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Using Oral History and Forest Management Plans to Reconstruct Traditional Non-Timber Forest Uses in the Swiss Rhone Valley (Valais) Since the Late Nineteenth Century

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ABSTRACT

Changes in forest use are considered as a potential key driver for recently observed changing forest dynamics in the pine forest belt of the upper Rhone valley (Canton of Valais, Switzerland). In this region, traditional non-timber forest uses, such as forest litter harvesting and wood pasture, were practised until the second half of the twentieth century. The practice of traditional non-timber forest uses led to specific environmental conditions which favoured pine as a pioneer species. With the abandonment of these practices the pine was subjected to increased competition and largely replaced by deciduous trees. In this study, the history of traditional non-timber forest uses was reconstructed by combining the analysis of forest management plans and the results from oral history interviews. The forest management plans represent the view of the forest administration whereas the narratives obtained from oral history interviews allow putting the traditional non-timber forest uses into the context of people's daily life. The different characteristics of the two source types are illustrated with two regional case studies. Different socioeconomic and political drivers were identified (changes in non-farming employment, changes in demand for forest products, access to substitute products, regulations), which led to the abandonment of traditional non-timber forest uses in the Valais. The combination of forest management plans and oral history leads to a comprehensive picture of the history and significance of traditional non-timber forest uses. Our findings confirm that information on traditional non-timber forest uses is crucial for an understanding of present day dynamics in the pine forest ecosystems of the Valais.

KEYWORDS

Valais, Switzerland, oral history, forest management plans, land-use change, wood pasture, forest litter harvesting

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INTRODUCTION

In the pine forest belt of the upper Rhone valley (Valais canton, Switzerland) increased mortality and a significant shift in tree species composition from the sub-Boreal Scots pine (*Pinus sylvestris* L.) to the sub-Mediterranean downy oak (*Quercus pubescens* Willd.) has been observed over the last few decades.[1] Besides climatic warming, forest use changes were considered as a potential key driver for changing forest dynamics.[2] Investigating the competition between pine and oak, Weber[3] concluded that pine as a pioneer species was favoured by traditional non-timber forest uses, such as wood pasture and litter raking. After these practices were abandoned, pine as a light demanding species was subjected to increased intra- and interspecific competition for light. Rigling and others recently showed that pine recruitment prevailed on raw soils and assumed that traditional non-timber forest uses resulted in specific environmental conditions which were more favourable for regeneration of pine than of oak.[4] Thus, it becomes important to understand the traditional practice of non-timber forest use and the causes and chronology of change to this practice that has led to this observable difference in forest composition. As such the aim of this study is to reconstruct the history of traditional non-timber forest uses in the pine forest belt of the upper Rhone valley. By triangulating the evidence from both documentary sources and oral history (both described later) two key research questions were addressed:

a) Which traditional non-timber forest uses were practised in the pine forests of the Valais since the late nineteenth century?

b) When did traditional non-timber forest uses disappear and which socioeconomic and political drivers led to the abandonment of certain practices?

This study is based on the combination of written documents (i.e. forest management plans) and oral history interviews with contemporary witnesses. In order to highlight the different quality of the two source types the reconstruction of past traditional non-timber forest uses is illustrated with case studies from two municipalities in the upper Rhone valley (Salgesch and Visp/Eyholz). In addition the spatio-temporal patterns of the forest use history are described for the whole pine forest belt.

Relevance of traditional non-timber forest uses in Alpine regions

The history of traditional forest uses is crucial for an understanding of processes in present-day forest ecosystems. For centuries throughout Europe, the various non-timber forest uses were essential and more important than timber harvesting for the bigger part of the peasant population.[5] Wood pasture and forest litter collecting were a basic necessity for societies with a high degree of self-sufficiency.[6] Loup mentioned this important role of forests for traditional

agricultural life in the Valais.[7] Viazzo described the traditional Alpine village as a largely closed ecosystem.[8] An example of such a traditional socioeconomic structure of a mountain community in the upper Valais is given by Netting.[9] In Switzerland, forest litter harvesting and wood pasture were among the most important agricultural uses of the forest.[10] Especially in remote Alpine regions these traditional practices had been conducted for much longer than in the more central areas of Switzerland.[11] Elias Landolt wrote in his report of 1862 to the federal council of Switzerland, which was the basis for the Swiss Federal Forest Police Law in 1876, that in many Alpine regions wood pasture and litter harvesting were still regarded as more important than timber production.[12] In Alpine regions wood pasture was practised above all with goats and sheep.[13] Whereas the sheep, together with the cattle, were driven to the alpine pastures during the summer, most of the goats stayed in the villages and provided the local population with milk.[14] These goats were driven to the nearby forests. Forest litter, i.e. leaves and needles, were collected in order to bind the cattle's manure in the barn as a substitute for straw. The litter was collected with iron or wooden rakes and either transported directly into the barns or stored on piles in the forest. In the lower parts of Switzerland (the so-called 'Kornland'[15]) this practice gained in importance with the introduction of indoor stable feeding in the context of agricultural modernisation,[16] as the demand for litter increased. In the mountainous regions (the so-called 'Hirtenland') the litter was mainly used during the winter season. Here, as in all regions where grain production was not profitable, a permanent lack of appropriate litter was prevalent**.**

Wood pasture and litter collecting had significant local impact on forest ecosystems. Damage to leaves and needles as a result of browsing and the destruction and removal of seeds and seedlings due to litter raking were often lamented by the foresters. Missing or diminished regeneration and soil impoverishment were seen as the most important negative consequences of these practices. Goats were particularly problematic and were often called 'the razors of the woods' and subject to bans and restrictions in movement through woodlands.[17] Therefore, these traditional forest uses resulted in various conflicts between farmers and forest authorities. These conflicts became more widespread with the introduction of modern forestry in the late eighteenth and the nineteenth century, as the forest authorities increasingly focused on timber production, which became the main forest use. At the same time, and linked with this shift in interest, forest authorities declared many traditional forest uses to be 'harmful minor forest uses'.[18]

Oral history in environmental history

To include the perspectives of both foresters and farmers, information from forest management plans was combined with oral history interviews conducted with contemporary witnesses. The concept of oral history has mostly been applied in

social history research. Howarth noted that in the rush by historians to use oral history to study social history, other areas of the discipline have been neglected.[19] Fogerty referred to oral history as a tool that is suited for understanding and reconstructing historic ecosystems.[20] But in the field of environmental history, and particularly in historical ecology, the use of oral evidence is not widely used. Some efforts have been made by the American Forest History Society, which provides an oral history collection of more than 250 interviews conducted with individuals involved with the management and the use of forests and their related resources.[21] Recently the annual meeting of the UK branch of the European Association for Environmental History in 2004 dealt with the role of oral history in environmental history.[22] At the beginning of the oral history movement, some studies of agricultural history were already using this approach.[23] In his pioneering publication Evans, for example, highlighted the relevance of oral tradition in recording the remains of old rural communities in East Anglia.[24] Other articles have linked oral history with climatic issues.[25] Using oral history interviews, Brummond focused on the sociocultural consequences of Chernobyl nuclear accident.[26] Egoz showed that landscape tastes of New Zealand farmers are underpinned by ideologies, worldviews and social values, and suggested a framework for interpreting the meanings embodied in the farming landscape.[27] The strength of oral history lies in the fact that it complements written, printed and visual sources and can often clearly call into question the validity of those other sources.[28] A striking example of such a combination of different sources was conducted by Fairhead and Leach.[29] Linking oral history with aerial photographs and written evidence, they showed that dense forest islands in the savanna of Guinée are a result of human cultivation and not relicts of a once more extended forest cover as they had long been regarded by scientists. Riley evaluated the value of oral history to today's discussion of nature conservation.[30] He showed how the personal experience and collective memory of farmers can complete sparse ecological data sources. Furthermore, interview techniques have been widely used in order to investigate local and indigenous ecological knowledge, especially for regions with a living oral tradition and a lack of written ecological sources.[31] In the context of conservation ecology, oral history is seen as a tool for incorporating local knowledge into ecosystem management strategies which leads to a better acceptance of the regulations.[32]

Howarth calls for the use of oral history techniques as a tool to widen the scope of historical research.[33] Thompson argued that oral history not merely results in a shift in focus, but also in the opening up of important new areas of inquiry.[34] This article should contribute to a better establishment of oral history interviews in environmental and ecological research.

