

Report

# Organic Farming and Social-Ecological Resilience: the Alpine Valleys of Sölktaier, Austria

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**ABSTRACT.** Farming in the Austrian Alps is small in scale and involves a high degree of manual labor. In the face of structural changes in agriculture, alpine farms are finding it increasingly difficult to remain economically viable. Organic farming presents a promising alternative for alpine farmers because it receives considerable financial support under the Common Agricultural Policy of the European Union. Recent years have seen an increase in the number of organic farms in Austria in general, and in alpine areas in particular. Using data from an empirical study carried out in the alpine area of Sölktaier, Austria, this paper examines the issues of how closely the regulations and principles of organic farming match farmers' perspectives on sustainable agriculture and whether or not organic farming is capable of building social-ecological resilience for local farms. Qualitative interviews and a series of workshops were used to learn about farmers' "desired system state" with regard to their region, disturbances to this system, and their perspectives on organic farming. The desired system in Sölktaier as formulated by the farmers depicts a vivid farming community that manages a diverse traditional agricultural landscape and performs a number of ecological services. The desired system and the principles of organic farming have several aspects in common, and many management practices and features of the social system support social-ecological resilience. The vulnerability of farms increases, however, when farmers must deal with structural changes in agriculture, the erosion of traditional ecological knowledge, and societal transformation. In conclusion, organic farming is a tool that can be used to build social-ecological resilience for Sölktaier farms, because it secures economic funding for the area and makes it possible to sustain environmentally benign practices. What remains is the question of whether the farming community is capable of reorganizing the social system under the pressures of modernization so that the desired system state can be reached.

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*"Social continuity does not mean the absence of change."* (Redclift 1986)

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## INTRODUCTION

Austria is playing a pioneering role in the field of organic farming. Since the end of the 1980s, the number of organic farms has increased from 1200 in 1989 to 19,000 in 2000 (Federal Ministry of Agriculture, Forestry, Environment and Water Management 2001). The number of organic farms grew even more quickly after Austria entered the European Union (EU) in 1995. The EU subsidizes agriculture to a high extent, and one way for small-scale alpine farmers to obtain high subsidies is by converting to organic farming. Other reasons for the increase in the number of organic farms in Austria include political support, a high consumer demand for organic products, consumer interest and trust in organic produce, marketing, and the high availability of organic products in supermarkets. Today, 10 % of all farms in Austria are certified organic, most of them

located in the mountainous areas of the Alps, which occupy a large part of Austria. Conditions for farming in the Alps are difficult (cf. Bätzing 1991). The degree of mechanization is low, farming practices are still largely traditional, and most farms are highly dependent on subsidies. The overall number of farmers is steadily declining.

In the current situation, the further expansion of organic farming is seen as uncertain (Groier 1998, 1999, Vogl and Hess 1999, Hadatsch et al. 2000, Kirner and Schneeberger 2000). The rapid growth phase has lost its momentum, and the number of organic farms has remained stable at 18,000–20,000 since 1998 (Freyer et al. 2001, Kirner and Scheeberger 2002). The question arises as to what role organic farming can play in the persistence of small-scale mountainous farms in Austria.

The definitions of organic farming used in this article are based on those of *European Council Regulation 2092/91* and the International Federation of Organic Agriculture Movements (IFOAM). IFOAM

emphasizes the ecological, social, and economical survival of farms, whereas the European Council (EC) regulation focuses mainly on ecological measures (Le Guillou and Scharpé 2001, International Federation of Organic Agriculture Movements 2002). The differences between the IFOAM Standards and the EU guidelines are illustrated in Table 1. In this paper, the IFOAM Basic Standard is also referred to as the "organic principles," and the EC regulation is generally referred to as "organic farming."

**Fig. 1.** Map of Austria and the Liezen region. The enlarged segment shows the Liezen region with the Söltkäler municipalities.



Organic farming is relatively well accepted by farmers in Austria, especially in alpine areas (Eder et al. 2001). This paper tries to answer the questions of whether or not organic farming matches farmers' perceptions of sustainable agriculture and whether or not organic farming is capable of building social-ecological resilience for farmers. Therefore, this paper has two objectives.

1. The perspectives of Austrian small-scale farmers on sustainable agriculture, current changes, and organic farming are explored. For this part of the paper, a group of Austrian farmers formulated their perspective on sustainable agriculture. Throughout the paper,

this will be called the "desired system" (cf. Carpenter et al. 2001). Farmers also identified threats to the desired system state and assessed organic farming in relation to the desired system.

2. The study of the farmer's perspectives is analyzed and discussed in the context of social-ecological resilience (Berkes and Folke 1998, Berkes et al. 2003).

The term "resilience" is often used to describe the features of a system that are related to sustainability and sustainable development. In this paper, we use the definition of the Bruntland report, which states that sustainable development is progress that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Council on Environment and Development 1987). Resilience is the capacity to lead a continued existence by incorporating change (Holling 1986, van der Leeuw 2000, Gunderson and Holling 2002) and is a key property of sustainability (Folke et al. 2003), with learning, trust, and engagement as central features (Gunderson 2000). Resilience applies to the entire social-ecological system, not just the ecological subsystem (Carpenter et al. 2001). Systems may be ecologically resilient but socially vulnerable, or socially resilient but environmentally degrading (Folke et al. 2003). Thus, it is necessary to abandon the dichotomy between socioeconomic and ecological systems to better understand the process that confers sustainability (Scoones 1999). Carpenter et al. (2001) state that resilience has three properties: 1) the amount of change the system can undergo while still remaining within the same domain of attraction, known as "buffer capacity"; 2) the degree to which the system is capable of self-organization as compared to organization forced by external factors; and 3) the degree to which the system can build the capacity to learn and adapt. Folke et al. (2003) describe the following factors as crucial in social-ecological systems: learning to live with change and uncertainty, nurturing diversity for reorganization and renewal, combining different types of knowledge, and creating opportunities for self-organization. Sustainable development is generally regarded as desirable. Resilience differs from sustainability in this respect, because both desirable and undesirable system states can be resilient. Hence, sustainable development is the overarching goal that includes assumptions about which system state is desirable (Carpenter et al. 2001) and depends on the temporal and spatial scale at which the analysis is made (Costanza and Patten 1995).

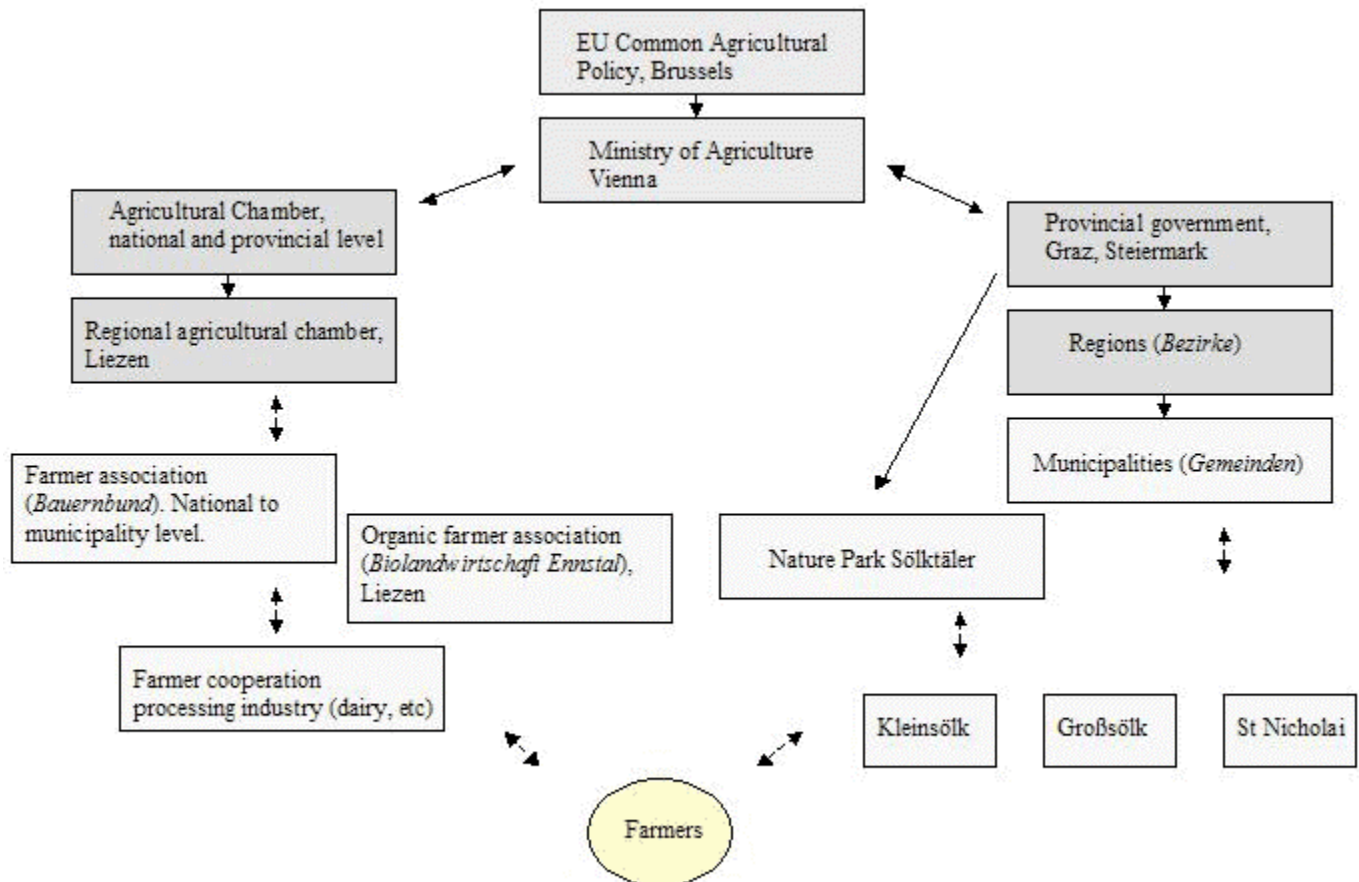
**Table 1.** Correlations between the functions of an organic production system according to *European Council Regulation 2092/91* (Le Guillou and Scharpé 2000) and the International Federation of Organic Agriculture Movements (IFOAM 2002).

