

## **Forest Development and Changes in Stakeholders' Demands in the High-Alpine Valley of Avers, Switzerland**

*Desarrollo forestal y cambios en las demandas de los gestores en el valle alpino de Avers, Suiza*

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### **Abstract**

Alpine forests have been part of a pastoral landscape in many regions for centuries. In the nineteenth century, a professional forestry service developed, and the local needs for specific forest uses were supplemented by non-local actors with their specific interests. Using the example of an Alpine valley in Switzerland, the development of the different demands of the stakeholders and their effects on forest development were analysed using an interdisciplinary multi-source approach. Forest history studies contribute to a better understanding of the development of the current situation and provide an important basis for the search for sustainable forest utilisation concepts for the future.

**Keywords:** Forest History, Woodland Pasture, Stakeholders, Alps, Switzerland.

### **Resumen**

Los bosques alpinos han sido parte de un paisaje pastoril en muchas regiones a lo largo de siglos.

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En el siglo XIX, se desarrolló un servicio profesional de silvicultura, y las necesidades locales de usos forestales específicos se suplementaron por actores no locales con sus intereses particulares. Usando el ejemplo de un valle alpino en Suiza, el desarrollo de diferentes demandas de los gestores y sus efectos sobre la dinámica del bosque fueron analizados usando un enfoque interdisciplinario con múltiples fuentes. Los estudios históricos de bosques contribuyen a un mayor entendimiento de la situación actual y propocionan una base importante para la búsqueda de conceptos de uso sostenible para el futuro.

**Palabras clave:** historia forestal, pastos del bosque, gestores, Alpes, Suiza.

## 1. INTRODUCTION

The close proximity of treeless meadows and pastures on one side of the valley and forests full of ancient larches (*Larix decidua*) and Swiss stone pines (*Pinus cembra*) on the opposite side characterises the landscape of the upper valley of Avers municipality, located in the Canton of Grison, in the Central Alps of Switzerland (Fig. 1). This has caught the eye of visitors for centuries and speculations have been made about the reasons for the one-sided lack of trees, with mining and the need for wood to build houses and stables often being mentioned. There are also numerous descriptions of the hardships involved in bringing firewood to these higher settlements - a consequence of the lack of forest. And what about the obviously very old Swiss stone pines and larches, which are found in large numbers in various forest areas on the other side of the valley: How old might they be? And why have they survived in the sparsely wooded upper part of the Avers valley?



Figure 1. View of the upper valley of Avers municipality, located in the Canton of Grison, Switzerland, with the village Cresta, 1960 masl, in the foreground.

Photo: Susan Lock, 2022.

Starting in December 2020, an interdisciplinary team of the Swiss Federal Research Institute of Forest, Snow and Landscape WSL ([www.wsl.ch](http://www.wsl.ch)) has been working on the forests of the Avers (RIGLING and BÜRGI, 2023). Early during the project we stumbled over two interesting aspects. On one hand it became clear that up to the present day, some parts of the forests are still pastured, despite this practice has been banned for more than hundred years. On the other hand, locals referred to parts of today's forest area as being "Alp" i.e., alpine pasture, and not as being forest (BÜRGI and LOCK, 2022). Obviously, different concepts of what a forest is and what the benefits derived from it, prevail.

Differences in forest conceptualizations have been highlighted in historical analyses before, e.g., by STUBER (in press), distinguishing between different visions of sustainability brought forward by different stakeholder groups in the establishment the principles of sustainability in Swiss forestry in the nineteenth century. BÜRGI (1999) analysed in his case study of forest change in the Swiss lowlands how forestry officials, community officials and local people differ regarding their specific needs, interests, and way of acting and the changes therein in the nineteenth and twentieth century. In many studies of forest use, a main distinction is made between local stakeholders with a focus on the diversity of forest products (including the so-called "minor forest products", i.e., non-timber forest products) and forestry officials, which tend to focus on timber production as their core interest.

Obviously, different actor groups differ in their intentions regarding what a forest should be used for, and consequently also, how it should look like. How many trees must stand together, and how densely do they have to stand that they qualify to be called "forest" and not only a group of trees? The diversity of forest definitions in different countries across Europe, often providing precise numerical thresholds (PULLA *et al.*, 2013), is astonishing. Whereas such numerical thresholds allow to operationalize the term for administrative and scientific purposes, they do not necessarily align with stakeholder's perceptions on what a forest is, let alone on what its main uses and functions are.

For the region of Avers, we explored the following two research questions:

How did the forest develop?

