

Sector: Rural - Urban Transition

Final Report of the MEDUSA project



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Introduction

This study is focused on rural-urban transition in the Var catchment, France. Its duration was from 2nd September to 30th November 2008. It is a part of the MEDUSA project. This acronym means *Managing the human environment system to provide and sustain ecosystem services for all users safeguarding human wellbeing and biodiversity – developing strategies to adapt to future changes*.

The study area of the Var catchment (3760 km²) is situated in southern France and is part of Provence-Cote d'Azur region. The Var catchment belongs to three administrative units: Var, Alpes-Maritimes and Alpes de Haute Provence.

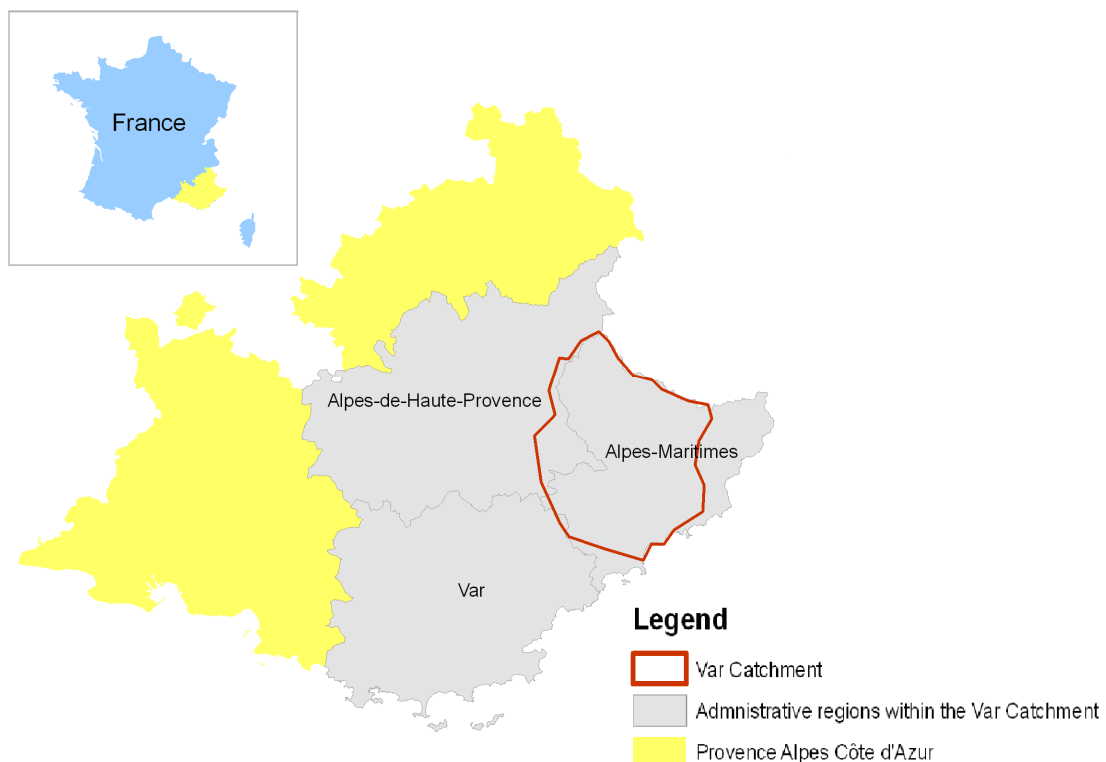


Figure 1 - Study are of the MEDUSA project

According to the MARS report (Schoder, Amann et al. 2005), the Provence-Alpes-Côte d'Azur belongs to the least sustainable regions in the whole Alpine area. Environmental pressures, which are represented by mean material and energy flow, are very high. Sustainability levels in terms of social and economic aspects are very low and improvement with regard to sustainability is not expected. From this follows that expert analyses concerning the future development of this area are highly needed.

The Var catchment is specified by a strong position of urban versus rural areas, with the urban area of Nice and its surroundings in the south of the catchment and the otherwise marginal rural areas covering the rest of the territory. Thence rural-urban transition is one of the key aspects of its future state. It is necessary to take management measures

that assure at least the continuation of the current state of sustainability with future development.

The aim of this study is to provide management recommendations for policy makers and stakeholders in terms of rural-urban transition. The study is focused on the description of possible future developments and further identification of adaptation strategies for maintaining sustainable use of ecosystem services within this sector. Basic research questions are: How will urban and rural development differ in the future? What will be the challenges to cope with? How might the varying demands in the catchment pose a threat to biodiversity?

Materials and methods

We structured our work according to the time frame of two weeks, and spent the first period on a literature review of available sources in English to get an overview of the rural and urban trends in the Var catchment as well as qualitative interviews with key stakeholders (described below). The most important drivers we looked at were climate change, demographics, market dynamics, policy, life style, tourism and technology as all of these factors were considered to have a direct or indirect effect on future rural-urban transition.

