



GLOCHAMOST – BR Val Müstair Parc Nazionale

The UNESCO-Biosphere Reserve Park National Suisse from 1979 has been extended and completed with a buffer and a transition zone in Val Müstair according to the Seville strategy conditionally approved by UNESCO in 2010. Until 2013 the buffer zone has to be extended around the whole core area (Figure 1).

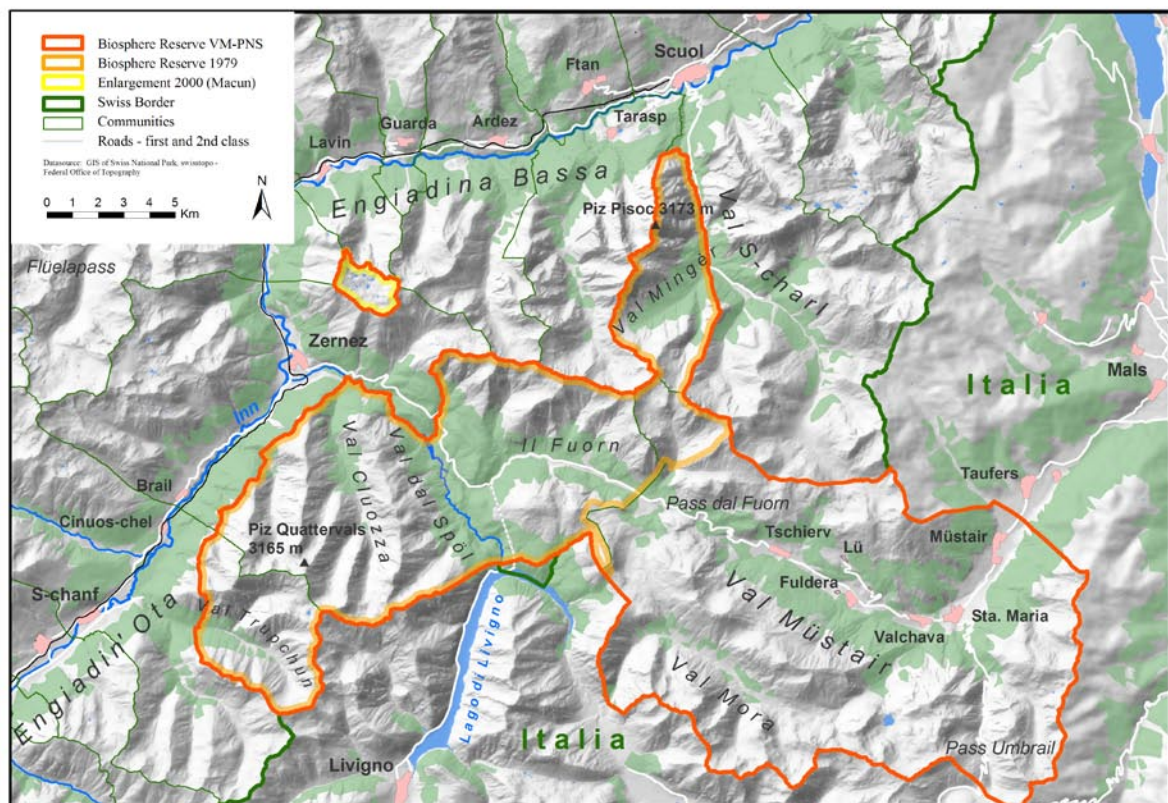


Figure 1: Overview of the biosphere reserve Val Müstair Parc Nazionale

2010 and 2011, the fundamentals for different long term monitoring programs within the new buffer and transition zone have been planned and initiated. The new monitoring programmes are planned in accordance of both, existing monitoring programmes in the core zone (SNP), and planned indicators for all Swiss Parks including UNESCO World Heritage Sites and Biosphere reserves.