What are the most important benefits the different stakeholder groups would like to gain from the forest?

The following text in large parts relies on the results presented in BÜRGI and LOCK (2022), where more detailed references, sources and quotes are provided.

## 2. STUDY AREA AND HISTORICAL CONTEXT

### 2.1. The municipality of Avers

The Avers is a high-altitude alpine valley and forms an independent municipality with around 170 inhabitants on an area of 9.309 ha (Fig. 2). The lowest-lying settlement is Campsut at 1.670 masl, the highest is Juf at 2.126 masl, which

is also said to be the highest permanent settlement in Europe. The municipality consists of eight fractions and individual farms (<https://gemeindeavers.ch/portrait>). The main economic activities are agriculture and tourism.



Figure 2. Central part of the municipality of Avers with Cresta (see Fig. 1) in the centre and location of the forest “Cröterwald”. The square indicates the location of the aerial photograph shown in Fig. 6. Data source © swisstopo.

The Walser immigration to the Avers took place at the end of the thirteenth century (STOFFEL, 2021:78). Romansh people had already settled in the area before the arrival of the Walser, as evidenced by the Romansh place names such as Juf, Juppa, Riva, Piatta, Cresta, Casal, Cröt and Campsut (CLAVADETSCHER, 1942). The date for this early settlement is placed in the eleventh to thirteenth century, although traces of human presence are older (WEBER, 1985: 37). The clearing activity for the creation of pastureland and hay meadows as well as the need for wood for mining, houses, and fuel, together with the high grazing pressure, probably led very early on to the forest vs. open land distribution in the Upper Valley that is still characteristic today. Reports of wood-devouring mining as a cause do not appear to be based on sufficiently reliable sources, at least for the Upper Valley (ANNAHEIM, 1930; WEBER, 1985). Livestock and dairy farming were certainly at the centre of attention due to the altitude alone (WEBER, 1985). Not least the proximity to the cattle markets of northern Italy favoured the keeping of cattle, as well as sheep and goats. It is also characteristic that the cattle were moved to follow the fodder, which led to semi-nomadism and different residences throughout the year - FORRER and WIRTH (1925) show concrete examples of these migratory movements for families from Juf.

To this day, the weeks of hay harvest are still a key period of the year, and despite modern mechanisation, it is still necessary to rely on external labour,



as within a short period of time large areas must be mown, the grass dried and brought into the barns.

## 2.2. The forest “Cröterwald”

We focus our analysis on the so-called Cröterwald (Fig. 2), a forest area in which the various forest functions, from protection against avalanches, production of wood and timber, grazing ground for cattle and habitats for rare species are all present in a park-like forest stand (Fig. 3).



Figure 3. The Cröterwald in the Avers in autumn. Ancient larches and pine trees form a pasture forest with species-rich dry meadows (photo: Susan Lock, WSL, 2022). In other parts of the Cröterwald, also spruce trees (*Picea abies*) can be found.

The “Cröterwald” is located in the front part of the Madris Valley (a side valley) on the orographic left side, starting from the road and spreading up to the tree line. We are essentially referring to forest compartment 14 (“Im Brand”) as defined in the first forest management plans (WPs). At the top and in the north its borders are marked by the ridge Wandflue and in the south by the creek Eggabächli. In the 1932 management plan (WP, 1932), compartment 14 is described as “an actual alpine forest of larches/alps at the top, with spruce at the bottom”. The stand was described as a selection forest with all age groups being represented, regeneration occurring in groups and individually and the compartment being interspersed with larger pasture areas.

To this day, the forest is part of the Cröter-Alp. In 1899, forest grazing was partially banned, which repeatedly led to conflicts of use and could never

be permanently enforced. The forest-covered land, including the woodland, is owned by the municipality of Avers. The neighbouring alpine area (Cröteralp) is owned by the Cröteralp cooperative.

### 3. MATERIAL AND METHODS

Our historical analysis focused on the period since 1900, which allowed us to analyse forest management plans, statistical data, interviews with contemporary witnesses, aerial and terrestrial photographs.

For the study in the Avers documented here, eight interviews were conducted with locals aged between 64 and 92, two of whom no longer live in the area. The interviewees were selected based on recommendations from locals and - given the small population and other limitations in terms of experience and health - include all potential interviewees in the study area. In accordance with standard practice, a declaration of consent was signed in advance, describing the use and further processing of the interviews. The interviews were conducted according to a previously prepared guideline. It listed the most important questions on forest development, along which the interviews were conducted. The interviews were recorded and then partially transcribed. The transcription was carried out in standard German and focussed on information about the forest and factors influencing its structural change. The interviews are archived as audio documents and transcriptions at the WSL and in the Cantonal Library of Grison.