STUDY AREA

Valais

'Valais' is the French name of a Swiss canton situated in the south-western part of the country (Figure1) bordering Haute-Savoie in France to the West and the Val d'Aosta in Italy in the south. The Valais contains the main part of the catchment area of the upper Rhone to its river-mouth into the Lake of Geneva. The mountains surrounding the valley (highest top 4,618m asl) shield the inner part of the valley from the moist oceanic air masses transported by west winds. Due to this inner-Alpine situation and the rain shadow that it creates the central Valais is a very dry region (annual precipitation at Sion = 598mm/yr).[35]

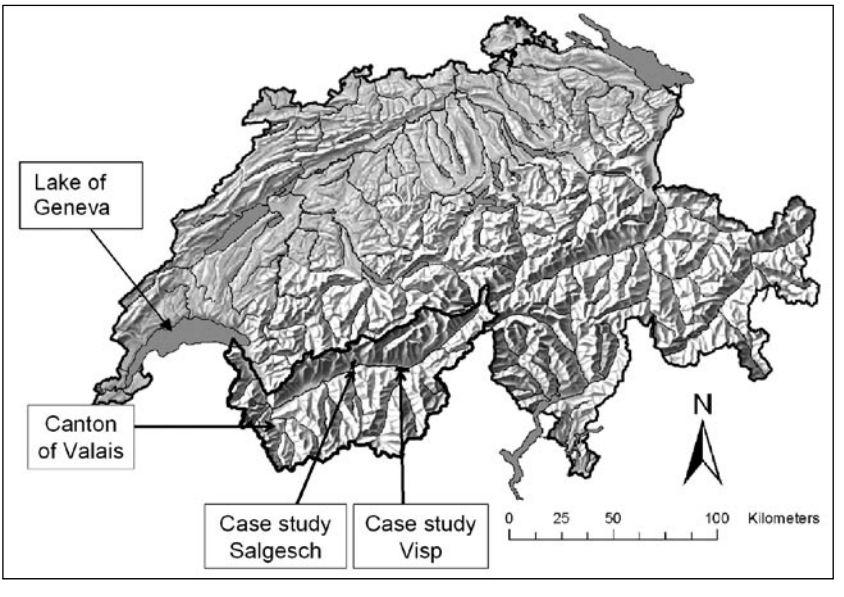

FIGURE 1. The study area (Canton of Valais) in the south-western part of Switzerland and the location of the two case studies (Salgesch and Visp). Map base: swisstopo 2004

Pine forests constitute an important forest type in the region. They cover about 11 per cent (12,000ha) of the total forested area of the Valais, and they are mainly located in the central part of the valley (Figure 2). Forests dominated by Scots pine occur above all in the main Rhone valley from the valley bottom (450–680m asl) up to altitudes of around 1600m asl.

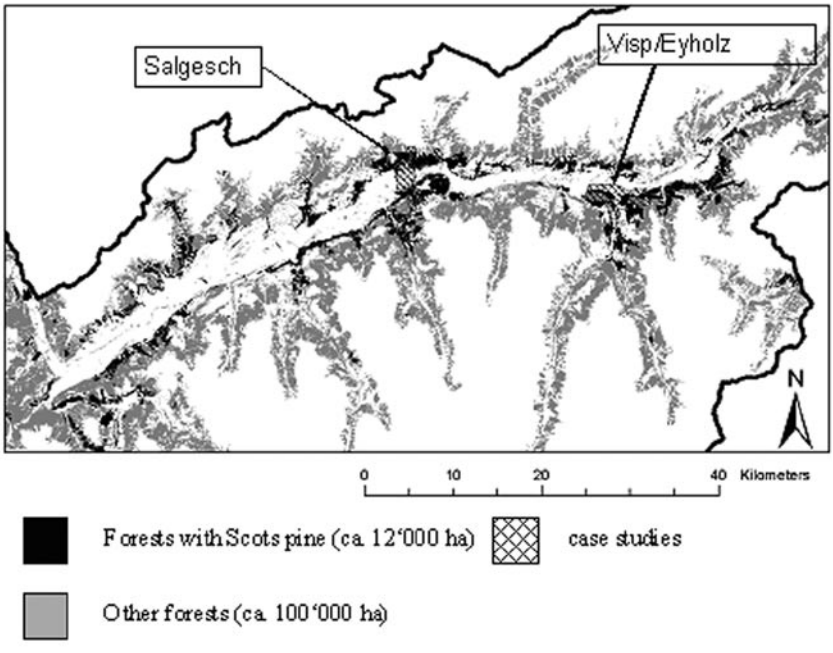

FIGURE 2. Forest distribution in the Central Valais and location of the two case studies. Source: Werlen (1994)

Case study region

Based on excellent source availability, two regions in the upper Rhone valley were selected as case study areas. The first case study covers the municipality of Salgesch situated in the central Valais. The municipality is located at the German-French linguistic border (see Figures 1 and 2). The Rhone divides this study area in a northern and southern section. The altitude of the municipality ranges between 450m and 2150m asl.

The second case study covers the municipalities of Visp and Eyholz located in the eastern central part of the Valais at the entrance to the valleys of Visp (Saas valley and Matter valley) (see Figures 1 and 2). The two municipalities of Visp and Eyholz merged in 1972. The study area is restricted to the left hand side of the Rhone with altitudes between 640m and 1600m asl. With an annual precipitation sum of about 500mm the region is the driest part of Switzerland.

SOURCES AND METHODS

The reconstruction of the history of traditional non-timber forest uses in the pine forest belt in the Valais is based on combining written sources (i.e., forest management plans) and oral evidence from contemporary witnesses.

Forest management plans

Forest management plans or forest surveys and reports have often been used to reconstruct changes in forest use and the related ecological effects.[36] Forest management plans are the main planning tool in forestry.[37] The plans were written by forest engineers and refer to a specific study period. The plans should be rewritten regularly.[38] For the Valais the cantonal forestry law of 1873 asked for the implementation of forest management plans for all public forests within the next 20 years.[39] This demand was confirmed in the Forest Law of 1880, which was released as an adjustment of the cantonal law to the Swiss Federal Forest Police Law of 1876. Consequently, the earliest forest management plans in the Valais were established in the 1880s. The early plans from the late nineteenth and the first decade of the twentieth centuries were called provisional forest management plans. These early plans include a general description of the forests, a report about the previous use, and guidelines for future management. In the last part of the plans the different forest compartments are described in detail, including data about topographic issues, soil properties, tree species, age class distribution (mostly based on visual estimation), production capacity and timber reserve. In some cases, a small map is attached which allows one to locate the forest compartments.

In 1923 the government of the canton of Valais enacted instructions for the implementation of definitive forest management plans. Among other things it was recommended that exact regulation of wood pasture and forest litter collecting should be added to these plans.[40] From the 1920s to the mid 1940s, definitive forest management plans were written for the forests of most municipalities in the Valais. These plans are much more comprehensive and provide more tabulated information (e.g. standing timber inventories by full callipering) than the provisional forest management plans. Most of the plans contain small-scale maps of the respective forest stands. For the second half of the twentieth century, only sporadic revisions of forest management plans have been conducted. For the period from 1881 to 1990, a total number of 81 forest management plans (28 provisional, 41 definitive and 12 revisions) have been examined conducting content-thematic analysis (see Figure 3). The plans were written either in German or in French.

The forest management plans have to be carefully evaluated, as they are biased to some extent by the interests of the authors and the intended readers.[41] The forest management plans represent the viewpoint of the forest authorities. Therefore, they have a normative character, which means they rather represent the official line on how forest management should be (the theory) and tend to neglect the important and often non-official practice of traditional non-timber forest uses in the people's daily life. Non-timber forest uses were essential for the poor people, but forest officials often characterised wood pasture and litter collecting as minor forest uses, because their main interest was in timber production. Furthermore, it should be noticed that forest management plans give account only of the management of communal forests; they do not include information about private woods. Despite these limitations forest management plans are a key source for reconstructing forest use history as they provide a wealth of information about forests and forest use and management.

Oral history interviews

In this study forest management plans were combined with information from oral history interviews. In the Valais, traditional non-timber forest uses were still practised until the mid-twentieth century.[42] Therefore it is still possible to collect first hand information (expert knowledge) from contemporary witnesses, who have personally practised litter raking and/or have intimate knowledge about wood pasture conducted some decades ago. The basic guideline of the interviews was designed for collecting this expert knowledge and did not aim at studying the variability of perceptions. The interviews allowed access to information on specific issues where the official sources remain silent. Particularly in the field of non-timber forest uses, oral history interviews provide essential additional information to the forest management plans. Most traditional non-timber forest uses were practised by specific social groups. Usually children herded the goats in the forests whilst litter raking was generally the job of women and children. A major strength of oral history is to give a voice to those people who are underrepresented in the official records such as forest management plans.[43]

In this project, 12 interviews were conducted. The interviewees were between 69 and 90 years old and in respect of gender equally distributed. The selection of interviewees was focused on people who had personally carried out traditional non-timber forest uses and therefore were able to provide first-hand information. Additionally, people with a broad agricultural and/or silvicultural background were also questioned. Most interviewees we found responded to an article about the pine-forest research project published in a local newspaper. The article was accompanied with a call for contemporary witnesses with the profile as described above. Other suitable informants were found on the occasion of a public information evening about the pine forest project and through local contacts.