Some information on the study of the impacts of global and climate change on the Biosphere Reserve Val Müstair / Swiss National Park regarding (1) biodiversity, (2) freshwater resources, (3) land use change, and (4) local economy

1) Biodiversity

In the **core area** (= Swiss National Park), biodiversity is mainly preserved by the protection of processes, and less by the protection of species. Following the results from long-term monitoring of

vegetation and fauna in the core zone until 2010, no loss of biodiversity could be registered since 1914. But due to climate change, habitat properties and with it the distribution and/or composition of species are changing. Specifically, the following processes are monitored or analysed:

- The upward migration of plants and butterflies (global GLORIA-project, see below; Monitoring of butterflies, snails, international biodiversity days with partners from Italy)
- Impact of warming on the biodiversity of high mountain ponds and lakes (Macun-project)
- Species composition of plant communities on vegetation plots, regarding grazing of all groups of herbivores (research project Trophic Cascades)
- Survey of vegetation plots (grassland, forest, burnt areas, etc.)
- Survey of invasive plant species
- A complete species list for the core area is in preparation

The goal of the global research project GLORIA is to monitor the development of high alpine vegetation and to assess the effects of climate change and global warming scenarios. At selected peaks in the Swiss National Park two plant inventories have been conducted so far, one 2002/03, the other 2009/10. Although the time interval between the two inventories was relatively short, the species turnover rate of 15-30% per peak was surprisingly high, between 5 and 24 new species per peak were discovered in 2009/10 in contrast to 2002/03, while the total number of species remained more or less unchanged. This may be explained by different phenological developments between the years. However, in 2009/10 the larch (*Larix decidua*) was discovered on three peaks for the first time. This may be a sign for an upward shift of species due to global warming. The inventories will be repeated in the following years to test this assumption and to monitor future trends.

In the **buffer zone and in the transition area**, the main impacts on biodiversity come from intensification and extensification of land use superposed by climate change. Main impacts concern:

- Dry meadows (extensification, projects: ECONNECT, GEO-Day of Biodiversity 2011, see below)
- Intensification is linked to sprinkling irrigation (Project Water channels)
- Fertilization experiment in pastures (Global Nutnet-project)
- Strengthening of (transboundary) ecological networks (JECAMI, measures; see below)

Diversity of species has been analyzed during the "International GEO-Day of Biodiversity 2011". Together with the Stelvio National Park and other partners from Italy, a transboundary area was defined and investigated. During 24 hours, 120 experts from Switzerland, Northern and Southern Tyrol identified as many animals, plants and fungi species as possible. Besides the research activities, several excursions offered the possibility for the general public to get in touch with the topic "biodiversity" and to learn more about local flora and fauna. More than 1850 species were discovered, including 93 birds, 93 fungi, 150 lichens, 118 mosses and over 700 plant species. Highlights include the finding of the hemiparasite *Melampyrum arvense* and the first evidence of the Alpine long-eared bat (*Plecotus macrobullaris*) in the area. The "International GEO-Day of

Biodiversity" will be repeated in the next years in different areas of the buffer and transition zone to get a clearer image of biodiversity in the valley.

2) Freshwater Resources

Monitoring the impact of climate/atmospheric change on water systems in the core area is focusing on three sites: The river basin of Macun (since 2000), the rivers Spöl, Fuorn and Cluozza (since 1960), and a couple of springs in the Fuorn area (since the 1950-ies). Further, all natural events have been registered since 1989, but no significant trends concerning floods have been detected until now.

In the **core area**, no freshwater is used, disregarding the use of some few springs for drinking water. The major impact on the water systems in the core area comes from the use of the Inn and the Spöl River for hydropower production. Since 2000 the regulated flow regime of the Spöl River has been dynamised by artificial floods. The floods (1-3 per year) are planned following findings from a scientific ecological monitoring programme of the riverbed. Regarding the ecological benefits of artificial floods, the new regulated flow regime has been legally approved by the Swiss Confederation in 2011.

In the **buffer zone and transition area** (= Val Müstair) the conflict of the use of water for energy production with river conservation strategies has been solved some years ago by a clear separation of areas for energy production (in one lateral valley) and areas with natural flow. In this context large parts of the main river Rom have been restored. Moreover, the initiatives "Pro Rambach" and "Umweltschutzgruppe Vinschgau" insist on an effective protection of the river Rom (Rambach) in the Vinschgau. Since it is one of the last uninfluenced main valley rivers in the whole Alps, the prevention of any energy production, the protection of the river and the amelioration of its status are of major importance, also in accordance to the Waterframework Directive of the European Union (Directive 2000/60/EC).

