Food and Agriculture Organization of the United Nations

Globally Important AGRICULTURAL HERITAGE Systems

Heumilch

TRADITIONAL HAY MILK FARMING

IN THE AUSTRIAN ALPINE ARC

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Description of the agricultural heritage site	Sustainable hay milk farming in the Austrian Alpine Arc
Applicant organisation	ARGE Heumilch Österreich
Responsible ministry	Federal Ministry of Agriculture, Forestry, Regions and Water Management
Location of the region	Alpine Arc with Alpine foothills Mountainous regions from Vorarlberg to Tyrol and Salzburg and as far as Styria, as well as the Alpine foothills in Salzburg's Flachgau and Mondseeland regions and the Mühlviertel region
Accessibility of the location to the capital or to larger cities	The two largest cities in the region are the state capitals of Innsbruck and Salzburg: The nearest metropolis is Munich (2 hours by car from Innsbruck, 1.5 hours by car from Salzburg). Innsbruck and Salzburg each have their own airport, with Salzburg being better connected to the regions in Europe due to its topography. Salzburg is a traffic junction in the east-west as well as north-south direction (West Autobahn A1, Tauern Autobahn A10); Innsbruck is located on the Germany-Italy transit route (Inntal Autobahn A12, Brenner Autobahn A13).
Coverage area (expressed in ha) of the GIAHS site (core area and buffer zone, if applicable).	Core area: 148.473,14 ha
Agro-ecological zone for agriculture, forestry, fishery and aquaculture.	In general, the Alps limit the amount of usable land in the region. The sea level of the agricultural land is between about 400 and 1400 metres above sea level. Tyrol[1]: 61% of the agricultural land is alpine pasture and mountain meadow, 35% is meadow and pasture; Salzburg[2]: 96% of the agricultural land is permanent grassland Vorarlberg[3]: 55.5% of the agricultural land is Alpine pasture
Topographical features	The region is located at the eastern end of the Central Alps and at the transition to the Alpine foothills, with the landscape featuring mountains and valleys and hills in the Alpine foothills. Permanent grassland shapes the landscape between the valley floor and the forest. Above the timberline, Alpine pastures extend the economic zone.
Climate type	Alpine climate: warm summers with radiation weather (high-pressure weather with little cloud cover) and cold-air pools in winter; precipitation is distributed throughout the year, snow in winter
Approximate population	421.485 persons

[1] Statistik Austria, Agrarstrukturerhebung 2010 (via Website Land Tirol, https://www.tirol.gv.at/statistik-budget/statistik/landwirtschaft/)

[2] Moser, Franz: Grüner Bericht des Landes Salzburg 2016-2018, Salzburg 2019

[3] Amt der Vorarlberger Landesregierung: Strukturdaten Vorarlberg 2018; Bregenz 2018; p. 160

Traditional communities and/or indigenous populations (not applicable)	No specific ethnic groups
Main source of livelihood	Tourism, trade and commerce, industry Agriculture The region is characterised by tourism, which is particularly dominant in Tyrol, Vorarlberg and parts of Salzburg. However, the production sector is also an important source of both commercial and industrial revenue. Agriculture plays a minor role in direct added value, but also contributes significantly to tourism by preserving the landscape.

II. SUMMARY

Hay farming is the most original form of milk production in the Alpine region, which is increasingly threatened by the industrialisation of agriculture and international competition. Because of the cold and snowy winters in the region, fodder must be conserved for the winter in summer. Winter feeding with hay is particularly species-appropriate and the biggest difference between hay farming and other dairy farming systems.

The landscape basis for hay farming is the permanent grassland of the grassland mountain regions, which is managed in the form of pasture, alpine pasture farming as well as fresh grass feeding in summer and hay feeding in winter. This management of permanent grassland without ploughing and according to the annual cycle causes a carbon sequestration in the soil that is much higher than in arable land and even higher than in commercial forest.[4]

The proposed system is basically about feeding fresh grass and herbs in summer and hay in winter. This feeding method is not only healthy for the animals, but also represents a form of agriculture adapted to the location, which is very environmentally friendly and climate-friendly for various reasons:

- Preservation of biodiversity through mosaic-like grassland use (see proposal Chap. IV, 2).
- Contribution to climate protection - permanent grassland stores carbon (see proposal Chap. III, 3.2).
- Limited share of concentrated feed conserves resources (see "Higher basic feed performance", Chap. III, 3.2)
- High organic share - currently 38%
- High animal welfare standards (Chap. III, 3.2)
- Strengthening of rural areas (Chap. III, 3.2)

Hay-milk farmers also voluntarily submit to a strict restriction on the use of concentrated feed. This, along with other regulations, is laid down in the hay-milk regulations. This also includes pasture and/or

[4] Zollitsch Werner, Hörtenhuber Stefan., Lindenthal Thomas, Penicka Alexandra, Scheurich Anja (BOKU - Universität für Bodenkultur Vienna, Zentrums für Globalen Wandel und Nachhaltigkeit): Heumilchproduktion im Kontext der Sustainable Development Goals; Vienna 2019, p. 41f

outdoor exercise on at least 120 days a year as well as fertiliser regulations. Fertilisation is mainly done with own manure from dairy farming.