The research questions (see Introduction) were addressed by first developing a causal diagram of the current situation in the Var catchment consisting of the drivers mentioned above. The diagram shows key relationships between the drivers and served as a tool to keep in mind when we developed the scenarios for the future. When developing scenarios for future changes we used the methodology provided by the Millennium Ecosystem Assessment (MA 2005).

We selected three key ecosystem services we found of particular relevance to the urban-rural transition based on interviews with the stakeholders. These were biodiversity, water and aesthetic/recreational services. The main drivers considered to be of importance for rural-urban transition are described in the casual diagram (Figure 4).

The four scenarios were chosen from the Millennium Ecosystem Assessment (MA 2005) and adapted to the local situation of rural-urban transition in the Var catchment. Stakeholder interviews and data on economy, environment, and society formed the baseline for the development of the scenarios. For the development of the sectoral storylines we used downscaled scenarios for the region provided by the Synthesis Group of the MEDUSA project. All assessments, synergies, tradeoffs, and adaptation strategies are expert judgments.

Data sources

Baseline data

We used statistical data on economy, environment and society of the Alpine Space Regions from the MARS report (MARS 2005), land cover data from Corine (EEA 1990). We developed maps by using ArcGIS 9.2 on distribution of land use, urban areas and Natura 2000 sites, and used statistics on demography as baseline tools for developing the future scenarios. In addition the MARS report (2005) gave us an impression of possible future pressures.

Stakeholder interviews

Five stakeholders were interviewed qualitatively to gain knowledge about their situation, expectations, possible trends, preferences, and fears. Table 9 in the appendix includes the relevant information to describe rural-urban transition according to subjective statements from the different stakeholders. The water stakeholder is a civil engineer working in the local administration of Nice, the developer is working with real estate investment, the actors from nature conservation were one staff member from the national park and an NGO representative (protection of predators, bird of prey and fish), the EU actor is a coordinator for EU development programs, and the farmer is a representative from the local farmers union. Synergies and tradeoffs among the rural-urban development and the other sectors as well as within the rural-urban development were assessed using expert knowledge (e.g. stakeholder interviews, see appendix). From our assessment of drivers and processes we propose adaptation strategies for each scenario using expert judgment.

Causal diagram and Sectoral storylines

The causal diagram (Figure 4) represents the major drivers that influence the development of rural/urban transition. On the diagram we explore the interconnections between the different drivers in order to identify pressures and processes that have a direct or indirect influence in urban rural development.

The diagram was conceived in order to answer the main research questions and it was the basis for deriving the sectoral storylines according to the different scenarios provided by the synthesis group.

Results

Current land use & demographic information

In the Var catchment urban land use covers 4.5%, cropland 3.6%, grazed areas 21% and the rest is occupied by natural and semi-natural areas (see Figure 2).

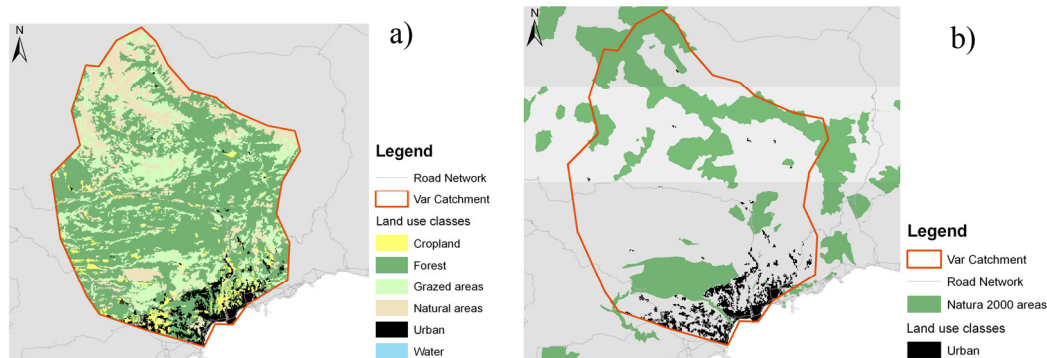


Figure 2 - Map of the Var catchment with a) distribution of land use and b) distribution of urban areas and Natura 2000 sites. (EEA 1990)

The population of Var catchment is 0.8 million with 45% are males and 55% females. About one third of the population is above 60 years old (Figure 3). Population density is 191 inh/km². The average of the gross domestic product (GDP) is 18 531 US\$ per capita. In the Var catchment exist 0.5 million dwellings and 0.4 million households, which means that 24% of houses are empty or only temporarily used.