3) Land use change (buffer zone and transition area)

In 2006, an aerial infrared image has been taken from the new zones in the Val Müstair (initial state of the buffer zone and transition area). Until the end of 2011, the whole area will be completely analyzed and captured by aerial photo interpretation, according to the categorical object key developed in the alpine wide project "HABITALP" (Interreg III B). This key has been structured for the specific needs of large protected areas. Currently, a change detection key is on the way, developed together with three national parks in Austria and Germany. In the core area of the Swiss National Park, pilot regions have been analyzed to identify the change and verify the key. It is planned to realize a complete change detection database on landscape level 2012 and 2013.

The base for change detection with this method is a time series of aerial images (Figures 2-4). Therefore, we identified for the whole area the oldest full covering aerial images existing. So we do have images going back to 1946. These images were digitized and aero triangulated. Currently, we are looking for images from the 1960ties or 1970 to shorten the time lag from present to 1946.

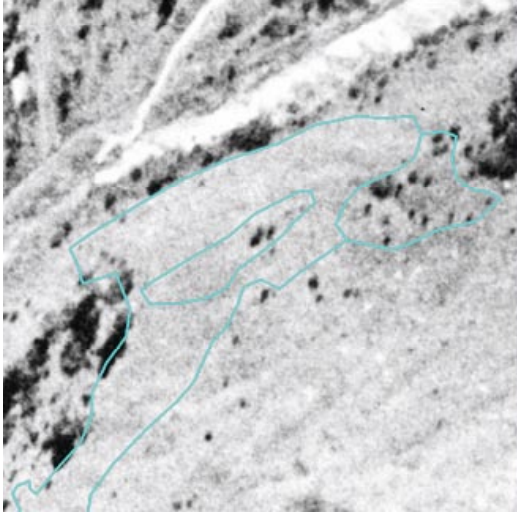


Figure 2: Example of the development of an avalanche area in Val Mingèr (core area), 1946

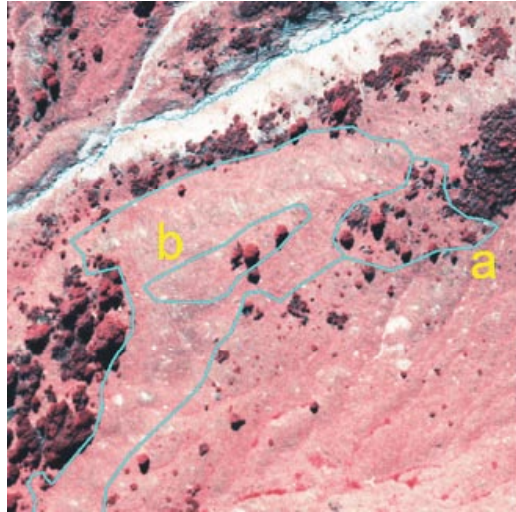


Figure 3: The area in 1988



Figure 4: The area in 2000

All these work will be concluded with a report on land use change on landscape level. Further analysis will be done in appropriate time sequences. Additionally to the own data capturing and analysis we will integrate all data available from official bodies in this field.

Another project realized with substantial input from the UNESCO Biosphere Reserve Val Müstair Park Nazionale that been called Joint Ecological Continuum Analysing and Mapping Initiative. The Acronym JECAMI stands for an online tool to assess and visualise connectivity (Figure 5) and has been developed by the Swiss National Park GIS team in cooperation with the Arinas Company. JECAMI combines three different approaches: the analysis of the landscape as a whole in a Continuum Suitability Index (CSI), the distribution and movements of specific key species with the Species Map Application (SMA) and the Connectivity Analysis of Riverine Landscapes (CARL). The CSI service defines a continuum suitability index from the interaction of ten different indices and allows for the measurement of connectivity suitability over a matrix of different areas. Through the SMA-Service it is possible to detect barriers and corridors for a specific animal species. The CARL module allows to study and quantify the fragmentation level of riverine landscapes and to identify the barriers effective in the longitudinal, lateral, vertical and temporal dimension.

