Part X
Nature Conservation

Group members

Kristin Bohn
Marleen Cobben
Markus Didion
Michael Padmanaba
Katharina Sabellek
Theodoro Semeraro
Jonna Timonen

Supervisors

Wolfgang Cramer
Allan Watt

Contents

Introduction

Current conditions in the Var catchment for the Nature Conservation

The Var catchment is situated in the Southern Alps of France and comprises parts of the two departments Alpes de Haute-Provence and Alpes Maritimes. The climate is characterised by high temperatures and aridity in summer and mild, humid winters. The precipitation is highly variable and droughts are common (Diren,PACA 2007). Forest fires are highly probable during summer. Floods, erosion, rock falls and landslides are additional threats to the region. The combination of Mediterranean and Alpine climates creates a unique variety of flora and fauna, and landscapes (Le Mercantour Parc National, introduction pamphlet). The population density in Alpes de Haute-Provence is on average 22.1 persons/km^2 and currently slightly increasing with a high portion of older people. Land use encompasses mainly forestry, agriculture and urban areas (Figure 1.) with an overall trend in land abandonment due to rural emigration.
The upstream part of the catchment is mountainous and characterised by subalpine vegetation of pine forests, shrub vegetation and grasslands. Intensive sheep grazing is causing problems with soil erosion and nitrification, which make up 9% of the agricultural profit in the region. The majority of the population lives below 1000 m and currently shifts from rural to urban areas that lead to land abandonment in some parts of the catchment. In the lower parts and villages traditional agriculture is using the land for different cereals, vegetables and fruit trees. Land use encompasses mainly forestry, agriculture and urban areas with an overall trend in land abandonment due to rural emigration. Close to the gauge and the cost the industrial areas of Nice are dominating.

The region around the Var, is one of the most important tourist regions in France. 15 million tourists per year (mostly from France, Benelux, Italy, Germany and UK) are visiting Alpes de Haute-Provence, mainly in spring and summer and spending around 43 € per day and person.

Trends in Nature Conservation

Recreational activities are becoming more and more important. However, ecotourism and considerations of city dwellers to have a second home in the Alps are becoming of growing interest. Simultaneously, nature conservation has become an important issue in the Var catchment. The national parc “Parc Mercantour” and several small “Natura 2000” areas as well as inventories of flora and fauna are part of conservation measures.

Research question
How to conserve the cultural ecosystem services that the Var catchment provides, such as spiritual, aesthetic and educational value? What are they, and how can they be managed in a sustainable way in the future?
Focal questions:

1. Threats to cultural ecosystem services: how to adapt?
2. What are appropriate measures for achieving cultural ecosystem services?
3. How can cultural ecosystem services contribute to maintain livelihoods?

Definition of cultural ecosystem services:
"Cultural ecosystem services are nonmaterial benefits obtained from ecosystems."

- cultural heritage and diversity,
- spiritual and religious,
- knowledge systems (diversity and memory),
- educational and aesthetic values,
- inspiration,
- sense of place, and
- recreation and ecotourism

Key elements to preserve in the Var catchments

- Traditional livelihoods (TL): Different ecosystem types provide a range of cultural ecosystem services such as educational and spiritual values, e.g. traditional shepherding practices.
- Open landscapes (OL): Open and cultural landscapes provide a range of cultural ecosystem services such as aesthetics and opportunities for recreation as well as supporting services such as primary production.
- Intrusive recreation (IR): The Var catchment provides opportunities for cultural ecosystem services such as summer and winter recreation.
- Non-intrusive recreation (NIR): Non-intrusive recreation such as spiritual retreats and eco-tourism are cultural ecosystem services that are available in the Var catchment
- Traditional ecological knowledge (TEK): The wide range of different ecosystem types and the remoteness of the Var catchment allowed the development of traditional ecological knowledge such as the use of plants for medical purposes, which represents an important cultural ecosystem services.
- Closed habitats (CH): Productive mature forests provide a wide range of ecosystem services including provisioning (e.g. fuel), supporting (e.g. nutrient cycling), and regulating services (e.g. climate regulation). They also serve as movement corridors along the Var river and headwaters.
- Open habitats (OH): A range of ecosystem services is supplied by open habitats such as provisioning (e.g. meadows for pollinators) and regulating services (e.g. floodplains).
- Species diversity (SD): The Var catchment is rich in wild animals (e.g. wolves, ibex) and plants, which serve as supporting and provisioning ecosystem services.

