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Fragile ecosystems and scarce resources meet growing food demand: Is “business as usual” land use an appropriate long-term solution for the Alpine countries?

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The Alpine region is exposed to two major challenges in terms of sustainable agriculture: 1) topographical conditions constrain the area, which can be used for agricultural production and 2) the Alps have suffered a dramatic loss of biodiversity in the last few decades. This loss is to great extent caused by a) intensified use of agricultural land in high-yielding areas (e. g. excessive nitrogen depositions) and b) abandonment of agricultural areas with low productivity. In the near future, these challenges are expected to amplify, as the Alpine region will have to contribute to a growing global food demand. In order to find anchor points which help to tackle these challenges a qualitative system analysis was conducted to identify and analyse the variables which influence agricultural land use in Austria, Liechtenstein and Switzerland. Results suggest that our Alpine land use system exerts an enormous pressure on the level of certain variables. If current trends of land use continue to maintain, the level of the variables “ecological quality of agricultural areas” and “attractiveness of landscapes” will most likely decline. Contrarily, the level of “land use intensity on arable land and grassland” will increase further. This shows an imminent need to substantially change land use especially if we seek for long-term food security and conservation of natural resources.

Keywords: land use, food production, ecosystem services, Alpine region, qualitative system analysis

1 Introduction

Soil is the most sensitive and valuable natural capital of mankind (Haber and Bückmann, 2013: 1 ff.). It is a scarce resource and the basis for growing food. In order to contribute to increasing food demand, the Alpine region is exposed to two major challenges. Firstly, topographical conditions in the Alps constrain areas, which can be used for agricultural production (Stöcklin et al. 2007, 33-35). Secondly, the Alps have already suffered a dramatic loss of biodiversity (BAFU 2015, 59). This loss is to great extent caused by a) intensified use of agricultural soils in high-yielding areas (e. g. excessive nitrogen depositions) and b) abandonment of agricultural areas with low productivity (European Commission 2008, 23). In times of a global population growth related to increasing food demand and a changing climate, it is more than ever important to preserve ecosystem services especially those in ecologically fragile zones.

2 Material and Methods

In order to find anchor points which help to tackle the challenges described above, a qualitative system analysis (Scholz and Tietje, 2002) was conducted. This analysis helped to identify and examine the variables which influence land use in Austria, Liechtenstein and

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Switzerland. Based on a qualitative assessment 30 variables were selected. Experts from Austria and Switzerland reviewed these variables and determined relations and levels to which these variables impact each other in a workshop. Subsequently, these variables and their interrelationships (impact matrix) were analyzed with the software SystemQ. Within this analysis it has been assessed a) the level of pressure that the system exerts on the variables under the assumption that “business as usual” land use will continue to maintain in the Alpine Region (system feedback) and b) the potential of variables qualifying as a suitable starting point for policy measures targeting sustainability objectives.

3 Results

Figure 1 shows the feedback of the land-use system in the Alpine countries. It demonstrates how the level of different variables will change up to 2030, if “business as usual” land use continue to maintain – displaying the degree of change (bar size) and the direction of change (increase (+) or decrease (-)). As figure 1 reveals, our Alpine land use system exerts a relatively high pressure on specific variables acting as “receivers”. If current land use practices and trends continue to maintain, the level of the variables “land use intensity on arable land” and “land use intensity on grassland” will most likely increase. Consequently, the level of the “ecological quality of the agricultural areas” and “attractiveness of landscapes” is set to decrease further.

