fruit trees (Hintermann & Weber 2016). The measures implemented also included building dry stone walls. The redstart population in the canton's territory has since been checked annually. The measures will be continued over the coming years and extended into agricultural areas.

4.4.2 Desired effects (outcome)

Environment

The abovementioned measures enhanced habitats for redstarts or created new ones. This promotes the settlement of rhinoceros beetles and many other insects as well as the settlement of reptiles (e.g. lizards), small mammals (e.g. hedgehogs, bats) and various plant species. These other species are indicator species in some cases and are helpful to the monitoring of redstarts. Habitats rich in structures, which perform key corridor functions for various animal and plant species, were also created.

Economy

Implementation/project coordination: The Municipal Parks and Gardens Department of the canton of Basel-Stadt managed the project coordination. It also carried out site visits and monitoring activities.

Implementing actors: The allotments require regular maintenance which is carried out by local gardening companies. The gardening work and the communications services (incl. printing of brochures) were awarded to local companies. The consultancy services were also provided by a local environmental firm. A local social organisation was also involved in the project.

Value creation and employment effects: The total amount of funding for the project stands at around CHF 107,000 (tab. 10). The project enabled value creation of around CHF 56,700 at local level over the project duration of four years. This includes around 0.5 full-time equivalent (FTE) positions at local companies. A further CHF 12,800 in value creation is accounted for by external companies with the remaining CHF 37,500 being spent on preliminary services in Switzerland and abroad. The local value creation is represented by the income available to employees of the local companies involved in the project. By spending this income, these employees in turn generate value creation and employment.

Table 9. Summary of 'Measures to help redstarts' case study.

Name	Description
Canton	Basel-Stadt
Title	Measures to help redstarts
Cantonal survey reference	Section 5.7 (FOEN 2019)
Measures	Enhancement of ten allotments as 'stepping stone' biotopes and habitats for redstarts as part of nature conservation
Implementation area	Ten allotments
Project type	Cantonal
Project partners	Municipal Parks and Gardens Department of the canton of Basel-Stadt
Duration	2016–19 (with continuation)
Total volume	CHF 103,800
Funding	<ul style="list-style-type: none"> • Federal government contribution (as part of programme agreement): CHF 41,500 (contribution of 40%) • Contribution from the canton of Basel-Stadt (as part of programme agreement): CHF 62,300 (contribution of 60%) • Contributions from communes: nil • Contributions from third parties: nil • Canton's own resources: approx. CHF 3,200
Use of funds	<ul style="list-style-type: none"> • Transformation of the plots: approx. CHF 49,900 (gardening company, one-off) • Biologist consultation fee: CHF 2,800 (one-off) • Trinational environment centre: CHF 8,300 (one-off) • Building of nesting boxes: CHF 18,800 (social organisation for young people, one-off) • Communication services (incl. printing of brochures): CHF 24,000 (one-off)

Society

Several elements of the project make various direct contributions of social relevance. Public awareness about redstarts and nature conservation was raised through a brochure. The allotment holders were directly involved in the project with the provision of various practical tips.

By organising site visits, the Municipal Parks and Gardens Department provided valuable educational activities for allotment holders and passers-by (walkers and cyclists etc.). They play an important role by passing knowledge on.

In view of its urban setting, the project raises awareness due to its high visitor footfall. Various feedback from the public indicates that the perception of the intangible asset of well-established species like redstarts contributes to the preservation of the knowledge passed on by previous generations and to the general appreciation of nature and local recreational areas.

The nesting boxes used in the project were also made by a social organisation for young people. This means they also contribute indirectly to the success of the project.

Landscape gardening apprentices were trained as part of the construction of dry stone walls during project weeks. This met with great approval from apprentices and trainers. The fences required for the garden plots were also made by the apprentices.

The elimination of invasive neophytes or other extraordinary tasks were carried out by social organisations (e.g. employment scheme for the unemployed).

Table 10. Overview of the funding of measures and the use of funds (CHF) in the 'Measures to help redstarts' case study.

Funding [CHF]		Usage [CHF]	
Federal government	41,500	Local value creation	56,700
Cantons	62,300	External value creation	12,800
Communes	0	Preliminary services from Switzerland/abroad	37,500
Third parties	0		
Canton's own resources	3,200		
Total amount of funding	107,000	Total amount used	107,000

4.4.3 Additional effects (impact)

Environment

In this example, the general benefits for biodiversity and the related ecosystem services are focused on the enhancement of the natural environment in the urban area. The creation of habitats for insects resulted in better pollination of the allotments and neighbouring agricultural areas. Through the planting of shrubs, the de-paving of the ground and leaving old trees untouched, the measures had a climate-regulating cooling effect in the urban area which should not be underestimated.

Economy

The Municipal Parks and Gardens Department is generating indirect economic effects through its awareness-raising activities: the holders of the allotment plots and the general public are being encouraged to buy suitable, high-quality plants. This also benefits nurseries and garden centres etc. The purchase of bee hotels and bat boxes is also being encouraged. The Municipal Parks and Gardens Department also sometimes tries to persuade gardeners and allotment holders to use a landscaping company to build certain structures, such as dry stone walls.

Society

The project generated nationwide media coverage in Switzerland (e.g. TV programme on 'Schweizer Radio und Fernsehen SRF' and an article in the daily newspaper '20 Minuten'). Further projects aimed at raising public awareness have since been launched e.g. 'Mission B', an initiative organised by SRF²⁹. Studies are also being carried out, including one by the Swiss Federal Institute for Forest, Snow and Landscape Research WSL on allotments.³⁰

Giving allotments a rich design in terms of structures and habitats makes them more attractive as places to visit and of local recreation. This is also indicated by a broad-based survey conducted by the WSL together with the Research Institute of Organic Agriculture (FiBL).³¹

²⁹ <https://missionb.ch/> (consulted in Jan.-Jun. 2019)

³⁰ Artenreiche Gärten: Oasen im Siedlungsraum von hohem sozialem Wert (Biodiverse gardens: oases of great social value in urban areas) (Website only. Consulted in May-June 2019): [Species-rich gardens: social meeting points in residential areas - WSL](#)

³¹ Artenreiche Gärten: Oasen im Siedlungsraum von hohem sozialem Wert (Biodiverse gardens: oases of great social value in urban areas) (Website only. Consulted in May-June 2019): [Species-rich gardens: social meeting points in residential areas - WSL](#)

4.5 Canton of St.Gallen: Helping the capercaillie at the Amden forest reserve

4.5.1 Description (output)

The capercaillie lives in mountain forests rich in structures which are relatively undisturbed by people. The capercaillie population in Switzerland has been declining for decades and the dispersal area of this forest bird is becoming increasingly smaller. In view of this situation, FOEN published a national action plan on the protection and promotion of the capercaillie in 2008. FOEN has since been supporting the cantons that promote this highly endangered forest bird species as part of the programme agreements.

An approx. 975-hectare area of forestry in the commune of Amden was designated as a special forest reserve in the canton of St.Gallen in 2006, the main aim of which is to preserve and enhance the habitat for the capercaillie. Careful thinning (including on forest edges), the promotion of the silver fir and the tending of young forest has created light mixed mountain forest with an underlayer of bilberry bushes. These improvements also benefitted the extensive upland and lowland fens of national importance. These are key requirements in relation to the habitat of the capercaillie which is an endangered and national priority species in Switzerland. In the special forest reserve, synergies exist between promoting forest biodiversity and the project objectives in the area of nature conservation (PO3, promotion of several national priority species). The silvicultural impact analyses and capercaillie population surveys conducted in the winters from 2015 to 2017 confirm the positive effects of the habitat improvements in the forest reserve on the capercaillie population in the commune of Amden.

In the canton of St.Gallen, the forestry contributions are generally paid to the forest owners, as they are responsible for forest management. In the case of the Amden forest reserve, the forest owner is the local commune itself (without tax jurisdiction). The maintenance work was carried out by the Amden community forest enterprise and a private forestry company.

The basic costs for the voluntary contractual safeguarding of the forest reserve over a 50-year period and for compensation for the discontinuation of timber use (natural forest section; in Amden without loss of revenue) were met with funds for the funding of immediate measures for forest biodiversity. The amount was CHF 810,000 and in 2017 was paid out by the canton of St.Gallen for the full 50-year project period. Federal government and the canton each contributed half of the funding. The measures to enhance the habitat were contractually agreed with the local commune per programme period. The gross costs stand at around CHF 200,000 per year and the revenue from the sale of timber is around CHF 100,000 per year. The remaining amount of CHF 100,000 was met by contributions from the programme agreement with federal government. The local commune also receives around CHF 100,000 per year for targeted forest management measures within the reserve. The costs are met by the contributions from the programme agreement and from the revenue generated by the timber sales (tab. 11).

4.5.2 Desired effects (outcome)

Environment

Forest reserves – in contrast to old wood areas or biotope trees – cover very large areas which are secured long-term with contracts. In forest reserves, nature conservation objectives take precedence over other requirements and forest functions, making them an optimal protective instrument (Ehrbar et al. 2015). In the Amden special forest reserve, carefully thinning (including on forest edges), the promotion of the silver fir and the tending of young forest has created a light mixed mountain forest with well-established bilberry bush vegetation. These are key requirements for the habitat of a capercaillie. The measures contributed to increasing the capercaillie population. With the capercaillie as an 'umbrella species', lots of other rare species are also being promoted which are not being targeted, such as the Three-toed Woodpecker (key species), the Woodcock (good indicator for forest structure), the Pygmy Owl, the Hazel Grouse and many other species which are unknown. As a result, attractive habitats are also created for the game.

Table 11. Summary of the 'Amden forest reserve to help the capercaillie' case study.