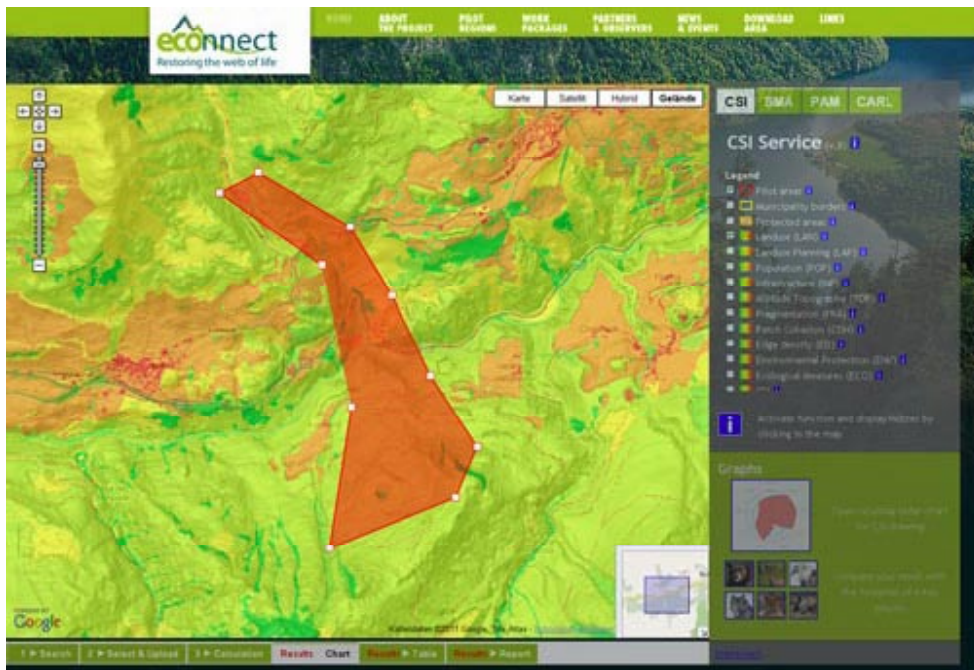


Figure 5: The GIS server application JECAMI used to assess the potential of an area to serve as a wildlife corridor

In the **core area** a survey of visitors has been established in 2007 covering the main visited areas with 8 automatic counting plots. In 2010 the estimated number of visitors was 150'000. The number of visitors counted was 96'014 and represents only a part of the visitors. However, the survey counts can be used for a comparison between years and between areas. With 37% of all visitors the Val Trupchun was by far the most visited area in 2010, followed by Champlönch with 16% and La Schera with 13%. In comparison to 2009 the number of visitor at Champlönch increased by 6.5%, while the number of visitors in Val Mingèr decreased by 8%. Based on these figures, the economic impact of National Park tourism can be estimated. As the data for estimation are from 1999 (PhD thesis Küpfer), a repetition of this sampling is planned in the next year.

Parameters describing the local population and economics from official regional bodies have been collected and analysed for the **Val Müstair**. Special emphasis is placed on population structure and indices describing tourism and agriculture (organic farming).

The community of Val Müstair has a size of 19 863 ha and a total of 1592 permanent residents (2010). In 1880 the number of permanent residents was 1444 and increased to 1787 in 1950. During the last 20 years, the number of permanent residents in Val Müstair increased until the mid 1990's before decreasing again until reaching today's level. The number of residents ranged from 1624 in 1981, to 1609 in 1984 (lowest number before the 1990's increase) and then increased to 1897 in 1997 (highest number).

In 2010 22% of permanent residents worked in the primary sector (agriculture and forestry), 63% worked in the secondary sector (commerce and industry) and 15% in the tertiary sector (services). According to the cantonal tax revenue the community is considered a low income community.

Tourism is a central economic factor for the community of Val Müstair. The total number of overnights stays increased from 111'522 in 2004 to its highest level of 138'001 in 2008 and then dropped

again slightly to 125'228 in 2010 (Figure 6). The majority of the guest stayed in hotels followed by group accommodations, holiday flats and camping grounds. Most guests visit the Val Müstair during the summer months June to October, with July and August having the highest number of over-night stays. In each of these two months more than 10'000 over-night stays were recorded in 2010 (Figure 7). The winter seasons peak occurs in February and March with over 4500 and 3000 over-night stays in 2010, respectively.