To elevate the credibility of the interview, it is essential to know as much as possible about the narrator's biography.[44] Furthermore, information on personal background is helpful to contextualise the results of the interviews. Such information helps to assess how close the interviewee was to the events he or she recounts and to ensure that the statements are first hand information.

To conduct the interviews, a semi-standardised technique was used which is a combination of specific questions and an open conversation.[45] The application of an interview guideline in all interviews enables comparability between the different interviews. The narrative part of the conversation allows the interviewee to introduce new aspects and to emphasise the most important points in his view. If possible, the interviews were conducted in the forests, because an enhanced capacity for remembering was supposed if the interviews took place in the location of the former practices. Additionally, conducting the interviews directly in the forests gave the interviewee the opportunity to point out traces of past forest-uses. As the statements of the narrators were interpreted as expert knowledge the interviews can consequently be characterised as expert interviews.

All interviews were tape-recorded and then transcribed. Because of the manageable number of interviews we performed a content and thematic analysis without any coding techniques.[46]

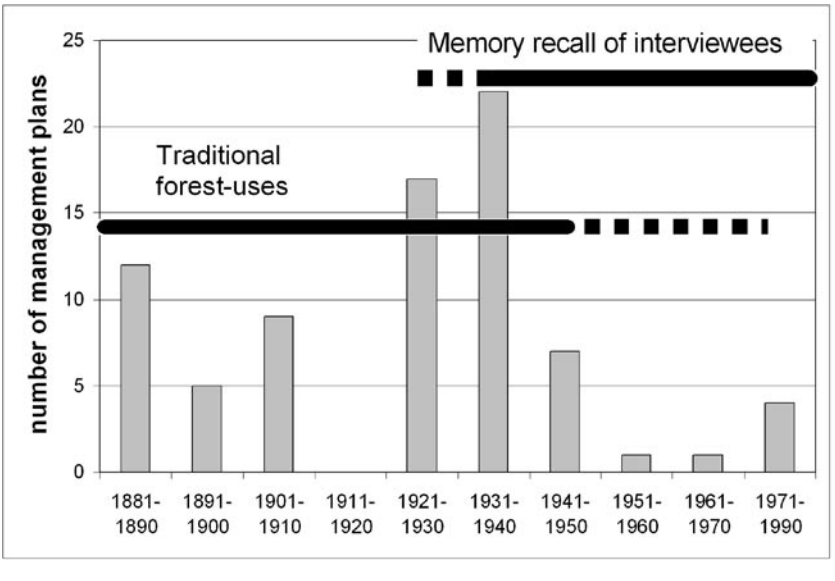

FIGURE 3. Oral history interviews and management plans in the context of traditional non-timber forest uses in the Valais.

Combination of forest management plans and oral history interviews

The value of the information gained from oral history interviews was enhanced by combining them with evidence from other sources. This combination enables one to assess past forest uses from different perspectives and therefore leads to a more comprehensive picture. The two sources complement and often clearly call into question one another. In this study the reconstruction of traditional non-timber forest uses is based on information taken from forest management plans for the late nineteenth and the beginning of the twentieth century (Figure 3). The range of reliable memory recall of the interviewees goes back to the second quarter of the twentieth century. That was also the time when the definitive forest management plans were implemented. Therefore, the two source-types can be compared and their quality can be evaluated for this overlapping period. In the second half of the twentieth century only a few forest management plans were established. Consequently, oral history interviews are the primary source of information for this last period. This period is of particular interest because traditional non-timber forest uses were abandoned in many regions at this time.

RESULTS

First case study: the municipality of Salgesch

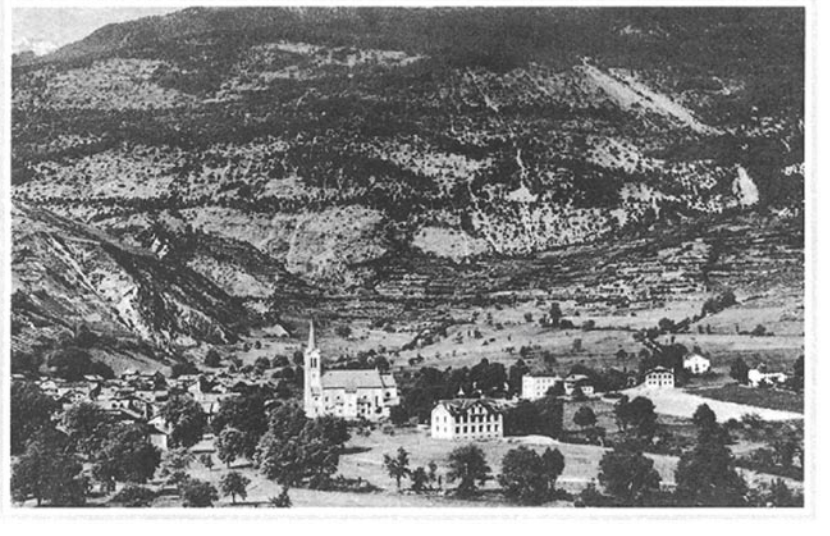

FIGURE 4. Salgesch in the late nineteenth century. In the background the extremely dry south exposed slopes of the upper forest. Clearly visible are the relatively densely stocked stands along the irrigation channels ('Varener Wasserleitung' and 'Mengis Wasserleitung'). Reproduced from Meichtry (2002).

General description

The forested area of Salgesch is divided in three different sections (see Figure 5). The upper forest (forest 1) is located on a southern exposure and is predominately stocked with pine. Two irrigation channels[47] ('Varener Wasserleitung' and 'Mengis Wasserleitung') cross the area (see Figure 4). The pure pine stands of the Pfynwald (forest 2) cover a hilly area on the right hand side of the Rhone. The Pfynberg (forest 3) situated on a northern exposure was almost completely destroyed by forest fire twice in 1921 and 1996 respectively.[48] After the first fire, the area was reforested with larches. In contrast, no reforestation was undertaken after the second fire.

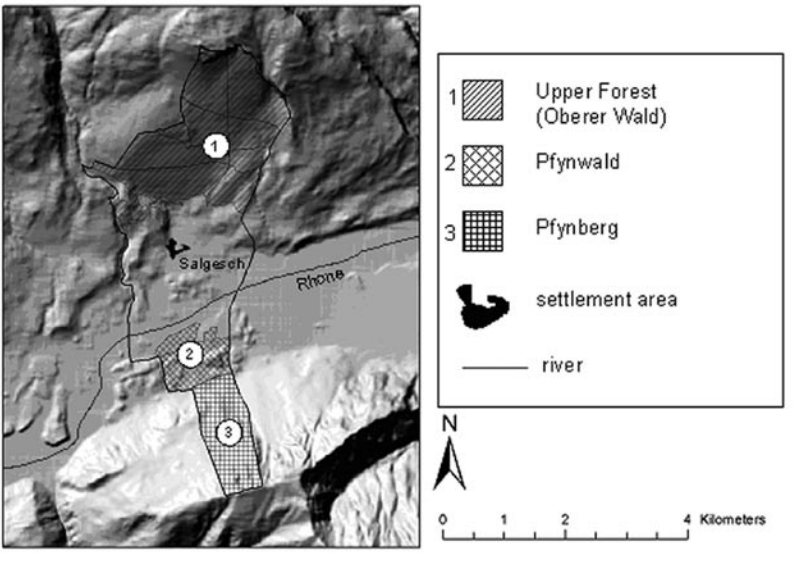

FIGURE 5. Forests of Salgesch.

Sources and material

To reconstruct the forest use history of the municipality of Salgesch four forest management plans (MP) were available: MP 1888 (provisional), MP 1932 (definitive), MP 1973 (revision) and MP 1982 (revision). An exceptionally detailed interview was conducted with A.M. (born 1923) who was employed by the municipality of Salgesch as local forester from the early 1950s to the mid 1970s. The father of A.M. held this position until the interviewee took over

the job. Basically the family lived on agriculture at a subsistence level and the earnings from viniculture. The interview included two half-day walks through the forests of Salgesch. Furthermore, A.M. provided personal documents (see Archival Sources) from his time as a forest supervisor.