Repeat photography is a powerful method to document and communicate about changes in forest structure (PEZZONI, 2017). As a base, historical photographs have been collected in local and regional as well as in digitized archives which were available online. Details about repeating procedures applied and detailed results are provided in BÜRGI and LOCK (2022). Aerial photographs were available from the years 1933, 1957, 1961, 1977 and 2015.

Forest management plans (WPs), which are updated every 10-20 years, are used to plan the forest management of the forests for example in a municipality. As they allow for reconstructing changes in forest structure quantitatively and provide insights into use and management of the forest over time, they are - if available - prime historical sources for forest history (e.g., ÖSTLUND *et al.*, 1997, GIMMI and BÜRGI, 2007). For the forests of the Avers, WPs from the years 1932, 1956 and 1980 were analysed. The WPs contain information in text form on the utilisation of the forests, any events and other special incidents and the results of the stand surveys. The data contained in the WPs on growing stocks and the number of stems per tree species and forest division provide a picture of the forest structure. However, we needed to consider that the categorisation into diameter classes changed over time and the figures were therefore only comparable to a limited extent. In the WP 1932, the trees were categorised into the diameter classes rounded to even numbers, i.e., 16-18 cm, 20-28 cm, 30-38 cm, 40-48 cm and over 50 cm. To be able to compare these values with the later surveys, the figures

for the 20-28 cm class from the 1932 WP were divided equally between the two diameter classes I (16-24 cm) and II (26-38 cm). The descriptions of the individual compartments provide valuable additional information on the structure and structural changes, which have also been analysed.

Quotes included in the following text are own translations from the original German (WPs, other written documents) and Swiss German (interviews). Interview quotes are references by anonymized codes (e.g., ML, KP).

According to the MILLENNIUM ECOSYSTEM ASSESSMENT (2003), benefits people obtain from ecosystems can be conceptualized as ecosystem services. We therefore classify the benefits determined within the broad categories provided in this assessment by distinguishing between provisioning, regulating and cultural services.

#### 4. DEVELOPMENT OF FOREST STRUCTURE

An entry point into the study of the forests in the Avers is provided by FURRER (1955) in his description of the decline of the Swiss stone pine in Switzerland. He explicitly addresses the development in the Cröterwald, which he contrasts with the changes in the close-by Letziwald. While a dense regeneration of larch and Swiss stone pine was established in the latter due to the banning of forest grazing in 1899, the decay of the Cröterwald had progressed further and the average growing stock had fallen from 120 m<sup>3</sup>/ha in 1932 to less than 80 m<sup>3</sup>/ha. The numerous completely or half-dead trees were not allowed to be felled as they represented the only protection against avalanches and for any future forest regeneration. It remains unclear where FURRER'S (1955) figures come from, as they could not be found in the management plan to which Furrer seems to refer to. In the 1930s, only the reasonably stocked part of 7 ha was measured, which was stocked with 657 m<sup>3</sup> (corresponding to a stock of 96 m<sup>3</sup>/ha; WP 1932), for 1955 it was 2116 m<sup>3</sup> on 15 ha (corresponding to 141 m<sup>3</sup>/ha) and for 1975 1986 m<sup>3</sup> (corresponding to 132 m<sup>3</sup>/ha). The growing stock consists mainly of thick larch trees (Fig. 4). At least for 1932, it must be considered that the standing dry wood was not counted (WP, 1932).