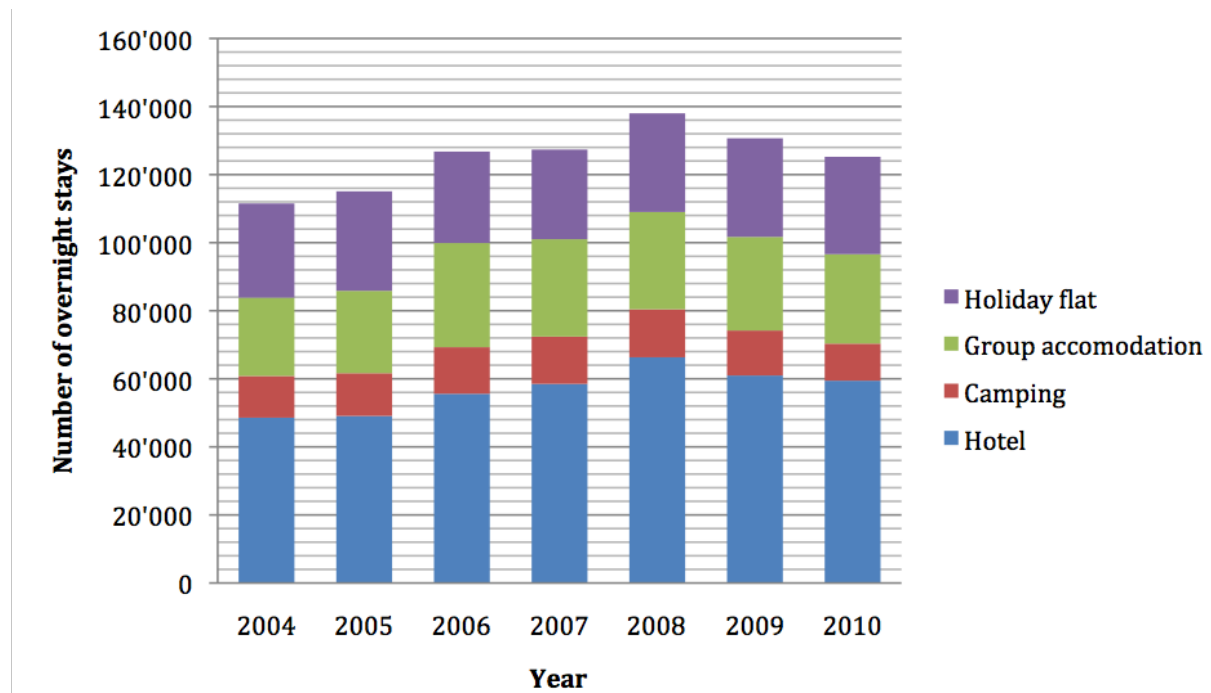


Figure 6: Over-night stays per year in the Val Müstair grouped by the type of accommodation. (Data source: Tourist Office Val Müstair)