Name	Description
Canton	St.Gallen
Title	Amden forest reserve to help the capercaillie
Cantonal survey reference	Section 5.16 (FOEN 2019)
Measures	Maintenance of forest reserve (forest management: thinning, promotion of the silver fir, dead wood enrichment, thinning at the forest edges etc.)
Implementation area	Commune of Amden (SG)
Project type	Cantonal forest reserve
Project partners	Canton of St.Gallen, commune of Amden, Switzerland. Swiss Ornithological Institute in Sempach and Swiss Federal Institute for Forest, Snow and Landscape Research WSL
Duration	2016–19 (four-year programme agreement phase)
Total volume	CHF 810,000 (for 50 years) 50% federal government contribution and 50% cantonal contribution ³² .
Funding	<ul style="list-style-type: none"> • Federal government contribution (as part of programme agreement): CHF 405,000 (one-off) • Contribution from the canton of St.Gallen (as part of programme agreement): CHF 405,000 (one-off) • Contribution from communes: nil • Contributions from third parties: contributions from own resources in Switzerland. The Swiss Ornithological Institute in Sempach, the Swiss Federal Institute for Forest, Snow and Landscape Research WSL and the Forestry Service in the form of publications/public relations work, coordination meetings • Income from sale of timber: around CHF 100,000 a year³³ • Canton's own resources: around CHF 100,000
Use of funds	<ul style="list-style-type: none"> • Costs for forest maintenance measures and timber harvest (Amden community forest enterprise): around CHF 140,000 per year • Costs for wood harvest via helicopter: approx. CHF 60,000 per year

Another key aspect of the measures for the capercaillie is the creation of ecologically valuable dead wood areas. Old wood and dead wood are important elements of the forest ecosystem and play a vital role in the lifecycle of many organisms. Old wood and dead wood provide nesting opportunities for breeding birds, food and habitat for insects, which in turn provide sources of nutrition for birds and other insect eaters³⁴. In the Amden special forest reserve, the process of the natural dying-off of trees is being used to promote the supply of dead wood in the forests. The wood left on the ground when trees are felled improves the supply of dead wood and benefits rare insects and fungi species.

³² The measures for the enhancement of the habitat are set out in the programme agreement with federal government. Measures are agreed with the local commune in a contract per programme period. The canton contributes around 50% to the cost of the measures.

³³ To determine the value creation and employment effects, we deducted the income from the sale of timber from the gross costs and only included the net costs. The contributions from federal government and the canton are used to meet the net costs.

³⁴ Also see <https://totholz.wsl.ch/de/funktionen-von-totholz> (consulted in Jan.-Jun. 2019)

The third aspect from an environmental perspective is the optimised management of the lowland fen in the special forest reserve (in accordance with NCHA³⁵ and ForA³⁶). The forest reserve area has significant potential in terms of landscape ecology with a high proportion of lowland and upland fens which are interconnected by the forest areas (Ehrbar et al. 2015).

Economy

Implementation/project coordination: The canton of St.Gallen managed project coordination. The regional and district forest rangers (canton) are responsible for the planning and approval of the felling of timber and ensuring that it is carried out correctly. The operational manager (district forest ranger on behalf of the local commune) implements the measures with their own forestry enterprise or forestry contractors. The Swiss Ornithological Institute in Sempach, the Swiss Federal Institute for Forest, Snow and Landscape Research WSL and the Forestry Service supported the project with expertise while at the same time conducting research in the area (using their own resources). This workload is estimated at around 20 working days per year for the canton, the Swiss Ornithological Institute in Sempach and the Swiss Federal Institute for Forest, Snow and Landscape Research WSL. There is regular exchange of knowledge between the project participants.

Implementing actors: The companies involved included those commissioned for forest maintenance and timber harvesting. This was primarily the local forestry enterprise of the local commune of Amden, which has been maintained thanks to the forest reserve and employs twice as many staff since the foundation of the special forest reserve (local value creation in the mountain area). Some of the timber is collected from the forest by an external company by helicopter as the area is very steep in parts and therefore difficult to access (it was decided not to extend the forest roads). As a result, some of the timber revenues (around 30%) go to a company which carries out the helicopter flights (external value creation).³⁷

Value creation and employment effects: In total, the funding for the project stands at around CHF 810,000 (tab. 12) in addition to the contributions from the canton's own resources of around CHF 100,000 over the four-year period. The project enabled value creation of around CHF 344,000 to be generated at local level over the project duration of four years. It created around 6.5 full-time equivalent (FTE) positions at local companies. A further CHF 295,000 in value creation is accounted for by external companies and the remaining CHF 271,000 was spent on preliminary services in Switzerland and abroad. Local value creation is represented by the income received by employees of the local companies involved in the project. By spending this income, the employees in turn generate value creation and employment.

Table 12. Overview of the funding of the measures and the use of funds (CHF) in the 'Amden forest reserve to help the capercaillie' case study

Funding [CHF]		Usage [CHF]	
Federal government	405,000	Local value creation	344,000
Cantons	405,000	External value creation	295,000
Communes	0	Preliminary services from Switzerland/abroad	271,000
Third parties	0		
Canton's own resources	100,000		
Total amount of funding	910,000	Total amount used	910,000

³⁵ Nature and Cultural Heritage Act, NCHA, SR 451.0

³⁶ Forest Act, ForA, SR 921.0

³⁷ According to the canton, such interventions are undertaken as rarely as possible and only as often as necessary for forest maintenance to keep the disturbance of capercaillie to a minimum. Extending the forest road was decided against but this means timber must be collected from the forest by helicopter.

Society

The reserve contributes to environmental education. An information panel and training room were constructed on site. Lots of trips for school classes, specialist professionals, local people, day-trippers and holiday-home owners take place in the area. They are well attended and interest in the forest reserve is deemed high by the project managers.

4.5.3 Additional effects (impact)

Environment

The Amden special forest reserve is enabling and making a significant contribution towards research on the capercaillie in Switzerland which is being coordinated and carried out by the Swiss Ornithological Institute in Sempach and the Swiss Federal Institute for Forest, Snow and Landscape Research WSL.

At superordinate level, the forest reserve contributes towards improving the performance of the ecosystem services, such as the diversity of species (gene pool) and protection against natural hazards, such as landslides and mudslides.

Economy

The work in the forest reserve has helped to maintain the local forestry enterprise of the commune of Amden. Compared to the situation before 2006, it now employs twice as many trained employees and an apprentice. The local employment is also increasing acceptance of the forest reserve amongst the local population and expertise about management of the reserve is being retained locally (interface with impact at social level).

The decision to refrain from grazing on the Schafberg as part of the special forest reserve (since 2000) in favour of wild ungulates (red deer, roe deer, chamois, ibex) and, in general, the creation of attractive habitats for game is contributing towards greater benefits for fauna and, to a certain extent, also hunters.

Another positive effect, which was not previously recorded quantitatively, is a possible increase in the attractiveness of the Amden region as a tourist destination. Sparse forests create a more attractive landscape and may attract more tourists (e.g. hikers, ski touring, mountain bikers) who eat in local restaurants and use local accommodation. The organisation of conferences or training events may achieve similar effects. Since the establishment of the forest reserve, training days as part of national gamekeeper training and the national conference on the management of mountain forests have been held in Amden. International natural history delegations have also organised events here.

Society

The enhanced forest image is appealing to lots of people seeking recreation, such as day-trippers, holiday-home owners and the local population. Tiered forests, timber left untouched and thinned forest edges provide attractive and diverse forest scenery. This has increased appreciation of the forest – people were mainly aware of the protection forest in the past. There has been lots of positive feedback from visitors. According to the forest ranger, the residents of Amden are very proud of their forest, particularly in light of media coverage.

In 2006, the commune of Amden received the 'Binding Waldpreis' award from the Sophie and Karl Binding Foundation (endowed with CHF 250,000). This resulted in various publications and media articles. According to the forest ranger, all these factors have contributed to the increased profile, positive image and acceptance of the forest reserve. The findings in Amden are also evident in other regions with parks of national importance (Swiss Academies of Arts and Sciences 2014) which strengthen cultural and agricultural values and the local identity.

4.6 Canton of Nidwalden: Habitat improvement at the Rieter Oberrickenbach fen

4.6.1 Description (output)

The Woodland Brown, a rare species of butterfly, both nationally and in the canton of Nidwalden, was spotted for the first time in half a century in 2006 in the Rieter Oberrickenbach fen (canton of Nidwalden). It was designated as a target species for the region which is why specific measures for the Woodland Brown were implemented (Von Moos 2010). In the fen the adjacent forest is being thinned and the forest edges are being given a tiered structure. These measures prevent shrub encroachment, reduce shadowing, forest litter and root competition around the forest edges and provide a more diverse forest edge structure. This means the area is ideally suited as a habitat for the Woodland Brown and around 60 other butterfly species. The enhancement of the fen has also created synergies between the promotion of forest biodiversity and the project objectives in the area of nature conservation (PO3, promotion of several national priority species). The maintenance of the forest has also enabled traditional agricultural management to be carried out again.

The project costs amount to CHF 187,000. The federal and cantonal authorities paid a total of CHF 105,000 with CHF 82,000 coming from timber revenues, i.e. from the landowners (FOEN 2019). The measures were implemented in four stages, each with a volume of around CHF 30,000 to CHF 60,000 (tab. 13).

4.6.2 Desired effects (outcome)

Environment

The most important environmental effect of the enhancement of the Rieter Oberrickenbach fen is reflected in the promotion of biodiversity. The measure is specially designed for the Woodland Brown, a rare species both nationally and in the canton, which was therefore designated as a target species for the fen. The project also promotes a further 60 butterfly species (FOEN 2019).

Economy

Implementation/project coordination: The canton of Nidwalden was responsible for the implementation of the project inside and outside of the forest. The activities inside the forest were coordinated by the Forestry and Energy Office while the Department of Nature and Landscape Conservation was responsible for those outside of the forest (e.g. agricultural management) – (FOEN 2019).

Implementing actors: A local forestry engineering studio drew up a plan to implement the measure in close cooperation with the Forest and Energy Office (Von Moos 2010). This plan describes the forestry work to be carried out in detail. This work, which only took place in the forest and on the forest edges, was carried out by local forestry companies.

Value creation and employment effects: In total the funding of the project stands at around CHF 229,000 (tab. 14). The project enabled value creation of around CHF 109,000 to be generated at local level over the project term of ten years. It created two full-time equivalent (FTE) positions at local companies. A further CHF 53,000 in value creation is accounted for by external companies with the remaining CHF 67,000 being spent on preliminary services in Switzerland and abroad. The local value creation is the income available to employees of local companies involved in the project. By spending this income, these employees in turn generate value creation and employment.