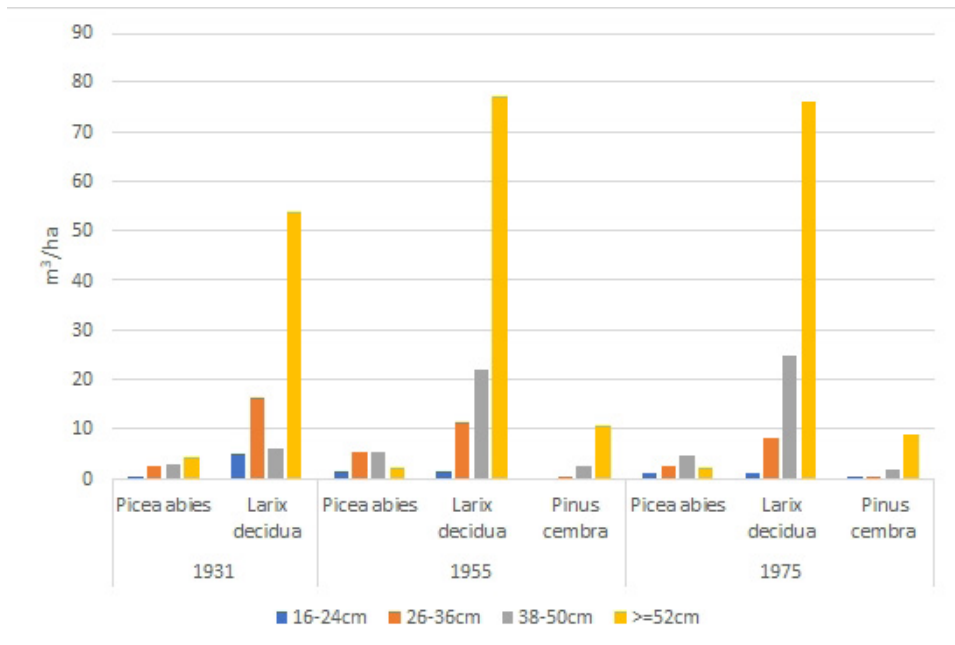


Figure 4. Development of the growing stock in the Cröterwald (Division 14), based on the information in the forest management plans (WP, 1932; WP, 1956; WP, 1980).

However, the latter data should be treated with caution, as the inventories in 1955 (WP, 1956) and 1975 (WP, 1980) were carried out under the direction of a slightly hard-of-hearing district forester. This seems to have led to errors, as the measured values were shouted to the recorder (mem. O. Hugentobler). The 1932 management plan states it to be a “forest ruin” due to “sharp grazing”, and it is assumed that the mortality in the Cröterwald is much greater than the ingrowth (WP, 1932). There is no mention of heather or other dwarf shrubs, but of a “grass cover”.

This is also shown by the development of stem numbers, which remained very constant during this period at 96 stems/ha (1931), 105 stems/ha (1955) and 94 stems/ha (1975) (Fig. 5). When interpreting the rather high numbers of stems in the smaller diameter classes in 1931, it must be taken into consideration that in 1931 not the entire 15 ha, but only a partial area of 7 ha was measured. It must be assumed that this was limited to those areas of the division in which a certain amount of wood utilisation could be considered at all and that the stands regarded as pure pasture forests were rather excluded. Consequently, the values for 1931 refer to the denser and better regenerated stands, which explains the high values in the younger diameter classes compared to the subsequent inventories, which also included the pasture forests dominated by old larches.



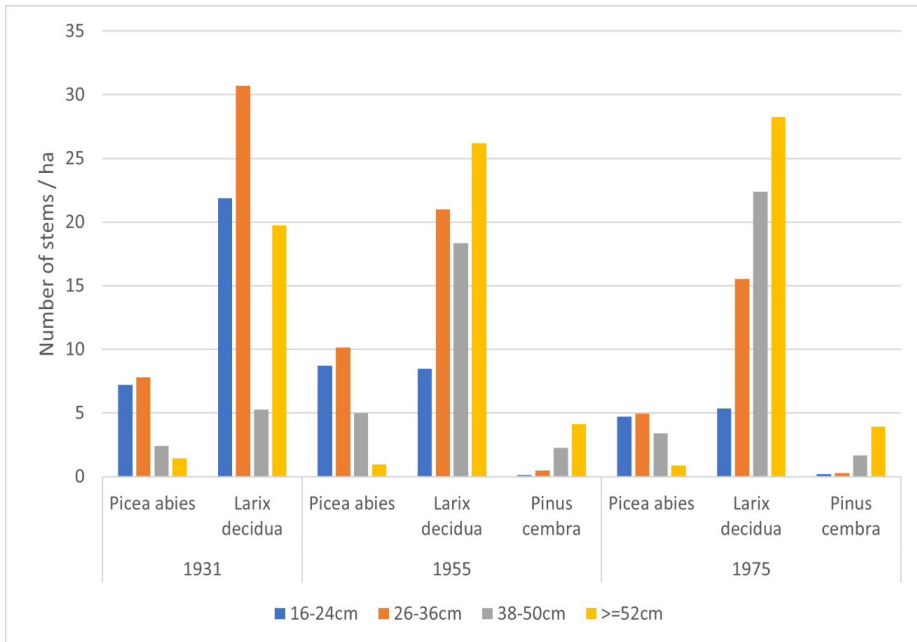


Figure 5. Development of the stem numbers in the Cröterwald (Division 14), based on the information in the forest management plans (WP, 1932; WP, 1956; WP, 1980).