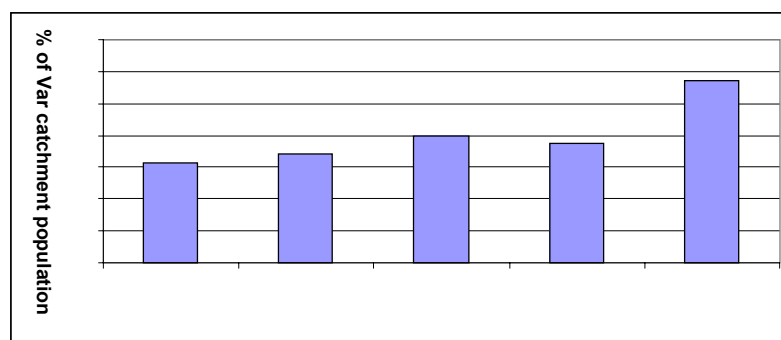


Figure 3 - Age structure of the population in the Var catchment

In comparison with the whole Alpine area the GDP per capita of the Provence-Alpes-Cote d'Azur is the lowest (MARS 2005). Urban regions in this province have higher GDP per capita than other rural areas, and the urban sector contributes to 44% of the production, which confirms the important roles of Nice and the tourism in Nice (MARS 2005).

Present and future of the Var catchment

According to the MARS report (2005), the Provence-Alpes-Cote d'Azur is at the lowest level of sustainability within the whole Alpine area. In other words, environmental pressures, which are represented by mean material and energy flow, are very high. Also, sustainability levels in terms of social and economic aspects are very low. Consequently, improvement of the current sustainability level is not expected. However, all of these might affect the development and/or the management of the Var catchment in the near future.

There are two examples that have direct effects on the Var catchment region and show the present and the near future of the Var catchment: infrastructure and tourism. Firstly, it is planned to further develop infrastructure in mountainous areas of France, which means to quadruple the amount of roads and increase the amount of railways by one and a half (European Environment Agency 2005).

Secondly, income from tourism is about 12% of the regional gross domestic product. Tourism accounts 12% of jobs in the region. These jobs increased by 14.5% between 1999 and 2004. Over 30% are seasonal workers, and 20% do not have a regular work contract. 80% of tourists are French and 20% come from other countries (led by Italy and the UK). Each tourist stays an average of 6.6 nights and spends on average 43 € per day. The majority of tourists come during the summer (www.humaniteinenglish.com; www.planetpeschel.com).

Causal diagram

This conceptual diagram was developed in order for identifying main drivers and investigating their impacts on the development of the Var catchment in terms of rural-urban transition in relation to biodiversity and ecosystem. Also, four different scenarios about the Var catchment's future were created based upon the processes described in the diagram (Figure 4).