Table 13. Summary of the 'Habitat improvement at the Rieter Oberrickenbach fen'

Name	Description
Canton	Nidwalden
Title	Habitat improvement at the Rieter Oberrickenbach fen
Cantonal survey reference	Section 5.14 (FOEN 2019)
Measures	Enhancement of forest edges and agricultural management to prevent the fen from becoming wooded
Implementation area	Rieter Oberrickenbach
Project type	Cantonal
Project management	Canton of Nidwalden
Duration	2011–20
Total volume	CHF 187,000
Funding	<ul style="list-style-type: none"> • Federal government contribution (as part of programme agreement): approx. CHF 52,500 (estimated at around 50%) • Contribution from the canton (as part of programme agreement): approx. CHF 52,500 (estimated at around 50%) • Contributions from communes: nil • Contributions from third parties: CHF 82,000 from timber revenues of landowners • Canton's own resources: approx. CHF 42,000
Use of funds	<ul style="list-style-type: none"> • Forestry engineering studio (local): approx. CHF 25,000 for planning and design of the measure (one-off). • Forestry company (local): approx. CHF 162,000 for the work in the forest (in four stages at intervals of two to three years: Stage 1: CHF 33,270; stage 2: CHF 61,380; stage 3: CHF 37,380; stage 4: CHF 30,330; according to forest management plan).

Table 14. Overview of the funding of the measures and the use of funds (CHF) in the 'Habitat improvement in the Rieter Oberrickenbach fen' case study.

Funding [CHF]		Usage [CHF]	
Federal government	52,500	Local value creation	109,000
Cantons	52,500	External value creation	53,000
Communes	0	Preliminary services from Switzerland/abroad	67,000
Third parties	82,000		
Canton's own resources	42,000		
Total amount of funding	229,000	Total amount used	229,000

Society

The project has not been used for environmental education nor marketed for touristic purposes so far. No specific direct effects on society have been identified.

4.6.3 Additional effects (impact)

Environment

The project maintains and increases biodiversity in the Rieter Oberrickenbach fen. Even though the topic of CO₂ storage in this fen has not been analysed thus far, various studies indicate that the conservation of fens contributes to climate protection, for example as a carbon sink. CO₂ compensation measures have been launched as part of renaturation projects in some cases, generating income for the enhancement measures.

Economy

The timber generated was sold to a local sawmill and to local wood energy users. The processing of the wood by the sawmill generates value creation and employment. Agricultural management of the fen has been made easier and more effective thanks to the measures implemented.

Society

The project has not been used for touristic purposes nor awareness-raising measures thus far. As a result, no information about the project's impact on society is available.

4.7 Summary of the case studies

On one hand, the case studies highlight the diversity of the measures implemented (level of output, for example, the enhancement of a fen or the shepherding of free-ranging goats on alpine pastures), and, on the other, the diversity of the types of impact that investment by federal government and the cantons in the areas of nature conservation and forest biodiversity as part of the programme agreement periods can have on the environment.

The main aim of the measures implemented is always the promotion and conservation of biodiversity. There are also additional – mainly positive – effects on the environment, society and economy. These additional effects can be direct (level of outcome, for example value creation and employment effects on the agricultural or forestry companies directly commissioned to implement the projects) or additional, long-term effects (level of impact, if, for example, the local population or tourists enjoy the greater biodiversity and more diverse landscapes or if restaurants benefit from an increase in visitor numbers in the area concerned).

The information basis of the case studies examined is very heterogenous and does not provide a (qualitatively adequate) basis for all examples evaluated in this study (FOEN 2019). However, interviews and discussions with the actors involved enabled the information gaps to be filled. As a result, most of the effects in the three areas of environment, economy and society could be recorded and presented (tab. 15).

Table 15. Overview of the case studies and the main effects of the investments on the environment, economy and society.

Abbreviations: PA = programme agreements; FTE = full-time equivalent; VC = value creation, OF = own funds.

	NE: Revitalising the Marais-Rouge (section 4.1)	GR/UR: Free-ranging goats project (section 4.2)	ZG: Repairing a dry stone wall (section 4.3)	BS: Measures to help redstarts (section 4.4)	SG: Amden forest reserve (section 4.5)	NW: Rieter Oberriekenbach fen (section 4.6)
Volume (CHF)	<i>Federal government (PA): 227,500 Canton (PA): 122,500 Canton's OF: 42,000</i>	<i>Federal government (PA): 99,000 Canton (PA): 66,000 NGO (incl. OF): 62,000 Canton's OF: 14,000 Revenue: 46,000</i>	<i>Federal government (PA): 32,500 Canton (PA): 32,500 Canton's OF: 6,000</i>	<i>Federal government (PA): 41,500 Canton (PA): 62,300 Canton's OF: 3,200</i>	<i>Federal government (PA): 405,000 Canton (PA): 405,000 Canton's OF & commune: 100,000</i>	<i>Federal government (PA): 52,500 Canton (PA): 52,500 Canton's OF: 42,000 Timber revenue: 82,000</i>
Environment	Soil removal resulting in increase in biodiversity (including National Priority Species) Indirect: CO ₂ storage	Conserving dry meadows and pasture, increase in biodiversity	Habitat for the smooth snake and other species	Maintaining and increasing biodiversity, corridor functions	Thinning and dead wood zones, maintaining and increasing biodiversity (including National Priority Species)	Habitat improvement/thinning, maintaining and increasing biodiversity (National Priority Species). Indirect: CO ₂ storage
Economy (VC in CHF)	<i>Local VC: 190,000 Local employment: 1.9 FTE External VC: 73,000 Preliminary services: 125,000 Direct VC: construction and forestry sectors, sawmill Indirect VC: education centre and museum</i>	<i>Local VC: 95,000 Local employment: 1.8 FTE External VC: 125,500 Preliminary services: 66,500 Direct VC: Shepherd team, environmental consulting Indirect VC: Sausage production, avoidance of scrub encroachment (improvement of the meadows' quality)</i>	<i>Local VC: 34,000 Local employment: 0.3 FTE External VC: 14,000 Preliminary services: 23,000 Direct VC: construction, transport, waste disposal sectors, surveying company Indirect VC: training of farmers</i>	<i>Local VC: 56,700 Local employment: 0.4 FTE External VC: 12,800 Preliminary services: 37,500 Direct VC: gardening, environmental consulting, communication services. Indirect VC: encouraging garden owners to plant and buy suitable plants</i>	<i>Local VC: 344,000 Local employment: 6.5 FTE External VC: 295,000 Preliminary services: 271,000 Direct VC: forestry company, timber harvest Indirect VC: increase in attractiveness as a tourist destination, holding of events and educational activities</i>	<i>Local VC: 109,000 Local employment: 2.1 FTE External VC: 53,000 Preliminary services: 67,000 Direct VC: forestry company and forestry engineering studio Indirect VC: supply of sawmill, less expenditure on agricultural/maintenance work</i>
Society	Only indirect: environmental education through educational centre and museum	Positive media coverage; raising awareness of traditional crafts; 'popular project'	Contribution to landscape; cultural and historical value	Information/education of local population; involvement of social organisations; popular project; significant & positive media coverage	Environmental education; attractive landscape and identification of the local population with 'their' forest; positive media coverage	Only indirect: enhancement of landscape

5 Literature analysis: findings from Switzerland and abroad

5.1 Overview

The literature analysis focuses on the following three topics: methods for assessing the impact of specific environmental measures or measures in the area of biodiversity (section 5.2), the empirically proven effects of biodiversity-promoting measures on the economy and society (section 5.3) and funding opportunities for biodiversity-promoting measures (section 5.4). The findings from the literature analysis are reflected, on one hand, in the case studies and discussed in the description of their effects (section 4) and, on the other, are addressed in the synopsis (section 7).

5.2 Impact assessment methods

Methods to assess the contribution of nature to people's wellbeing have been further developed over recent years as part of various research and political platforms, e.g. the Economics of Ecosystems and Biodiversity (TEEB) or the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES). The IPBES presents the methodical diversity and outlines various approaches to impact assessment (IPBES 2018a). In general, a distinction can be made between the following approaches to impact assessment:

- Market-oriented approaches, e.g. by observing paid-for admission prices for the use of a nature park;
- Contingent valuation methods, e.g. by carrying out a survey on the willingness to pay for the use of a forest area;
- Non-market-oriented approaches, e.g. travel/transport cost methods or hedonic price structuring whereby conclusions are drawn from the preferences expressed for private goods available on the market about the appreciation of other goods, such as a forest area or nature park;
- Non-monetary approaches, e.g. the qualitative description of the sociocultural value of particular environmental goods or the sensory perception of nature.

As part of the Biodiversity Indicators Partnership³⁸, indicator systems are developed to measure biodiversity and the application of these indicators and, as a result, uniform measurement are promoted.³⁹ However, in the assessment of specific measures, the real challenge lies in plausibly showing the causality between intervention (biodiversity-promoting measure) and effect (maintaining or improving the level of biodiversity), i.e. excluding other influencing factors which may have led to the change observed. This challenge of empirically proving causality clearly also applies to the other areas of the economy and society. For example, the greater popularity of a restaurant near to a raised bog cannot always be clearly attributed to the enhancement measures but may be due to other factors, e.g. the restaurant's cuisine or a friendly proprietor.

The fact that the socioeconomic effects of biodiversity-promoting measures are generally unintended is particularly challenging. An exception in Switzerland is the parks of national importance⁴⁰ for which the impact objectives include sustainable regional development, strengthening the regional identity and education on sustainable development⁴¹ in addition to maintaining and promoting biodiversity.

³⁸ www.bipindicators.net (consulted in Jan.-Jun. 2019)

³⁹ Another similar initiative is that of the Biodiversity Observation Network (BON) which has developed the so-called Essential Biodiversity Variables (EBV), see <https://geobon.org/ebvs/what-are-ebvs/> (consulted in Jan.-Jun. 2019)

⁴⁰ This includes the national parks, the regional nature parks and the nature discovery parks, including the biosphere reserves. See Bundesamt für Umwelt 2018: Handbuch Programmvereinbarungen im Umweltbereich 2020–2024 (manual for programme agreements in the area of the environment 2020–24, available in German, French, Italian only).

⁴¹ Education for sustainable development means that the sustainable development, as an issue affecting the whole of society, aims to involve all actors – including schools. It can help to convey the skills and knowledge required for sustainable development: <http://www.education21.ch> (consulted in Jan.-Jun. 2019)

Other examples are the efforts of 'Grünstadt Schweiz'⁴², 'Stiftung Natur und Wirtschaft'⁴³ and initiatives by communes and cities⁴⁴ to promote biodiversity in urban areas.