Main drivers
Main drivers as identified by the Synthesis Group that affect the identified key ecosystem services:

- Climate change
- Demographics
- Economics
- Land use
- Lifestyle
- Policy
- Technology
- Tourism

Materials and Methods

Material
The national park "Le Mercantour Parc National" provided information of existing and endangered species.

Stakeholder dialogues
For the assessment it was crucial to get feedback from the local people, presented by relevant stakeholders, in order to identify, understand and integrate the socio-economic processes in the region. Five different stakeholders, represented by the tutors, were asked to do an interdisciplinary interview. Their position towards nature conservation related issues were the following:

Nature conservation stakeholders
As nature conservation stakeholders the project had two representatives: a manager of the local National park and a representative from an NGO "Wolves International". They would like to maintain the current different ecozones in the area. They want to increase the numbers of predators (mainly wolves) and the areas of open landscape. Fires should not be controlled. Organic agriculture is not wanted to decrease. The Var catchment currently provides high biodiversity. Both want less sheep because of overgrazing and less intrusive recreation. They would like to see more nature conservation areas, and more research in these areas. They see a high educational value of these areas for local city kids.

The water manager
The water stakeholder, Madame l'Eau, has a land claim for an additional water reservoir to provide drinking water for the city of Nice. She would like to reduce forest cover by grazing.

The developer
The stakeholder for the Rural Urban Transition was a developer. Her customers of the housing developer appreciate the natural areas in the Var catchment. The Stakeholder makes a land claim for additional infrastructure.

The farmer
The farmers are proud of their traditions and want to keep them, they want to maintain the traditional communities and the landscapes. They are open to tourists and nature conservation. They are afraid that wolves eat their sheeps. They are troubled by fires and soil erosion.

Mr. EU
The Natura 2000 sites should be better connected. For the Var catchment the EU policies encourage the maintenance of lively rural communities, with an agriculture focused on local sustainability, not on international trade.

Results

Causal diagram development
We identified key ecosystem services that are provided by the Var catchment. Based on the direct and indirect drivers that were specified by the Synthesis Group, we developed a causal diagram (Fig. 1) that relates the most important interactions between drivers and key ecosystem services across all four storylines. Technology affects the smallest number of ecosystem services, whereas all other drivers can affect a majority or even all ecosystem services. The causal diagram emphasizes that drivers not only affect key ecosystem services but also influence other drivers. For example, climate change will influence policy decisions or the development of new technologies.

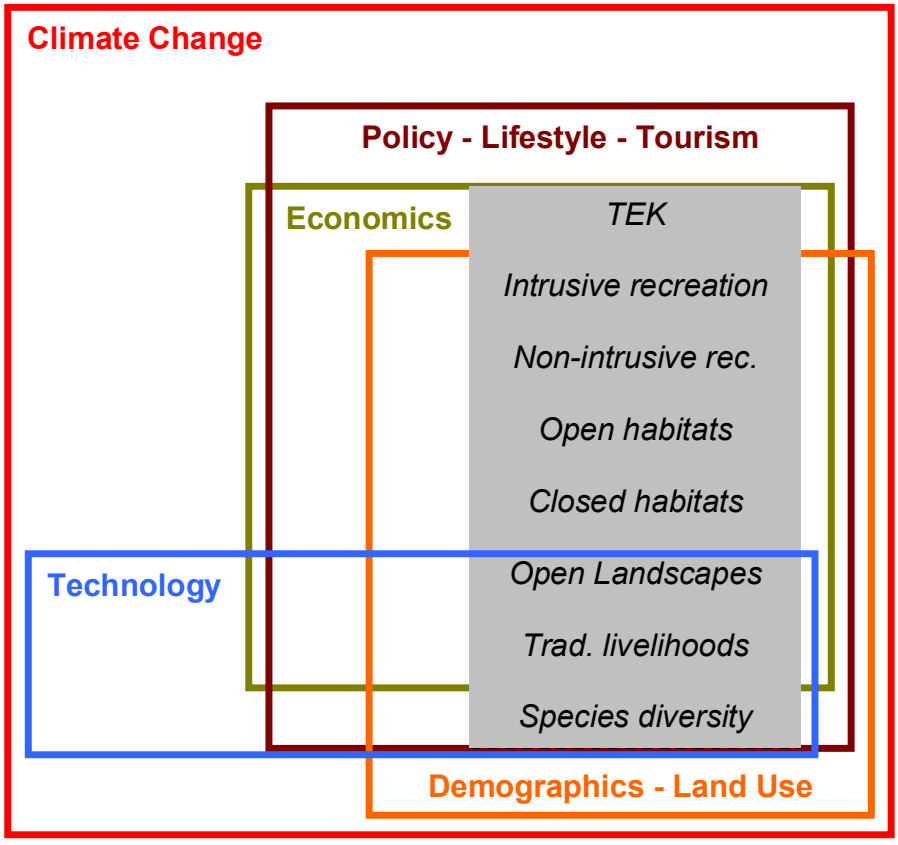

Figure 1. Causal Diagram: Drivers and key ecosystem services and their interactions

Scenarios
For the scenarios the four Millennium Ecosystem Assessment (MA, 2005) scenarios were downscaled and applied to the Var catchment. The general assumptions were used to design storylines.