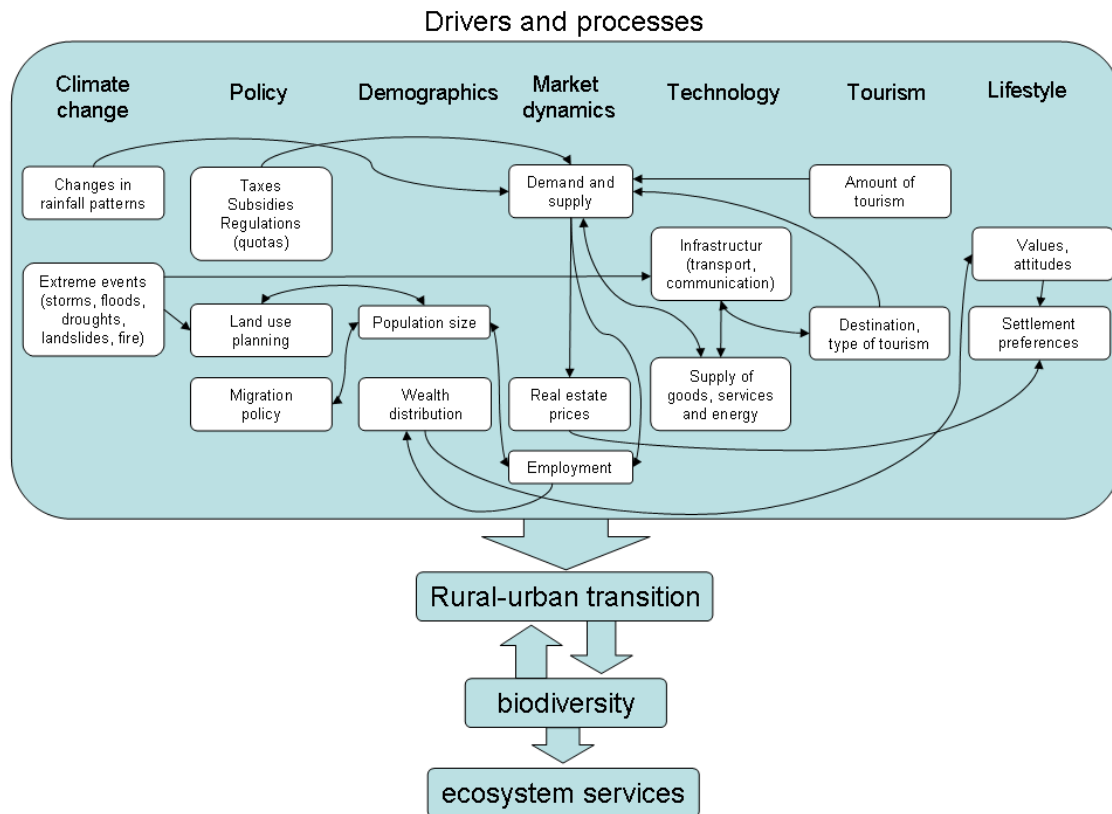


Figure 4 - A diagram of the rural-urban transition process in the Var catchment by defining main drivers

The main drivers considered to be of importance to urban-rural development are climate change, demographics, market dynamics, policy, life style, tourism and technology. For every driver we identified the most important factors that influence rural urban transition (e.g. rainfall pattern for climate change). Strong interactions between the factors are indicated by arrows.

Population size is influenced by employment opportunities, available space for settlement (land use planning) and also policies of immigration. The population is currently increasing in the Var catchment, especially in the urban areas around Nice. Type and availability of employment influence the distribution of wealth that affects values and attitudes as well as settlement preferences. Single extreme events such as storms, fire, floods may affect rural and urban land use planning. Frequently affected areas are e.g. less attractive for urban construction and building activities. Extreme events may also influence agricultural production and the amount of suitable agricultural land. Extreme events are an indirect driver influencing land use planning and migration from rural to urban areas due to unemployment in the urban areas. Demand and supply are important drivers that influence and are influenced by other drivers such as, policy, climate change, employment and tourism. Tourism is influenced by available infrastructure and vice versa.

Sectoral Story lines according to the synthesis group scenarios

The sectoral storylines were derived from the scenarios provided by the synthesis group. For the rural-urban transition the plausible scenarios can be represented on the following figure according to the axis of Global-Regional and Reactive-Proactive. From left to right we have the development of a more proactive world that tries to foresee the challenges of development and engages in proactive actions. From top to down we have a more regionalized world with more emphasis on local economies.