In the literature, the assessment of the economic effects of biodiversity-promoting measures is limited to value creation effects. This means that the analyses primarily evaluate whether the measures have resulted in higher revenues and more local employment. For Switzerland and its neighbouring countries, studies are available, in particular, concerning regional nature parks and their value creation in terms of tourism (Backhaus et al. 2013, Knaus 2018). These studies determine effects from tourism value creation in its entirety, i.e. direct effects (demand for goods from tourists e.g. restaurants, hotels, tourist services), indirect effects (preliminary services) and induced effects (spending by people with jobs thanks to tourism demand). With this method it is difficult to determine to what extent the existence and direct services of the park actually contributed to the decision to visit and therefore to value creation. Travel decisions generally depend on many factors, e.g. type of landscape, proximity to place of residence or the tourist service (Swiss Academies of Arts and Sciences 2014).

Estimations of the impact of biodiversity-promoting measures on sociocultural and other non-material values are usually based on contingent valuation methods.⁴⁵ For example, Bade et al. (2011) carried out a decision-making experiment on the willingness to pay for biodiversity-promoting measures in forests. Survey participants were presented with specific options with the costs involved using attributes of the forest (e.g. maintained, left natural). Studies to determine preferences of landscape adopted a similar approach, e.g. Soliva & Hunziker (2009) and Home et al. (2014).

Qualitative methods, such as the structured survey using questionnaires or observations, are also used e.g. to determine the importance of urban community gardens or allotments to social cohesion (Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Research Institute of Organic Agriculture FiBL and IBS⁴⁶).

With the publication of the report 'Biodiversity in Switzerland: Status and Trends' FOEN indirectly evaluates the impact of the measures in Switzerland on the basis that the measures may not yet have achieved the desired impact (FOEN 2017).

⁴² <https://www.gruenstadt-schweiz.ch/de/> (consulted in Jan.-Jun. 2019)

⁴³ <https://www.naturundwirtschaft.ch/> (consulted in Jan.-Jun. 2019)

⁴⁴ For example 'Grün Stadt Zürich': <https://www.stadt-zuerich.ch/ted/de/index/gsz.html> (consulted in Jan.-Jun. 2019)

⁴⁵ Contingent valuation methods are methods for the economic analysis of non-tradeable goods, including many environmental goods and services.

⁴⁶ <https://www.bettergardens.ch> (consulted in Jan.-Jun. 2019)

5.3 Impact of biodiversity-promoting measures on society and the economy

The question of the social and economic benefits of biodiversity is closely linked to that of the impact of biodiversity-promoting measures on society and the economy. Various reports and related research work are taken into account in this report.⁴⁷

5.3.1 Impact on society

An overarching theme in the literature concerns the question of which areas of life are actually affected by biodiversity and in which form. The dividing line from economic effects is blurred. The following areas are included:

- Promotion of health and wellbeing⁴⁸ and recreational benefits (IPBES 2018a, 2018b) where individual studies (e.g. ten Brink et al. 2016) focus more on the (urban) natural space than biodiversity. The biodiversity has a positive effect on the mental and physical health of nature users (Naturkapital Deutschland – TEEB DE 2016; Swiss Academy of Sciences 2019).⁴⁹
- In relation to the impact on mental wellbeing, studies in urban areas show that green spaces improve the wellbeing of urban residents, especially those who manage negative emotions less well by themselves.⁵⁰ The importance of urban community gardens and allotments for mental and physical recreation and recuperation, for social cohesion and biodiversity is currently being analysed by the Swiss Federal Institute for Forest, Snow and Landscape Research WSL and the Research Institute of Organic Agriculture FiBL.⁵¹ The studies show that built-up conurbations often have a lack of plant and animal species and, as a result, are avoided by many people in their leisure time. In contrast, open, unpaved spaces and parks and gardens that lie within them attract people. Most of the people surveyed were clearly in favour of the promotion of biodiversity. This is related, on one hand, to the perceived beauty of nature and, on the other, to the sense of ecological responsibility of those surveyed and because they identify with managed gardens close to nature. The study team recommends incorporating privately managed areas into the biodiversity strategies and concepts of the cities and taking advantage of the commitment of amateur gardeners.
- Social cohesion e.g. through intercultural gardens, meeting in green spaces close to the place of residence, using derelict land for leisure purposes (Naturkapital Deutschland – TEEB DE 2016). Urban gardens play an important social role in addition to their recreational one. They are meeting places and are not just used by allotment holders or owners but also by visitors from the neighbourhood and friendship groups.⁵² Environmental justice is also mentioned in this regard, e.g. provision of sufficient access to urban nature, including for socioeconomically disadvantaged people (Naturkapital Deutschland – TEEB DE 2018).
- Learning and education (IPBES 2018a, 2018b)⁵³, including in particular environmental education for which green learning spaces or nature discovery areas are particularly useful (Naturkapital Deutschland – TEEB DE 2016). The role of natural design elements in maintaining and enhancing

⁴⁷ Newsletter of the 'Informationsdienst Biodiversität Schweiz' IBS: https://naturwissenschaften.ch/organisations/biodiversity/publications/informations_biodiversity_switzerland (consulted in Jan.-Jun. 2019)

⁴⁸ e.g. Swiss Academy of Sciences (2019), "Biodiversität, eine Garantie für Gesundheit?" (Biodiversity – a guarantee of health?): https://naturwissenschaften.ch/uuid/7293f7d9-ef2b-5118-91fc-d8d527d7e4af?r=20190807115818_1572348111_92dc8c72-02b7-56e4-a84b-30f5e2a0f833 (consulted in Jan.-Jun. 2019)

⁴⁹ The Economics of Ecosystems and Biodiversity (TEEB), <http://www.teebweb.org/>; for Germany see the research programme 'Naturkapital TEEB DE': <https://www.ufz.de/teebde/>. According to the authors, Germany played a leading role in applying the methods in evaluation surveys (Naturkapital Deutschland – TEEB DE 2018) (consulted in Jan.-Jun. 2019)

⁵⁰ https://naturwissenschaften.ch/organisations/biodiversity/publications/informations_biodiversity_switzerland/search_details?id=1650 (consulted in Jan.-Jun. 2019)

⁵¹ Artenreiche Gärten: Oasen im Siedlungsraum von hohem sozialem Wert (Biodiverse gardens: oases of great social value in urban areas) (Website only. Consulted in May-June 2019): <https://www.wsl.ch/de/news-seiten/2019/03/artenreiche-gaerten-wertvolle-oasen-im-siedlungsraum.html#tabellement1-tab2>

⁵² Artenreiche Gärten: Oasen im Siedlungsraum von hohem sozialem Wert (Biodiverse gardens: oases of great social value in urban areas) (Website only. Consulted in May-June 2019): <https://www.wsl.ch/de/news-seiten/2019/03/artenreiche-gaerten-wertvolle-oasen-im-siedlungsraum.html#tabellement1-tab2>

⁵³ The regional report on Western Europe of IPBES (2018a) and its summary (IPBES 2018b) contain comprehensive documentation of the status of scientific research on correlations between biodiversity and social values.

areas of recreation, exercise and discovery close to nature was analysed in a concept study (HSR 2017) for the canton of Aargau. It shows that the design should be carried out using targeted maintenance measures (HSR 2017).

- Food security, including the pollination of crops, stopping the spread of disease/epidemics, genetic diversity and resilience against drought or pathogens (OECD 2019).
- Water supply security, i.e. quality of soil in wetlands, forest or pastureland, climate protection (mitigation) or resilience to climate-related effects (adaptation) (OECD 2019).
- Contribution to preserving (indigenous) cultures and language regions and spiritual values (IPBES 2018a, 2018b)

The questions of what importance individuals attach to the value of biodiversity for their personal quality of life and how biodiversity can be promoted so that the subjective quality of life ultimately improves are covered extensively in the literature. The following research results were produced:

- Bade et al. (2011) carried out a decision-making experiment on the willingness to pay for biodiversity measures in the forest and determined that those surveyed are willing to accept an increase in their tax bill of CHF 12 to CHF 27 a year for the promotion of endangered animal and tree species for a ten-year period. Tangible, emotionally charged terms, such as 'unspoilt nature' or 'endangered animal and tree species', achieved a positive response, whereas abstract terms, such as the 'diversity of forest species' and the 'genetic diversity of trees', triggered less willingness to pay. The authors estimate the willingness to pay for the promotion of forest biodiversity services for a ten-year project period at CHF 140 to 200 million a year.
- A series of Swiss studies looks at preferences in relation to the landscape of agricultural land, in particular with regard to measures aimed at habitat connectivity areas where biodiversity is being promoted (Soliva & Hunziker 2009; Junge et al. 2011, Home et al. 2014). An analysis was carried out as to whether the age, gender and level of education of those surveyed had an influence on their preferences (i.e. preferences for a particular type of landscape). Soliva & Hunziker (2009) determined that the local population in mountain regions tend to prefer cultural landscapes which means this population group do not favour the impact of biodiversity contributions to a great extent. Home et al. (2014) determined that around half of those surveyed do not have any clear preference for a particular landscape. The other half expressed preferences for diverse landscapes. Of those surveyed, around 50% prefer landscapes with connecting landscape elements (e.g. dry stone walls).
- Home et al. (2014) examined the extent to which preferences for types of landscape can be influenced by the provision of information on ecology. They determined that the provision of information does not have any significant impact on attitudes towards the landscape. The authors conclude from these results that simple, emotionally charged messages to influence landscape preferences are more effective than complex, ecological arguments.

5.3.2 Effects on business and the economy as a whole

Agriculture

Swiss agriculture receives agricultural subsidies of around CHF 400 million a year in the form of direct payments to promote biodiversity. This amount exceeds the funds made available for the programme agreements in the areas of nature conservation and forest biodiversity many times over. Extensive literature exists on the benefits of diversity of species and habitats and on the benefits of the diversity of agricultural crop seeds for agricultural production. There are also numerous evaluations of the contributions to promote biodiversity, such as the evaluation of quality and habitat connectivity contributions for the relevant areas where biodiversity is promoted (Econcept, Agridea & L'Azuré 2019). In relation to the economic benefits (food production), special attention is paid to biotic pollination. A study for Switzerland was carried out by Agroscope which quantifies the demand, supply and value of insect pollination in Swiss farming (Sutter et al. 2017). With regard to pollination, reference is often made to the study by Gallai et al. (2009). The authors estimate the global economic value of pollination services at EUR 153 billion, which equates to 9.5% of global agricultural production in 2005. Fruit and vegetables obtain the greatest benefit from pollination services at EUR 50 billion each. Other studies

estimate that the crop yields of 39 of the 57 most cultivated crops worldwide are higher thanks to biotic pollination. For example, the harvest of rapeseed can be increased by up to 15% through biotic pollination (with low abiotic pollination from the wind). Pome fruit and stone fruit benefit in particular, but also berries and vegetables, such as watermelons, cucumbers, pumpkins and herbs (Industrieverband Agrar, 2014).