Furthermore, within the framework of hay management, permanent grassland has the highest filtering effect with regard to nitrate leaching due to a particularly high and dense root mass. Last but not least, small-scale/mosaic farming contributes significantly to the preservation of biodiversity. (see chapter Agro-Biodiversity).
Hay farming has been practised in the Austrian Alpine arc since the development of specialised agriculture at the beginning of the modern era. Up until the 1960s and 1970s, the majority of milk was produced as hay milk. In Austria, the share of silage-free milk was constantly high in Austria 85% until the 1970s. It was only after this that hay farming was increasingly pushed back. More and more dairy farmers converted their farms because silage farming seemed more profitable and more in keeping with the times. In industrialised dairy farming (silage farming), more and more concentrated feed is used, which occupies arable land in favourable locations (plate-trough debate). Hay milk, on the other hand, is produced from permanent grassland, which in many cases would not be usable for human nutrition.

In the mountain area, silage preparation was not an option, as it did not promise any advantage due to the small and steep areas.

1. PRESERVATION OF THE FARMING METHOD

While the majority of milk in Austria was still being produced through hay farming until the 60s of the 20th century, today the figure is only 15%. Hay farming is feasible and practical wherever there is permanent grassland and winters are low in vegetation, especially in mountainous areas. Occasionally, there are smaller hay milk spots spread across Europe, but overall only about 3% of the milk in Europe is produced according to this system.

Hay farming is a form of agriculture that is optimally adapted to the conditions of the region, as small-scale farming structures make it possible to cultivate the often-steep slopes in a way that is suitable for the location. Over the centuries, the process has been adapted to the soil and climatic conditions of the mountainous region. Due to structural changes in dairy farming and climatic changes, hay farming is coming under increasing pressure.

The GIAHS region is intended to help preserve hay farming as a traditional and sustainable farming method. It assists in communicating the benefits of hay farming to consumers as well as to policy makers and administrators. Recognition as a GIAHS region will also be a great incentive for the preservation and sustainable further development of the farming method for hay milk farmers.

2. HAY FARMING AS A SUSTAINABLE OPPORTUNITY

In 2019, the Center for Global Change and Sustainability at the University of Natural Resources and Life Sciences, Vienna, conducted a study assessing the hay milk production system in the context of the United Nations Sustainable Development Goals (SDGs).[5] The report looks at the sustainability of hay farming holistically according to environmental, social and economic issues. The goal should be to combine productivity and profitability with important elements of sustainability: site-appropriate milk production based on locally available resources (grassland) is just as much a prerequisite as animal-

[5] Zollitsch et al., 2019

friendly husbandry practices with consistent pasture grazing in the summer period and high product quality. This will enable society and consumers to be involved in the sustainable development of grassland-based milk production. The statements made in the following text are taken from this report.

3. CHARACTERISTICS OF THE GIAHS REGION

3.1. Food and livelihood security

Small, family-run farms have always shaped the image of the region. In addition to milk production, their work also contributes to climate protection and the meadow and Alpine grazing of the animals preserves the cultural landscape. What's more, family-run hay milk farms play an important role in terms of revitalising rural regions.

Likewise, the processing plants tie jobs to the region. With their high-quality products, the plants also make a major contribution to the region's food security.

3.2. Agro-biodiversity

Preserving biodiversity, different types of meadows and pastures as well as important wildlife habitats is an essential part of hay farming. That's why hay milk farmers rely on small-scale, mosaic farming.

To promote biodiversity, hay milk farmers allow their meadows and pastures to mature, mowing many areas only when a variety of grasses and herbs are at full seed maturity and biodiversity is at its greatest. This is an important criterion when it comes to pollination and the continued existence of a wide variety of plants; one to two cuts less per summer are even accepted for this purpose. Almost 1,000 different grasses and herbs grow in hay milk meadows.[6]

Mowing is done spaced out at different times. In this way, all green areas are never mowed at once and important food sources and retreats are preserved for bees, butterflies or small game.

Old breeds of cattle whose milk yield would be too low for industrialised agriculture are also preserved through hay farming. After all, for hay milk farmers, it is not only milk yield and meat quality that count, but also a certain cross-country capability, which is important when the animals are taken to Alpine pastures for grazing. As a result, smaller breeds are also systematically bred, which would be of little importance for industrialised agriculture.[7]

3.3. Local and traditional knowledge

Knowledge of hay farming is passed down from generation to generation. ARGE Heumilch is an organisation committed to the transfer of expertise and, above all, to the preservation of knowledge and the contemporary further development of the farming method.

The specific knowledge of hay milk farmers includes the different cuttings and their respective importance for the basic ration. Hay farming is characterised by a high proportion of manual labour in haymaking due to the mountainous location and often steeply sloping land. Knowledge about this is passed on from generation to generation and is just as important as the sustainable further development of haymaking and drying methods, which ARGE Heumilch is committed to.