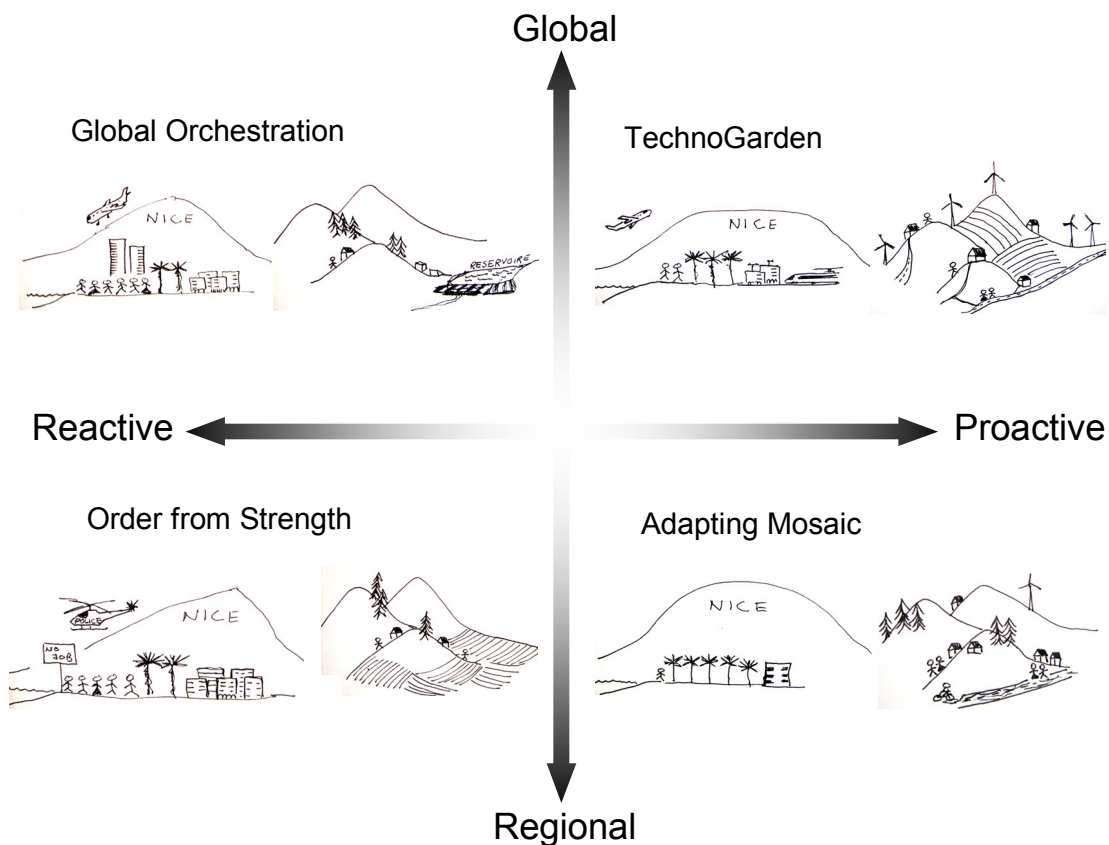


Figure 5 – Representation of the scenarios used for deriving the storylines

Sectoral storyline according to the “Global Orchestration” scenario

As the result of a decrease in the share of local agricultural markets and precipitation, agriculture activity will decline. People will migrate to cities leading to lower population density in the rural areas of the Var catchment. Increased population size in the urban areas will raise the need for the construction of more houses. Consequentially, rural or natural areas near the city will be urbanized. In addition, there will be an increased investment in constructions for tourism such as accommodation and infrastructure due to larger number of tourists visiting the catchment. Decrease in precipitation and increase of freshwater consumption will raise the demand for infrastructure for water management, mainly reservoirs.

Sectoral storyline according to the “Order from strength” scenario

The population will gradually increase in the Var catchment because of stable incomes from local production and subsidies that support regional products. At the same time, more land will be converted to the urban and agricultural areas from formerly other uses because of the growing population and agricultural production. Young people will inhabit the urban areas rather than the rural areas because of the access to more goods, services and employment. There is a pressure on rural land resources as the portion of agricultural land declines. Also, the number of tourists will grow and in the Var catchment more natural resources such as clean water and available land will be needed. Efficient security and protection measures keep immigration low. Due to climate change crops that are adapted to dryer and hotter conditions will be grown. For the growing population, there will be more needs to construct high standard accommodations and infrastructure and to provide water and new sources of energy.

Sectoral storyline according the “Adapting Mosaic” scenario

Less international tourism leads to higher unemployment in Nice. Former exported products are sold on the local markets, while the agriculture is less intensive. Therefore most of the urban population moves to the countryside to get jobs in agriculture or ecotourism. Due to the decrease of tourism, houses on the countryside are inhabited by migrants from Nice.

Factories in Nice are using green technologies to reduce their emissions, others are shut down. Consequentially, the resulting brown-fields enhance the urban biodiversity and recreational values. In rural areas renewable energies are used.

The local governance establishes subsidies for social learning and experience. Education changes the attitudes towards sustainable usage of environmental goods. Therefore and because of a reduced amount of imported meat the majority of people become vegetarian. To avoid traffic, people live near their working places. These mechanisms reduce the overall energy consumption.

Sectoral storyline according the “TechnoGarden” scenario

In the TechnoGarden scenario only minor transitions in the distribution of rural and urban areas happen in the Var catchment. Economical importance of rural areas will slightly increase while importance of urban areas decreases.

Due to the agricultural intensification the rural population will slightly increase without changes in employment rates. Increase of ecotourism will promote economic sustainability of rural areas (reconstruction of villages) and may demand additional buildings and infrastructure.

Though the number of tourists in Nice increases, the urban population decreases slightly. Increased demand for tourist accommodations will be supplied within the existing urban area.

Globalizing of markets, increase of tourist numbers and intensification of agricultural production will strongly foster the development of infrastructure. Furthermore,

infrastructure and constructions will be needed to satisfy the increased demand of green energy, e.g. solar panels, wind parks.

Synergies and tradeoffs between the developer & the other stakeholders for ecosystems services

Looking at rural-urban transitions, the plans of the developer were identified as the main driver and therefore, the developer is for us the main stakeholder for future changes in the region. The following tables show, for each scenario, if conflicts or synergies ***between the Developer and the other stakeholders*** related to the three selected ecosystem services are expected.

Synergies and conflicts in the Global Orchestration scenario

Table 1 - Synergies and conflicts in the Global Orchestration scenario

Ecosystem Services	Water manager	Nature conservation	Agriculture	EU actor
Biodiversity	No conflict	No conflict	Conflict	No conflict
Water	Conflict	Conflict	No conflict	Synergy
Recreation/ Aesthetics	Conflict	Conflict	Synergy	No conflict

Higher demand from touristic activities may cause conflicts with the use of water in other sectors (e.g. water manager). The building of new dams due to an increasing water demand from tourism could be in conflict with the aims of nature conservation. Both EU actor and the water manager are concerned with future water quality. The decline of agriculture will provide the developer with more areas for tourism infrastructures. Farmers and the developer want to maintain the current landscape.