European Council	IFOAM
	Produce food of high quality in sufficient quantity
Recycle wastes of plant and animal origin to return nutrients to the land, thus minimizing the use of nonrenewable resources	Interact in a constructive and life-enhancing way with natural systems and cycles
	Consider the wider social and ecological impacts of the organic production and processing system
Increase soil biological activity	Encourage and enhance biological cycles within the farming system, involving microorganisms, soil flora and fauna, plants, and animals
	Develop a valuable and sustainable aquatic ecosystem
Maintain long-term soil fertility	Maintain and increase long-term fertility of soils
Enhance biological diversity	Maintain the genetic diversity of the production system and its surroundings, including the protection of plant and wildlife habitats
Promote the healthy use of soil, water, and air	Promote the healthy use and proper care of water, water resources, and all life therein
Rely on renewable resources in locally organized agricultural systems	Use, as far as possible, renewable resources in locally organized production systems
	Create a harmonious balance between crop production and animal husbandry
	Give all livestock conditions of life with due consideration for the basic aspects of their innate behavior
Minimize all forms of pollution	Minimize all forms of pollution
Handle agricultural products with emphasis on careful processing methods	Process organic products using renewable resources
	Produce fully biodegradable organic products
	Produce textiles that are long-lasting and of good quality
	Allow all those involved in organic production and processing a quality of life that meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment
	Progress toward an entire production, processing and distribution chain that is both socially just and ecologically responsible

This paper starts with a description of the study area and the methodology, followed by three sections on the interviews and workshops held with Austrian mountain farmers in the valleys of Söltkäler. Next, the

empirical work is analyzed and discussed within a framework of social-ecological resilience. Finally, some general conclusions are drawn.

**Fig. 2.** The administrative and agricultural system surrounding Söltkäler. Agricultural policies from both Brussels and Vienna affect agricultural practices in these valleys. Farmers' organizations have representatives on all levels.



## STUDY AREA

The case study was carried out during 2000 and 2001 within a larger interdisciplinary research project in Austria (Bartel et al. 2002). Present and future farmers from the Söltkäler valleys in the Liezen region of Austria participated in the study presented in this paper (Fig. 1).

A "farmer" is defined as any person active in farming activities who defines her- or himself as a farmer. In the Liezen region, 30% of all farms are certified organic. Söltkäler was selected for this study because of its density of organic farms; every second farm is

certified organic. Another reason was the high degree of local participation thanks to the efforts of a nature conservation manager who showed a strong interest in attracting research to the area. The Söltkäler municipalities are joined together in a so-called Nature Park, which implies some conservation efforts and constraints to construction development. Figure 2 shows the administrative and agricultural system of which Söltkäler is a part.

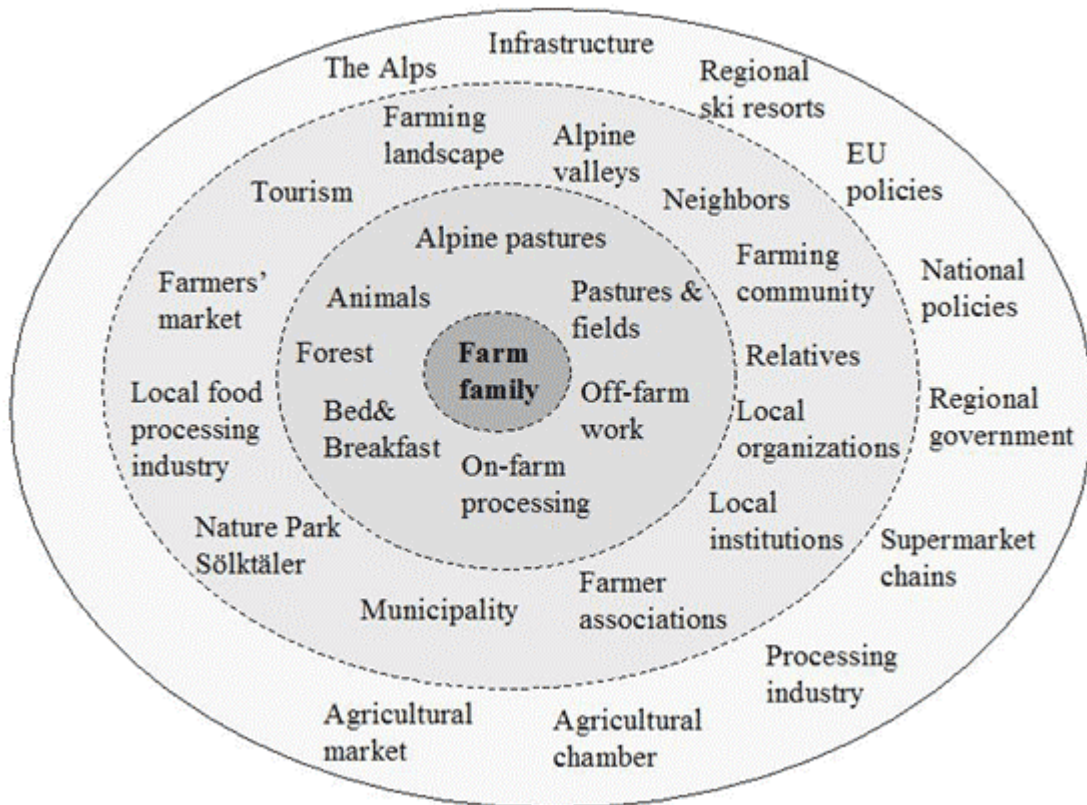
The ecosystem services provided by farming in Söltkäler are diverse. They include food and fiber products, biodiversity, beautiful patchy landscapes valued by tourists, a living countryside, and a base for



recreational activities (cf. Daily 1997). Farms in the valleys are generally small, with 8–10 cows; milk and meat production dominate. Forestry, tourism, off-farm work, home processing, and marketing are also important means of making a living. In the summer, cattle graze on alpine pastures called *Almen* for the production of butter and the local cheese specialty, *Ennstaler Steirerkas*. As in other alpine valleys, e.g.,

in Switzerland, there are a number of institutions that make it possible to manage resources held in common (cf. Netting 1981, Bätzing 1991, 1997, Ostrom 1999). Farmers own land privately or together, lease it from a landowner, or hold usufruct rights individually or as a group. Figure 3 describes the social-ecological system of a Sölk­täler farm at different scales.