Global Orchestration
The land cover in the Var catchment due to climate change becomes less managed by humans. Local sheep breeding has stopped and the higher parts of the catchment will be covered more by trees and woods. The traditional farms in the lower parts will be abandoned, because most people are living in Nice or have moved tp other cities to find work. High education is a big issue in the cities to find a good position afterwards, but there is no need anymore for natural knowledge. To recover from the hard work nearly all people use sportive actions in natural retreats, where else they are not sensitive to natural places.
Food production is made by big companies on high productive fields, but provides just a few work positions for the population. Pollution is a problem caused by the use of fertilizer and other new technology that needs high resources. Within the unmanaged areas a high diversity of plants and animals use this niche.

Order From Strength
The economy is growing. Most people are living in Nice, where they are working and have a high income. In contrast, the rural population is becoming poorer and poorer and suffer from extreme events caused by climate change, like extreme droughts and flood events. The population is moving to the city with the hope to find work and have a better life. However, less working opportunity and income disparity lead to conflicts among people. The food demand for the population is supplied by large industries and mainly monocultures. Technology becomes very important since a lot of species became extinct caused by loss of habitats and high pollution. Insects moved further away into protected areas and their population size decreased. Land is populated by grey species, and humans do not have knowledge for what it could be used.

Adaptive Mosaic
People live together with their environment in a simple life. Large areas are managed by small organic farms where a variety of food plants are grown. Some wild cautious species such as wolf moved to upper mountains, but many others can live in habitat corridors built by the humans. Pollination is not a problem. People have knowledge on the use of nature resources, for example collecting plants for medical purposes. Nevertheless biodiversity is endangered, because almost the hole area is managed. This endangers the conditions for wild large mammals.

TechnoGarden
The view on the landscape shows us unmanaged areas, nature is able to recreate the damages from the last decade.. Also vegetation has changed by this but policy focuses on nature conservation more unmanaged nature builds up habitats for a diverse species community. Agriculture gets more effective with a high input of energy and fertilizer as well as pesticides. The production of organic food is also increasing and becomes more effective, because investments in green technology are made. Biodiversity is endangered because of new invasive species and the use of fertilizer and pesticides.

Discussion

Synergies and tradeoffs between stakeholder demands for cultural ecosystem services and nature conservation.

	Nature Conservation and Farmer	Nature Conservation and Water	Nature Conservation and EU	Nature Conservation and Developer	Farmer and EU
Synergies	Open landscapes, tourism, organic agriculture	Less forest cover	Connect Natura 2000 sites	Maintaining natural areas	Lively communities
Disagreement	Wolves, fires	Grazing			

Table 1. Synergies and trade-offs between stakeholder demands for cultural ecosystem services and nature conservation

Synergies and tradeoffs between cultural ecosystem services

	TL	OL	IR	NIR	TEK	CH	OH	SD
TL		**Syn**	**Tra**	**Syn**	**Syn**	**Tra**		
OL	**Syn**							
IR	**Tra**					**Tra**		**Tra**
NIR	**Syn**				**Syn**		**Syn**	**Syn**
TEK	**Syn**			**Syn**				**Syn**
CH	**Tra**		**Tra**				**Syn**	**Syn**
OH				**Syn**		**Syn**		**Syn**
SD			**Tra**	**Syn**	**Syn**	**Syn**	**Syn**	

Table 2. Synergies (Syn) and trade-offs (Tra) between ecosystem services

Table 2 shows that benefits or services provided by ecosystem can actually be connected to one and another either in synergy or trade-off relation. Traditional livelihoods are well linked with open landscapes, traditional ecological knowledge and non-intrusive recreation. The sheep create open landscapes while the shepherds have traditional knowledge about, for example, when and where to take or to lead the sheep. Flocks of sheep grazing in open landscape are also attractive for tourists to come to that particular area.

Intrusive recreation causes some disturbances for habitat of wild animal species. Such recreational activities will increase erosion and deteriorate surrounding nature. Infrastructures development, in addition, supports the tourism activities but on the other hand it creates an unpleasant view.