The use of beneficial insects and the effects of buffer strips on the agricultural production system was also analysed. Modelling as part of the evaluation of the instrument of biodiversity contributions (SWISSland⁵⁴) also shows that the agricultural biodiversity contributions encourage adherence to environmental targets on nitrogen levels, but also have a negative impact on calorie production (and therefore on security of supply; Econcept, Agridea & L'Azuré 2019).

Tourism

The tourism sector (restaurants, hotels and tourist services etc.) is best analysed in terms of effects of biodiversity-promoting measures and the associated interdependencies. The value creation generated by biodiversity-promoting measures is often evaluated in the tourism sector. In the Swiss context, nature parks (national parks, parks of national importance) are particularly well suited for value creation studies because the Swiss Parks Ordinance explicitly provides for the strengthening of the regional economy as well as the conservation of nature and the landscape. The following findings were obtained from the studies on Swiss nature parks:

- The study by Ketterer Bonnelame & Siegrist (2014) outlines the interdependencies between biodiversity and tourism and therefore the existing benefit ratio. Here the significant to average negative effects of tourism on biodiversity (tourism mobility, tourism infrastructure, restaurants/accommodation, the various tourist activities, especially in the alpine areas and the cultural landscape) stand in contrast to the low to average positive effects of biodiversity on restaurants/accommodation and on tourist activities. A low to average positive effect on biodiversity is produced by marketing/communication as well as awareness-raising/environmental education. The effect of biodiversity on awareness-raising/environmental education is deemed very positive and that on marketing/communication as reasonably positive.
- Backhaus et al. (2013) determined the gross revenues generated by tourist demand and due to the 'Nationalpark' and 'Biosfera Val Müstair' labels⁵⁵. The value creation generated by the biosphere reserve estimated proportionately for the entire region stands at CHF 23.5 million. The national park accounts for CHF 19.7 million and Biosfera for CHF 3.8 million. This value creation is five times higher than the amounts originally invested by federal government and the canton and the donations received by the national park and Biosfera. The value creation from summer tourism creates around 296 full-time equivalent positions directly and indirectly in the region, 240 at the national park and 56 at Biosfera.
- The relationship between the public contributions in the nature park and the touristic, park-induced value creation was estimated by Knaus (2018) for four parks (Ela, Binntal, Gantrisch and Jura vaudois).⁵⁶ Total touristic value creation of over CHF 100 million (82 jobs) was estimated for Parc Ela whereby of this total amount of touristic value creation 8.8 million was causally attributed to Parc Ela. With a public contribution (federal government, canton, commune) of CHF 1.35 million, the value creation for Parc Ela is around six times higher than the funds invested. For all four parks the study concludes that the park-induced, touristic value creation is around 1.5 to 6 times higher than the public funding used (federal government, canton, commune).
- In addition to value creation in the tourism sector, parks are also a source of other regional value creation: with the production and sale of regional products, the manufacture of production plants for renewable energy, the implementation of nature conservation projects, research

⁵⁴ SWISSland – Structural Change Information System Switzerland, <https://www.agroscope.admin.ch/agroscope/en/home/topics/economics-technology/socioeconomics/swissland.html>

⁵⁵ Biodiversity is just one of four criteria for the awarding of the label.

⁵⁶ To derive the park-induced proportion of touristic value creation, the study uses visitor surveys to determine the park factor, which indicates the share of the flow of visitors that can be causally attributed to the park based on the reasons for travel to the region.

and tax income from inward migration, significant contributions can be made to the regional economy (Swiss Academies of Arts and Sciences 2014). Cultural and agricultural values and the local identity are also strengthened – but these cannot be measured in monetary terms.

- Knaus (2018) shows that significant potential of nature parks lies in creating additional services in the parks, including paid-for activities and overnight stays. This can trigger or generate other economically relevant regional knock-on effects.

5.4 Funding of nature conservation and biodiversity

The OECD has identified a big gap between the required and available resources for biodiversity (OECD 2019). In the global context, the OECD quantified the annual funding required until 2020 to achieve the 20 Aichi biodiversity goals at around USD 150 to 440 billion. In contrast, the OECD estimates that the global financial flows for biodiversity only stood at USD 52 billion in 2010.

Funding sources can be both public or private and can be used domestically or abroad. The OECD distinguishes between instruments for income generation and those for funding biodiversity objectives:

- For states, instruments that generate income to finance biodiversity objectives include, in particular, fees (worldwide USD 2.3 billion a year) and taxes (USD 7.4 billion a year) (OECD 2019). However, there is a lack of reliable figures concerning the question of what proportion of the income generated in this way effectively goes towards biodiversity measures.⁵⁷ In addition to fees and taxes, other conceivable instruments include concessions or licences, the sale of products or services and voluntary contributions.
- Instruments used for funding biodiversity objectives (so-called funding mechanisms) are based on private or public contributions. Impact investments, philanthropy or the funding of replacement or compensation measures for biodiversity are based on private contributions. Direct state contributions, subsidies, development cooperation funding or debt restructuring in favour of biodiversity (debt-for-nature swaps) are provided by the public sector. They can be used domestically or abroad. Investments or payments for ecosystem services, green bonds, loans or capital contributions can be financed with private or public funds. The 'blended finance' concept brings public and private funds together in a targeted way, particularly in the context of the UN's sustainability objectives (OECD 2018b).

In Switzerland, the funding of the conservation and promotion of biodiversity – in addition to the programme agreements in the area of the environment – comes from various channels, including in particular from biodiversity contributions to agriculture (art. 73 AgricA, e.g. Econcept, Agridea & L'Azuré 2019).⁵⁸ Many cantons have set up programmes for nature conservation and forest biodiversity that use various mechanisms to promote biodiversity. For example, nature conservation measures are financed through federal government and cantonal contributions as part of the canton of Aargau's 'forest nature conservation programme'. In addition, federal government contributions are used as part of economic support for forestry management (canton of Aargau 2013).

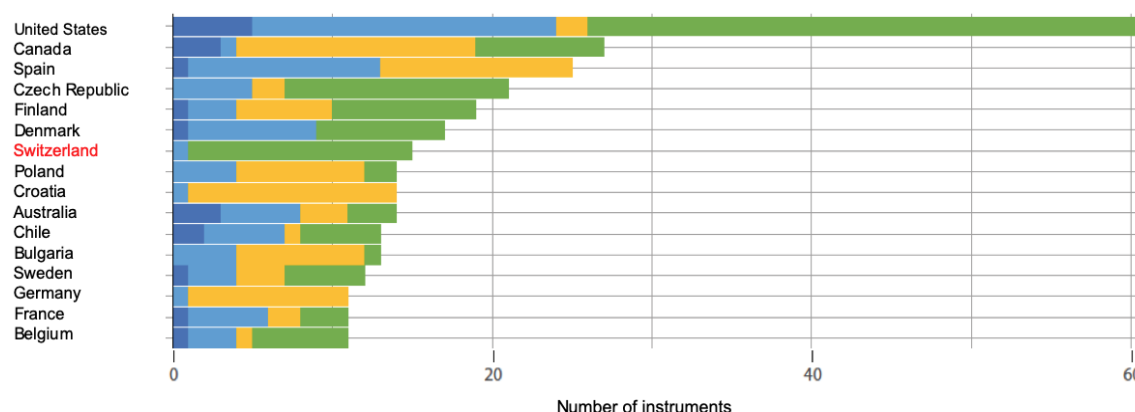
For international comparison, the OECD provides data on the key instruments for the funding of biodiversity (PINE database⁵⁹, OECD 2018a; fig. 2). It shows that Switzerland, in comparison to other countries in the panel, is lagging behind with regard to instruments aimed at mobilising funding: instruments to generate income for the promotion of biodiversity, such as fees or licences (e.g. parking fees, hunting permits, water concessions, fines), the taxation of products (e.g. pesticides, wood) or tradeable certificate exchanges (e.g. cap-and-trade approach) barely exist in Switzerland. Switzerland also has a very high proportion of environmental subsidies.

⁵⁷ OECD 2019; Global figures, annual average between 2012 and 2016.

⁵⁸ <https://www.blw.admin.ch/blw/de/home/instrumente/direktzahlungen.html> (consulted in Jan.-Jun. 2019)

⁵⁹ OECD Policy Instruments for the Environment (PINE) database. <https://pinedatabase.oecd.org/> (consulted in Jan.-Jun. 2019)

Figure 2. Number of biodiversity-related economic instruments for both income generation and funding, per country and type, in 2018 (OECD 2018a).



Dark blue: tradeable certificates; Light blue: taxes; Yellow: fees; Green: state funding contributions for the protection and sustainable development of the environment and natural resources

A series of national and international publications provides information on possible ways of modifying or supplementing the existing funding mechanisms of federal government as part of the programme agreements.

- The study by Ketterer Bonnelame & Siegrist (2014) provides information on alternative, supplementary funding options outside of the programme agreements (fig. 3). In particular, it looks at 'biodiversity francs' as a way of funding the promotion of biodiversity through tourism.
- EBP (2012) analysed possible funding instruments for the valorisation of ecosystem services in the forest. A criteria grid was developed for CO₂ storage, the provision of drinking water, the promotion of biodiversity and recreational services which evaluated the potential funding instruments per service under the existing legal framework, the related funding volume, efficient allocation of resources and political feasibility. The analysis shows that voluntary measures, in particular, such as the market for voluntary climate protection measures, voluntary contributions from water supply companies in conservation areas and sponsorship of recreational infrastructure can be implemented quickly and unbureaucratically. They also have the disadvantage of not generating high income or involving high transaction costs. Publicly funded measures were also rated positively (Switzerland's fiscal equalisation / performance agreements). The purchase of land that aligns the interests of beneficiaries, finance providers and producers is an effective instrument. Taxes and duties are less effective as they require constitutional or legislative amendments and are often met with low political acceptance and involve long preparation periods, e.g. the 'water cent' or the tax on fertilisers.
- Backhaus et al. (2018) determined that successful parks, which work with partners (e.g. associations, communes, local and regional economic actors), can acquire third party funding in addition to public contributions to a significant extent, such as from the new regional policy, agricultural policy or funds from sponsors or foundations. The evaluation of the referendum decision on 'Parc Adula', for example, showed that economic and ecological aspects played a decisive role in approval for supporters. The local population's awareness that the promotion of tourism was important to regional development was also an important factor in securing approval.
- The OECD (2017) points to the potential of market instruments in its Environment Performance Review, such as the levying of fees for the use of ecosystem services in forests, the introduction of admission charges in tourism and planning development fees in urban areas. The fees should be used for the expansion of green spaces.
- The promotion of the private certification of forests is also one of the OECD's recommendations (2017). Speich (2012), using the example of the 'Parco Nazionale Locarnese', outlined the procedure and opportunities for certificate price structuring to finance measures that promote forest services (e.g. via payment for CO₂ certificates).