[6] see Annex 3, p.91

[7] see chapter IV. 0, p. 39f

The processing plants have decades - in some cases even centuries - of experience in the production of traditional cheese types and maintain this experience. Regional cheeses have evolved over the centuries and continue to be produced by processing plants.

3.4. Culture, value system and social organisations

On the one hand, the value system of hay milk includes traditional values such as customs, traditional costumes and old recipes. On the other, UNESCO World Heritage Three-Step Alpine Transhumance and the tradition of the return from Alpine pasture are also part of this.

What's more, the values of the hay farming industry are shaped by ARGE Heumilch. The hay milk regulation sets the rules for hay farming and continues to evolve.

3.5. Features of the landscape

The region is located in the mountainous area along the main ridge of the Alps, as well as in the lakeland region with a small structure at its foothills.

III. IMPORTANCE OF THE PROPOSED SYSTEM

1. SPECIFIC VALUES AND CHARACTERISTICS

The production of hay milk is as old as the keeping of dairy animals in Europe. Throughout the Alpine region, the use of hay as a nutrient-rich winter feed has been a key technology for centuries to get ruminants through the vegetation-less cold season, thus ensuring livestock as the livelihood of farming families. A form of farming has therefore developed over the centuries that uses available natural resources efficiently and preserves them over the long term.

Figure 1
Traditional haymaking

Due to the industrialisation of agriculture in the second half of the 20th century, this form of dairy cattle farming was increasingly pushed back and a feeding system based on silage and concentrated feed (wheat, corn, soy) prevailed in Europe. In the mountainous regions of Austria and their foothills, however, traditional hay farming has been able to survive and today represents a sustainable system worthy of protection due to the sustainable farming of permanent grassland.

In hay farming, most of the feeding is done with grass in summer and hay in winter. The main difference compared to other production systems is that fermented feeds (silages made from grass or corn) are prohibited and the amount of concentrated feed is limited. *The roughage portion of the dry feed annual ration must be at least 75%, and 85% for organic hay milk. The grain ration* must originate from Europe and must not be genetically modified in accordance with current legislation. In the mountainous regions, the dairy animals are taken to Alpine pastures for grazing in the summer, while they are put out to pasture on the meadow in the flat regions such as the lakeland regions of the Alpine foothills. Hay milk farmers have been managing their farms according to ecological principles for more than 30 years.

1.1. ARGE Heumilch Österreich

To preserve this farming method, family-run farms and private as well as cooperative processors have joined together to form the ARGE Heumilch Österreich community: an association that brings together all 6500 hay milk farmers and the renowned 60 hay milk processors in Austria. The organisation's mission is to preserve hay farming and communicate the benefits of this sustainable farming method so that a fair milk producer price can be obtained in the marketplace. Thanks to a wide range of sales promotion measures, over the past 15 years it has been possible to bring the entire hay milk industry into value-added marketing. Sales in 2021 amounted to about 520 million kg of hay milk, or 15% of the total milk volume in Austria. The organic milk share is 38%. In the European dairy market, the traditional form of milk production has become a niche and only 3% of the milk produced in Europe now meets hay milk criteria.

1.2. Hay milk regulation

All members of ARGE Heumilch produce in accordance with the strict hay milk regulation[8], compliance with which is checked by independent, state-certified inspection bodies. In addition to the feeding method, the hay milk regulation also governs fertiliser regulations and extensive animal welfare requirements. The main criteria are:

- No silage on the entire farm for all animals on the farm, all year-round
- Open stall and/or meadow/Alpine grazing or outdoor exercise at least 120 days a year
- Controlled GMO-free feeding
- Obligatory veterinary care contract

At the instigation of ARGE Heumilch, hay milk was awarded the EU TSG quality seal in 2016, thereby receiving legal product protection in the European Economic Area. In 2019, the entry for TSG goat's hay milk and TSG sheep's hay milk followed.

Conventional and organic haymaking

Hay farming is in itself already a very sustainable form of milk production. In Austria, conventional hay farming means that producers and processors adhere to the hay-milk regulations of ARGE Heumilch (see annex to the proposal). This includes, among other things, limiting the use of concentrated feed to a maximum of 25% of the annual ration and specifies what the concentrated feed may consist of. Fertiliser regulations are also part of the hay-milk regulation, as are animal welfare measures. The hay-milk regulations are regularly adapted to the requirements of the market.

Furthermore, 38% of hay-milk is produced organically. This means that these hay-milk farmers additionally comply with organic regulations. In the case of organic hay-milk, the proportion of concentrated feed may only be 15% of the annual ration, which is much stricter than in the EU organic regulation. (for comparison: in the EU organic regulation, up to 40% is possible). The regulations on free stall and pasture are also stricter for organic hay-milk. Organic hay-milk is the highest quality type of milk on the Austrian market and is also rewarded with the highest producer milk price.

[8] Hay milk regulation of ARGE Heumilch Österreich, Rules for silage-free milk; 2022: https://www.heumilch.com/heumilch/regulativ/

1.3. Site-appropriate agriculture

The task of modern hay farming is to combine productivity and profitability with sustainability. Site-appropriate milk production using locally available resources, the preservation of biodiversity and the conservation of soil and water are just as much prerequisites as animal-friendly husbandry with grazing in the summer period and high product quality, to convince society and consumers of the advantages of this form of farming. The focus is on the sustainable farming of permanent grassland.

