Impact of Swiss agro-environmental policy on cattle farming and target species in the Entlebuch UNESCO Biosphere Reserve

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Abstract

The study area is situated in the northern foothills of the Swiss Alps. 42% of the study area is covered with forest, 30% is agricultural area and the alpine zone makes up a further 18%. The farms are characterized by a small size (on average 15.2 ha). Nevertheless, 75% of the farms are full-time holdings. 34.3% of the working population works in the first sector. The impact of four agricultural policy scenarios (SC1: current situation, SC2: new agricultural policy 2011, SC3 and SC4: approaching to EU conditions without and with environmental payments) on land-use and on selected target species (selected butterflies, bryophytes and vascular plants) was analysed for different cattle farm types. Dairy farm income decreases from SC1 to 3 whilst, for breeding farms, SC2, 3 and 4 reveal to be most profitable. In SC4, beef farms operate with a low productivity level. Dairy farms usually have the highest stocking rate, breeding and veal farms the lowest. The effects of the change in area of six land-use types (intensive pastures, extensive pastures, mown meadows, nature conservation area, abandoned land, forests) under the 4 scenarios on target species (two butterfly species, four vascular plants, one bryophyte taxa) was estimated. In the long term, most target species will decline as parts of abandoned land will be transformed into forest.

Keywords: Mountain region, Swiss agriculture policy, cattle farming, economy, land-use types, target species

Introduction

The new Swiss agricultural policy (Agrarpolitik (AP) 2011, 2005, Meier und Lanz, 2005) imposes a higher competitiveness and a stepwise approach to European conditions. According to AP 2011 and WTO negotiations, Switzerland is obliged to cut back tariffs, reduce product-bound internal measures of support and, in the medium to long-term, phase out any form of export aid. These measures are going to decrease the income of Swiss farmers, as Swiss agriculture is characterised by small-scale structures working with small herds in a high-cost context. For Swiss mountain regions, it is essential to analyse and quantify the nature and the magnitude of the impact of different political framework conditions on agriculture in general and on cattle farming, land-use types and target species in particular.

Materials and methods

The study area, the Entlebuch UNESCO Biosphere Reserve, is situated in the northern foothills of the Swiss Alps and exposed to a sub-oceanic climate. The bedrock is calcareous. It consists of 42% of forest, 30% of agricultural area, 18% of alpine zone, 3% settlement zone and 7% of non-productive area. Due to its topography, soil, climate and remoteness, the Entlebuch has sub-optimal site qualities with respect to agriculture, industry and trade. In 2005 75% of the 1015 farms are full-time holdings and 34.3% of the working population is employed in the first sector (AfS, 2007).
The impact of four scenarios (SC1 to 4) on six real farms (management units) in 2005, typical for the Entlebuch, was analysed. Farm 1 (F1) to F3 represent different types of dairy farms. They vary mainly with respect to their size. The other three farms keep either suckler cow (F4), breed heifers (F5) or conduct a milk based veal fattening (F6). SC1 reflects the business environment in 2003/04. SC2 represents the implementation of the new Swiss agricultural policy (AP 2011; milk price decreases by 30% and meat price, on a slaughter weight basis, decreases by 20% in comparison to 2003/04, while costs remain constant). SC3 is an example for the total cessation of governmental intervention and SC4 represents the strict linkage of public payments to environmental services. The last two scenarios simulate market prices of milk and meat products as well as concentrate which are similar to European conditions in 2005/06. The costs in SC3 and 4 are kept on the same level as in SC1.
Statistical data and data about prices and costs were taken from the structural analysis of Hofstetter *et al.* (2006), Hilty *et al.* (2005), Wirz Handbuch (2005), Ammann (2004) and Meyer *et al.* (2003). Market prices in SC3 and SC4 were taken from Agrarmärkte in Bayern (2007, 2006). The labour requirement in terms of agricultural working units (AWU, man-work unit), the amount of direct payments and, on this basis, the agricultural output were calculated using a linear programming (LP) tool (Kantelhardt *et al.*, 2005). The LP tool tries to maximize the farm's specific performance. The consequences on economic parameters like gross margin and cash-flow, on changes in the production systems and on the use of agricultural area were evaluated.
Target species were selected to evaluate possible effects of these scenarios on organisms dependent on one or a few land-use types. Transition matrices which were developed in the LACOPE project (Fernandes *et al.,* 2006) show the relative change in land-use types (intensive pastures, extensive pastures, mown meadows, nature conservation area, abandoned land, forests) under the different tested scenarios.

Results and discussion

In comparison to the status quo, the LP calculated that four farms produce milk in SC2, three in association with an additional production, while one produces meat (Tab. 1). Cash-flow per AWU markedly decreases from SC1 to SC3. Breeding, beef and dairy farms with pig fattening generate the highest income in SC1 and 2. Veal farms generate the highest income in SC3 in the majority of cases. The highest income per AWU is generated by beef and breeding farms. In SC3 (without direct payments), stocking rate is highest for F2, F3 and F5 farm types. But the need for agricultural area is essentially lower, because F1 needs only 9.6 ha, F2 13.2 ha, F3 8.6 ha, F4 7.9, F5 4.1 and F6 10.8 ha. In other scenarios with direct payments the LP showed that farmers would like to rent additional agricultural area, because the rent of 333 € ha^{-1} is low for Swiss conditions. Farms have a very low or negative cash-flow in SC3. Economically, they wouldn't be sustainable. F2 (dairy farm) has the highest stocking rate across the 4 scenarios. The breeding farm (F5) and the veal farm (F6) are extensive production systems. Within a given scenario, the stocking rate generally decreases from dairy to beef farm e.g. from F2 to F6. From SC1 to SC4 there is an increase of beef production together with a decrease of dairy farming and income.