**Fig. 3.** The social-ecological system for farms in Sölk­täler. Different scales are represented by ever-widening circles. EU stands for the European Union.



At the end of the 1980s, the regional dairy became aware of the growing consumer demand for organic milk and started to promote organic dairy farming. By 1999, 687 of the 2144 farms in Ennstal had been certified organic, and the regional organic farmer association, *Biolandwirtschaft Ennstal*, was the second largest in Austria (Vogl and Hess 1999). In the three Sölk­täler municipalities, between 43 and 65% of the farms are organic.

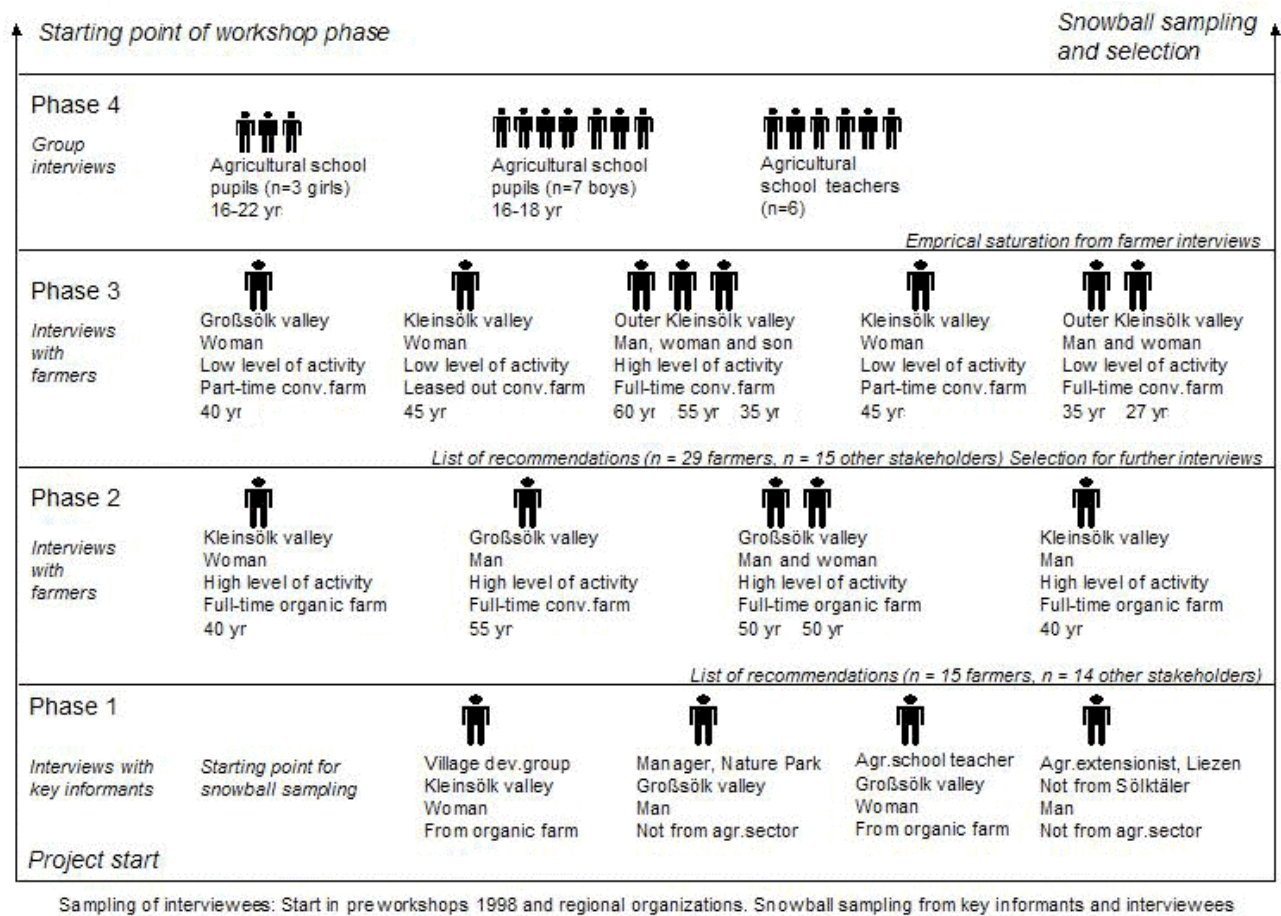
## METHODOLOGY

An underlying assumption of this study is that the people managing a natural resource, e.g., farmers or foresters, are knowledgeable about their agro-ecosystem, continuously learn about the system, and adapt to change (cf. Scoones and Thompson 1994, Johannes 1998, Berkes et al. 2000, Ellis 2000). Traditional ecological knowledge can contribute to the sustainable management of natural resources (Berkes et al. 2000). In alpine areas, this knowledge is well preserved and actively applied (Bätzing 1991). In this

respect, it seems useful to include resource users in the research and to explore their perspectives, i.e., to find out whether farmers' perspectives support social-ecological resilience or not. Thus, this study focuses more on the perspectives of farmers and less on what they actually do. The authors are aware that perspectives do not necessarily translate into actions and that actions cannot always be traced back to a formulated perspective (cf. Wilson et al. 1998). Nevertheless, exploring farmers' perspectives enables

us to get a grasp of their understanding of reality and thus to understand from what point of departure actions are, or could be, taken (Montgomery and Qvarsell 2001). This paints a rich picture of the realm of alternatives that farmers consider relevant. Although cross-scale interactions with other levels of society do influence farmers' decision making and range of action, the empirical study reported in this paper focuses on the local level.

**Fig. 4.** The sampling process for interviews in Söltkätler. Between each phase the results of the interviews that had already been conducted were analyzed, and new interview subjects were selected.



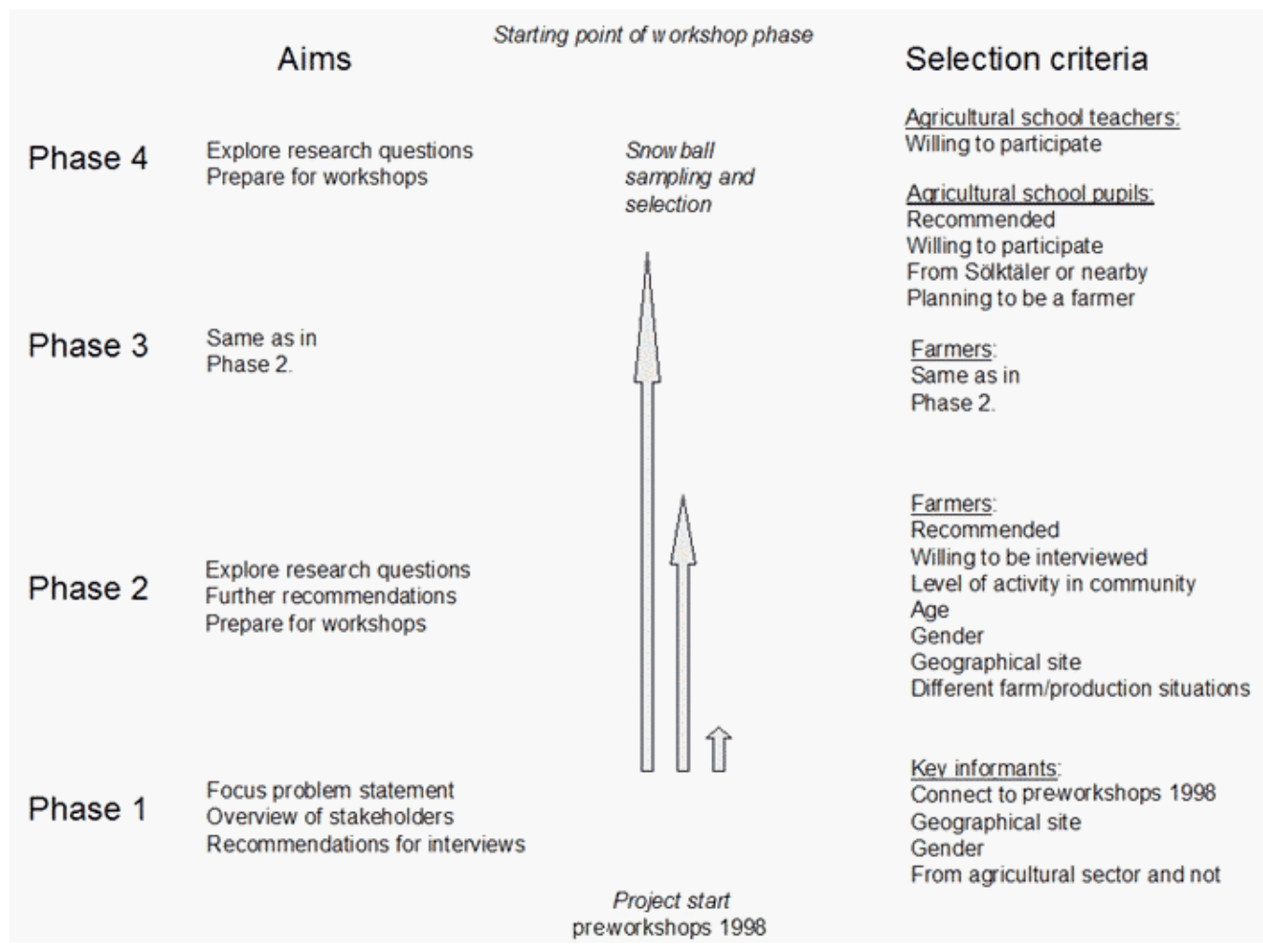
The case study conducted in Söltkätler was exploratory in nature (Yin 1994) and contained elements of action research (Reason and Bradbury 2001). Thus, we not only collected data but also actively aimed to encourage a learning exchange between farmers and researchers. Qualitative interviews and workshops were the main methods used in the case study. We selected the interview subjects by means of snowball sampling (Miles and Huberman 1994) based on a