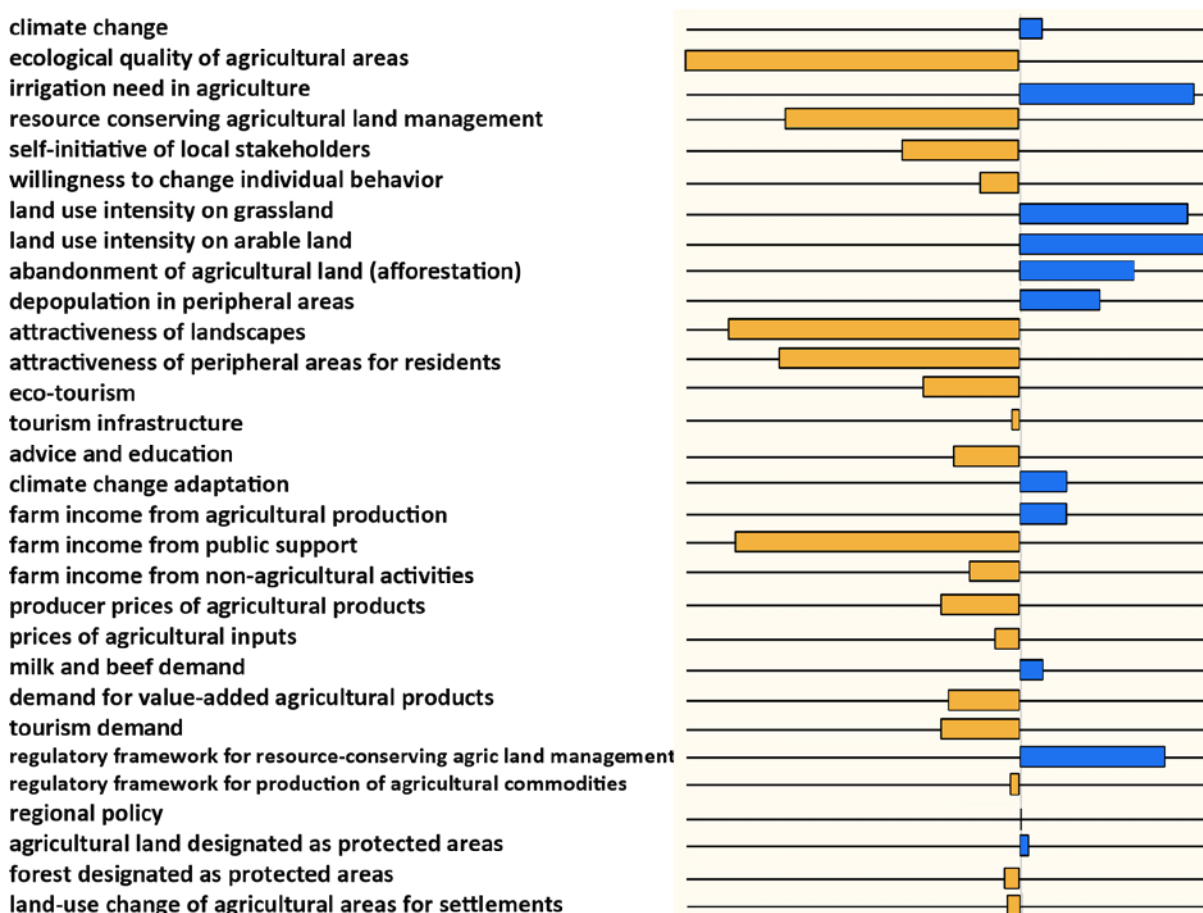


Fig. 1 System Feedback

In order to identify leverage points for influencing land use change, it is necessary to define an objective of sustainability. In our considered framework such an objective may be defined as to improve the level of “ecological quality of the agricultural areas” as soil protection is one of the main components of sustainable land use (Haber and Bückmann 2013, 1 and 187).

The analysis showed that such an improvement could be achieved by enhancing the "self-initiative of local stakeholders" and "resource conserving agricultural land management". For this, it is necessary to provide appropriate and specific policy measures at national and regional level.

4 Conclusions

Our investigation reveals an imminent need to substantially change land use in the Alpine region especially if we want to contribute to long-term food security and conservation of natural resources. Therefore, it is important to strengthen the self-initiative of local stakeholders and promote organic agriculture as a form of resource conserving agricultural land management. In addition, it is recommendable for the alpine region to focus on high value agricultural products, as mass scale commodity products will not pay for the higher cost of preserving ecosystems.

In a forthcoming step, we will use this knowledge in a global land use model (Schader et al. 2014) to quantitatively assess effects of several "more sustainable" land use options in the Alpine region. One of these land use options will be the adoption of pure roughage consuming cows which will not be fed on "imported" soybean meal.

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