Adaptation strategies for each storyline

Global Orchestration
A management authority can be created that will plan and apply sustainable conversion of land use of the abandoned areas using new technology when necessary, and establish traditional agricultural to achieve high employment rate.
Penalties can be imposed on companies that use excessive fertilizer, while organic fertilizer can be supported through incentives.

Order from Strength
An adaptation strategy could be to create policies against land abandonment and abandonment of rural areas. Next to this, an economic strategy can be developed to market local products, by associating them with traditions, and with the national park. This could support traditional and organic agriculture. Enhancing possibilities for education in traditional knowledge and the role of the biodiversity to support human well-being could increase public awareness.
Another adaptation strategy regards the creation of corridors between patches of natural area to maintain biodiversity resources, and the distribution of patches of natural area inside the agricultural matrix to support particular ecosystem services such as pollination.
A natural museum and botanical gardens can be set up to preserve genetic resources as well as to support public awareness.

Adaptive Mosaic
A seed bank and botanical gardens can be created to avoid extinction of plant species.
To improve the resilience of the cropping system to extreme events agriculture can be diversified.
Habitats can be diversified to protect from fire, drought and soil erosion risks and reducing meat consumption and production will make increase the amount of area outside agricultural production, as do inventions in green technology.

TechnoGarden
This scenario is fairly positively assessed with regard to nature conservation. However, several adaptations are still needed to improve benefits both for local livelihoods and to avoid climate change impacts. Such adaptations are the marketing of local products to ensure sustainable agricultural distribution in the area, preventing centralization of these areas; building partnerships among stakeholders; and conducting research and capacity building to monitor the impact of climate change.

Conclusions

Policy considerations for the sector
We recommend tax reductions for the environmentally sound investment including tourism and agriculture. Compensation payments for significant losses of income due to nature conservation actions should be provided. There is a need to develop appropriate policies to encourage the use of renewable energy, such as subsidies for solar panel acquirement. Policy to enhance public awareness on nature and conservation both through formal and informal education and campaign is also needed.

Further research needs
More research is needed to develop a comprehensive inventory of ecosystem services in the Var catchment. An inclusive survey of valued cultural ecosystem services amongst stakeholders, local people, tourists and other interest groups is under work. In addition, an integrated survey combining social, economic and cultural aspects should be undertaken to address possibilities for the development of local livelihood as well as maintaining traditional values. The impact of increasing recreational activities on alpine nature should be also examined carefully e.g. by mapping the changes in the environment in the areas used in these activities. We further suggest monitoring and evaluation activity to ensure sufficient data and improvement of future research and management. Monitoring should address species migration in response to habitats becoming unfavorable as a consequence of environmental change. The latter should also be efficient to quickly identify the arrival of invasive species. Finally, we recommend consultations with representatives of adjacent regions to identify common concerns.

Acknowledgements

We would like to acknowledge Georgia from the Water Group and Patrick from the Agricultural Group for providing us with very valuable information on the Var catchment without really getting anything in return.
Further we like to acknowledge Jean for his very interesting and entertaining view on the Var catchment and his willingness to share it with us.

References

Diren(Direction Régionale de l'Environnement) PACA., 2007 : Cartopas Environnement. Reicei CARTOgraphics des donnees de L'Environnement en Prêt à fervir – Provence- Alpes Côte d'Azur (PACA)

Millennium Ecosystem Assessment (MA) 2005 : Ecosystem and Human Well-being : biodiversity Synthesis World Resources Institute Washington DC.

MEDUSA Projekt Description of Work, 2008: Managing the human environment system to provide and sustin ecosystem services for all users safeguarding human wellbeing and biodiversity – developing strategies to adapt to future changes, ALTER-Net Material.

Second Alter-NET Summer School 2007: Trends in Biodiversity: European Ecosystems and Policy, Peyresq.

Appendix

		Key Ecosystem Services							
		Species Diversity	Traditional Lifelihoods	Open Habitat	Closed Habitat	Open Landscapes	Non-Intrusive Recreation	Intrusive Recreation	Traditional Ecological Knowledge
Drivers	Climatic Change	↑	↑	↑	←↑	←↑	↑	↑	↑
	Lifestyle	↑	↑	↑	↑	↑	↑	↑	↑
	Technology	↑	↑	↑	x	x	x	x	x
	Demographics	↑	↑	↑	↑	↑	↑	↑	x
	Economics	x	↑	↑	↑	↑	↑	↑	↑
	Land Use	↑	↑	↑	↑	↑	↑	↑	x
	Policy	↑	↑	↑	↑	↑	↑	↑	↑
	Tourism	↑	↑	↑	↑	↑	↑	↑	↑

Table.A1: Feed-backs between drivers and key ecosystem services.