defined set of criteria (cf. Glaser and Strauss 1967, Brandenburg and Carrol 1995, Kvale 1996). The aim was to obtain interview subjects who could offer a diverse mix of experiences and perspectives. Figures 4 and 5 show the sampling and selection process and the criteria for selecting interview subjects from Söltkätler. From a total 103 farms in the valleys, 13 farmers (seven female and six male) from nine farms were chosen and interviewed until empirical saturation was

achieved (cf. Miles and Huberman 1994). In addition, four key informants, six teachers from the agricultural school, and 10 pupils (three female and seven male) were interviewed individually or in groups. Interviews were semistructured, normally lasted 2 h, and focused on the present situation as well as the farmers' perspectives on sustainable agriculture and organic farming. All interviews were conducted by two researchers so that the results could be discussed afterwards. In addition, a series of workshops was held

with the interview subjects to validate the interview results, collect new data, and deepen our understanding of previous results. One workshop was held with local farmers, one with the pupils from the agricultural school, and one in which all participants were invited to join. The workshops are best described as a combination of methods including focus groups, observation, and discussion (Krueger 1994, Waddington 1994, Jackson 1997, Weisbord and Janoff 2000).

**Fig. 5.** Selection criteria for and objectives of interviews with key informants and farmers in Sölkätäl.



Interviews were recorded and transcribed. Additional documentation included protocols from observations, flip charts from group interviews and workshops, and the preliminary analysis made by the researchers in the form of research diaries (Strauss and Corbin 1990), memos, and diagrams (Miles and Huberman 1994).

The analysis of the material followed the three steps

recommended by Miles and Huberman (1994): data reduction, data display, and the drawing of conclusions. In data reduction, the process of selecting, focusing, simplifying, and abstracting data is illustrated through a set of codes around which the written material is organized. The codes were derived from the research and interview questions, along with emerging themes. The data were primarily displayed



by writing up field research and through graphs, tables, and mind maps (cf. Weisbord and Janoff 2000). Based on the two first steps, conclusions could be drawn in collaboration with fellow researchers and the interview subjects in the workshops.

The results of the empirical study in Sölktäler are presented in the following sections. In the discussion, these results are analyzed from a social-ecological resilience perspective (cf. Berkes and Folke 1998, Berkes et al. 2003).

## RESULTS

### Features of a desired system: Farmers' perspectives on sustainable agriculture

The farmers involved in the study described the features of the desired system in the interviews and workshops. As part of the discussion of the resilience of a system, its alternative states must be identified (Carpenter et al. 2001). Farmers in Sölktäler described two states. One is the forest state. In this situation, only a few people would live in the valleys and try to make a living from forestry and hunting tourism. Lowland farmers would use some pastures for their animals, but, on the whole, forests would dominate the landscape. Farmers see this state as a threat and use the word *Verwaldung*, meaning "undesired forest growth," which has a negative connotation.

The other system state farmers described has been prevalent for centuries: it is characterized by pastures, meadows and alpine pastures, cattle breeding and dairy production, and a dense farming population (cf. Netting 1981, Bätzing 1991). This is the state that farmers desire. The system scale the farmers referred to was the valleys as a whole, of which their farms were important parts. Even if forestry is a significant source of income, it is farming that makes life in the valleys meaningful. An elaboration of these features can be found in Table 2. What follows is a summary of the farmers' perspectives.

Sölktäler farmers consider agricultural activities to be a prerequisite for a sustainable future. In their opinion, the region would lose viability without agriculture. Farming identity and strong social cohesion among farmers are important elements of the desired system for the farmers. They also emphasize economic sustainability and the management of natural resources in a way that will enable future generations to continue farming.

Farmers find that a functioning Sölktäler farm includes these elements: the farm production itself, the farm family as a work force, production and grazing on the alpine summer pastures, forestry, tourist accommodation, home processing, and marketing. Farmers also stress that it is essential that nonagricultural income sources not interfere with farm activities. Thus, farmers strive for pluriactivity or reliance on multiple incomes (Mackinnon et al. 1991, Kinsella et al. 2000). By and large, the cultural landscape, the forest, and agricultural products are regarded as the basis for development.

With regard to ecological sustainability, farmers emphasize that they strive to work with nature and not against it. For example, they try to keep the soil, water, and waterways clean; to substitute renewable energy sources such as firewood for fossil fuels whenever possible; and to avoid overgrazing. However, the Sölktäler landscape shows signs of erosion on the steep slopes. The farmers explained that this erosion was the result of a labor shortage and new breeds of heavier cattle that destroy the slopes. It is less labor-intensive to let cattle graze than to mow a field.

Farmers believe that "working with nature" improves the capacity of the cultural landscape to generate what they want: stable production of pastures and hay to feed the animals, which in turn ensures milk and meat production. The landscape dynamic sets the boundaries for what is possible in the valleys. Agriculture is mainly traditional in Sölktäler. Machines and external inputs are used only moderately.

### The farmers' desired system in a policy perspective

The agricultural policies of the European Union (EU) and the Austrian government would appear to follow lines similar to those of the desired system described by the local farmers. The main objective of the Austrian Ministry of Agriculture is to sustain family farms, to give agriculture an ecological orientation, and to further develop economic viability (Federal Ministry of Agriculture, Forestry, Environment and Water Management 2002). The Austrian program for environmental measures in agriculture (ÖPUL) is called a "social and ecologically responsible agrarian policy" based on *European Community Regulation 2078/92*, which stipulates support for environmentally sound farming practices (Le Guillou and Scharpé 2001, Federal Ministry of Agriculture, Forestry,



Environment and Water Management 2002). Almost all the farmers in Sölk­täler are part of ÖPUL, and they can participate to the extent that suits them best. Compensation is available for farmers who refrain from using fertilizers, protect ecologically valuable elements, make proper use of pesticides, etc. The

program is believed to create a farming landscape that attracts tourists and that is considered worth protecting in national and EU policies (Federal Ministry of Agriculture, Forestry, Environment and Water Management 2002). In ÖPUL, organic farming renders the highest level of economic support.