Table 1. Influence of the 4 scenarios on production systems evolution, on cash-flow (€, AWU^{-1}), on gross margin (€, AWU^{-1}) and on stocking rate (LU ha^{-1}) in the Entlebuch UNESCO Biosphere Reserve (Swiss mountain region)

Management unit [1]		F1	F2	F3	F4	F5	F6
Production system	SC1	Dairy [2]	Dairy	Dairy [3]	Beef [2]	Breeding	Veal
	SC2	Dairy [2]+ Breeding	Dairy+ Fattening	Dairy [3]+ Fattening	Beef [2]	Breeding	Dairy
	SC3	Veal	Veal	Veal	Breeding	Breeding	Veal
	SC4	Dairy [2]+ Breeding	Veal	Veal	Beef [2]	Breeding	Veal
Cash-flow AWU^{-1}, €	SC1	34000	53100	38500	53000	66000	24900
	SC2	30200	43800	23300	35000	41400	20200
	SC3	10800	16200	9700	-17500	-7800	-2900
	SC4	21300	33800	25000	23300	29800	17300
Gross margin AWU^{-1}, €	SC1	45800	67500	52700	73600	110800	46200
	SC2	42700	66500	45500	57200	83700	45200
	SC3	18500	24900	20700	6200	30600	20000
	SC4	33400	42200	35700	44400	68900	38600
Livestock unit ha^{-1}	SC1	1.2	2.3	2.3	1.7	0.6	0.6
	SC2	1.3	1.6	1.1	0.9	0.5	0.8
	SC3	0.8	1.9	1.7	1.4	1.7	1.4
	SC4	1.3	1	1	0.9	0.5	0.6

[1] Original farm size of the farm type F1 is 14.6 ha, 24.7 ha for F2, 13.1 ha for F3, 13.4 ha for F4, 20.8 ha for F5 and 24.9 ha for F6 in 2005. [2] These farms graze their cattle on alpine pastures. F1 exploits alpine pastures (36 ha) with some boarded animals from lowland farms (42 livestock units) for a 100 days period. The summering period for F3 on 20 ha lasts 120 days. [3] Average dairy farm with pig fattening.

As forests are strictly protected by the Federal law, these areas can not decrease. In fact, under all scenarios they will increase as abandoned land will slowly turn into forest. In scenario 2, the areas of mown meadows and extensive pastures decrease, forests and intensive pastures increase and the area of protected habitats remains unchanged. The most radical scenario (SC3) will lead to a marked increase in abandoned land and forest, a slight increase in extensive pastures and a distinct decline in mown grassland, protected areas and intensive pastures. SC4 undergoes the same changes in land-use distribution as SC3 but to a lesser extent.

The response of the target species to the different scenarios which influence the area of the land-use types can be classified in three categories: Short-term positive reaction: The butterfly *Lycaena helle* is most frequently observed on abandoned land. Thus, it will profit from the strong increase in abandoned land in all four scenarios. However, as abandoned land will eventually become forest, it will decline on the longer term. The two vascular plants *Succisa pratensis* and *Swertia perennis* are most often found on abandoned, wet land. Whether the increases in population size of these species are long-lasting again depends on the time it takes for the abandoned land to transform into forest. Neutral reaction: The butterfly *Colias palaeno* depends on the fodder plant *Vaccinium uliginosum*, which often grows in bogs which will not be influenced by SC1 to SC4. *Parnassia palustris* is a small vascular plant species which mainly grows on pastures and mown meadows in the study area. Presumably only a small decline in population size will be observed as long as the area of these land-use types remains quite large. In the same way, it is not probable that the population of *Splachnacea* will suffer as long as pastured areas do not decline dramatically. Negative reaction: The butterfly *Boloria aquilonaris* depends on flower rich meadows on the edge of oligotrophic bogs. This species is already very rare and the population will probably decline further if conservation measures are reduced such as in SC3.

Conclusions

The decrease of the milk and meat prices in scenario 2, 3 and 4 is the reason why the total incomes are decreasing essentially in scenario 2 and 4 and even more in scenario 3. Because of the framework conditions (similar EU–prices and without direct payments) there is no sustainable development in economy and society in scenario 3 since there is around a third of the Entlebuch population working in the first sector. This shows that direct payments are essential for the existence of agriculture in mountain regions. In scenario 2 (AP 2011) dairy farms also get direct payments for roughage consuming livestock and there is an extra-payment for cheese production. Therefore more farms are changing to milk production. This is coherent to the Swiss political goal, which intends to strengthen milk production. In scenario 4 (only environmental payments and a similar EU-price) the farms are mainly producing meat. The use of agricultural area is less intensive which is beneficial to the target species in the short term.

In the short term, target species population changes in the Entlebuch will be rather low, although extensive and intensive pastures and mown meadows, which are the most species rich land-use types in the Entlebuch, will decrease in size. Target species population sizes in these land-use types will decrease, but, as there is still a large area of these land-use types left, viable populations will most probably remain. In the long run, however, most target species will decrease since parts of the agricultural land will be abandoned and turn into forest.

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