The forest supervisor of such a small municipality was strongly embedded in the local sociocultural structures surrounding a typical agricultural lifestyle and livelihood. Therefore he was anxious to find a balance between the implementation of the ideas of the superior forest administration and the considerations of the resource needs of the local community. This consideration should be taken into account when assessing the interviewee's statements from a source-critical point of view.

Wood pasture

The first MP 1888 only provides some general references about the wood pasture in the forests of Salgesch. Grazing by goats and sheep should be restricted to areas 'where the forests suffer as little as possible', but no specific regulation and spatial restrictions are given. The second MP 1932 highlights wood pasture as a central theme, with a particular focus on the damaging impacts of this practice. Sparsely stocked stands were interpreted as the harmful consequences of browsing on trees and trampling on regeneration. These effects were located notably in the lower eastern sections of the upper forests (forest 1 in Figure 5). In the guidelines for the future treatment of the forests, wood pasture had been excluded from the larger part of the forested area. Only on the sparsely stocked areas of the lowest part of the upper forest should grazing be allowed to continue. The forest authorities were ordered to strictly control these regulations. The guidelines do not mention specification of potential penalties in case of the violation of these restrictions. With the implementation of spatial restrictions in the MP 1932, the forest administration tried to displace the wood pasture to areas where the conflicts with timber management were negligible. In the MPs 1973 and 1982, wood pasture was not included anymore as a relevant topic – probably due to the rapidly decreasing number of goats shortly after World War II (Figure 7).

The oral history interview confirms that wood pasture was practised above all in the eastern part of the upper forest (forest 1 in Figure 5) and to a lesser extent in the Pfynwald (forest 2 in Figure 5). In addition, along the upper irrigation channel ('Varener Wasserleitung') in the western part of the upper forest, goats from the neighbouring municipality regularly entered the forests of Salgesch. In spring, the municipality of Salgesch employed a goatherd to guide the animals on a defined route through the forests. Every morning, the farmers brought their goats and sheep to a pen constructed of stones ('Schafferrich') located at the lowest corner of the Blattenwald (lowest section of forest 1 in Figure 5). Relicts of this gathering place are still visible today in the forest. From there, the herder

guided the animals up to the upper tree line of the upper forest and drove them back to the 'Schafferrich' in the evening. Interestingly, this traditional grazing route does not correspond to the spatial restriction made in the WP 1932, which restricted wood pasture to the lower part of the upper forest (see Figure 6). Conflicts between herders and the forest authorities were inevitable. In 1943, a goatherd had to pay a penalty for guiding 102 goats and sheep to a prohibited area of the upper forest.[49] According to the evidence given by the interviewee, the area around the 'Schafferrich' was a completely treeless pasture some 50 years ago. Nowadays, only a few bare areas remain, whereas the bigger part is covered with young pines and deciduous trees. While the sheep were driven to the alpine pastures in early summer, the goats stayed in the village all year round in order to provide the local people with milk. The poor people especially depended on goat keeping. The goat as 'the poor man's cow' was a common phrase in many regions.[50]

Also in the Pfynwald (forest 2 in Figure 5) some grazing was exercised, despite this practice being prohibited. From the few farms located in the Pfynwald, the cattle occasionally entered into the forest and grazed there. Furthermore, in autumn the sheep coming back from the alpine pastures were

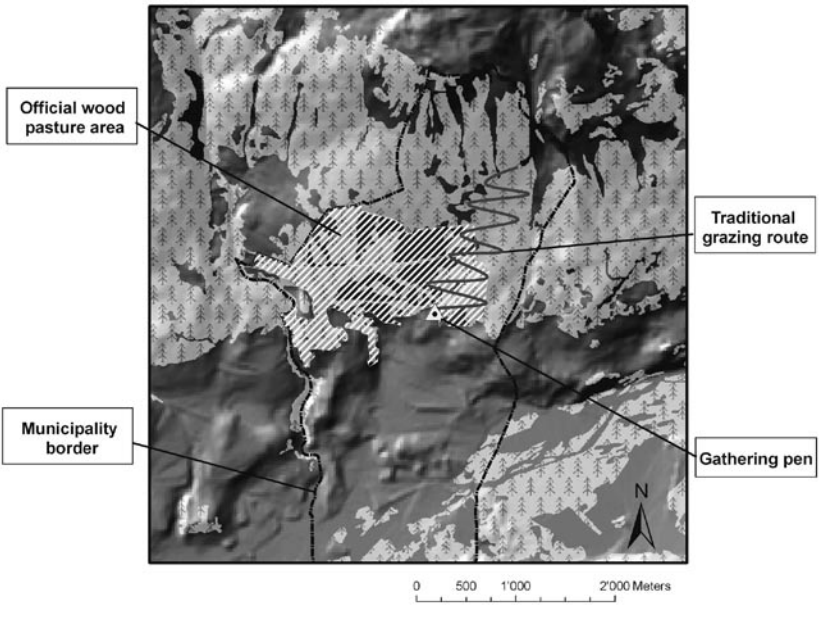

FIGURE 6. The MP of Salgesch 1932 restricted wood pasture to the lower part of the upper forest. From oral evidence we have knowledge about the traditional grazing route which obviously did not correspond to the official spatial restrictions.

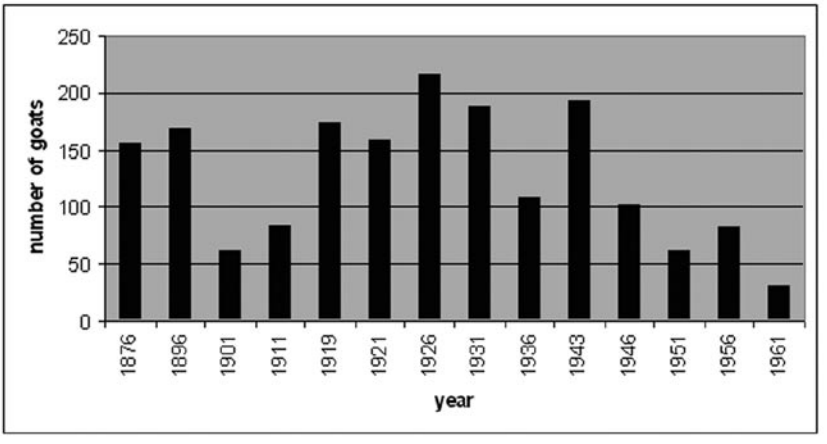

FIGURE 7. Number of goats in Salgesch 1876-1966. Source: Eidg. Viehzählungen 1876–1966.

brought to a specific lake in the middle of the Pfynwald in order to wash the animals before shearing them. Interestingly the current name given to this lake 'Schafsee' (Sheep's Lake) still reflects this past practice. Close to this lake two pens ('Schafferich') existed, where the sheep stayed and grazed during a few days in the end of October.

According to a report about wood pasture in Salgesch, in the late 1940s about 230 sheep during some days in spring and autumn and 42 goats over the whole year were still grazing in the upper forest.[51] In agreement with the findings from the forest management plans, A.M. dated the disappearance of wood pasture in the forests of Salgesch to the first decades after World War II.

Litter collecting

The MP 1888 only gives some short general guidelines concerning the litter raking in the municipality forests of Salgesch. According to this MP, the forest administration designated every two to four years the districts where litter collecting was allowed. Litter raking should be restricted to the 'minimal possible extent which is necessary' – a rather vague wording which is typical for the forest management plans of the late nineteenth and early twentieth century. In sum, it is known that litter collecting was practised in Salgesch in the end of the nineteenth century, but we have little information about its intensity and spatial distribution. The MP 1932 indicates that the collecting of litter had been strictly prohibited some years before for the whole municipality forests. No information is given about the exact year of the implementation of this ban or about the adherence of the regulation. In the latest MPs of 1973 and 1982, litter

collecting is not mentioned anymore. Obviously litter collecting disappeared during the second half of the twentieth century and therefore lost its relevance for the forest administration.

The interviewee confirmed the relatively early ban on litter raking in the forests of Salgesch. Nevertheless, litter raking was apparently still practised to a limited extent, above all in the Pfynwald (forest 2 in Figure 5) until the late 1950s. In contrast, the upper forest (forest 1 in Figure 5) and the Pfynberg (forest 3 in Figure 5) remained largely untouched by this forest use. Generally, litter raking seems not to have played an important role in the forests of Salgesch. Until the post-war period, the agricultural structure of Salgesch was geared to self-sufficiency. Large areas in the flatter part of the municipality, which are today cultivated with vines, were covered with grain fields (rye and wheat) until the 1950s (see Figure 4): 'In the flatter parts of the municipality large areas were cultivated with grain; everywhere you recognise vineyards today. It is incredible: the whole valley bottom was covered with grain fields.'[52] Therefore the demand for litter to be used in the barns was largely covered by straw from these crops.