Figure 3. Possible instruments outside of the programme agreement to finance biodiversity through tourism (source: Ketterer Bonnelame & Siegrist 2014).

<p>Admission charges</p>	<ul style="list-style-type: none"> • Admission charges for parks and conservation areas • Admission charges for other natural attractions, such as gorges and caves etc. • Fee share for admission tickets to parks, conservation areas and other natural attractions
<p>Concessions and licences</p>	<ul style="list-style-type: none"> • Licence fees, permits for hunting, fishing etc. • Concessions/licences for the activities of tour operators • Concessions/licences for the running of restaurants/hotels • Concessions/licences for the sale of souvenirs • Licence for the use of a label for regional products
<p>Usage fees</p>	<ul style="list-style-type: none"> • Boat fees • Camping fees • Bridge tolls • Diving charges • Hiking and trekking fees • Charges for viewing certain animal species • Parking fees
<p>Sale of products and services</p>	<ul style="list-style-type: none"> • Marketing of regional agricultural specialities • Sale of craft products from the region • Sale of gift items and souvenirs • Provision of discovery tours, guided nature sport activities, etc. • Organisation of trips • Organisation of events and workshops (for groups, companies and associations)
<p>Voluntary contributions</p>	<ul style="list-style-type: none"> • Membership contributions • Corporate donations/sponsorship • Salary contributions • Donations from estates • Forms of compensation • Nature tax • Outdoor dollar
<p>Volunteering</p>	<ul style="list-style-type: none"> • Management/enhancement of landscape by visitors • Programme partnership • Corporate volunteering (landscape management by tourism companies) • Planting schemes in mountain forests

6 Effects of biodiversity-promoting measures on the economy and society

A number of desired effects and – to a much lesser extent – undesired effects of biodiversity-promoting measures in the areas of the economy and society emerged from the six case studies, the literature analysis and the expert workshops. The main conflicting objectives during the emergence of the desired effects were also identified.

The effects on the environment – the objectives required to preserve and promote biodiversity and their attainment – are set out in the programme agreements between federal government and the cantons 2016–19 in the area of the environment and are being monitored by the cantons as part of the implementation of environmental policy with appropriate measures. The effects of these measures are analysed within the individual programmes and are therefore not discussed here.

6.1 Desired effects

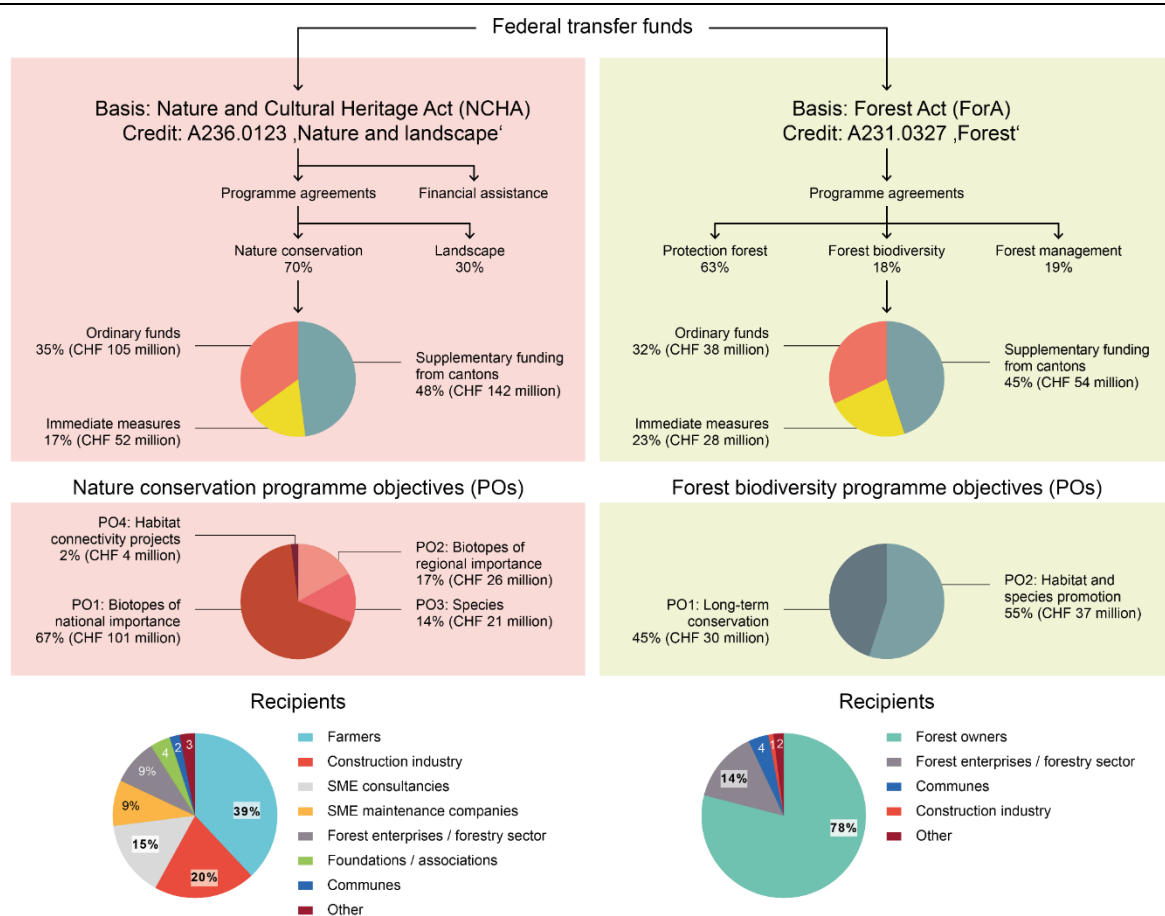
6.1.1 Desired effects on the economy

The direct effects in the area of the economy (value creation and employment) can be recorded and calculated in a structured way. The more funding provided by federal government and the cantons, the greater local and external value creation. In the case studies analysed, these direct effects over the duration of the measure range from several thousand to almost a million francs in direct value creation. Employment of between just under 0.5 and over 7 full-time equivalents was created depending on the case study.

The recipients of the funding from federal government and the cantons from the programme agreements in the area of the environment 2016–19 (fig. 4) are indicated in the cantonal survey (FOEN 2019).

- Agriculture – with a share of almost 40% – is the biggest funding recipient for implementation measures in the area of nature conservation. The construction sector receives around 20% of this funding. The remaining share goes to planning studios (small and medium-sized companies, SME), forestry companies and maintenance companies (SME).
- In the area of forest biodiversity, the forest owners received well over three-quarters of the funding. 14% went to forestry companies and a further 4% to communes. The remaining small proportion of funding was distributed between the construction sector, planning studios (SME), cantonal administrations, other landowners, foundations and associations or farmers (FOEN 2019).

Figure 4. Complete overview of the flow of transfer funds of federal government for the programme agreements in the area of the environment 2016–19, areas of responsibility of nature conservation and forest biodiversity and additional funds of the cantons* (FOEN 2019).



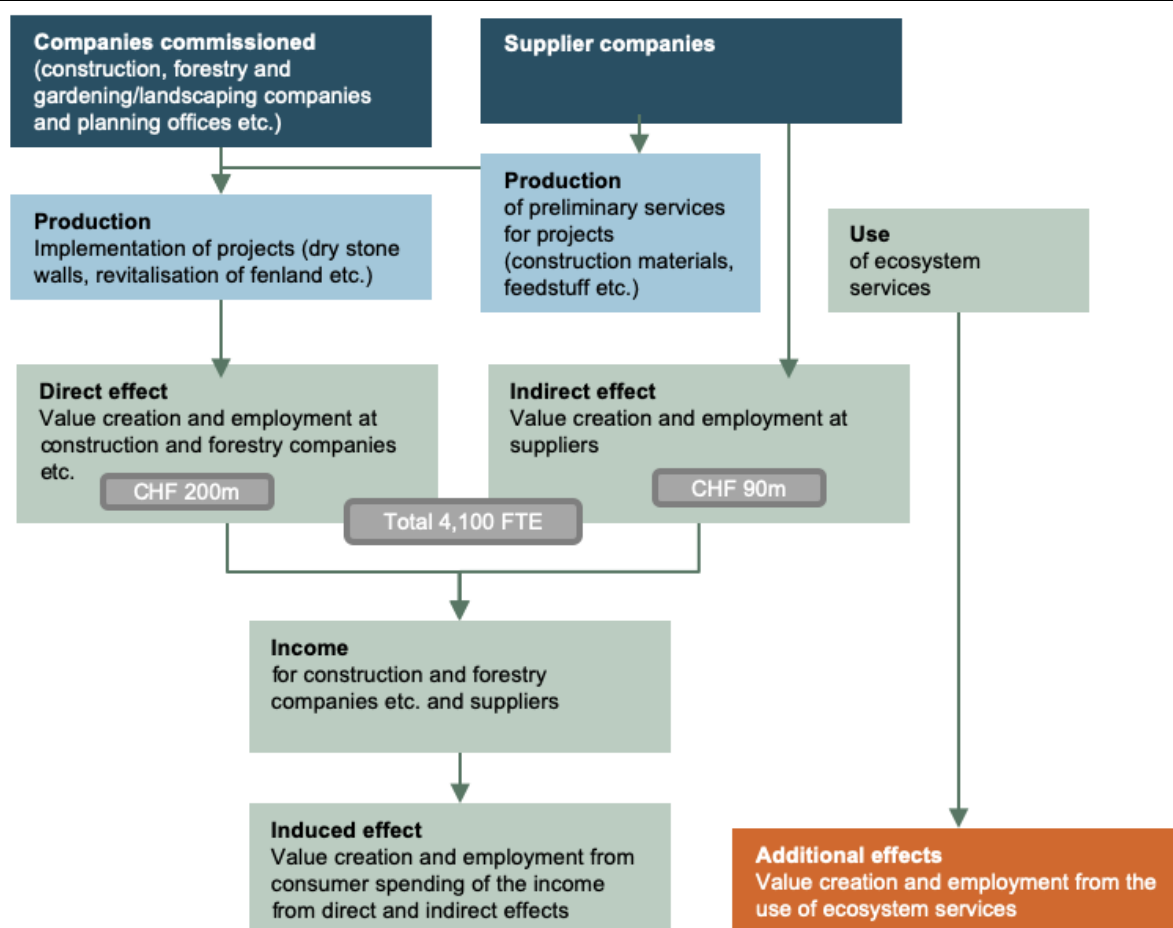
*The analyses of the supplements to federal government funds by the cantons and the use of the federal government funds in the cantons (programme objectives, recipients) are partly based on estimates by the cantonal offices. The cantons can only provide definitive feedback after the end of the programme period.