The aerial photographs show that the patchy, open structure of the Cröterwald forest has largely been preserved in the second half of the twentieth century (Fig. 6). Also repeat photography illustrates an increase in forest density in neighbouring forest stands, but a still rather open character of the Cröterwald (Fig. 7).

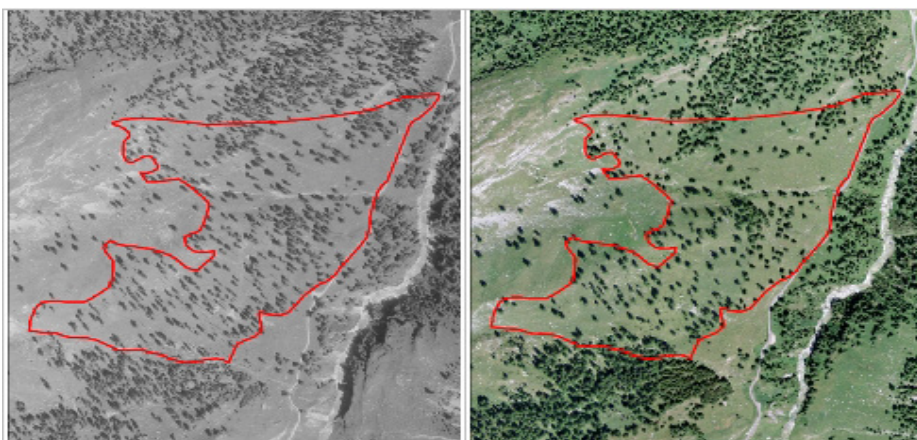


Figure 6 Aerial photograph of Cröterwald 1957 (left) and 2015 (right); the red lines show the boundaries of forest compartment 14. Data source © swisstopo/WSL.



Figure 7. View towards the Cröterwald. The forest stands to the left and right of the Cröterwald, which has remained open, have become denser and more closed. Left: Ernst Brunner, 1956 (SGV\_12N\_43233) © Schweizerische Gesellschaft für Volkskunde/ Empirische Kulturwissenschaft Schweiz (detail). Right: Susan Lock, WSL, 2022.

## 5. DEVELOPMENT OF THE DEMAND FOR MAIN TYPES OF BENEFITS

### 5.1. Provisioning services

#### 5.1.1. Firewood and timber

For a long time, the transportation of goods to and from the Avers was severely restricted by the gorge-like section of the Ferrera Valley between Innerferrera and Campsut. The population's external relations were orientated towards the south via the mountain passes. Overall, the local supply of goods largely depended on the locally available resources. In general, the amount of wood used was modest and was mainly limited to the stands from Cröt valley downward. Utilisation was hampered by the lack of a road network. There are numerous descriptions of the efforts and hardships involved in bringing firewood and timber to the higher located settlements. Only a small amount of wood was traded, most of it was used for personal consumption. Branch wood was important for the supply of firewood, as was dried sheep dung, which is still to this day piled up like bricks in front of some stables as a reminder of the past.

The construction of the valley road between 1890 and 1895 reversed the main economic orientation of the valley from south to north. In the second half of the twentieth century, the hydroelectric power plant was built in the neighbouring Valle di Lei, which led to the further extension of the road to Juf and the expansion of the electricity grid, both evoking a major developmental change in the Avers, which also impacted the utilisation of the forests. The need for firewood decreased

drastically, electric and oil heating systems were now warming the houses; in addition, firewood and construction timber could be imported from outside of the valley.

The harvest control tables show that only very little timber was extracted from the Cröterwald, whereby the comments therein show that it was mainly derived from windfall, less often from snow pressure and in some cases from general selection cuttings, without a more precise indication of the reasons. This is consistent with the comment in the 1932 economic plan: "In the Cröterwald, Letziwald and Capettawald forests, with the good intention of conserving the forests, nothing was extracted for long periods of time, not even the standing dry wood" (WP, 1932: 15). In view of the composition of tree species, it is not surprising that larches were used above all. The Cröterwald larches, were preferred used for stable buildings, where particularly robust wood is in demand. More intensive harvest took place in the post-war years from 1945 to 1949, when 64 larches were extracted, twice due to windthrow and once as part of a regular harvest.