Other non-timber forest uses

No non-timber forest uses other than wood pasture and litter collecting are mentioned in any of the forest management plans. In contrast, the oral history interview refers to a number of additional traditional non-timber forest uses.

On a small part in the lower east corner of the upper forest (forest 1 in Figure 5) resin was extracted from spruces. Today's field name 'Bächmannenwald' can be translated as 'resin-men forest' and therefore still refers to this practice, despite hardly any spruces being present today. The resin was used for the slaughter of pigs, where resin and hot water helped to remove the bristles of the pigs. The extraction of resin was practised until the late 1940s, when chemical products substituted the resin.

Mistletoes (*Viscum album* ssp. *austriacum*) were also collected for various purposes. The plants were used for fodder, for decoration on the occasion of several festive days (e.g. Christmas, Feast of Corpus Christi) and for different medicinal applications. 'We used the mistletoes to decorate the Christmas tree. Each tree had to have mistletoe.'[53]

In the Pfynwald (forest 2 in Figure 5) some relics of a former limekiln are still visible. Apparently other limekilns were in use at several places in the Pfynwald and in the upper forest (forest 1 in Figure 5). Additionally, some charcoal was also produced in the Pfynwald. Lime and charcoal production were extremely wood consuming processes. According to the references of the interviewee these practices were abandoned at least 100 years ago. Thus, the information is not based on direct experience by the interviewee.

Second case study: the municipalities of Visp and Eyholz

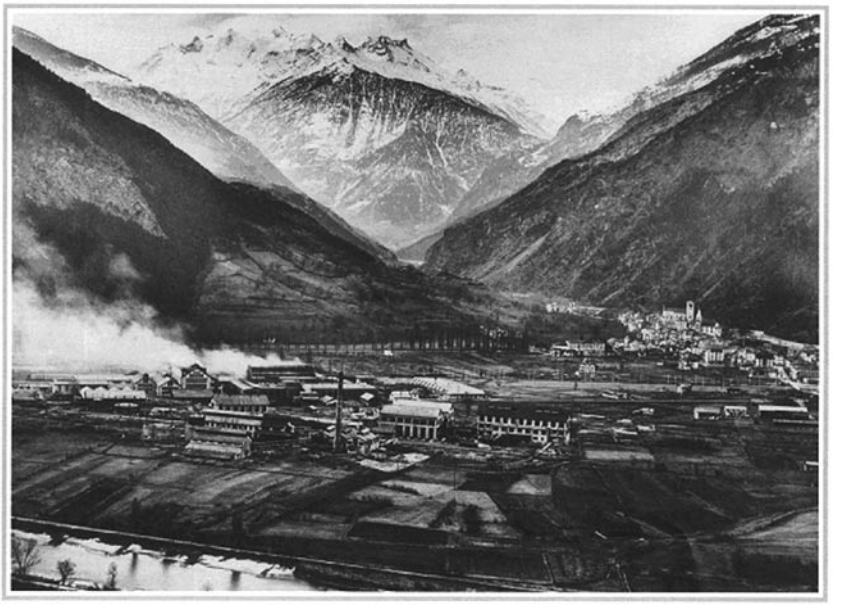

FIGURE 8. Visp in 1917. In the foreground the production plants of the Lonza SA. The chemical industry developed in the beginning of the twentieth century. In the background the village of Visp and parts of the municipality's forests. Reproduced from Fux (1996).

General description

The forested area is divided into six different sections (see Figure 9). The lower part on the left hand side of the Vispa river (forests 1) is dominated by almost pure pine forests. In the upper part (forest 2) grow mixed stands with silver fir, spruce and larch. In the forests of Visp on the right hand side of the Vispa river, we find almost pure pine forests in the lower and western part (forest 3) and mixed forests with silver fir, spruce, pine and larch in the eastern part (forest 4). In the lower part of the municipality's forests of Eyholz (forest 5) we find mixed stands dominated by pine and downy oak. A significant part of the lower forests is privately owned and therefore not included in the forest management plans. The upper forests of Eyholz (forest 6) are predominately stocked with spruce, silver fir and, near the upper tree line, with stone pine.

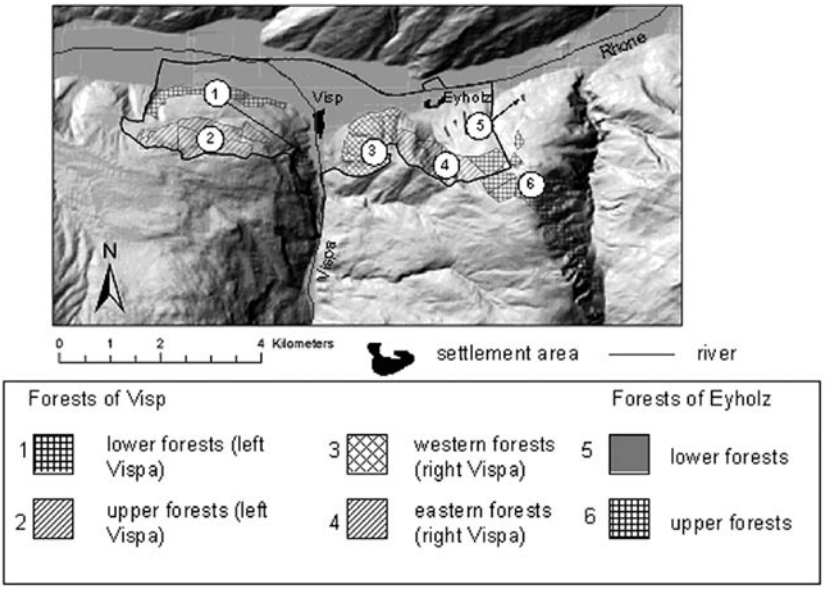

FIGURE 9. Forests of Visp and Eyholz.

Sources and material

The case study of Visp/Eyholz is based on three forest management plans from Visp – MP 1892 (provisional), MP 1924 (definitive, left hand side of the Vispa river), and MP 1926 (definitive, right hand side of the Vispa river) – and two plans from Eyholz – MP 1898 (provisional), and MP 1925 (definitive). For Visp, an interview was conducted with T.W. (born 1915), who was a shift worker in the chemical industry and who avocationally practised agriculture and viniculture. The second interview with R.T (born 1928) covers the situation in the municipality of Eyholz, where R.T. worked as local forester from the mid 1950s to 1972. The father of the interviewee held this position from the 1930s. The family made a living from agriculture.

Wood pasture

In the first MP of Visp dating from 1892, wood pasture is not mentioned at all. However, the MPs 1924 and 1926 refer to grazing as the most damaging forest use, which is not surprising considering a peak in goat numbers around 1920 (Figure 10). The negative impacts of wood pasture such as missing or diminished regeneration and soil compaction were observed over large areas of the forests.

These harmful consequences had already been noticed, as the MP 1924 refers to a series of regulations from the nineteenth century. The first restriction on wood pasture dates from 1848. Grazing was prohibited for the upper part of the forests on the left hand side of the Vispa river (forest 2 in Figure 9). In case of violations a monetary fine was imposed. In 1849, the neighbouring municipality of Visperterminen got the permission for grazing sheep in the Thelwald, an almost pure pine forest on the right hand of the Vispa river (part of forest 3 in Figure 9). In order to compensate for the negative impacts of wood pasture, a grazing charge was implemented in 1856 (only for non-citizens). In the 1880s, a general ban on wood pasture was even enacted. But by 1891, this ban had already been cancelled at the request of several citizens, and wood pasture was tolerated again in the lower forests on the left hand side of the Vispa river (forest 1 in Figure 9) which are also predominately pine stands. This regulation persisted until the creation of the definitive WPs in 1924 and 1926. The authors of the WPs 1924 and 1926 suggested the local permission for wood pasture should continue. Only for a small compartment was an additional ban on grazing implemented. Furthermore, the repeated penetration of goats and sheep from the neighbouring municipality of Eyholz was lamented (especially in the eastern part of forest 4 in Figure 9).

The interview with T.W. from Visp indicates that grazing was practised up to the late 1950s when the number of goats rapidly declined (see Figure 10). No further information was available form the interviewee about wood pasturing, because he never personally owned goats or sheep.