**Table 2.** The desired system described by Sölk­täler farmers.

Feature of desired system	Explanation	How to obtain the feature
Persistence of farms	Farming is vital for viability of the region	Focus on high-quality products to ensure higher prices Take advantage of European Union subsidies
Social cohesion	A strong farming community and close ties between people counteract out-migration from the valleys	Cooperation instead of competition: <ul style="list-style-type: none"> <li>• neighbor-to-neighbor help (Nachbarschaftshilfe)</li> <li>• machinery cooperation (Machinenring)</li> <li>• regulars' table at the local pub (Stammtisch) and local organizations as platforms for communication</li> <li>• religious and traditional festivities</li> </ul>
Farming identity	Combining traditional farming community values with a modern lifestyle	Integrate traditional farming with modern practices: <ul style="list-style-type: none"> <li>• persuade children to stay in farming</li> <li>• educate children in farming</li> <li>• transmit joys and traditions of farming</li> </ul>
Economic sustainability	Increased income in agriculture strengthens farm viability	Foster creation of regional job opportunities Pluriactivity as a strategy for household income: <ul style="list-style-type: none"> <li>• farming</li> <li>• low-intensive tourism</li> <li>• home processing</li> <li>• direct marketing of farm products</li> <li>• forestry</li> </ul>
Nature conservation	Leave farm in the same or better shape as when it was passed on from the former generation	"Work with nature, not against it": <ul style="list-style-type: none"> <li>• avoid overgrazing and soil mining</li> <li>• mow and graze meadows and pastures regularly</li> <li>• practice "sensible forest management" (replant trees in the same place in which they were cut)</li> <li>• no forestation of farmland</li> <li>• keep soil, water, and waterways clean</li> <li>• substitute renewable energy, e.g., firewood, for fossil fuels</li> </ul>
Cultural landscape management	Farmers feel responsible for sustaining and managing a diverse agricultural landscape	Develop locally adapted management practices: <ul style="list-style-type: none"> <li>• mow every inch of hay meadows even if manual work is needed</li> <li>• allow grazing only if the soil can regenerate after the animals</li> <li>• use barn manure and forage from the farm</li> <li>• minimize or eliminate the use of chemical pesticides and high-energy feed</li> </ul>

**Table 3.** Recent changes described by the farmers in Söltkätler and problems related to those changes.

Recent changes	Explanation	Associated problems
Declining income	Decline in product prices, especially since Austria joined the European Union(EU) Common Market in 1995	Off-farm work improves economic sustainability of farms, but may decrease social cohesion and farming identity
Increased dependency on subsidies	EU subsidies contribute more to household income than did pre-EU subsidies (Schneeberger et al. 2001)	Subsidies improve the economic sustainability of farms, but challenge farmers' identity as autonomous entrepreneurs
Decreasing employment in agriculture	Farms close down due to financial or generational difficulties and suffer shortages of labor	Less open and patchy landscape as farms close down or do not have enough labor to manage the land
Changing functions of agriculture	Farmers feel they are expected to be landscape wardens and tourist entrepreneurs, not the food producers they want to be Part-time farming increases Increased importance of tourism, home processing, and marketing (Schneeberger et al. 2001)	Tourism is dependent on the landscape that is created through farming Increased commuting to off-farm work gives farmers less time for agriculture
Less tolerance for failure	Strained household economies and shortage of labor give farmers less freedom for experimentation	Persistence of farms is endangered
Increasing demand for education	Children leave home early for boarding schools and normally have two educations, one in agriculture and one in a profession for off-farm work	Young people can be alienated from the farming community and choose other professions
Changing values	Diversification of values in the farming community: <ul style="list-style-type: none"> <li>• increased individualism</li> <li>• changing gender roles</li> </ul>	Farmers are confused concerning their role in the new situation

### Perceived threats to the desired system

As in many other rural areas in Europe, the number of farm holdings has decreased over the last few decades (Knöbl et al. 1999). In Söltkätler, this can be seen in the landscape in the form of increasing forest area. There has also been a change in the types of foodstuffs produced (Loseries-Leick 2000). Until the 1960s, farmers grew potatoes, vegetables, and some cereals along with milk and meat production. Milk and meat production has persisted, as well as the still-prevalent subsistence gardens (cf. Vogl-Lukasser 2000). Table 3 shows the recent changes identified by Söltkätler farmers and the ways in which they think these changes affect the desired system state. Below are

some of the issues of concern to these farmers.

Even if subsidies are able to compensate for the decreasing prices of farm products to some extent, there are fewer employment opportunities in agriculture. Although more off-farm work improves the economic sustainability of farms in the short term, the farmers felt that it may also have negative implications in terms of social cohesion, farming identity, and ecological knowledge. Pluriactivity is nothing new in the Söltkätler, but when people commute out of the valleys to work, this changes agricultural practices. Because it is increasingly common for the husband to take a job and leave the wife at home to manage the farm, gender relations are

altered. Bulk production becomes less relevant for Sölktäler farmers when market prices are low, and home processing and selling produce on the farm and on the alpine pastures gain importance for household income (Scheeberger et al. 2001). Farmers feel that they are expected to be landscape wardens and tourist entrepreneurs rather than the food producers they would prefer to be. This leaves farmers confused concerning their own role. In the Sölktäler and other alpine communities, agro-ecosystems have been managed over centuries through social structures that did not leave much space for the individual (Knöbl et al. 1999). Now these social structures are being weakened, and traditional values are eroding. Women and the younger generation are becoming increasingly empowered, which some male farmers view as a threat to social cohesion and the whole farming system, because many of the farm and household tasks are gendered. Also, some male farmers complained that it is increasingly difficult for them to find wives. Thus, the farmers feel that they are facing challenges in two areas. First, agricultural policies and the common agricultural market fluctuate because of increased economic integration, which puts farmers in competition with producers in other regions and countries. Second, the traditional farming community is becoming increasingly subject to the values of modern society (cf. Giddens 1990).

### **Farmers' perspectives on organic farming**

The farmers were asked to assess the potential of organic farming for reaching the desired system state. This was done directly in the workshops and implicitly in the interviews. In the workshop, mixed groups of organic and conventional farmers listed the features of their desired system and then assessed whether organic farming would support, constrain, or not have any influence on reaching a particular feature. The results of this assessment can be seen in Table 4 and are described below.

### **Farmers' assessment of organic farming**

The assessment did not provide a straightforward answer as to whether or not farmers believe that organic farming helps to sustain farms in the Sölktäler. There are a number of supporting factors, e.g., the creation of local job opportunities, innovations, and environmental soundness, as well as a number of constraining factors, e.g., strict regulations and labor intensity. Farmers do not think that organic farming influences the identity of the farming community or

the way in which they bring up their children. Thus, organic farming, as the farmers perceive it, is not incorporated into the identities that farmers transmit to the next generation.

Because all agriculture in Sölktäler is on a small scale and has few external inputs, the differences between organic and conventional farming are hardly noticeable in the landscape. Accordingly, most farmers do not perceive large differences between the organic and the conventional farming systems in the valleys. The difference lies mainly in the certification. Conventional farmers see practical and institutional barriers to a formal conversion, such as increased dependence on financial support, inspections, and a potentially high initial investment.

For many Sölktäler farmers, the conversion to organic farming was easy. They did not have to make investments, because their farm practices and farm buildings were already in compliance with organic regulations. Other farmers were reluctant to convert their farms, because they would have been required to make large investments in cowsheds to comply with organic regulations. They were not prepared to run up large debts and therefore chose not to convert their farms.

Autonomy is a strong element of farmer identity. Farmers perceive the increasing dependence on subsidies as threatening (cf. Gunnarsdotter 1999, Ljung 2001). Because organic farmers usually have lower yields (Steinwender et al. 2000, Gruber et al. 2001), they tend to be more dependent on external support than are conventional farmers. The autonomy of farmers is also at stake when it comes to the annual inspection of organic farms. Although most organic farmers do not find this practice disturbing, conventional Sölktäler farmers do.

## **DISCUSSION**

### **Farmers' perspectives in a context of social-ecological resilience**

Social-ecological resilience emerges from intact social relations, institutions, identities, economic mechanisms, and agro-ecosystem processes. Within this complex framework, organic farming is a tool that farmers can use to build social-ecological resilience. The qualities farmers seek may be found in the type of farming practice that adds value, maintains small structures, and guarantees a certain security for farmers. Organic farming can deliver this, but it is not a panacea.

**Table 4.** Summary of the findings of the concluding workshop in Söltkätler as to whether organic farming supports, constrains, or has no influence on the desired system.