### 5.1.2. Forest pasture

As agriculture focussed on livestock farming, the remaining forests were under heavy grazing pressure for a long time. The higher forest stands served as spring and autumn pasture and as weather protection for the grazing cattle, while the lower-lying forests were of great importance as so-called "Heimweide" (i.e., home pasture) due to their proximity to the settlements. This intensive forest grazing was a thorn in the eye of the forestry service due to browsing damage, and the restriction of grazing rights repeatedly gave rise to conflicts between the forestry service and the local population.

In addition to cattle, whose numbers remained fairly constant over time, there were also many sheep and goats in the Avers until after the Second World War. In the course of the structural change in the middle of the last century, away from small farms with different animal species towards individual larger farms with increasing specialisation in suckler cow husbandry, the number of goats and sheep in the valley decreased drastically, the ban on forest grazing was implemented and in many places vital tree regeneration took place.

A decades-long dispute was taking place between the forestry service and the local population over the restriction of grazing rights in the Cröterwald, Letziwald and Capettawald forests - as in many communities in the Canton of Grison (STUBER, 2021), although it lasted longer in the Avers than elsewhere. As it is not so much the legal history as the forest history that is of interest here, we will refrain from a detailed description of these disputes and focus on the portrayal of the explicitly practised forest grazing. Although being gradually restricted, for example in 1899 by corresponding contracts (e.g., in WP, 1932), forest grazing continued to be practised. The 1956 management plan states: "The aim of future management must be a strong regulation of grazing. The separation of forest and

pasture in compartments 14 and 15 of the Cröterwald and in compartment 20 "Uf em Bergli" is particularly urgent..." (WP, 1956). The management plan of 1980 also states that the grazing regulation and afforestation project proposed in 1932 for the Cröterwald had not yet been worked out, as the grazing rights could not be replaced lacking compensation for the lost spring and autumn grazing ground (WP 1980, 24).

Of the stands analysed, the Cröterwald was grazed the longest and most intensively. STOFFEL (2021, 37) comments:

According to the forest regulations of 1882, the protected area in the "Cröterwald" was limited to the area between the "Teifa Bächli" and the "Ramsenalp", where spruce was afforested around 1900 instead of the usual Swiss stone pine and larch. The afforested area was banished for 15 years in return for compensation for grazing. Further: The "Cröterwald" between the "Wandflua" and the "Teifa Bächli" continued to be grazed and suffered to such an extent that practically no young growth had appeared since time immemorial and the old Swiss stone pines and larches gradually died off.

In the middle of the twentieth century, the spring grazing of large livestock is described as follows: "The farmers of Cröt use the Cröterwald forest from the Wandfluh to outside Ramsen (south of compartments 13, 14 and north of compartment 15) as grazing areas". The same also holds true for goats and sheep of Cröt: "The herd from Cröt has its daily course to Cröteralp through compartment 13 and 14" (WP, 1956). And: "The replacement of the pastures in Cröterwald is finally to be realised. Except for a lower strip of home pasture and a narrow cattle path to Cröteralp, the entire area is to be fenced off and afforested" (WP, 1956: 33).

At the beginning of the twentieth century, the Cröteralp itself was stocked with 39 grazing cattle, 10 bovines, 10 calves, and 10 goats (STRÜBY, 1909). In the summer of 1958, the Cröteralp was stocked with 69 head of cattle (52 of which were foreign) and 23 goats (WP, 1956: 31).

The forest also still serves as a shelter for bad weather conditions:

Then he usually comes down to the forest with the cattle, where they are protected. In the Cröterwald as we call it. Then he comes down and they are quite sheltered in the trees. If it's too grey and there's snow, they must be stabled. Then they come down into the valley, but that's very rare. (ML).

The intensity of goat grazing in the Cröterwald has declined in recent years:

It may be that there used to be more cattle or goats in there, perhaps. Because in recent years the trees have been popping up everywhere. [...] Every farmer used to have a few goats, maybe 40-45, 50 animals at most. And now there are just under 30, because it's only us now. (ML).

Additionally, these goats do not permanently graze within the Cröterwald:

No, the goats aren't in the forest that much. They go through in the morning and then they go up. When the weather is nice, they are always up where there is no



forest (ML).

Forest regulations repeatedly state that dying trunks should be removed, leaving tall stumps, in order to obtain at least a small amount of firewood. The forestry service also calls for reforestation projects and the redemption of grazing rights. Sowing with larch seeds and several plantings repeatedly failed due to the grazing pressure.