Permanent grassland is land that is naturally used for forage production through self-propagation for at least 5 years without being converted to cropland. High-quality permanent grassland stocks are rich in species. Sustainable use creates a high humus content in the soil, which in turn binds a great deal of carbon and ensures high soil fertility.

To produce high-quality basic ration for dairy animals from permanent grassland, haymaking techniques with modern drying equipment are essential, in addition to good plant stock and optimal harvest periods. From an ecological and economic point of view, these techniques will become even more important in the future.

Figure 2
In mountainous regions, haymaking is still often done by hand, albeit with machine assistance due to the steep slopes.

2. HISTORICAL SIGNIFICANCE

Humans have been practicing agriculture since they became settled about 10,000 years ago. This was the prerequisite for increasing population figures. They domesticated animals and raised livestock for meat and milk production and at the same time, stockpiled to be prepared for climatic and seasonal changes. When humans also settled in the Alpine region, they inevitably had to store food for the winter.

Exactly when the first hay was produced can probably no longer be traced today. In the Alpine region, however, agriculture can be traced back for more than 4,000 years[9], and findings in the Tyrolean Ötztal verify rudimentary Alpine farming back in around 6300 BC.[10] This must also have been associated with at least rudimentary hay farming, as otherwise the survival of dairy animals would hardly have been possible in the Alpine climate zone with cold, snowy winters.

Figure 3
Hay carrier, photography, 20s, 20th century;
Source: Genbank, Land Tirol

Until well into the 20th century, dairy farming in the Alpine regions automatically meant hay farming. However, for a long time it was closely associated with arable farming because specialisation in agriculture only began in modern times.
The rapid agricultural developments of the 20th century made the formerly widespread hay farming industry the regional niche of agricultural production that it is today. The goal of ARGE Heumilch is to preserve this niche of sustainable and generation-oriented farming.

The production of cheese and other dairy products throughout the ages is also closely related to dairy farming. Back in the Old Testament, Jesse has his son David bring ten pieces of cheese to the chief.[11]

[9] Wopfner. Hermann: Bergbauernhandbuch. Von Arbeit und Leben des Tiroler Bergbauern; Vol. 3: Wirtschaftliches Leben; published by Grass, Nikolaus; Innsbruck 1997; p. 5/ p. 183
[10] Bracharz, Kurt: Von der Alp auf den Teller. Käsekultur in Vorarlberg; Innsbruck 2014; p.42
[11] Book of Samuel, chapter 17, verse 18, quot. after Bracharz K.: Von der Alp auf den Teller. Käsekultur in Vorarlberg; Innsbruck, 2014; p.15

And, according to archaeological sources, the Sumerians (3rd millennium B C) were knowledgeable about cheese production.[12] In that region along the Fertile Crescent, however, this probably was not hay milk cheese. However, cheese was also produced early on in the hay milk regions along the Alps. In his work about Tyrolean mountain farmers back in the 1930s, Wopfner emphasised that "cheese (...) (played) a greater role in the popular diet in olden times than today."[13]

There is evidence from back in Roman times that cheese was exported to Rome from Rhaetia - which stretched from what is now eastern Switzerland through Vorarlberg and Tyrol to South Tyrol.[14] This can also be found in Roman sources as "caseus alpinus" or "caseus raeticus".[15] The Roman Empire had a great need for food and for dairy products and cheese from the Alpine areas.

2.1. Middle Ages to modern times

Until the Middle Ages, however, agriculture was generally characterised by self-sufficiency. Where possible, everything necessary for life was produced on the farm and what was needed beyond one's own production had to be earned through trade in livestock, cheese or other products. Due to the convenient location on transit routes, supraregional trade was of great importance in the hay milk regions from early on. The better the development of transport routes over the centuries, the more importance was given to dairy farming and the export of milk, butter and especially cheese.[16]

While in Tyrol the farmers were already free in the Middle Ages, elsewhere they had to pay interest to the landowners. Sources such as the Churrätische Reichsurbar of 843 show that cheese was also quite common as interest.[17]

In the "Little Ice Age" from the 16th century, conditions were so cool and damp that arable land was abandoned again in the valley and converted into pasture, and at higher elevations land was increasingly cleared to create mountain pastures.[18]

Even in the city, most households had dairy cattle for self-sufficiency until the Middle Ages. As the population of cities increased in the transition between the Middle Ages and modern times, so did the demand for milk and cheese, which were eventually imported from the surrounding countryside and traded at urban markets.[19] Increasing numbers of people moved to the cities at the beginning of the modern era and took up specialised professions there. They could no longer supply themselves with food, and as fewer agricultural workers now had to supply more people in the city with food, this development eventually led to specialisation in agriculture as well. However, not only the increasing demand from the cities, but also improved conditions for agriculture (draining of swamps, regulation of rivers, clearing) favoured this development.[20] Dairy farming - at that time exclusively hay farming - was born as a separate branch of agriculture.