Feature of the desired system	Effect of organic farming
Persistence of farms	<p><b>Support:</b> Organic farmers are innovative.  <b>Constraint:</b> Organic farming is subject to strict rules and is labor-intensive.</p>
Social cohesion	<p><b>Support:</b> Organic farmers initiate projects and attract project funds to the region.  <b>Constraint:</b> Organic farming regulations hamper the exchange of land and fodder between farmers.  Farmers are divided into two groups, conventional and organic.  <b>No influence:</b> Conventional and organic farmers market their products together, e.g., farmers' market, the regional dairy.</p>
Farming identity	<p><b>No influence:</b> Organic farming is not an identity issue.</p>
Economic sustainability	<p><b>Support:</b> Organic farmers are innovative.  Organic farming uses resources efficiently.  Organic products have high quality and higher prices can be obtained in direct marketing.  Organic farming attracts tourists.  Organic farming uses few external inputs.  <b>Constraint:</b> Direct marketing is labor-intensive.</p>
Nature conservation	<p><b>Support:</b> Artificial pesticides are not allowed in organic farming.  Organic farming induces better use of renewable energy sources.</p>
Cultural landscape management	<p><b>Support:</b> Organic farming keeps the landscape open.  <b>No influence:</b> Both conventional and organic farmers manage their pastures appropriately.</p>

In respect to the questions this paper focuses on, the following three issues are discussed: 1) the relationship between farmers' desired system, organic farming policies, and resilience; 2) farmers' vulnerability; and 3) the role of organic farming in building resilience

### **The desired system, organic farming, and resilience**

The Söltkätler farmers believe that the continuation of existing practices is sustainable and that their desired system is achieved as long as farming is kept viable in the valleys. Therefore, they tend to focus on socioeconomic issues such as social cohesion, identity,

the persistence of farms, and economic sustainability. The farmers take ecological sustainability for granted as long as farms are in business and have enough people to work the land. The latter is not necessarily the case, as can be seen in the increased erosion of steep slopes in Söltkätler.

The high level of trust between the people of the valleys makes it easier for them to accommodate change (cf. Pretty 1998). Local organizations (e.g., the Nature Park, village development groups, the local branch of the farmers association) strengthen the sense of community and provide platforms for new ideas. Institutions for common property resources, e.g., common ownership of alpine pastures and forests,



agreements between landowners and farmers regarding the use of these pastures, and the tradition of neighbors helping neighbors make resource use more efficient (cf. Netting 1981, Ostrom 1990). The pluriactivity of Söltkätler farmers is a source of improved social resilience because multiple sources of income increase their flexibility and options (cf. Kinsella et al. 2000).

Both traditional alpine farming and organic farming are characterized by the dynamic interplay between sustaining and developing (Bätzing 1991, 1997, Holling 2001). Shifting time scales are part of this interplay. Farmers refer to a short-term time frame, especially if the economic viability of their farms is threatened. On the other hand, farmers also think in terms of a time scale that overlaps more than two generations, because they are deeply concerned about farm succession and sustainability.

As described, the values underlying organic farming and the desired system formulated by the Söltkätler farmers are similar in many ways. However, the farmers' assessment of organic farming showed that the dependency on the Common Agricultural Policy of the European Union (EU) and the whims of the market cannot be overcome by a conversion to organic farming. There is a mismatch between farmers' perspectives and the concept of organic farming as promoted by policy makers, processors, and advisors. The farmers describe their desired system as a holistic structure that incorporates social, economic, and ecological features that promote both long-term survival and short-term viability. The European Council regulations governing organic farming do not cover all aspects of this desired system (cf. Le Guillou and Scharpé 2001). Organic farming is promoted mainly by economic arguments such as higher prices for producers and higher subsidies. Even if economic sustainability is crucial for farm survival, this misses the point of the holistic social-ecological system that farming is.

There are two sides to the organic farming coin. On the one hand, organic farming is promoted through agricultural policies that farmers often experience as a top-down practice that decreases their autonomy and increases their dependence on external funding. In this context, organic farming certification is less an innovation and more a short-term adaptation to the EU's Common Agricultural Policy, a fine-tuning to available funds for environmental measures in agriculture (cf. Walker 2000). On the other hand, organic farm management is in line with many of the

views held by Söltkätler farmer on sustainable farming and is a bottom-up approach to the modernization of traditional farming. In this respect, Söltkätler farmers use organic farming as a certification of the high quality of their products and their environmental standards in agriculture.

### **Farmers' vulnerability**

Farmer vulnerability increases when the capacity of the agro-ecosystem to produce services is eroded. EU funding is a cross-scale subsidy that can work both ways. If financial resources are used to enhance farmers' capacity to persist, they help build resilience for the valleys, e.g., diversification of farm income and the introduction of environmentally sound practices. However, if excessive use of land is encouraged, the effect will be the opposite. In general, there is a need to be aware of the pitfalls of relying on outside inputs and incentives because they undermine the capacity for self-organization (Carpenter et al. 2001). In Söltkätler, it seems that the shortage of labor and pricing pressures are similarly influential as policies when it comes to the erosion of ecological resilience.

Environmentally speaking, the resilience of the desired system state depends on ecological services that are essential for agricultural production and tourism. The redundancy of these ecological services provides insurance against vulnerability (Levin 1999). Specialization and the declining number of farms imply a loss of redundancy and thus of resilience (van der Leeuw and Aschan 2000). The desired system state requires high-intensity human labor, of which there is not enough at hand. The other resilient state, the forest state, is less labor-intensive, but undesired. Nevertheless, the slow but steady transformation of agricultural land to forests is a fact in Söltkätler. Keeping farming viable is the only way to stop this undesirable development, according to farmers.

Farmers see challenges to their desired system in the economic, social, and political spheres. These changes can modify the way in which the agro-ecosystem is managed and endanger the sustenance of ecosystem services (Walker 2000). However, negligence by farmers is not the only cause of ecosystem change, which also results from cross-scale interactions (cf. Peterson et al. 1998) that farmers cannot influence directly, e.g., climate change, pest outbreaks, and transboundary air pollution. The farmers themselves did not mention such changes, because they are not perceived as an immediate threat to the economic

survival of farms. The point is not which changes occur, but the fact that there is always the possibility that changes may take place. Human perception can be "blind" to some of the links in the complex system with which it deals (van der Leeuw 1998). Novelty cannot be anticipated, but a community can develop mechanisms to cope with surprise (Folke et al. 2003). In Sölktäler, farmers have mechanisms for coping with the surprises that can occur in the local agro-ecosystem, including help from neighbors, multiple income sources, and insurance for unforeseen events such as failed harvests, illnesses, and natural disasters. However, the types of social change caused by modernization are a novelty to the farmers and seen as threatening by some of them (cf. Giddens 1990, Bätzing 1991).

The knowledge embedded in farming management provides a framework for adaptive capacity and creativity when coping with change (Folke et al. 2003). With regard to the changes that the farmers did mention, it appears that local ecological knowledge (cf. Olsson and Folke 2001) is in the process of being eroded in Sölktäler or is at least in a reorganization phase from a social point of view. This knowledge base is eroding for several reasons, including dependency on external funding, the disinclination of the younger generation to continue farming, and the new functions of agriculture. Knowledge is "stored" and manifested in management practices and institutions for resource use (Tengö and Hammer 2003). Examples in Sölktäler include the management of alpine pastures and the manual cutting of meadows where machinery cannot be used. These practices may be neglected or abandoned because of the shortage of labor. This has implications for ecological resilience, because the system could shift to the undesired state if the social system does not manage to renew itself. Therefore, the key to successful ecosystem management lies in the links between social structure and the understanding of resource and ecosystem dynamics expressed in management practices (Tengö and Hammer 2003).

### **Organic farming for building resilience**

According to the definition of resilience offered by Carpenter and others (2001), the capacity to buffer change, to reorganize, and to adapt is central. Furthermore, local ecological knowledge, an understanding of the dynamics of the social-ecological system, and learning are all fundamental to building resilience (Scheffer et al. 2000, Carpenter et al. 2001, Folke et al. 2002).

In the case of Sölktäler, its buffer capacity is reflected in the fact that farmers are committed to maintaining local organizations, institutions, and traditions; to preventing the transformation of farmland into forests; and to sustaining traditional farming practices. Organic farming can foster this development, because certification secures funding for farms in the short term and is in line with traditional practices. However, the capacity to reorganize is constrained by EU regulations, the hegemony of the regional dairy, and the lack of marketing options. At the same time, EU funding and the multitude of income sources also provide opportunities for local flexibility and innovation. The capacity for adaptation and learning is enhanced by the predominantly traditional and environmentally benign farming practices, in which local ecological knowledge and a balance between productive and reproductive work in the landscape are imperative (Bätzing 1997). The social system needs to adapt and reorganize to sustain the socially desired system. In Sölktäler, the forest increases gradually and reduces landscape mosaics, which is a biotic factor of adaptive capacity (cf. Peterson et al. 1998). If farmers stay economically viable, e.g., with the help of organic farming, the transformation of farmland to forests can be halted.