The first MP for Eyholz, dated 1898, mentioned an easement for the neighbouring municipality of Visperterminen on wood pasturing by sheep in the Lindwald and the upper part of the Zügenwald (upper part of forest 6 in Figure 9). This easement was combined with the right to use timber for repairing the irrigation channels. Otherwise wood pasturing was not widely practised in the forests of Eyholz according to the MP 1898. This is partially inconsistent with the general statement of the following MP 1925, which indicates that grazing had been tolerated without any confinement in all forests so far. According to the MP 1925, in particular two small, pine dominated compartments surrounded by private woods in forest 5 (see Figure 9) were grazed heavily by goats. In the Lindwald (upper part of forest 6 in Figure 9), the easement for Visperterminen on wood pasture by sheep still existed in 1925. In all the other forests of the municipality of Eyholz, grazing was allowed but apparently only practised on a limited scale. The MP 1925 suggests a restriction of wood pasture to the forested areas below approximately 1500m asl, which is the potential growing area of pine forests. Thus grazing was displaced to areas with a significant portion of pine forests.

From the oral history interview with R.T. from Eyholz it is known that in the 1940s, about 70 to 80 goats grazed in the forests of Eyholz (see Figure 10). The grazing season (period of estivage) for goats lasted from April (when the snow

cover had disappeared) to late autumn. In addition, the sheep were guided to the forest from April to 24 May when they were brought to the alpine pastures, and again from St. Moritz day (22 September) to the first snow. The pen for the animals was situated at the lowest edge of the forest near the village. Everybody who owned a goat or a sheep was bound to guide the animals through a defined grazing route at regular intervals. This work was mostly undertaken by school-children. The traditional route led through lower parts of the forests, which were predominantly private woods. As in Visp, wood pasture disappeared in Eyholz at the end of the 1950s.

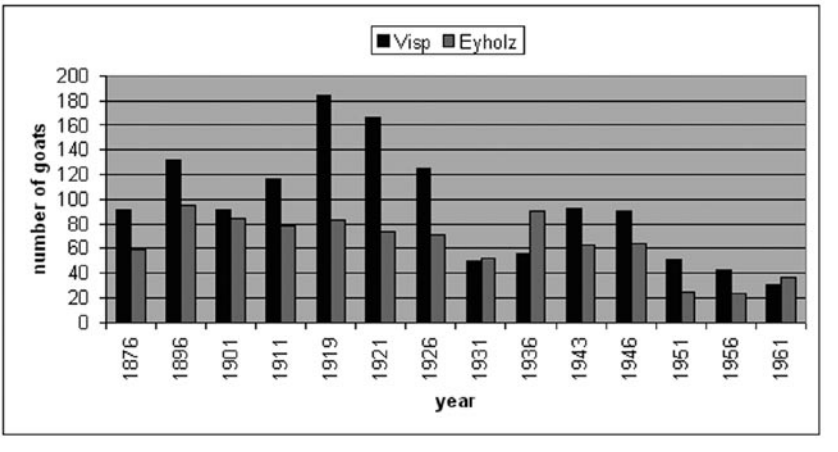

FIGURE 10. Number of goats in Visp and Eyholz 1876–1966. Source: Eidg. Viehzählungen 1876–1966.

Litter collecting

In the first MP for Visp of 1892, the problem of litter raking was not mentioned. The following definitive MPs 1924 and 1926 attest that the forests did not suffer much from litter collecting. The interview with T.W. confirms these findings. Litter raking evidently was only rarely practised in the forests of Visp. The chemical industry that developed at the beginning of the twentieth century offered a lot of jobs to people in the region (see Figure 8). Consequently, many families gave up or significantly reduced their agricultural activities. Many households did not own livestock anymore. In addition, sufficient amounts of straw were generally available from the cultivation of grain.

The situation in Eyholz was in many ways different from Visp. No information about litter collecting can be found in the first provisional MP 1898, but the MP

1925 complains that litter raking had been tolerated without any confinement so far, and asks for regulations. The idea was to exclude litter collecting from the three compartments in the upper part of the municipality's forest (forest 6 in Figure 9). Obviously, this idea was put into practice, as the consequences of this prohibition are mentioned in the interview with R.T. He points out that the exclusion of litter raking from the municipality forests caused a displacement of the practice to private forests. Almost every family owned a piece of private wood, mostly located below the irrigation channel (*Suonen* or *Wasserleitung*) – the '*Rohrbergerii*'. Most of these forests are almost pure pine forests. The interview provides detailed information on the practice of litter collection and the socioeconomic background of the litter collectors. Litter raking was practised mainly by women and children. The litter was collected in late summer and stored on a pile (see Figure 11). Some information enables quantitative estimation about the size of these litter piles. According to an interviewee from the valley of Saas the piles measured about 2.5m in height and 2.5m in diameter.[54] This is in quite good agreement with corresponding figures for the municipiality of Zeneggen where at the beginning of the twentieth century about 80 piles were counted that were 2.5 to 4m high and measured 3 to 4m in diameter.[55] Based on these quantities we assume an essential ecological significance taking into account that litter raking was practised above all in forests with a small natural productivity and in a dry region.

According to the interview with R.T., litter from spruce, pine and birch were preferred whereas the needles of the larch were not collected because they were regarded as unsuitable.[56] Probably larch needles decompose too fast and therefore they are not very practical to bind the manure. Occasionally, the upper soil was carried away as well.[57] In autumn and winter, the litter was used in order to bind the livestock's (cows, sheep and even chicken) manure in the barn. Obviously forest litter was not used for pigs: 'Forest litter was not used for the pigs. The needles penetrated into their nostrils and they fell ill.'[58] In order to overwinter a cow, at least 10 bags of litter were needed. The demand for forest litter depended on the availability of straw from the cultivation of grain. The family of the interviewee, for example, did not require much forest litter. Furthermore, the financial circumstances determined whether or not a family could afford to buy additional straw. In the period of World War II, generally more litter was collected in the forests. About the end of the 1950s the practice had completely disappeared in Eyholz.

Other non-timber forest uses

The MP of Visp 1926 refers to the resin extraction practised in the Thelwald (part of forest 3 in Figure 9) from 1874 to 1877 and again in the late 1890s. As raw material old pine stumps were cut just above the ground. As pine wood is extraordinarily rich in resin, the stumps were boiled in order to gain the resin.

FIGURE 11. Litter pile in the valley of Saas (in about 1965) Source: A. Imboden, Zollikofen; repr. In Kempf 1985.

After the MP 1926, the forest authorities tolerated this practice. According to the interview with T.W. in certain forests of Visp resin from spruces was used for the same purposes as in Salgesch (see above) until World War II.

Main patterns of traditional non-timber forest use history in the pine forest belt of the Valais

Apart from the case studies, different factors determined the spatio-temporal patterns of traditional non-timber forest use history in the pine forest belt of the Valais. These factors were identified based on the analysis of all available forest management plans and the full sample of oral history interviews from the whole pine forest belt of the Valais.

Regulations

On the regulation level, it is noteworthy that in the provisional forest management plans at the turn of the twentieth century only a few restrictions were found concerning non-timber forest uses. Most regulations refer to protected forests. Extensive regulation tended to provoke the resistance of the local people, e.g. the general ban on grazing enacted for Visp in 1880 (see above). Obviously, the practices of wood pasture and litter raking were basic necessities for a significant part of the poor people. The definitive forest management plans written between the mid-1920s and the mid-1940s contain numerous rules, restrictions and bans on litter raking and wood pasture. The MP for Feschel of 1929, for example, defined that an upper limit of 10 bags ('Maltersäcke', 1 Malter ≈ 1.5hl) of litter could be collected by each legitimate person.[59] Similar quantitative limitations are given in several other forest management plans. Obviously, the forest administration tried to limit the amount of litter harvested and to generally exclude traditional non-timber forest uses from areas where they had a high potential for damaging timber growth. These intentions often led to a concentration of litter raking and wood pasture in sparsely stocked pine forests.

Accessibility of the forests

The easily reachable forests near the settlements were highly attractive for litter collecting as people were anxious to avoid long and arduous journeys. In the MP of Glis 1930 for example, it is noted that in the easily accessible forests close to the village the whole litter cover was removed each year.[60]

Access to alternatives

In most municipalities, the demand for litter was partially covered by straw from the cultivation of grain. The availability of straw essentially determined the intensity of litter collecting in the forests.