Synergies and conflicts in the Order from Strength scenario

Table 2 - Synergies and conflicts in the Order from Strength scenario

Ecosystem Services	Water manager	Nature conservation	Agriculture	EU actor
Biodiversity	No conflict	Conflict	No conflict	Conflict
Water	No conflict	Conflict	Conflict	Conflict
Recreation/ Aesthetics	Conflict	No conflict	No conflict	No conflict

Concerning water there might be a conflict between the developer and agriculture in terms of scarce resources (urban versus rural). A conflict might also occur between the developer and the EU actor as a policy maker that wishes to secure resources. With the

nature conservationists could be conflicts about the biodiversity in terms of construction legislation (policy measures).

Synergies and conflicts in the Adapting Mosaic scenario

Table 3 - Synergies and conflicts in the Adapting Mosaic scenario

Ecosystem Services	Water manager	Nature conservation	Agriculture	EU actor
Biodiversity	No conflict	No conflict	No conflict	No conflict
Water	No conflict	No conflict	No conflict	No conflict
Recreation/ Aesthetics	No conflict	Synergy/ conflict	No conflict	Synergy

If the customers of the developer want to do fancy sports, e.g. paragliding, it might be in conflict with nature conservation purposes. If only the beauty of the landscape is demanded by the developer, it would be a synergy effect. As the EU actor, the developer wants to have a beautiful landscape.

Synergies and conflicts in the TechnoGarden scenario

Table 4 - Synergies and conflicts in the TechnoGarden scenario

Ecosystem Services	Water manager	Nature conservation	Agriculture	EU actor
Biodiversity	No conflict	Conflict	No conflict	Conflict
Water	No conflict	No conflict	No conflict	No conflict
Recreation/ Aesthetics	No conflict	Synergy	Conflict	Synergy

Conflicts exist between the developer and the stakeholder of Nature Conservation and the EU concerning biodiversity, since increased density of infrastructure causes a fragmentation of habitats and landscapes. Both stakeholders want to maintain connectivity of Natura 2000 sites. On the other side, synergies are among the developer, the nature conservationist and the EU actor, in terms of maintaining habitats and aesthetic value of the landscape. Furthermore, there is a conflict between the developer and agriculture, since intensified agriculture may reduce the aesthetic value of the landscape.

We can therefore conclude that conflicts between the Developer and the other stakeholders will exist in every possible scenario. Some scenarios like the adapting mosaic present conflicts only for one ecosystem service while for Order from Strength and Global Orchestration conflicts arise for every ecosystem service demanded by the

Developer. These kinds of conflicts can to some extent be overcome with implementations of rules by politicians.

Synergies and tradeoffs between ecosystems services within the sector Rural-Urban transition

In an uncertain world, the developer will very likely be faced with tradeoffs and synergies regarding the objectives she stated in the previous interviews. In this chapter we identify the possible synergies and tradeoffs for the ecosystems services that future scenarios can carry with regard to the developer objectives.

Global Orchestration

Under the Global Orchestration scenario, the construction of water dams will have an impact on landscape, disturbing some of the aesthetical values demanded by the developer. The increasing demand on water supply to the new tourism oriented investments will increase the pressure on ecosystems and biodiversity. As people leave rural areas, more agricultural land is available for conversion to natural land, values on landscape will be maintained but some conflicts for biodiversity may arise.

Order from Strength

In the “Order from Strength”, for saving water, several small dams are required, and therefore biodiversity will be affected negatively, and at the same time aesthetical values also will decrease due to the artificial structures. Due to the demand of tourists on enjoying their activities in a natural area, it can degrade the quality of biodiversity. So, developing activities will cause some conflicts between ecosystem services including water, biodiversity and aesthetic and recreational values.

Adapting Mosaic

The demands on water, biodiversity and aesthetics do not contradict to each other. Fancy sports could have a negative impact on biodiversity or the scenery.

TechnoGarden

Within the sector synergies exist between aesthetical value and biodiversity, because high biodiversity positively influences aesthetic and recreational value.

Synthesis board of the effects of each scenario for the important ecosystems services in the rural-urban transition sector.

From each description of the tradeoffs and synergies mentioned before, positive, no change or negative effects of each scenario on the ecosystems services demanded by the developer were synthesized on the next figure. A ranking was made by adding up all the negative effects of each scenario regarding the ecosystems services.