When describing their desired system, farmers point out that their niche lies in production methods based on environmentally sound practices. Organic farming offers the possibility of remaining in this niche, which is favored by policy makers. This explains the fact that nearly all conversions to organic farming in Austria have taken place in areas where farmers do not have to make major changes to their farms and where agricultural practices are already ecologically benign (Groier 1998). Sölktäler is no exception. Thus, in terms of ecosystem management, organic farming does not imply a great advantage, but rather the perpetuation of the status quo.

### **CONCLUSION**

The alpine farming landscape has developed through gradual endogenous transformation of structures and processes by adaptation and refinement, which has formed multifunctional, characteristically patterned, and diverse landscapes (cf. Vos and Meekes 1999). Since humans settled in the Alps, farmers have learned to cope with, adjust to, and shape the dynamics of the alpine ecosystem (Bätzing 1991).

The Sölktäler farmers fear that the changes they are currently experiencing (see Table 3) will eventually

cause the system to lose resilience and shift into a less desirable state, i.e., to change from a patchy farming landscape into a completely forested area. Whereas farmers are aware of changes in the social, political, and economic realms, they tend to pay less attention to changes in the ecosystem, in part because these are more long term than socioeconomic issues and in part because farmers generally do not anticipate cross-scale ecological changes, e.g., climate change. The challenge in Sölkttäler is to maintain ecosystem services within an altered social structure, where the need for social cohesion and farming identity has to be satisfied in other ways than the traditional.

In Sölkttäler, the short-term survival of farms is vital for long-term sustenance of farming and maintenance of the desired cultural landscape. Financial sustainability is a moving target for the farmers, as it has always been. Producer prices and agricultural policies are fast-changing variables that have significant effects on farming. Because Sölkttäler receives EU funding, the area's social resilience is subsidized on another spatial scale.

The farmers' ideas of the desired system and the principles of organic farming are closely related. Organic farming offers farmers a chance to perpetuate the status quo with no or few external inputs and using traditional farming practices that are environmentally benign. Organic farming also allows farmers to stay in business and withstand pressures to intensify or perish. However, physical degradation such as erosion is not prevented by organic farming. The qualities farmers seek in their desired system may be found in a farming system that adds value, maintains small structures, and guarantees a certain security for farmers. To obtain this, Sölkttäler farmers need to move from selling goods to selling value (cf. van der Leeuw and Aschan 2000). Indeed, income based on the existence and enhancement of ecological resilience will ensure the economic sustainability of Sölkttäler farms in the long term and is a prerequisite for a successful reorganization of the social system.

Responses to this article can be read online at:  
<http://www.consecol.org/vol8/iss1/art3/responses/index.html>

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## LITERATURE CITED

- Bartel, A., I. Darnhofer, M. Eder, B. Freyer, S. Hadatsch, T. Lindenthal, R. Milestad, A. Muhar, H. Payer, M. Penker, H. Rützler, W. Schneeberger, A. Velimirov, and A. Waltzer. 2002. *Flächendeckende Umstellung auf biologischen Landbau: Integrative Akzeptanz- und Wirkungsanalyse anhand ausgewählter Untersuchungsregionen*. Final Report of the Austrian Landscape Research Program. Federal Ministry for Education, Science and Culture, Vienna, Austria.
- Bätzing, W. 1991. Die Alpen im Europa der neunziger Jahre. Pages 247-291 in W. Bätzing and P. Messerli, editors. *Die Alpen im Europa der neunziger Jahre: Ein ökologisch gefährdeter Raum im Zentrum Europas zwischen Eigenständigkeit und Abhängigkeit*. Geographica Bernensia, Bern, Switzerland.
- Bätzing, W. 1997. *Kleines Alpen-Lexikon*. Umwelt.Wirtschaft. Kultur. Beck, Munich, Germany.
- Berkes, F., and C. Folke, editors. 1998. *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge University Press, Cambridge, UK.
- Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10(5):1251-1262.
- Berkes, F., C. Folke, and J. Colding, editors. 2003. *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, Cambridge, UK.
- Brandenburg, A. M., and M. S. Carrol. 1995. Your place or mine? The effect of place creation on environmental values and landscape meanings. *Society and Natural Resources* 8:381-398.
- Carpenter, S., B. Walker, J. M. Anderies, and N. Abel. 2001. From metaphor to measurement: resilience of what to what? *Ecosystems* 4:765-781.
- Costanza, R., and B. C. Patten. 1995. Defining and predicting sustainability. *Ecological Economics* 15(3):193-196.
- Daily, G. C., editor. 1997. *Nature's services: societal dependence on natural ecosystems*. Island Press, Washington, D.C., USA.

- Eder, M., W. Schneeberger, and H. Gernig. 2001. Anteil der Biobetriebe steigt mit der Erschwernis. *Blick ins Land* (6/2001):34-36.
- Ellis, F. 2000. *Rural livelihoods and diversity in developing countries*. Oxford University Press, Oxford, UK.
- Federal Ministry of Agriculture, Forestry, Environment and Water Management. 2001. *Grüner Bericht 2000*. Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna, Austria.
- Federal Ministry of Agriculture, Forestry, Environment and Water Management. 2002. *Die österreichische Agrarpolitik*. Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna, Austria. Available online at [www.lebensministerium.at/land/](http://www.lebensministerium.at/land/).
- Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C. S. Holling, and B. Walker. 2002. Resilience and sustainable development: building adaptive capacity in a world of transformations. *Ambio* 31(5):437-440.
- Folke, C., J. Colding, and F. Berkes. 2003. Synthesis: building resilience and adaptive capacity in social-ecological systems. Pages 352-387 in F. Berkes, J. Colding, and C. Folke, editors. *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, Cambridge, UK.
- Freyer, B., M. Eder, W. Schneeberger, I. Darnhofer, L. Kirner, T. Lindenthal, and W. Zollitsch. 2001. Der biologische Landbau in Österreich—Entwicklungen und Perspektiven. *Agrarwirtschaft* 50(7):400-409.
- Giddens, A. 1990. *The consequences of modernity*. Polity Press, Cambridge, UK.
- Glaser, B., and A. L. Strauss. 1967. *The discovery of grounded theory: strategies for qualitative research*. Aldine, Chicago, USA.
- Groier, M. 1998. *Entwicklung und Bedeutung des biologischen Landbaus in Österreich im internationalen Kontext*. Facts and Features, Number 19. Bundesanstalt für Bergbauernfragen, Vienna, Austria.
- Groier, M. 1999. Agrarische Umweltpolitik und biologische Landbau in Österreich und Europa. Pages 148-166 in Kritische Geographie (ÖGKG). *Landwirtschaft und Agrarpolitik in den 90er Jahren: Österreich zwischen Tradition und Moderne*. Promedia, Vienna, Austria.
- Gruber, L., R. Steinwender, T. Guggenberger, J. Häusler, and A. Schaner. 2001. Comparison of organic and conventional farming on a grassland farm; second communication: feed intake, milk yield, health and fertility parameters. *Bodenkultur* (Austrian Journal of Agricultural Research) 52(1):55-70.
- Gunderson, L. H. 2000. Ecological resilience—in theory and application. *Annual Reviews of Ecological Systems* 31: 425-439.
- Gunderson, L. H., and C. S. Holling, editors. 2002. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington, D.C., USA.
- Gunnarsdotter, Y. 1999. *Svenska bondehushåll på 90-talet och deras roll på landsbygden*. SLU Kontakt 7. Swedish University of Agricultural Sciences, Uppsala, Sweden.
- Hadatsch, S., R. Kratochvil, A. Vabitsch, B. Freyer, and B. Götz. 2000. *Biologische Landwirtschaft im Marchfeld: Potentiale zur Entlastung des Natur- und Landschaftshaushaltes*. Monographien Band 127. Umweltbundesamt, Vienna, Austria.
- Holling, C. S. 1986. The resilience of terrestrial ecosystems: local surprise and global change. Pages 292-317 in W. C. Clark and R. E. Munn, editors. *Sustainable development of the biosphere*. Cambridge University Press, Cambridge, UK.
- Holling, C. S. 2001. Understanding the complexity of economic, ecological and social systems. *Ecosystems* 4:390-405.
- International Federation of Organic Agriculture Movements. 2002. *Final draft 2002: basic standards for organic production and processing*. IFOAM, Tholey-Theley, Germany. Available online from [www.ifoam.org](http://www.ifoam.org).
- Jackson, M. C. 1997. Pluralism in systems thinking and practice. Pages 347-378 in J. Mingers and A. Gill, editors. *Multi methodology: the theory and practice of combining management science methodologies*. Wiley, New York, New York, USA.
- Johannes, R. E. 1998. Government-supported village-based management of marine resources in Vanuatu. *Ocean and Coastal Management* 40:165-186.
- Kinsella, J., S. Wilson, F. de Jong, and H. Renting. 2000. Pluriactivity as a livelihood strategy in Irish farm households and its role in rural development. *Sociologia Ruralis* 40(4):479-496.
- Kirner, L., and W. Schneeberger. 2000. Österreich: Wie kann der biologische Landbau gesichert und ausgeweitet werden? *Ökologie & Landbau* 114(28.Jg.2):30-33.
- Kirner, L., and W. Schneeberger. 2002. Österreich: Weniger Biobetriebe, mehr Bioabsatz. *Ökologie & Landbau* 121(1/2002):33-35.
- Knöbl, I., M. Kogler, and G. Wiesinger. 1999. *Landwirtschaft zwischen Tradition und Moderne: Über den Struktur- und Wertewandel in der österreichischen Landwirtschaft*. Forschungsbericht, Number 42. Bundesanstalt für Bergbauernfragen, Vienna, Austria.
- Krueger, R. A. 1994. *Focus groups: a practical guide for applied research*. Sage Publications, Thousand Oaks,