Based on the total funding paid out and the applicable parameters according to section 3.3, the value creation and employment effects for the total funding for nature conservation and forest biodiversity agreed by federal government and the cantons as part of the programme agreements 2016–19 are estimated approximately (tab. 16). In total, the funding agreed by federal government and the cantons of just under CHF 420 million generated value creation of around CHF 290 million (direct and indirect), preliminary services of around CHF 130 million and around 4,100 FTEs (fig. 5).

Table 16. Estimation of value creation triggered by the funding from federal government and the cantons from the programme agreements in the area of the environment 2016–19 for the areas of nature conservation and forest biodiversity.

Funding	
Federal government and cantons (revenue)	CHF 420m
Direct value creation ⁶⁰	CHF 200m
Indirect value creation ⁶¹	CHF 90m
Preliminary services from Switzerland and abroad ⁶²	CHF 130m
Employment	
Direct and indirect effect ⁶³	FTE 4,100

Figure 5. Economic effects at the outcome level (implementation of the projects) and at impact level (use of ecosystem services and the resultant additional effects) as per section 3.2.



In summary, the following desired effects on the economy were identified:

⁶⁰ Direct value creation: revenue of CHF 420 million minus the share of preliminary services (average figure for relevant sectors, such as agriculture and construction etc. from IOT).

⁶¹ Indirect value creation: [revenue for preliminary service providers of CHF 220 million (= preliminary services from the direct effect) minus preliminary services from abroad (import share of preliminary services according to IOT)] minus preliminary services share (average figure for all sectors from IOT).

⁶² Preliminary services from Switzerland and abroad: revenue minus direct and indirect value creation.

⁶³ Full-time equivalent (FTE): value creation of CHF 290 million divided by the sector-specific work productivity according to the Federal Statistical Office.

- **Positive effect of various ecosystem services:** Without biodiversity there are no ecosystem services. The projects supported with the investment contribute to strengthening biodiversity and providing the ecosystem services according to the ecosystems. These are vital for economic activities.
- **Generation of local employment and local value creation.**
- **Strengthening of peripheral regions and their future prospects:** The initial investments and annual maintenance work financed by federal government and cantonal funds generate value creation and employment for the companies and organisations commissioned with implementing the projects. This strengthens the local economy and the annual maintenance work improves the future prospects of the companies commissioned. The salaries paid for from the value created in turn generate further value creation and employment when they are spent.
- **The development and retention of local expertise:** The training of local actors in the agriculture, forestry, landscape design and gardening sectors etc. ensures that the skills required are developed locally and ideally also transferred (for example, by training apprentices). If this expertise is well established locally and does not 'migrate', skills are retained which will benefit the region over the long term.
- **Promotion of innovative business models:** The investments act as start-up funding for new innovative business models which would not be implemented without this support. These business models in turn generate value creation and employment.

6.1.2 Desired effects on society

Additional effects (impact): The projects implemented with the investments contribute to economic activities which would not occur without this investment. These activities also generate value creation and employment. The effects of the biodiversity-promoting measures analysed at social level are very wide-ranging and, on one hand, have an impact at the level of the individual (individual knowledge and behaviour) and, on the other, at the level of society as a whole (cultural heritage, shared values, integration and cohesion).

At individual level, the most frequently indicated effects include raising the awareness of the local population and external visitors (tourism) and the aspect of environmental education. The specific activities extend from the provision of premises for environmental education (e.g. Amden forest reserve, Marais-Rouge) and the organisation of tours for school classes and visitor groups (e.g. bird protection associations, garden owners and tourists) to media coverage (e.g. free-ranging goats project, measures to help redstarts, Amden forest reserve). Further effects include contributions to mental and physical health (recreational benefits, positive effects of a 'beautiful landscape' on wellbeing) or the creation of training places (e.g. Amden forest reserve). Environmental education can also be easily accessible, for example through the exemplary design of public green space which passers-by notice and replicate in their own gardens.

However, the case studies analysed also show that not all target groups can be addressed to the same extent. Depending on the location and profile of the measure, just a few or a large number of people are informed or made aware of it. In an urban environment, a relatively high number of people can be reached through communication on an individual project thanks to the higher population density and frequentation, e.g. in the case of measures to help redstarts in the canton of Basel-Stadt. In areas that are remote, not visited by tourists or the local population or not actively used – such as in the case of the dry stone wall in the canton of Zug or the Rieter Oberrickenbach fen in the canton of Nidwalden – the impact of awareness-raising and information is quite low. This is sometimes also due to awareness-raising not being intentionally carried out amongst wide groups for some measures. At a superordinate, social level, the measures implemented contribute to regional identity (e.g. shepherding), to the recognition and preservation of historic crafts or cultural landscapes (e.g. dry stone walls) and to the promotion of a local identity through protection areas (e.g. Amden forest reserve). The involvement of social organisations also promotes social integration (e.g. the building of nesting boxes by young people) or new meeting places are created in public spaces.

In summary, the following desired effects on society were identified:

- **Information and awareness-raising:** With a few exceptions, every measure offers potential for information and awareness-raising. The exception is measures in areas to be expressly protected against an influx of visitors.
- **Environmental education:** Most measures provide good opportunity for providing environmental education. Target groups often include school classes and groups/associations with a special interest, but the general public is also addressed. Cooperation with research or the opportunity to carry out training and educational activities locally (for sectors, companies, associations and NGOs etc.) can create positive synergies.
- **Involvement of social organisations in the implementation of the measures:** Some projects are ideally suited to involving persons on civilian service or the employees of social organisations (e.g. as part of integration projects for the unemployed or immigrants). These persons also benefit from the social structures created through involvement in the project.
- **(Local) recreation, human wellbeing:** The local population and tourists benefit from the biodiversity measures because they increase the value of nature in terms of recreational or leisure activities or because the beauty of nature improves the mental wellbeing of people seeking recuperation.
- **Added value for the local population:** Local residents also benefit from a higher quality of life and living space locally or regionally.
- **Identification with the landscape, tradition and culture:** The local population and tourists can identify with elements from the landscape, performance of traditional crafts or elements of cultural heritage.

6.2 Undesired effects on the environment, the economy and society

Several undesired effects were also identified during the analysis of the six case studies, in the literature analysis and in the expert workshops. Countermeasures to eliminate or at least minimise these negative effects were also sought during the discussions.

6.2.1 Undesired effects on the environment

- Disruptive pressure on the local ecosystem due to the increase in visitor numbers whereby the disruption can be caused by both the local population and external tourists.
→ Possible measures: raising awareness of visitors, visitor management, ranger services (all three options in turn generate value creation), quiet zones for game, prohibition on access, positive and negative list of areas.⁶⁴
- Increased traffic due to external visitors travelling into the areas (CO₂ emissions, loss of land due to transport infrastructure).
→ Possible measures: visitor management, parking charges, ensuring good public transport links.

6.2.2 Undesired effects on the economy

- Value creation is (mainly) generated outside of the commune or canton or abroad. Possible measures: awarding of contracts controlled by canton/commune unless it must be carried out in accordance with WTO rules or certain criteria.

6.2.3 Undesired effects on society

- Incursions into private law (e.g. prohibition on access, exclusion on use of wood in private forest etc.). → Possible measures: compensation of loss of earnings; provision of alternative services or reference to alternative areas.
- Criticism that the protection of biodiversity costs too much and that there are funding shortages in other areas. → Possible measures: 'educational work' on comprehensive socioeconomic benefits and the contribution to securing ecosystem services.

⁶⁴ A positive list sets out all areas that may be accessed or used whereas a negative list includes all areas that cannot be accessed or used. Such lists apply, for example, to types of sporting activity, such as canyoning.

6.3 Conflicting objectives and obstacles

To identify relevant areas of action it is important to identify the main conflicting objectives with other sectoral policies and other obstacles and to reduce or overcome them as far as possible as they restrict efficient and transparent use of resources and the development of the socioeconomic effects outlined in this report. This report identifies the following conflicting objectives:

- Biodiversity generally involves the **issue of environmental goods** whereby the external costs caused by environmental impacts are not internalised, i.e. the party causing the impact does not foot the bill. For biodiversity, the internalisation of these costs would mean, for example, that compensation would be paid for the impacts caused by tourism to a protected landscape and these funds would go towards the protection and conservation of this landscape. This would increase or extend the positive effects of biodiversity-promoting measures.
- The following **conflicting objectives with other sectoral policies** were identified as being of central importance:
 - Agriculture⁶⁵: issue of plant protection products⁶⁶
 - Tourism: lack of compensation for the use of the ecosystem services in relation to agriculture
 - Climate change and use of renewable energies: increasing the height of dams, wind turbines vs. bird protection etc.
 - Conflicts over use of resources: water supply as a potential area of conflict, particularly if drinking water supply is located in protected areas/wetlands⁶⁷
 - Conflicts over use of forests regarding hunting

A current study being conducted by the Federal Institute for Forest, Snow and Landscape Research WSL and the Swiss Biodiversity Forum is analysing the biodiversity-damaging incentives in all sectoral policies. The study is set to be published in 2020. This study may provide further findings on conflicting objectives. At an overarching level, conflicting objectives can always arise if other spending plans are deferred or prevented due to the use of funds for biodiversity investments.