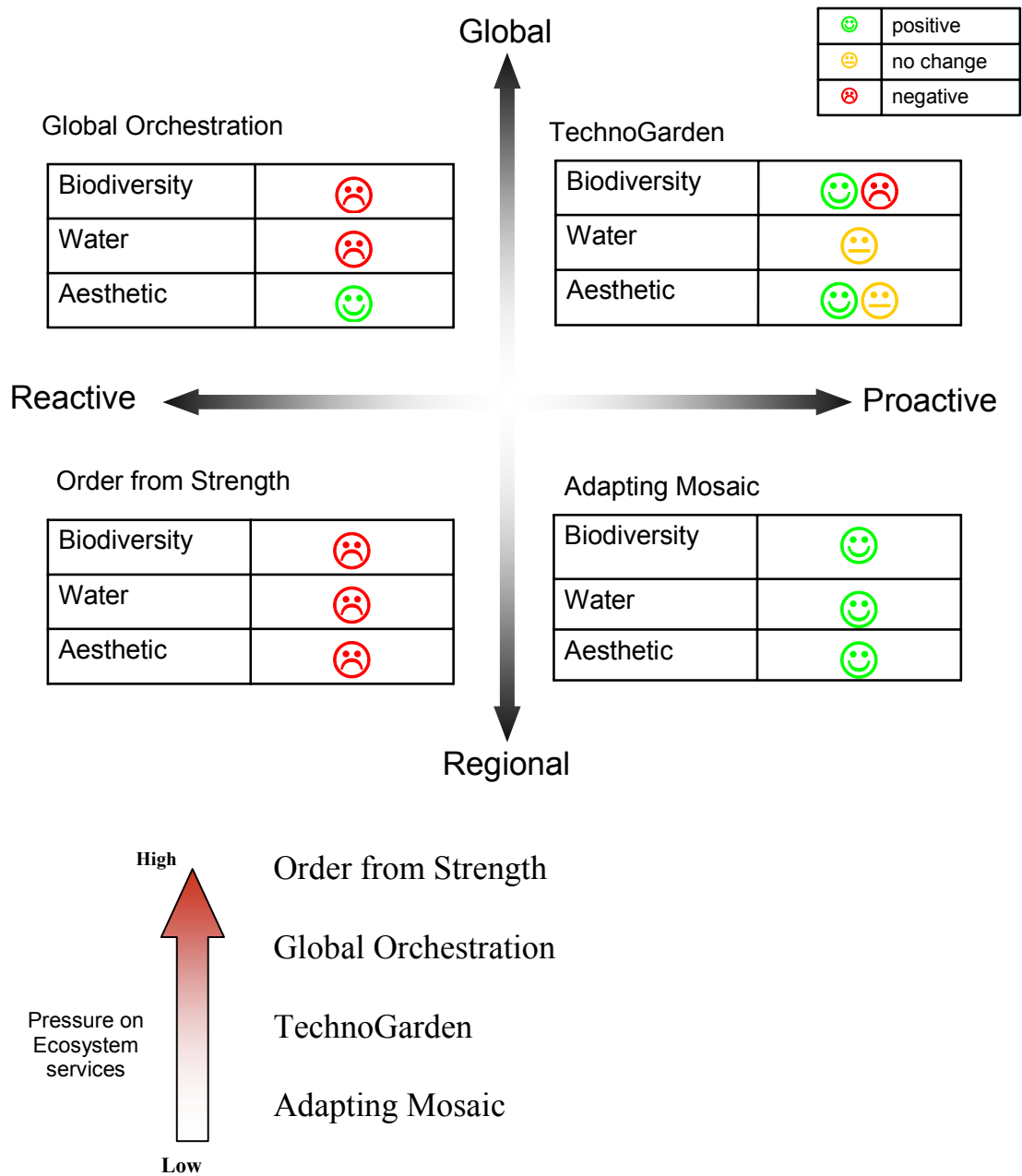


Figure 6 - Synthesis board of the effects of each scenario for the important ecosystems services

From the ranking we can conclude that Order from Strength is the future scenario that will raise more negative consequences to the ecosystems services demanded by the developer. On the other hand, Adapting Mosaic seems to be the scenario that will least affect ecosystems services that are important for the developer. In addition, from the analysis in table 1 to 4, we can conclude that this is also the scenario where fewer conflicts arise between the developer and the other stake holders for the same ecosystems services.

Adaptation strategies for each storyline

Once the main disadvantaged for ecosystems services in each scenario regarding the developer's objectives were identified, adaptation measures (summarized in the coming tables) can now be proposed.

Table 5 - Adaptation strategies under the Global Orchestration scenario

Ecosystem service	Adaptation strategies
Biodiversity	-After a forest fire occurs reforestation of the area should be done with fire adapted species, if possible indigenous species. -More opportunities for the creation of protected areas on abandoned rural areas in order to maintain biodiversity and the type of landscape for tourists. -The construction of new water dams in rivers should include measures for maintaining the river connectivity.
Water	-Due to water shortage, new tourism oriented development should promote water efficient practices. -New tourism oriented facilities should use water from precipitation for some selected uses.
Aesthetic / recreational values	-Location of new infrastructures should be planned in order to cause as little visual impact as possible.

Table 6 - Adaptation strategies under the Order from Strength scenario

Ecosystem service	Adaptation strategies
Biodiversity	-The preservation of biodiversity and areas of high aesthetical and recreational values (such as conservation areas) should be secured by developers in construction work.
Water	-For sustainable water supply, construction of a factory for purifying seawater on coastal areas should be considered on a larger scale, provision of rain collecting tanks associated with tourist accommodations to cope with drought and construction of several small dams in the water course are suggested
Aesthetical / recreational values	-To avoid additional pressure on these ecosystem services construction of higher and larger buildings and upgrading old houses and abandoned buildings rather than constructing new ones are suggested.