California, USA.

Kvale, S. 1996. *Interviews; an introduction to qualitative research interviewing*. Sage Publications, Thousand Oaks, California, USA.

Le Guillou, G., and A. Scharpé. 2000. *Organic farming: guide to community rules*. European Commission Directorate-General for Agriculture, European Communities, Luxembourg.

Levin, S. 1999. *Fragile dominion: complexity and the commons*. Perseus, Reading, Massachusetts, USA.

Ljung, M. 2001. *Collaborative learning for sustainable development of agri-food systems*. Doctoral Thesis Agraria, Number 308. Dissertation. Swedish University of Agricultural Sciences, Uppsala, Sweden.

Loseries-Leick, A. 2000. *Sölkspuren I. Eine Kulturgeschichtliche Dokumentation des Naturparkes Sölktaäler*. Naturschutzbund Steiermark & Verein Naturpark Sölktaäler, Stein an der Enns, Austria.

Mackinnon, N., J. M. Bryden, C. Bell, A. M. Fuller, and M. Spearman. 1991. Pluriactivity, structural change and farm household vulnerability in Western Europe. *Sociologia Ruralis* 31(1):58-71.

Miles, M. B., and A. M. Huberman. 1994. *Qualitative data analysis*. Sage Publications, Thousand Oaks, California, USA.

Montgomery, H., and B. Qvarsell, editors. 2001. *Perspektiv och Förståelse: Att kunna se från olika håll*. Carlssons, Stockholm, Sweden.

Netting, R. M. 1981. *Balancing on an Alp: ecological change and continuity in a Swiss mountain community*. Cambridge University Press, Cambridge, UK.

Olsson, P., and C. Folke. 2001. Local ecological knowledge and institutional dynamics for ecosystem management: a study of crayfish management in the Lake Racken watershed, Sweden. *Ecosystems* 4(2):85-104.

Ostrom, E. 1990. *Governing the Commons: the evolution of institutions for collective action*. Cambridge University Press, Cambridge, UK.

Ostrom, E. 1999. Coping with the tragedy of the Commons. *Annual Review of Political Science* 2:493-535.

Peterson, G., C. Allen, and C. S. Holling. 1998. Ecological resilience, biodiversity and scale. *Ecosystems* 1:6-18.

Pretty, J. 1998. *The living land: agriculture, food and community regeneration in rural Europe*. Earthscan, London, UK.

Reason, P., and H. Bradbury, editors. 2001. *Handbook of action research: participative inquiry and practice*. Sage

Publications, London, UK.

Redclift, M. 1986. Survival strategies in rural Europe: continuity and change; an introduction. *Sociologia Ruralis* 26(3/4):218-227.

Scheeberger, W., M. Eder, L. Lacovara, and J. C. Garcia-Rosell. 2001. A comparison of the economic performance of organic and conventional farms in Austria. *Bodenkultur* (Austrian Journal of Agricultural Research) 52(4):249-261.

Scheffer, M., W. Brock, and F. Westley. 2000. Socioeconomic mechanisms preventing optimum use of ecosystem services: an interdisciplinary theoretical analysis. *Ecosystems* 3(5):451-471.

Scoones, I. 1999. New ecology and the social sciences: what prospects for a fruitful engagement? *Annual Review of Anthropology* 28:479-507.

Scoones, I., and J. Thompson, editors. 1994. *Beyond farmer first: rural people's knowledge, agricultural research and extension practice*. Intermediate Technology Publications, London, UK.

Steinwender, R., L. Gruber, A. Schaner, T. Guggenberger, J. Häusler, and M. Sobotik. 2000. Comparison of organic and conventional farming on a grassland farm; first communication: grassland yield, forage feed value, amount of slurry. *Bodenkultur* (Austrian Journal of Agricultural Research) 51(4):267-281.

Strauss, A., and J. Corbin. 1990. *Basics of qualitative research: grounded theory, procedures, and techniques*. Sage Publications, Thousand Oaks, California, USA.

Tengö, M., and M. Hammer. 2003. Management practices for building adaptive capacity: a case from northern Tanzania. Pages 132-162 in F. Berkes, J. Colding, and C. Folke, editors. *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, Cambridge, UK.

van der Leeuw, S., editor. 1998. *The Archimedes Project: understanding the natural and anthropogenic causes of land degradation and desertification in the Mediterranean basin: research results*. European Commission Research DG, Brussels, Belgium.

van der Leeuw, S. 2000. Land degradation as a socio-natural process. Pages 357-383 in R. J. McIntosh, J. A. Tainter, and S. K. McIntosh, editors. *The way the wind blows: climate, history, and human action*. Columbia University Press, New York, USA.

van der Leeuw, S., and C. Aschan-Leygonie. 2000. *A long-term perspective on resilience in socio-natural systems*. Working Paper of the Santa Fe Institute. Available online at <http://econpapers.hhs.se/paper/wopsafiw/01-08-042.htm>.

Vogl, C. R., and J. Hess. 1999. Organic farming in Austria. *American Journal of Alternative Agriculture* 14(3):137-143.

Vogl-Lukasser, B. 2000. *Studien zur funktionalen Bedeutung bäuerlicher Hausgärten in Osttirol basierend auf Artenzusammensetzung und ethnobotanischen Analysen*. Dissertation. University of Vienna, Vienna, Austria.

Vos, W., and H. Meeks. 1999. Trend in European cultural landscape development: perspectives for a sustainable future. *Landscape and Urban Planning* 46:3-14.

Waddington, D. 1994. Participant observation. Pages 107-122 in C. Cassel and G. Symon, editors. *Qualitative methods in organizational research: a practical guide*. Sage, London, UK.

Walker, B., editor. 2000. *Analyzing integrated social-ecological systems: report on a workshop funded by the Marcus Wallenberg Foundation for International Cooperation in Science, September 12-14, 2000*. Royal Swedish Academy of Sciences, Stockholm, Sweden. Available online at: <http://www.resalliance.org/reports/wallenberg-report.dec00.html>.

Weisbord, M. R., and S. Janoff. 2000. *Future search: an action guide to finding common ground in organizations and communities*. Berret-Koehler, San Francisco, California, USA.

Yin, R. K. 1994. *Case study research: design and methods*. Sage, London, UK.

Wilson, M., M. Daly, and S. Gordon. 1998. The evolved psychological apparatus of human decision-making is one source of environmental problems. Pages 501-523 in T. Caro, editor. *Behavioral ecology and conservation biology*. Oxford University Press, Oxford, UK.

World Council on Environment and Development. 1987. *Our common future*. Oxford University Press, Oxford, UK.