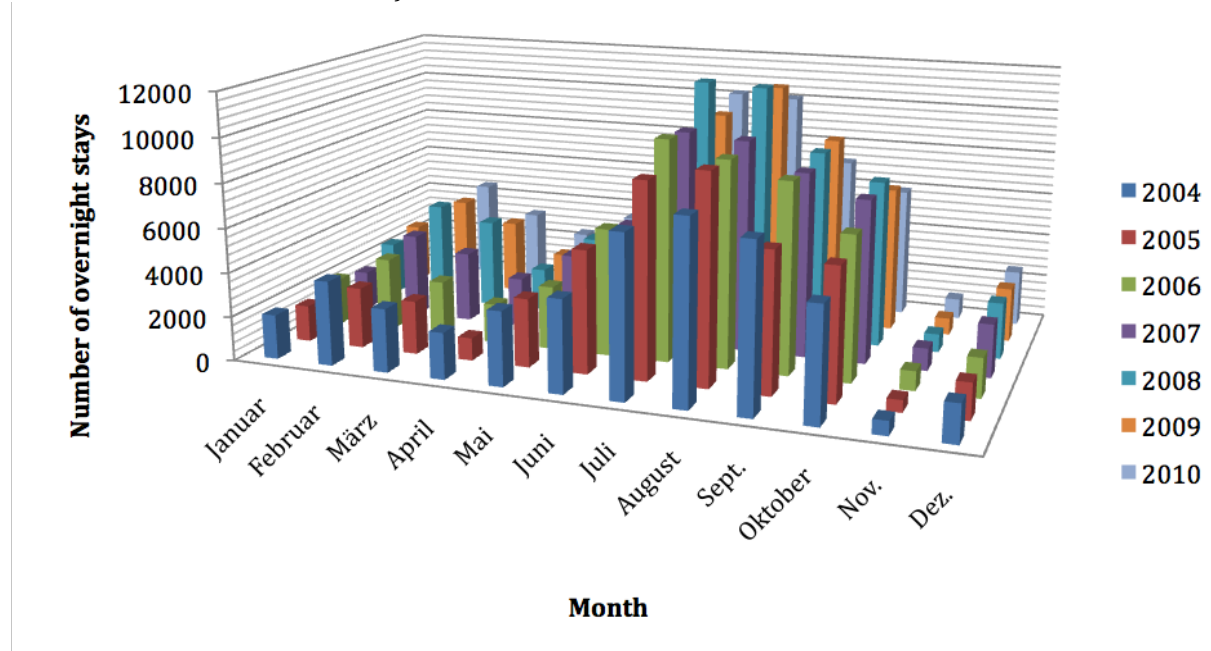


Figure 7: Over-night stays in the Val Müstair during the seasons. (Data source: Tourist Info Val Müstair)

The total number of agriculturally used area (Figure 8) did not change much from 1990 to 2010, ranging between 988.5 ha in 1997 (lowest level) to 1034.8 ha in 2009 (highest level). However, since the early 1990's the amount of organically farmed land increased considerably, from 5.2 ha in 1990, to 518.4 ha in 1996, 866.8 ha in 2000, 922.9 ha in 2004 (highest level), before decreasing to 847.4 ha in 2010.

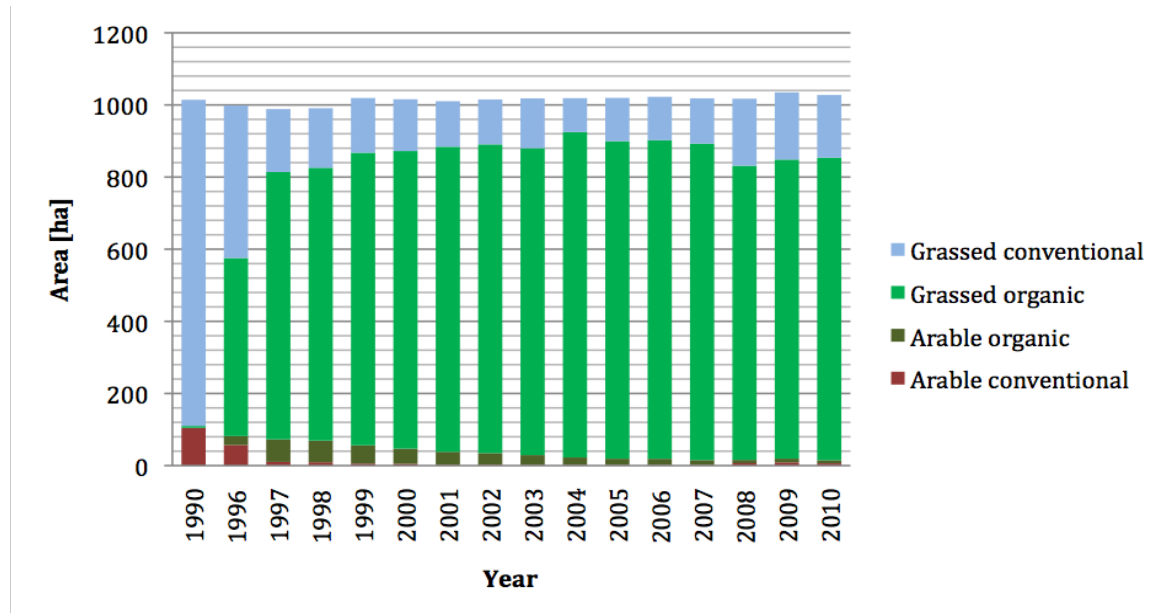


Figure 8: Agriculturally used area in the community of Val Müstair categorized in grassed and arable land for conventional and organic cultivation systems. (Data source: Federal Statistical Office)

However, the total number of farms dropped from 85 in 1990, to 68 in 1996 and 55 in 2009, before reaching 57 in 2010 (Figure 9). Since the early 1990's the number of organic farms increased, reaching its highest level in 2004 with 50 organic farms. Since then the number dropped slightly to 44 in 2010.