- Political and social acceptance can be increased if the **fear of ownership restrictions** can be alleviated. In particular, this applies to ownership status in the forest (high proportion of private forests) and agriculture. Acceptance here can also be increased – according to experts – through targeted communication by highlighting individual room for manoeuvre and alternative use options.
- **A lack of communication of the economic and social added value:** In the promotion of biodiversity, the protection of biodiversity as a moral or ethical value worthy of protection per se (e.g. national priority species, endangered type of landscape) is often focused on. A particular ecosystem service is often promoted at the same time (e.g. pollination, pest control or recreational service). If only the first point is communicated, this can restrict acceptance of the measure, often due to a lack of understanding of the high costs. Acceptance can be increased if it is communicated at the outset that an ecosystem service (i.e. a contribution to economic prosperity or human wellbeing) is being promoted through the measure being implemented (section 7.2).

⁶⁵ Joint objectives can also exist, e.g. compensation for areas where biodiversity is being promoted in agriculture (quality and habit connectivity of areas). These should be used.

⁶⁶ Action plan for risk reduction and sustainable use of plant protection products (Federal Council, 2017): "The influence of plant protection products on terrestrial biodiversity in the overall context of the intensification of agriculture is well established. There is scientific evidence that plant protection products are jointly responsible for these declines." (p.19)

⁶⁷ For example in Belp (area between airport and Aare).

7 Synopsis

7.1 Desired effects predominate

The socioeconomic analysis of the effects of investment in nature conservation and forest biodiversity shows a number of desired and – to a much lesser extent – also undesired effects of biodiversity-promoting measures in the areas of the economy and society (fig. 6).

Desired effects on the economy:

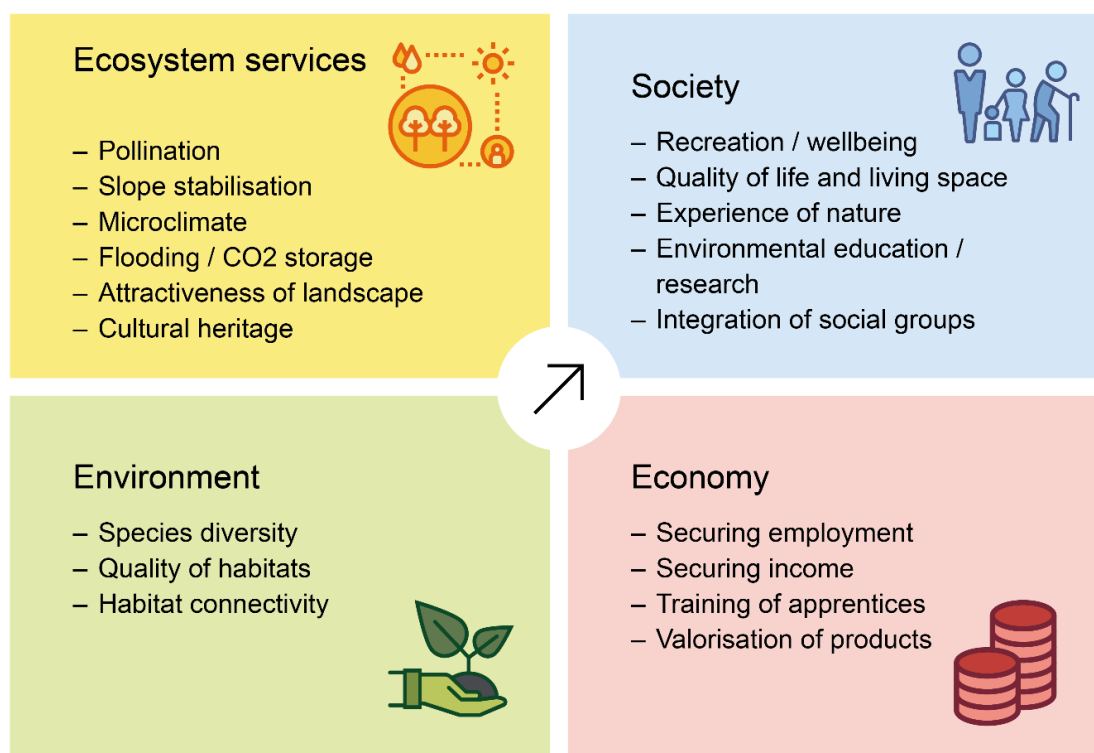
- Positive impact of various ecosystem services which are vital for the resulting economic activities
- Generation of local employment and local value creation
- Strengthening of peripheral regions and their future prospects
- The development and retention of local expertise
- The promotion of innovative business models which in turn generate value creation and employment
- Further effects (impact) generated from the investments of the projects implemented

Desired effects on society:

- Information and awareness-raising amongst the local population and external visitors
- Environmental education and cooperation with research organisations or NGOs
- Involvement of social organisations
- Opportunities for (local) recreation, contribution to human wellbeing
- Better quality of life and living space for local residents
- Identification with agricultural, traditional and cultural values

The undesired effects identified are limited to disruptive pressure on the local ecosystem through the potential increase in the number of visitors and the resultant need for additional infrastructure (e.g. parking spaces) or potential restrictions on usage for forest owners (e.g. loss of timber revenues but for which financial compensation is provided).

Figure 6. Main desired effects of biodiversity-promoting measures on the environment, economy and society.



7.2 Taking advantage of opportunities for nature, the economy and society

7.2.1 Making biodiversity tangible and perceptible

The wide range of benefits of biodiversity-promoting measures for the economy and society have barely been analysed in depth, documented, communicated or used for awareness-raising purposes to date (section 5). Possible negative effects related to cutback decisions have also hardly been systematically recorded and analysed on a target-group-specific basis. However, the transparent presentation of the flow of funds for biodiversity-promoting measures and the impact of this investment in various areas constitutes the basis for comprehensive information for decision-makers and the population. If processed and conveyed in a target-group-specific way, this information can contribute towards ensuring biodiversity-friendly decision-making. The communication should not focus exclusively on key data e.g. on the nature or objectives of the investment or which actors ultimately benefit from the funding deployed. Instead biodiversity should be made tangible and perceptible. A target-group-specific approach therefore also takes account of the values and/or emotions of the audience.

7.2.2 Building on success

Investment in biodiversity must be used efficiently and effectively. Supporting measures which prove successful for biodiversity, generate positive effects for the economy and society and are scalable and replicable are ideally suited as model projects for future investments. Scalable measures can be implemented in a larger area than in the past. The scalability does not just concern the area covered. In addition to the area, it also includes the targeted use of synergy effects between ecosystem services, e.g. climate control and cultural benefits. Such measures have a very high overall level of economic benefit. Cross-sector cooperation, e.g. between the healthcare system and green urban planning, can make a significant contribution towards developing qualitatively scalable measures. Replicable measures can be implemented again at other locations under similar conditions. For example, dry stone walls can be built at many different locations and will achieve similar effects as those outlined in section 4.3 for the canton of Zug.

7.2.3 Funding mechanisms with potential for biodiversity

In order to achieve the Aichi targets, investment in biodiversity must increase significantly globally from both private and public funds (OECD 2019). With a view to increasing effectiveness, economic instruments – such as environmental taxes, the introduction of fees for ecological services or certificate systems – should be used to a greater extent for the protection and development of natural capital and ecosystem services, where minimum standards are not suitable or are not sufficient (Naturkapital Deutschland TEEB DE 2018).

In Switzerland, the programme agreements in the area of the environment are a key funding mechanism for biodiversity investments. Target agreements and measures financed via transfer funds (autonomous implementation by the cantons) enable the cantons to act independently and to finance locally adapted measures and permit the mobilisation of third-party funds using individual measures and a wide range of locally or regionally relevant measures. By international comparison, there is a certain degree of potential to expand the funding mechanisms in Switzerland, particularly in terms of fees and tax on products (fig. 3). An exchange of experience or in-depth country case studies, for example, could be used here to obtain a more extensive understanding of the relevance for Switzerland. In the context of the issue of plant protection products, the introduction of a pesticide tax based on the Danish model has already been addressed (Federal Council 2014).

8 Annexes

8.1 Literature

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8.2 List of interview partners

Case study	Name, function	Organisation/institution
NE: Revitalising the Marais-Rouge	Sébastien Tschanz Scientific officer	Canton of Neuchatel, Office for Fauna, Forestry and Nature (SFFN)
GR/UR: Free-ranging goats project	Corinne Vonlanthen Commissioning party	Pro Natura
	Erik Olbrecht Deputy head of department; Biotope and species protection team leader	Canton of Graubünden, Nature and Environment Office
	Pierre Coulin Project manager	oekoskop
ZG: Repairing a dry stone wall	Stefan Rey Protection of species and databases project manager	Canton of Zug, Spatial Development and Transport Office
	Bruno Vanoni Information officer	Swiss Landscape Fund
BS: Measures to help redstarts	Yvonne Reisner Measures to help redstarts project manager	Canton of Basel-Stadt, Municipal Parks and Gardens Department, Nature, Landscape and Trees Unit
SG: Amden forest reserve	Kurt Ehrbar Regional forest ranger	Canton of St.Gallen, Economic Affairs Department, Cantonal Forestry Office
	Pascal Gmür Forest engineer	Canton of St.Gallen, Economic Affairs Department, Cantonal Forestry Office
	Kurt Bollmann Head of biodiversity and nature conservation biology	Swiss Federal Institute for Forest, Snow and Landscape Research WSL
NW: Oberrickenbach fen	Rudolf Günter Senior forest ranger	Canton of Nidwalden, Forest and Energy Office

8.3 List of participants at the expert workshops

First workshop, 2 May 2019, Federal Office for the Environment, Ittigen

Name	Organisation / Institution
Franziska Humair	FOEN, Biodiversity and Landscape Division
Gabriella Silvestri	FOEN, Biodiversity and Landscape Division
Claudio de Sassi	FOEN, Biodiversity and Landscape Division
Basil Oberholzer	FOEN, Economics and Innovation Division
Kurt Bollmann	Swiss Federal Institute for Forest, Snow and Landscape Research WSL

Second workshop, 6 September 2019, Federal Office for the Environment, Ittigen

Name	Organisation / Institution
Franziska Humair	FOEN, Biodiversity and Landscape Division
Claudio de Sassi	FOEN, Biodiversity and Landscape Division
Basil Oberholzer	FOEN, Economics and Innovation Division
Thomas Abt	Conference on Forest, Wildlife and Landscape (KWL)
Urs Käzlig	Conference of Delegates for Nature and Landscape Protection (KBNL)
Daniela Pauli	Swiss Biodiversity Forum
Sascha Ismail	Swiss Biodiversity Forum