Driver	Indicator	Trend	Scenario	Key ecosystem services							
				TL	OL	IR	NIR	TEK	CH	SD	OH
Climate	Temperature	+	AM, OS, GO, TG	=	+	+ / -	+ /-	=	=	+/-	=
Change	Precipitation	-	AM, OS, GO, TG	-	+	+/-	+/-	=	=	+/-	=
	Extreme Events	+	AM, OS, GO, TG	-	+	-	-	=	=	-	-
Demographics	% Urban/Rural	-	AM, TG	+	+	-	-	+	+	+	-
		+	OS, GO	-	-	+	+	-	-	-	+
	Year-round residents	+	AM, OS	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	-
		+/=	TG	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	-/=
		-	GO	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	+
	Total population	-	AM	+	+	-	-	=	+	+	+
		+	OS, GO	-	-	+	+	=	-	-	-
Economics	Income disparity	-	AM, TG, GO	+	=	=	=	=	=	=	=
		+	OS	-	=	=	=	=	=	=	=
	Market share of local products	+	AM, OS	+	+	+	+	=	=	=	=
		=/-	TG	-	-	-	-	=	=	=	=
		-	GO	-	-	-	-	=	=	=	=
	Income per capita	-	AM, GO	-	=	-	=	=	=	=	=
		+	OS, TG	+	=	+	=	=	=	=	=
	Employment rate	-	AM, GO	-	-	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.
	Rural employment	+	AM	+	+	=	=	=	-	=	=
		=	TG	-	=	=	=	=	=	=	=
		-	GO	-	-	=	=	=	+	=	=
Land Use	Agric land use	=	AM, TG	=	=	=	=	=	=	=	=
		+	OS	+	+	-	-	+	-	-	-
		-	GO	-	-	+	+	-	+	+	+
	Urban land use	=	AM	=	=	=	=	=	=	=	=
		+	OS, TG, GO	-	-	+	+	-	+	+	+
	Sustainable Agric	+	AM, TG	+	=	=	=	=	=	+	=
		=	OS	=	=	=	=	=	=	=	=
		-	GO	-	=	=	=	=	=	-	=
Lifestyle	Freshwater cons	-	AM, TG	=	=	+/-	+/-	=	+	+	+
		+	OS, GO	=	=	+/-	+/-	=	-	-	-
	Energy cons	-	AM	=	=	+/-	+/-	=	+	+	=
		+	OS, TG, GO	=	=	+/-	+/-	=	-	-	=
	Attitude tw environment	+	AM, OS, TG	+	=	+	+	+	+	+	=
		-	GO	-	=	-	-	-	-	-	=
	Fossil fuels	-	AM, OS, TG	=	-	=	=	=	+	+	+
		+	GO	=	+	=	=	=	-	-	-

TableA2: Feed-backs between scenarios and key ecosystem services.

Driver	Indicator	Trend	Scenario	Key ecosystem services							
				TL	OL	IR	NIR	TEK	CH	SD	OH
Policy	Education investment	+	AM, TG, GO	=	=	=	=	+	=	=	=
		= ?	OS	=	=	=	=	=	=	=	=
	Local markets	+	AM, OS	+	=	=	=	=	-	=	=
		-	TO, GO	-	=	=	=	=	+	=	=
	Payment for envt services	+	AM, TG	+	=	+	+	+	=	=	+
		=	OS	=	=	=	=	=	=	=	=
		-	GO	-	=	-	-	-	=	=	-
	Local subsidies	+	AM, OS	+	+	+	+	=	=	=	=
Policy	Local subsidies	-	TG, GO	-	-	-	-	=	=	=	=
	% Land area under conservation	=	AM, OS	=	=	=	=	=	=	=	=
		+	TG	=	-	=	=	=	+	+	+
		-	GO	=	+	=	=	=	-	-	-
	Quotas	-	AM, TG, GO	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	=
		+	OS	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	=
Technology	Green vs. Non-green	+	AM, TG	+	=	=	=	=	=	+	+
		-	OS, GO	-	=	=	=	=	=	-	-
Tourism	Number	-	AM	-	=	-	-	=	+	+	=
		+	OS, TG, GO	+	=	+	+	=	-	-	=
	% Ecotourism	+	AM, TG	+	+	+	-	=	+	+	+
		-	OS, GO	-	-	-	+	=	-	-	-

Table, second part. Feed-backs between scenarios and key ecosystem services.