As part of the activity of the NGO “Bergwaldprojekt” (bergwaldprojekt.ch) some protective fences in the Cröterwald were renewed, whereby the large amounts of snow in the winters placed high demands on their stability. The young growth of spruce and larch was viewed critically as it led to a conflict of services between stand stability and preservation of the park-like forest structure and the species-rich dry meadows.

### 5.1.3. *Other non-timber forest uses*

We often learn about other non-forestry uses indirectly in the prohibition articles of the forestry legal documents and forest regulations. For example, they prohibit “collecting litter, grass and resin, peeling bark and pruning trees, cutting off of branches for the use of litter, extracting kindlings and collecting pine nuts” (own translation). The latter used to be a merchandise and their collection, e.g., for oil extraction, was highly regulated, as entire branches were sometimes torn down and the trees badly injured and distorted in their growth. Among the contemporary witnesses interviewed, only collecting of pine nuts was still remembered - as a popular “snack”. Berries, such as cranberries, blueberries, redcurrants, and red elderberries, were also collected in the forest, while mushrooms did not play a role for the locals: “The locals are no mushroom gourmets”.

## 5.2. **Regulating service**

### 5.2.1. *Avalanche protection*

Avalanches are an important factor influencing forest dynamics in mountainous regions. For the Avers, the sources show that the settlements were repeatedly hit by avalanches. For example, on November 30, 1808, an avalanche destroyed several buildings in Juf, killing two men and 18 cows, and in December 1836 a house with eleven children was swept away by an avalanche in Cresta, luckily leaving the children undamaged (CAVIEZEL, 1904: 29). TÄUBER (1912) mentions, albeit without more precise spatial information, that deforestation led to avalanches, “as a result of which numerous locations that once had buildings had to be abandoned”. Various sources refer to special avalanche winters, such as for the winter of 1887/88 (STOFFEL, 1938: 190), 1900/01 (annual report 1901), the

year 1917 (STOFFEL, 1938: 190), or for April 1975 (WP, 1980: 5). The Madris Valley is particularly affected by avalanches, explicitly mentioned were the winters of 1885/86, again 1919, 1950/51 and 1985/86 by STOFFEL (2021), and the year 1977 in an interview (RK). The entries in the avalanche data of the WSL Institute for Snow and Avalanche Research SLF confirm an accumulation of events in the years mentioned, with a spatial focus in Madris Valley.

Consequently, some forests in the Madris Valley were set aside as protected forests since long, certainly to protect the settlements from avalanches, which was already mentioned in the Landbuch of 1622/44 (STOFFEL, 2021: 25). The harsh winter conditions in this high-alpine valley are also expressed by the fact that the inhabitants of Madris Valley had to clear the municipal road from snow themselves for a salary of 70 Centimes an hour to ensure access to the outside world. The drastic changes that life in the Madris Valley underwent in winter are made clear in STOFFEL'S (1938: 190ff) dramatic descriptions of the avalanche winter of 1887/88, as well as in the interviews. The following quotation, which refers to the situation in the Madris Valley, illustrates how people came to terms with the constant threat and consequences of avalanches especially also for forest regrowth:

And for that part there, where the avalanche always comes down, you can cut it (young growth) all away. It's just always lying down in the meadow anyway. When another avalanche comes... You don't need a protective forest there. No forest will establish there anyway. There's always an avalanche coming. (KP)

The loose stocking with old trees, which is characteristic of the Cröterwald, but under which regeneration is certainly occurring, is described as follows:

There are avalanches everywhere. When there is a lot of snow, yes. But if you go for a walk there now - I like to walk through it in summer - you can see young trees, Swiss stone pines and larches everywhere. You can see quite a few here and there, above and below the road. They are growing again. And the old Swiss stone pines are still fighting, they're fighters. (ML)

### 5.2.2. Habitat protection

Dry meadows and pastures are species-rich habitats often resulting from long-term extensive land use by mowing or grazing (DIACON-BOLLI *et al.*, 2012). To counteract the continuing decline of this habitat, in 2010 the Federal Council included dry meadows and pastures of national importance (TWW) in an inventory in accordance with Article 18a of the Federal Act on the Protection of Nature and Cultural Heritage (DIPNER *et al.*, 2010).

As the upper part of the Cröterwald meets the criteria to be include in this inventory, it is part of the TWW object no. 9325 "Ramsa". This implies that it has to be kept open by law, in order to maintain the light conditions necessary for the survival of the light-demanding plant species of dry meadows and pastures.