The accessibility of a municipality decided the possibility of importing substitute products for forest litter, such as straw, in sufficient quantities and with competitive costs. According to the information taken from oral history interviews conducted in the municipality of Mund, litter raking immediately disappeared after 1975 as a consequence of the construction of a road which connected the village to the main transport infrastructure in the valley bottom.[61] In many regions, connection to the traffic network not only improved transport facilities for commodities, but also initiated the development of winter tourism. This phenomenon is reported for the Saas valley:

> Fundamental changes of the traditional lifestyle and economic structure were strongly linked with the traffic development such as the construction of the road in 1951 and the railway connection in 1953. These changes went on extremely fast and they were also the starting point of the winter tourism.[62]

Economic situation

The economic structure of the Valais was largely dominated by agriculture up to the mid-twentieth century (Figure 12). Economic revival, essentially based on the rise of the hydroelectric industry and the rebound of the tourism sector

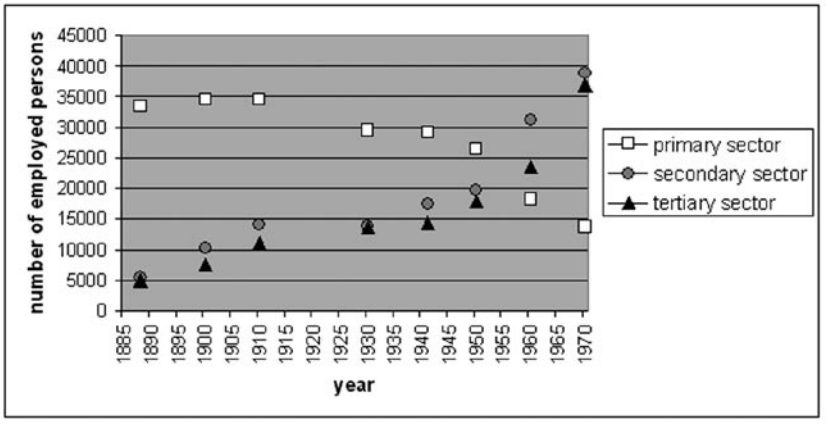

FIGURE 12. Number of persons employed in the different sectors in the Canton of Valais from 1888 to 1970. Source: Eidgenössische Volkszählung 1970.

after World War II, created a lot of new jobs in the Valais, and indirectly fostered the abandonment of traditional forest uses in many regions. The economic circumstances of the local people were decisive in determining whether and for how long litter raking was practised. In the first decades of the twentieth century, litter raking was widespread. In regions where additional sources of income were established early on, such as the chemical industry in Visp, agriculture became less important and the demand for forest litter and the need for wood pasture decreased.

Changes in demand

Up to the first half of the twentieth century, almost every family owned one goat for milk production. As already mentioned in the case studies, the number of goats decreased shortly after World War II (see Figure 13) as a consequence of fundamental socioeconomic changes and structural changes to Valaisan agriculture.[63] Consequently, wood pasture was almost completely abandoned in the Valais up to the 1960s.

In time of scarcity such as World War I and World War II, traditional non-timber forest uses gained increased importance. In the municipality of Glis, for example, wood pasture was partially reintroduced in 1943 as a wartime measure.[64] Similar effects for litter collecting were observed for the Swiss lowlands[65] and Germany during World War I.[66]

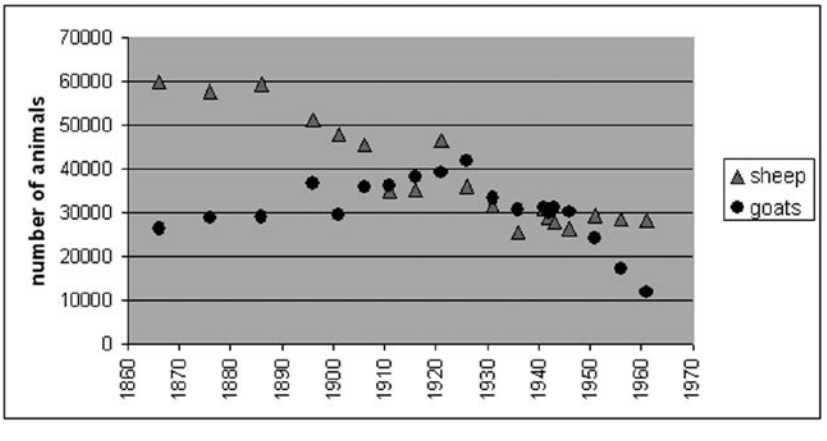

FIGURE 13. Changes in livestock of goats and sheep in the Canton of Valais from 1866 to 1961. Source: Ritzmann-Blickensdorfer (1996).

DISCUSSION

Wood pasture and litter collecting were the most important non-timber forest uses in the pine forest belt of the Valais during the late nineteenth century and the first half of the twentieth century. Other non-timber forest uses did not play an essential role, apart from the extraction of resin and the collecting of mistletoe, which were of local importance. The local and temporal intensity of these practices was influenced by legislative, topographical and socioeconomic factors.

A number of studies from Switzerland and neighbouring Alpine countries have shown that traditional non-timber forest uses continued much longer in remote mountainous regions than in more central areas.[67] This study confirms this fact. In most regions of the Valais traditional non-timber forest uses were given up in the first decades after World War II. Only in extremely remote regions were wood pasture and litter raking still practised to a significant extent until the 1970s. Several socioeconomic drivers finally led to the disappearance of these practices. The level of accessibility was crucial if straw could be imported in sufficient quantities to a municipality. In many regions the extension of the transport infrastructure directly resulted in the disappearance of litter raking. The existence of supplementary sources of earning in addition to agriculture (e.g. industry, tourism) was another decisive factor for determining when traditional non-timber forest uses were given up. Changes in society's demands directly caused changes in land use. In this context, Bürgi has proposed a classification of forest use for the Swiss lowlands in three overlapping periods: the 'period of traditional multiple use', the 'period of primacy of timber production' and the 'period of modern multi-impact management'.[68] In the Valais the traditional multiple use lasted 50 to 100 years longer than in the lowlands of Switzerland. In consequence, a period with primacy of timber production was never completely established.

Ecological significance for pine forest ecosystems

From the findings of this study it can be assumed that the practice and the abandonment of traditional non-timber forest uses has considerable impacts on pine forest ecosystems. The efforts of the forest authorities to displace traditional non-timber forest uses to areas of minor importance for timber production during the first half of the twentieth century resulted in increased pressure on sparsely-stocked pine forests. The practices of wood pasture and litter raking led to specific environmental conditions which favoured pine as a pioneer species. Damage to pine from browsing was negligible in comparison to damage to other tree species, particularly deciduous trees. In addition, the continuous removal of the litter cover and parts of the upper soil led to excellent conditions for pine regeneration. After abandonment of these practices pine was subjected

to increased competition. The recovery of the soil after a long period of massive biomass removal is a very long-term process.[69]

In many regions mistletoes were collected for different purposes. Mistletoes are parasitic plants that deprive the host tree of water and nutritive salt, which may lead to increased drought stress in extended dry periods. Therefore, mistletoes are suspected of contributing to the pine decline in the Swiss Rhone valley.[70]

Strength and limitations of the two source types

All source-types have their specific strengths and limitations[71] – which also holds true for forest management plans and oral history interviews (Table 1).

	Management plans	Oral history interviews
Description of practices	★	★ ★ ★
Spatial information	★ ★	★ ★
Temporal information	★ ★	★ ★
Socioeconomic context	★	★ ★ ★
Quantification	★ ★	★ ★

TABLE. 1. Comparison between management plans and oral history interviews. The number of stars indicates a qualitative weighting of the applicability of the source type for a specific research aspect (three stars: good applicability, two stars: medium, one star: strongly limited).

The description of the practices of non-timber forest uses is generally more detailed in the interviews, as they provide detailed insights about the technique and the practical exercise of litter collection. Forest management plans, on the other hand, mostly simply mention whether a practice took place or not.

Information about the spatial extent of the practices on a regional scale is usually given in forest management plans. But from local comparison with oral history interviews some inconsistencies can be identified. The prohibition of a specific forest use in the forest management plan does not necessarily mean it was not practised. And vice versa, if a practice was officially tolerated it was not inevitably executed. Here, the interviews in many cases provide locally ac-

curate information. With a larger number of interviews it would be possible to get this kind of information for the whole research area.