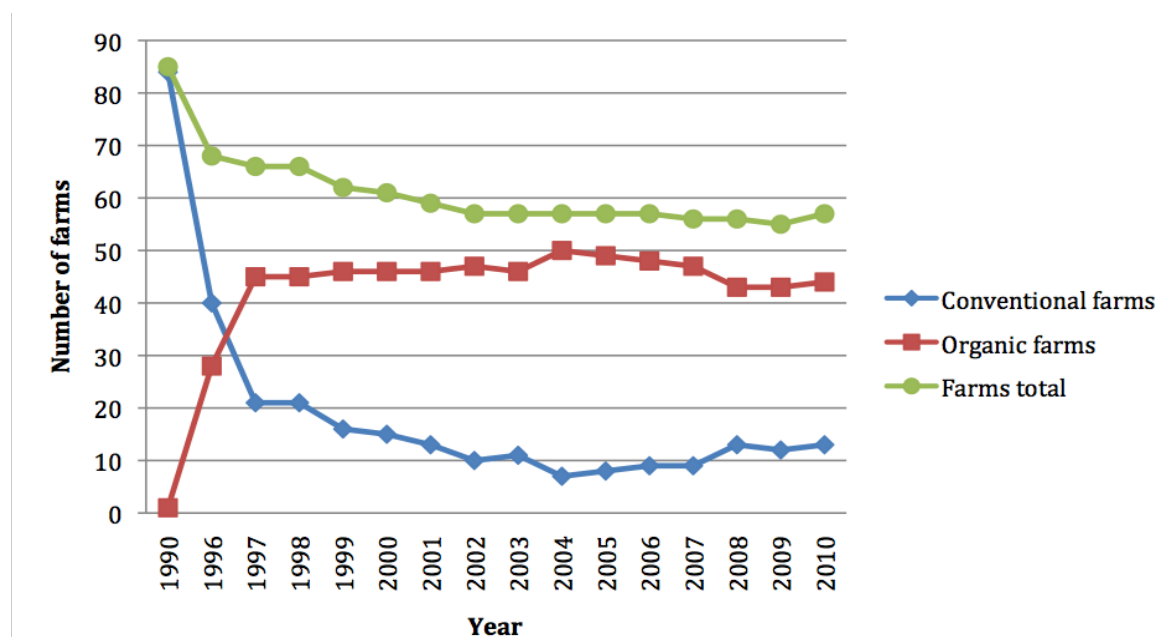


Figure 9: Organic and conventional farming in the community of Val Müstair. (Data source: Federal Statistical Office)

The statistics on the number of workers employed on farms shows a similar picture (Figure 10). While the total number of workers on farms decreased from 218 in 1990, to 169 in 1996, reaching its low in 2005 with 115 workers and increased again to 132 in 2010, the number of workers on organic farms increased and reached a more or less stable level of about 105 employees around the year 2000.

The total number of livestock units produced (Figure 11) decreased since the early 1990's. The number of organically produced livestock units reached its highest level in 2002 with 1860 and is now (2010) at 1711.