Table 7 - Adaptation strategies under the Adapting Mosaic scenario

Ecosystem service	Adaptation strategies
Biodiversity	<p>-To maintain or even increase the biodiversity, the agricultural practice should be less intensive.</p> <p>-The availability of natural areas for urban dwellers could be increased by converting abandoned urban buildings for recreation purposes.</p>
Water	<p>-People have to be educated to change their attitudes towards the usage of less water and energy. Additional water saving technologies should be used.</p>
Aesthetical / recreational values	<p>-Old houses should be reconstructed in respect to local traditions, and new houses should also be built in a local style. In consequence, both, tourists and inhabitants are able to enjoy the aesthetical and recreational values of the landscape.</p> <p>-The development of a sustainable ecotourism is advised (low density of tourists, bicycling, hiking, environmental education).</p>

Table 8 - Adaptation strategies under the TechnoGarden scenario

Ecosystem service	Adaptation strategies
Biodiversity	<p>-Building activities that cause habitat disturbances should be restricted to areas with lowest impact on biodiversity. Increase landscape connectivity by including migration corridors in infrastructure planning.</p>
Water	<p>-Houses with water reservoirs and waste water treatment recommended; Desalination to stabilize water supply</p>
Aesthetical / recreational values	<p>-Restrict building activities to certain areas, i.e. far from aesthetic valuable regions or nature conservation areas). Preserve traditional style of houses while including green technology (e.g. solar panels).</p>

Conclusion

Our analysis has shown that conflicts between the different stakeholders exist for all the scenarios evaluated. Therefore a conflict management or discussions between stakeholders in the region should be encouraged. Policy and planning needs to clarify the development goals to enable a targeted conflict management.

The most sustainable development is characterised by regional and proactive strategies which is described in the Adapting Mosaic scenario (see ranking in Figure 6). Global and proactive strategies will lead to bigger impacts on biodiversity and ecosystem services, as e.g. shown in the TechnoGarden scenario.

In both reactive scenarios, Global Orchestration and Order from Strength, there are large impacts on ecosystem services. In order to cope with these, possible solutions are seen in education strategies and technology for water and energy supply. Varying demands in the catchment will pose a threat to biodiversity, because of water cuttings and the new construction of infrastructure.

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Appendix

Table 9 - Main results of stakeholder's dialogue regarding their current knowledge, problems, expectations and wishes for the Var-catchment

	Water	Developer	Nature Conservation	EU	Agriculture
Current situation	<ul style="list-style-type: none"> -Technical solutions exist -Nice presents the highest demand of water (120 liters per day/ household) -Main focus on urban region -Water framework directive is too restrictive - Leaking water tubes leads to 15% loss of water - Groundwater salinity problems 	<ul style="list-style-type: none"> -Increasing demand for high standard housing in natural areas near Nice (permanent) 	<ul style="list-style-type: none"> -High natural values in the area -Some protected areas near Nice -Problem with overgrazing by sheep, pesticides from fruit plantations 	<ul style="list-style-type: none"> -EU wants rural development - Sustain livelihoods in rural areas - Not enough lively rural communities 	<ul style="list-style-type: none"> -Production is not sufficient for survival -Young people migrate to cities -Water shortage, droughts, soil erosion, fire -Farms abandoned -Value of the land for agricultural production is decreasing, selling more profitable
Expectations for future developments	<ul style="list-style-type: none"> -More tourism -Population growth - Reduce flood risks from rivers by damns -No desalination (too expensive) 	<ul style="list-style-type: none"> - Water will be a major concern 	<ul style="list-style-type: none"> -Fire risks -Insufficient water capacity and water pollution -No extension of protected areas -Decrease of nature values -Growth of tourism and population size -Growth of agricultural pressure 	<ul style="list-style-type: none"> -Lack of water quality and quantity due to climate change 	<ul style="list-style-type: none"> -Farmers Union are open to new developments such as eco tourism and nature conservation
Future development	<ul style="list-style-type: none"> -Sustaining pastoralist on behalf of forestry -Higher demands for water -More reservoirs, power plants and dams 	<ul style="list-style-type: none"> -Better infrastructure, sport facilities and public services near Nice 	<ul style="list-style-type: none"> -More rigorous laws and protection 	<ul style="list-style-type: none"> - More diversification in rural areas and agriculture - Maintenance of habitats - Enough water quality and quantity - Natura 2000 sites interconnected 	<ul style="list-style-type: none"> -Keep lifestyle and landscape like it is -Get young people back -Help from scientists and politicians -Production without subsidies