Both source-types have specific limitations with regards to information on the temporal development of traditional non-timber forest uses. Forest management plans cover a specific time frame for the period when they were written. Since the mid 1940s only a limited number of forest management plans are available. Therefore, the forest management plans provide only sparse information concerning the question when traditional non-timber forest uses have been abandoned. The oral history interviews are restricted to the interviewee's ability to remember (at most about 80 years). In addition the exact dating of the information was often very difficult. Thompson remarked that most people are less interested in calendar years than historians, and therefore do not arrange their memories with dates as markers.[72]

The socioeconomic context of a certain practice is best accessible through oral history interviews. In the forest management plans, non-timber forest uses are often labelled and treated as minor forest uses, because the main focus of forest authorities was on timber production.[73] The harmful consequences of the non-timber forest uses are usually strongly emphasised. By contrast, interviewees are able to integrate the information into their own context of experiences and their way of life ('Lebenswelt').[74] They often point out the importance of traditional non-timber forest uses for people's daily life.

Both source types provide much quantitative information about uses such as wood pasturing and litter raking. In forest management plans, quantitative information is mostly related to restrictions of a specific forest use (e.g. quantitative limitations). Quantitative evidence from oral history interviews usually refers to practical aspects of the forest uses (e.g. how much litter was needed to overwinter a cow). This kind of information enables one to reconstruct traditional non-timber forest uses in terms of intensity as well as spatial and temporal distribution. Such quantitative information is essential for assessing the impact of these practices on forest ecosystems.

CONCLUSION

In order to reconstruct the history of traditional non-timber forest uses in the pine forest belt of the Swiss Rhone valley (Valais), official documentary sources (forest management plans) were combined with oral history interviews. The forest management plans represent the view of the forest administration whereas the oral history interviews provide first-hand information from people who had personally practised the traditional non-timber forest uses. The major strengths of forest management plans are spatial information on a regional scale and description of legislative regulations. In contrast, the main advantages of the interviews emerge in detailed description of the practices and in information

about the socioeconomic background. Combining these two approaches allows the assessment of past forest use changes from different perspectives, and allows a comprehensive reconstruction of the history of wood pasture and litter raking in the pine forests of the Valais.

The study revealed that wood pasture and litter raking have been the most important traditional non-timber forest uses in the pine forest belt of the Swiss Rhone valley during the late nineteenth century and the first half of the twentieth century. These practices were a basic necessity for a significant part of the population whose lifestyle was based on self-sufficiency. The local and temporal extent of traditional non-timber forest uses and their abandonment was determined by the regulations of the forest authorities, the accessibility of the forests, the access to substitute products, the economic situation of the local people and changes in demand.

From the findings of this study it can be assumed that traditional non-timber forest uses produced considerable impacts on pine forest ecosystems of the Valais. The recovery of the ecosystem after abandonment of these practices is still in progress. The results of this study therefore establish a basis for the understanding of current ecological processes.

ACKNOWLEDGMENTS:

First of all we would like to thank our interviewees for providing such rich and helpful information. The insightful comments of Klaus C. Ewald, Anton Schuler and Marcus Hall on earlier drafts helped to improve the quality of this paper. We wish to thank also the two reviewers for their constructive comments and additions.

NOTES

[1] Flühler et al. 1981; Rigling and Cherubini 1999.
[2] Rigling and Cherubini 1999.
[3] Weber et al. 2005.
[4] Rigling et al. 2006.
[5] Hasel 1985, 152; Radkau and Schäfer 1987, 19.
[6] Bühler 1889.
[7] Loup 1965, 160.
[8] Viazzo 1989.
[9] Netting 1981.
[10] Stuber and Bürgi 2001, 2002.
[11] Bürgi 1999a; Stuber and Bürgi 2001
[12] Landolt 1862, 240.

'Die Zeit, in der man den Weide- und Streuertrag der Wälder höher achtete, als den Ertrag an Holz, ist in den meisten Gebirgsgegenden noch nicht weit hinter uns, an vielen Orten lebt man sogar noch mitten drin.'

[13] Fankhauser 1887; Grossmann 1927.

[14] These goats were called 'Heerdgeissen', 'Heimgeissen', 'Dorfgeissen' or 'Kehrgeissen'. Fankhauser 1887, 30 ff.

[15] For the history of the concept of 'Kornland' and 'Hirtenland' see Mathieu 1992, 38–41.

[16] Pfister 1983, 1985.

[17] Delfs 2001. Radkau and Schäfler 1987, 63.

[18] Bürgi 1999a, 572.

[19] Howarth 1998.

[20] Fogerty 2001, 101.

[21] http://www.lib.duke.edu/forest/Research/ohiguide.html

[22] http://www.uea.ac.uk/~e490/eaeh.htm

[23] Carter 1974; Cregeen 1974; Faiers 1976.

[24] Evans 1965, 1966, 1970, 1975.

[25] Gant 1986; Preston 2002.

[26] Brummond 2000.

[27] Egoz 2000.

[28] Howarth 1998, viii.

[29] Fairhead and Leach 1996.

[30] Riley 2004.

[31] e.g. Calheiros et al. 2000; Fernandez-Gimenez 2000 ; Olsson and Folke 2001.

[32] Shindler and Aldred Cheek 1999; Lykke 2000; Robertson et al. 2000; Robertson and McGee 2003.

[33] Howarth 1998.

[34] Thompson 1978, 7.

[35] For the climatological data we refer to Rebetez and Dobbertin 2004.

[36] e.g. Östlund et al. 1997; Bürgi 1999a, 1999b; Axelsson and Östlund 2001.

[37] Bürgi 1999a, 568.

[38] The governmental instructions for the implementation of the definite forest management plans in 1923, asked for revising the plans every 10 years. (Kempf 1985, 57).

[39] Kempf 1985, 56. An overview of the development of the forest laws for the Canton of Valais is given in Kempf 1985, 45 ff.

[40] Kempf 1985, 56.

[41] Bürgi 1999a, 569; Bürgi 1999b, 150.

[42] Kempf and Scherrer 1982; Kempf 1985.

[43] Botz 1984; Howarth 1998.

[44] Yow 1994, 270 ff.

[45] Flick 1995, 99 ff.

[46] Thompson 1978, 126.

'The recording is a far more accurate and reliable account of an encounter then a purely written record and only the transcription of the interviews allows the recording to be cited in a book or article'

[47] For the importance of irrigation systems in the Valais see Mariétan 1948, Reynard 1995, Crook and Jones 1999a, 1999b, Crook 2001

[48] Gimmi, Bürgi and Wohlgemuth 2004, 438.

[49] PAM: Procès-Verbal, Délit de Bois No. 9 (15 Juni 1943)

[50] Radkau 1987, 63.

[51] PAM: Bericht über den Schafweidgang im 'oberen Wald', Abt. 2. (7 Juni 1949)

[52] translated OHI A. M., Salgesch 2004

'Die ganzen flacheren Partien, wo heute vorwiegend Reben sind, waren Getreidefelder. Es ist unglaublich: Die ganze Ebene – Getreide.'

[53] Translated OHI A.M., Salgesch 2003

'An Weihnachten hat man sie [die Mistel] auch zur Zierde genutzt. An jedem Baum musste eine Mistel sein.'

[54] OHI F B., Saas Bidermatten 2004

[55] Stebler 1921.

[56] The composition of the forest litter varied a great deal depending on which tree species were growing locally. For the Bernese Oberland the use of beech leaves is reported (Kasthofer 1822, 20–21) whereas in the people in the Engandin predominately collected litter from spruce, stone-pine, Scots pine and larch (Kasthofer 1825, 193)

[57] This practice is also reported for pine forests in Bavaria. Hölzel 1996, 46.

[58] Translated OHI M.F, Mund 2004

'Für die Schweine konnte man es nicht gebrauchen. Die haben die Nadeln in die Nasenlöcher gekriegt und wurden krank.'

[59] MP Feschel 1929.

[60] MP Glis 1930.

[61] OHI M.F., Mund 2004.

[62] Translated OHI E. I., Saas Fee 2004.

'Ein Umbruch in der traditionellen Lebens- und Wirtschaftsweise trat mit der Erschliessung (Strasse 1951) ein und vollzog sich sehr rasch (1953 erste Bahn). Damit kam auch der Wintertourismus.'

[63] Loup 1965, 245 ff.

[64] Weidgangreglement für die Waldungen der Burgschaft Glis für die Dauer des Krieges (1943).

[65] Bürgi 1999a, 571.

[66] Reuter 1920, 40.

[67] Glatzel 1990, 1991; Johann 2000, 2004a, 2004b; Bürgi 1999a; Stuber and Bürgi 2001, 2002; Bruckbauer 2003; Waldmeier-Brockmann 1941.

[68] Bürgi 1999a, 573.

[69] Glatzel 1990, Glatzel 1991.

[70] Dobbertin et al. 2005.

[71] Sheail 1980.

[72] Thompson 1978, 157.
[73] see also Schuler 1998; Bürgi 1999a.
[74] Vorländer 1990, 12.

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