[12] Bracharz K, 2014; p.18
[13] Wopfner H. 1997; p. 7
[14] Wopfner H.1997; p. 7
[15] Bracharz K., 2014; p..42f
[16] Wopfner H., 1997; p. 184
[17] Bracharz K., 2014; p. 43
[18] Bracharz K., 2014; p.44
[19] Wopfner H., 1997; p. 190
[20] Wopfner H., 1997; p. 259ff

The next qualitative leap was made at the end of the 18th/beginning of the 19th century, when common pastures were abolished during the Josephine reforms.[21] As a result, those areas that previously had to be kept free as pastures for the animals in the entire village could be converted into meadows and mowed more often. The additional land, but above all the fact that the farmers in question made more of an effort for their own yield, increased the yield. Cattle were increasingly fed in the barn, but also taken to Alpine pastures for grazing.[22] Stable feeding also increased the fertiliser yield, which in turn increased the yield of the meadows.

At the same time, from the 17th/18th century, Vorarlberg landlords and farmers became increasingly interested in the high-quality semi-hard cheeses produced in Switzerland. This led to immigration from the Appenzell region to the Bregenz Forest, which brought knowledge of cheese to the cheese region we know today.[23] Previously, only butter, which had to be sold to the government, and cream and sour cheeses were produced for home consumption. The government was not enthusiastic about the production of semi-hard cheese and issued several bans in 1699, 1700 and 1715. In the end, however, renneting prevailed - also due to some minor uprisings.[24]

In the Bregenzerwald, especially in the 2nd half of the 19th century, so-called "cheese barons" bought up the milk and traded the cheese up to the fringes of the Habsburg monarchy. The winter milk was paid for in advance at a slightly reduced price, which put the farmers in a debt relationship.[25]

Due to industrialisation and rural exodus, agricultural labour became a scarce commodity over the centuries. Cattle and dairy farming therefore became even more attractive because it required less labour than, for example, arable farming. In the Alpine Arc, hay farming has thus made a decisive contribution to the security of supply for the entire population since the early modern period.

Throughout the 19th century, agriculture became increasingly specialised, which gave even more importance to hay farming. In the middle of the 19th century, in the municipality of Natters, south of Innsbruck, for example, the area covered by meadows and pastures already exceeded that of arable farming.[26] In the 19th century, people also began to deliberately sow higher-yielding grasses and fertilise more. The farm's own liquid manure acted as the main fertiliser.[27] This specialisation and agricultural practice created the cultural landscape that we associate today with the Alpine areas in Austria.

Structural change during the Industrial Revolution also led to a move toward hay farming in the Salzburg lakeland region. Until then, in this hilly region north of the city of Salzburg, arable farming (grains) and cattle breeding were practiced in addition to dairy farming. However, the opening up of the Danube Monarchy by rail brought cheaper grain from the eastern crown lands to the monarchy, so that agriculture in the region increasingly focused on the more lucrative dairy farming industry and especially the production of cheese.[28]

[21] Wopfner H., 1997; p. 282ff
[22] Wopfner H., 1997; p. 27
[23] Bracharz K., 2014; p.44
[24] Bracharz K., 2014; p.50
[25] Bracharz K., 2014; p.57
[26] Wopfner H., 1997; p. 300
[27] Wopfner H., 1997; p. 293ff
[28] Ramminger Leopold: Unser Seekirchen – Aus vergangenen Tagen; Band 8: Die ehemaligen Seekirchner Käsereien, Seekirchen am Wallersee 2019; p. 5

2.2. Development in the 20th century

Industrialisation only reached Austrian agriculture at a very late stage. It was not until the 60s to 80s of the 20th century that large-scale farms begin to further specialise and focus their operations.[29] In the Alpine Arc, this development started particularly late for various reasons: Austria did not join the EU and thus the Common Agricultural Policy until 1995, which put further pressure on small farms.

In the hay-milk regions, a hard cheese tradition has developed over the centuries as a characteristic cheese culture. The hard cheeses have a particularly long ripening period (from at least 3 months up to 3 years). Clostridia spores/butyric acid bacteria develop in the silage, enter the cheese dairy via the milk and cause major problems, especially during cheese ripening due to secondary fermentation. The cheeses then taste bitter, puff up and form misshapen holes. For this reason, the processing companies that produced hard cheese demanded hay milk from their milk suppliers, as this is hardly contaminated with Clostridia spores. This led to the creation of silage restricted areas where farmers were not allowed to produce or feed silage. These areas contributed decisively to the preservation of the farming method.

Furthermore, during the structural change until EU accession in 1995 and beyond, Austrian agricultural policy deliberately supported the preservation of small-scale agriculture in mountain areas. On the one hand, this policy was intended to secure the incomes of farming families, and on the other hand, it was also intended to acknowledge their contribution to the preservation of the cultural landscape. Due to this policy, the retreat of hay farming could be stopped.

Hay farming has been and continues to be taken into account in the support measures of ÖPUL (Austrian Policy for Sustainable Agriculture), which is also due to the efforts of ARGE Heumilch as the lobby group of hay-milk farmers.