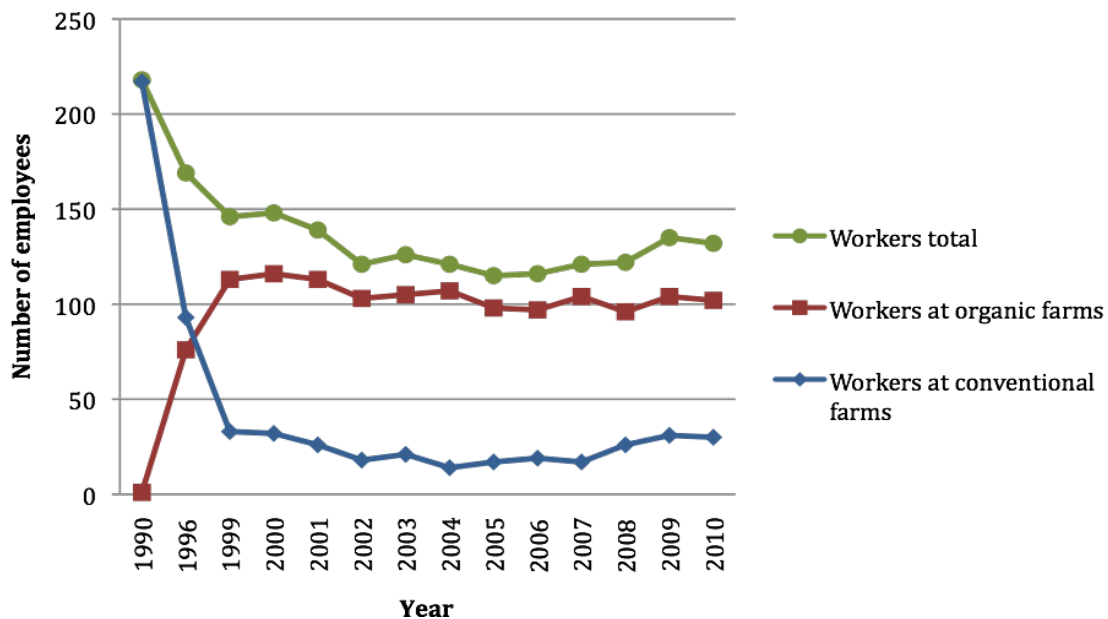


Figure 10: Persons employed on farms in the community of Val Müstair. (Data source: Federal Statistical Office)

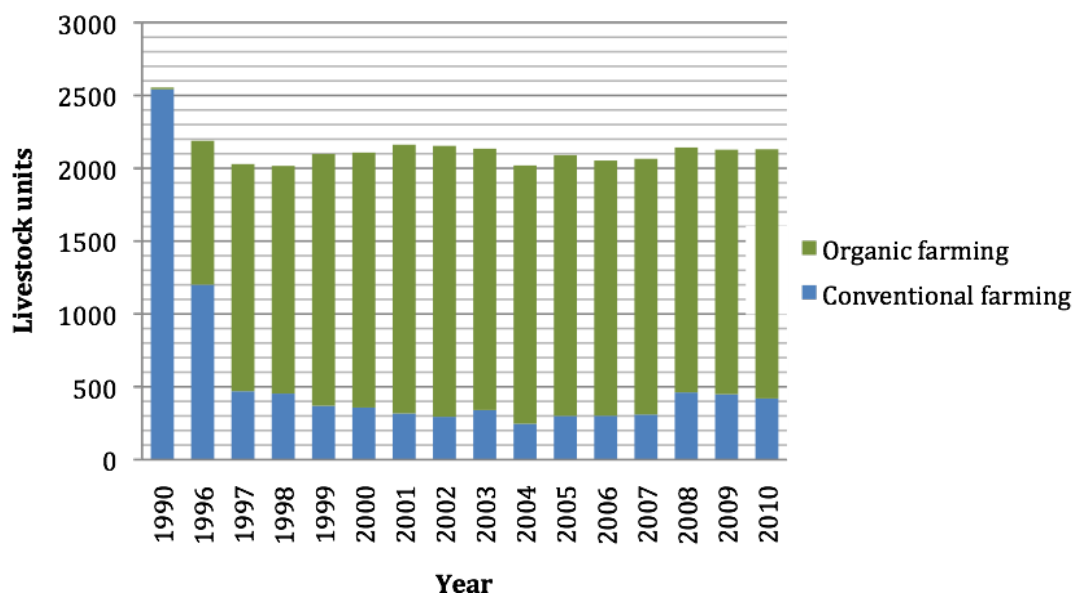


Figure 11: Livestock units on organic and conventional farms in the community of Val Müstair. (Data source: Federal Statistical Office)

Authors

Dr. Flurin Filli, head of the SNP's research department, will be in charge of the data acquisition in Val Müstair. Dr. Ruedi Haller, head of the SNP's geo information department, is responsible for all land, use and land use change data collection on landscape level. Moreover, he has organised the first biodiversity day 2011. Seraina Campell , Anna Schweiger, Dr. Thomas Scheurer .

Zernez, 8th of August 2011/ completed 29th of November 2011