### 5.3. Cultural services

#### 5.3.1. Cultural heritage

In line with this request for keeping the Cröterwald in its present open and park-like state, in recent years, voices have been raised, e.g., from the NGO “Bergwaldprojekt”, which regard grazing forests as part of an aesthetically and ecologically valuable cultural landscape that forms part of the region’s cultural heritage, which can only be preserved by maintaining adapted grazing (KREILIGER, 2023).

## 6. WHO WANTS WHAT TYPE OF FORESTS?

Our analysis revealed that different stakeholder groups prioritize different benefits they would like to obtain from the forests, which lead to different ideas about how the Cröterwald should look like. Local farmers traditionally use the area as pastureland and they are consequently interested in good fodder quality, but also some shelter, as the forest is located below alpine meadows and can be used as a shelter for the cattle in the case of heavy snowfall. Thus, a park-like, open stand with old trees and a dense grass cover is in line with their requirements.

Forest engineers/local forestry service, on the other hand used to focus on timber production, to increase the revenue from the forest area. As forest pasture damages young trees and saplings, they try to limit or ban pasturing and promote forest regeneration by fencing areas, potentially also in combination with planting of young trees. The structure aimed at is much denser and darker and – as an additional benefit and service – provides also much better protection against natural hazards, such as rockfall or avalanches.

At the same time as the demand for safety from natural hazards, for example for underlying road connections, voices in favour of the protection of rare species became increasingly heard in the course of the twentieth century. Indeed, the Cröterwald includes rare, species rich habitats, especially dry meadows, which also gained protective status. However, the forest structure supporting these habitats are the result of the traditional practice of forest pasture - which means prohibiting this practice, as intended by the forest service, stands in conflict with the societal demand for biodiversity protection and the protection of cultural heritage.

Setting this case study in an international context, reveals that the forest structure of the Cröterwald is probably typical for heavily pastured mountain forests throughout the alps, and larch wood pastures have e.g., been described for Northern Italy by GARBARINO *et al.* (2011). During the nineteenth century, the professionalized forest service throughout the Alpine Ark increasingly promoted the abandonment of forest pasture. In most cases successfully so, not to the least

part, as the demand for pastureland declined in many places anyway, leading to overall abandonment of agriculture (e.g., USTAGOLU and COLLIER, 2018). It is rather unusual, that a forest stand, such as the Cröterwald, is pastured to a certain extent up to the present day and consequently continues showing the resulting park-like structure. The Cröterwald therefore can be rightfully called a relic forest illustrating the structure resulting from a formerly very widespread traditional forest use.

Traditional wood-pasture systems are in transition throughout Europe, with severe implications for biodiversity and societies associated (HARTEL and PLIENINGER, 2014). Our case study contributes to the growing body of literature documenting these transitions and highlights the importance to consider diverging stakeholder demands. The modern demand for some of ecosystem services, such as forest pasture, and habitat for rare species, but also cultural services of the forest as a part of the cultural heritage, are well aligned, but they conflict with demands for increased timber production and higher protection against avalanches. These differences in demands for specific benefits is also reflected in differences between notions on how a "good forest" should look like, i.e., open, and park-like, or dense and dark.

## 7. CONCLUSION

The history of the forests of the Avers and their utilisation shows impressively how forests develop because of changes in forest use. Traditionally pastured forests, which were widespread throughout Europe, are especially prone to such changes, as the demand for forest pasture declined in parallel to an increasing focus on timber production, and – especially in alpine regions – also the call to increase the protective function of forests. As the demand for the benefits required by the various stakeholder groups changes differently over time, the lines of conflict also change depending on the context. Local needs do not always correspond to the intentions and goals of the forestry service – also these differences become visible in the various forest images.

Forest history studies reveal these different perspectives and their effects on the forests and thus contribute to a greater understanding of the development of the current situation. This understanding is not only exciting for those interested in history but in addition provides an important basis for the search for sustainable forest utilisation concepts. Here, too, it is important to understand the various utilisation interests and the included economic, social, and ecological goals and to take them into account accordingly.

An interdisciplinary forest history can contribute to these debates by placing the current socio-ecological conditions in a historical-ecological context. It can do this by tracing the most important lines of development both in terms of changes in the benefits in demand and in the ecosystems affected. In addition, it is advisable to invest sufficient time and resources in dialogue with local



stakeholders. A dialogue at eye level in all phases of the project (from project design to communication of the results) is a prerequisite for the results to be perceived as an effective contribution to the search for sustainable solutions.

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