Figure 4
The hard cheese tradition contributed to the preservation of hay milk farming.

[29] Bätzing W.: Landleben. Geschichte und Zukunft einer gefährdeten Lebensform; Munich, 2020; p. 127

3. CONTEMPORARY RELEVANCE

3.1. Relevance in the food trade

Today, more than ever, consumers want products that are produced sustainably. This desire can be fulfilled with hay milk and hay milk products. After all, hay farming protects the environment, preserves biodiversity and helps protect the climate. One of the tasks of ARGE Heumilch is to clearly communicate these advantages to increase awareness of hay milk and boost demand. For this purpose, national promotion programs within the framework of rural development (EAFRD) are being tapped into, as well as promotion programs (AGRIP - Promotion of Agricultural Products) on the part of the European Union. The following objectives are being pursued:

- Improving the competitiveness of primary producers (farmers)
- Primary producers (farmers) receive a higher share of the final price
- Higher added value of the agricultural products of the primary producers

Through traditional communication measures financed by membership fees and subsidies, as well as through cooperation with the food trade in Austria and Germany, it is possible to continue marketing for the entire hay milk industry. Sustainability and animal welfare as well as tradition, regionality and originality are playing an increasingly important role in purchasing. As the traditional and earliest form of milk production, hay milk is therefore fully on trend and can position itself well as a niche product. This differentiation also enables dairies and cheese factories as well as food retailers to achieve higher prices.

In addition to the 100% marketing of TSG hay milk nationally and abroad, the promotion of competition between cheese factories and dairies is an essential factor. Competition for the raw material is created and thus a greater incentive to pay primary producers (farmers) a higher share of the value chain.

The sales measures of ARGE Heumilch Österreich achieve a clear differentiation on the market for TSG hay milk to decouple the sales market for TSG hay milk from the general milk market as far as possible. As a result, dairy farmers receive a higher premium and the most stable milk price possible, even in the event of market slumps. This is the only way to preserve the endangered system.

In 2021, the delivery volume of TSG hay milk in Austria was around 520 million kilograms. This corresponds to about 15% of the total volume of milk delivered. Comparison in Europe: The hay milk share of the total European milk volume is less than three percent. Organic hay milk accounts for a share of about 38% of Austria's TSG hay milk[30]. This is currently the raw material most in demand.

Hay milk premium:

2009: ~ 1 cent

2021: 5-7 cents

[30] Data based on the delivery quantities ARGE Heumilch 2021

A comparison of RollAMA[31] data for the full year in 2009 with data for the full year in 2021 shows that turnover and sales of hay milk products have developed very well since marketing began in 2009. In 2021, about 47,000 tons of dairy products made from TSG hay milk with a turnover of more than 147,000,000 euros were sold in the Austrian retail trade (incl. discounters). The hay milk market share in 2021 was therefore 7.5% of the total sales of all dairy products.

	VOLUME (t)			VALUE (1,000 EUROS)		
	2009	2021	% change	2009	2021	% change
Total diary products	618,476	642,346	3.9%	1,448,077	1,952,159	34.8%
Hay milk dairy products	18,580	46,979	152.8%	43,684	147,199	237.0%
White pallet	401,550	409,333	1.9%	461,408	636,457	37.9%
White pallet hay milk	15,256	38,239	150.6%	16,024	61,407	283.2%
Yellow pallet	66,167	88,417	33.6%	535,902	786,426	46.7%
Yellow pallet hay milk	3,313	6,816	105.7%	27,608	77,495	180.7%

Figure 5
Comparison of sales and revenue figures for 2009 and 2021

For years, Germany has been the strongest export market for hay milk products, especially cheese made from TSG hay milk. Meanwhile, more than 60% of Austrian hay milk is delivered abroad[32].

An online survey conducted between November 11 and 25, 2021 among 1613 Austrians aged 15 to 64, revealed awareness of TSG hay milk at 86.7%. In the core HH ABC1 target group, an awareness level of 92.5% was even recorded[33].

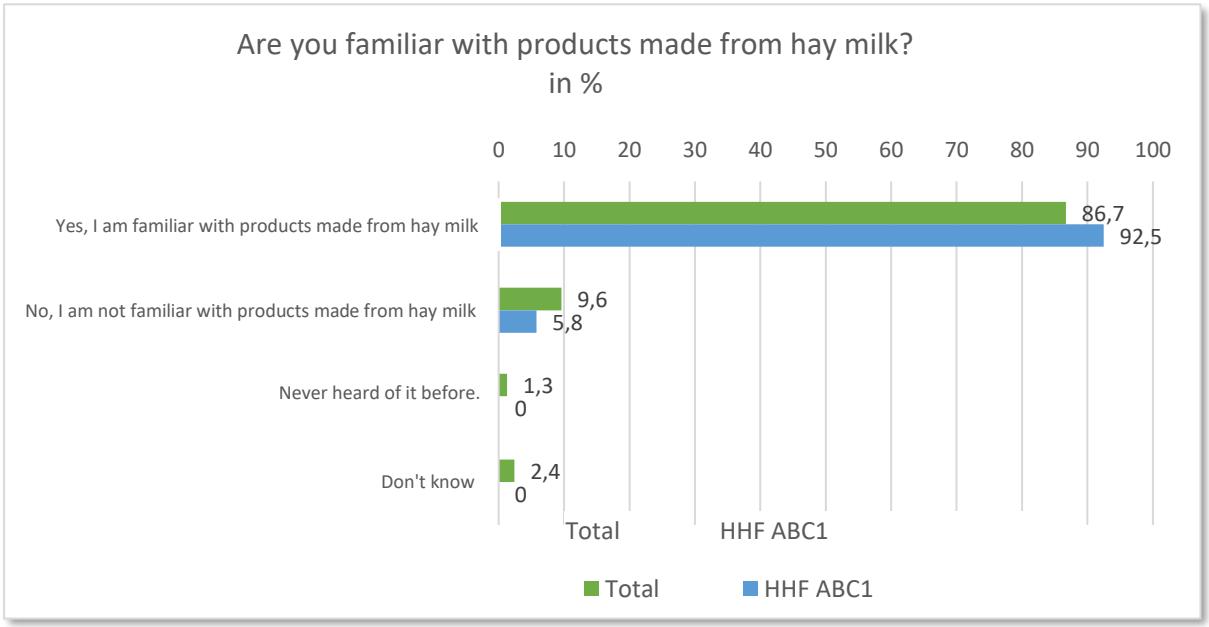


Figure 6
Awareness of hay milk in Austria

[31] RollAMA is a rolling agricultural market analysis and is prepared on behalf of AMA Marketing GesmbH as a joint project of the market research institutes KeyQUEST Marktforschung GmbH and GfK Austria GmbH.
[32] Estimate based on voluntary information provided by member companies. Exact data is not collected.
[33] Consumer-Connection Study for Heumilch, Carat, Vienna 11/2021

Hay milk is not only well known, but it is also readily purchased. The HHF ABC1 target group in particular with high purchasing power (heads of household with average or above-average income) likes to opt for hay milk products.

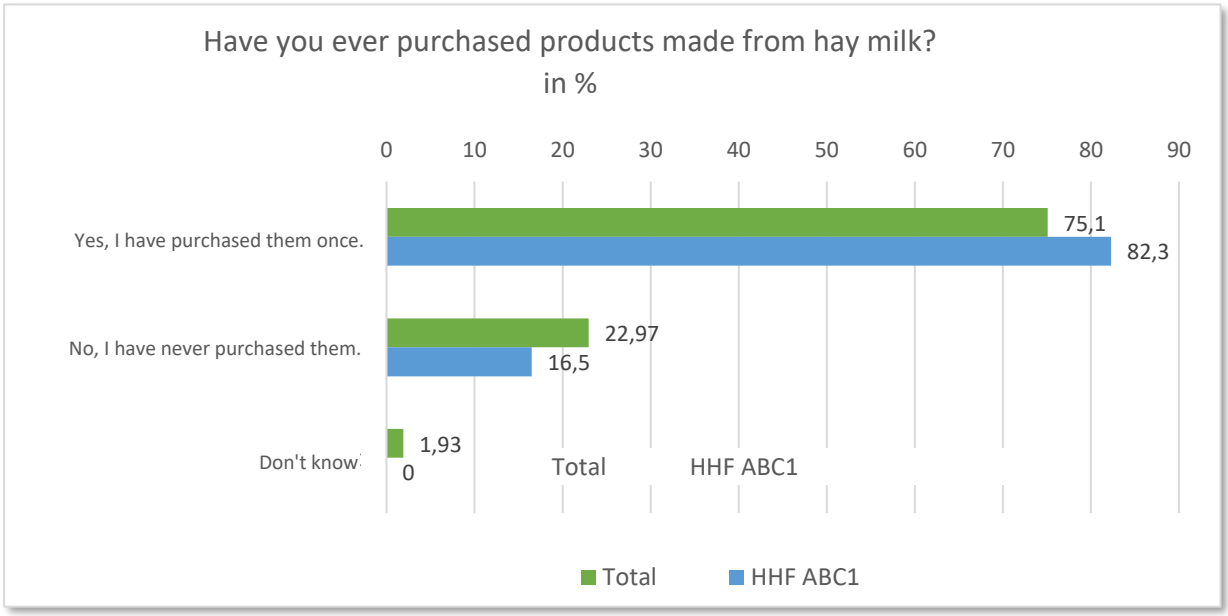


Figure 7
Buyer reach of hay milk products

Despite this positive development, it must be pointed out that this development could only be achieved due to the implemented activities. Without these efforts, the amount of hay farming would have decreased tremendously.

The current energy crisis due to the Ukraine war clearly shows that sustainable systems like hay farming can always come under pressure. The development is still positive but currently not to the same extent as in previous years. Therefore, hay farming must continue to be supported in the future to cushion the extent of fluctuations in the volatile dairy market for hay milk farmers.

3.2. Contribution to the UN Sustainable Development Goals (SDG's)

With its gentle, site-appropriate farming method and small-scale agriculture with family-run farms, hay farming contributes to the "Farm to Fork" strategy as well as to the "EU Biodiversity Strategy".

The Center for Global Change and Sustainability at the University of Natural Resources and Life Sciences, Vienna, conducted a study on behalf of ARGE Heumilch Österreich in 2019 that assesses the hay milk production system in the context of the United Nations Sustainable Development Goals (SDGs).[34] The report looks at the sustainability of hay farming holistically according to environmental, social and economic issues. The arguments given in the following text are taken from this report.

Mosaic grassland use promotes/protects biodiversity

Sustainable farming of permanent grassland is the central core of hay farming. Mowing is done spaced out at different times, which preserves refuge areas for zoological species and promotes their existence. In a report by the International Lake Constance Foundation in Radolfzell[35] on biodiversity criteria in standards and quality seals of the food industry, it is stated that hay farming with site-appropriate and less intensive grassland use contributes to the preservation of biological species diversity. A study by the Institute Suske Consulting Vienna[36], in which hay farming was analysed in relation to the preservation of biodiversity, also confirms the positive effects. Biodiversity in hay milk meadows is greater because the first mowing is later and there is a stronger mowing mosaic with important refuge areas for insects. The usage intensity is also lower and the average plant height is more varied.

Tangential SDGs

[34] Zollitsch et. al., 2019

[35] Internationale Bodensee-Stiftung Radolfzell: Baselinereport, Biodiversitätskriterien in Standards und Qualitätssiegeln der Lebensmittelbranche; 2013.

[36] Suske W., Depisch B., Huber J., Frieß T., Holzinger W., Derbuch G., Kahapka J., Huber E., Gunczy W.L.: Analyse der Zielerfüllung der ÖPUL-Maßnahme „Silageverzicht“ in Bezug auf Biodiversität; Vienna, 2020

Figure 8
Mosaic farming: All areas are never mowed at the same time.

Figure 9
Mosaic farming: All areas are never mowed at the same time.

Limited amount of concentrated feed conserves resources

Another sustainable aspect of hay farming is the limited amount of concentrated feed. Roughage in the form of grass and hay constitutes the bulk of the feed. The proportion of the dry feed annual ration is at least 75%. Just like organic milk, the use of concentrated feed is limited in hay milk, must originate from Europe and must not be genetically modified according to current legislation. According to the EU Organic Regulation (VO-EU 2018/48), max. 40% concentrate feed is allowed for organic milk, only 25% for hay milk and just 15% for organic hay milk. In a study conducted by BOKU Vienna[37], which analysed the eco balance of model dairy farms, hay farming performed significantly better than industrialised agriculture. The study confirms that sustainable farming of permanent grassland preserves special habitats and conserves valuable resources such as grain and water. The water footprint is three times less with hay farming than with intensive agriculture. The EU Biodiversity Strategy points out that the targets set *must not lead to deforestation in other regions of the world*. *Primary and virgin forests are meant here.* With limited grain purchases exclusively from Europe, hay farming also meets this goal. This also means that farm animals do not become direct food competitors for humans in poorer regions (plate-trough debate), considering that one third of the world's arable

[37] Hörtenhuber S., Zollitsch W.: Ökobilanz von Milchvieh-Modellbetrieben; Vienna, 2013

land is now used to produce animal feed. Moreover, permanent grasslands do not exhibit any competition for human nutrition even in mountainous regions, since they are unproductive as arable land. Rather, farming takes precautions against scrub encroachment and forestation and keeps the Alpine areas open.

Low water footprint

In addition, the water footprint of milk depends very much on the system in which the milk is produced. If dairy cows are fed large quantities of purchased feed such as soy and maize from overseas, the water footprint increases significantly due to the long transport distances.

Milk production based on locally produced grassland fodder such as hay farming reduces the water footprint of milk and therefore helps to conserve resources.

Tangential SDGs

Figure 10
Species-appropriate feeding with only a small proportion of concentrated feed, which must be GMO-free and originate from Europe.

Permanent grassland as a CO_2sink

The EU Biodiversity Strategy under point 2.2.3. states that poor soil management such as deforestation, overgrazing, unsustainable agricultural and forestry practices, construction activities and soil sealing contribute to soil degradation. Hay farming also counteracts this. Sustainable use of grassland with pasture farming is crucial for climate change as it prevents soil degradation and leads to high humus content and healthy soils. This stores enormous amounts of carbon that would otherwise escape into the earth's atmosphere and would be relevant to the climate as CO_2.

Figure 11
Grassland soils store approx. 196 t CO_2/ha

According to a study by the Center for Global Change and Sustainability at BOKU Vienna[38], permanent grassland stores significantly more carbon C (70 t/ha) in absolute amounts in the upper 30 cm than arable soils (50 t/ha). In transitional cropland, ruminants protect grassland from conversion to cropland or protect some stored carbon from loss. In deeper soil layers, carbon storage in permanent grassland (196 t/ha) is even one third higher than in arable land (149 t/ha) and also higher than in commercial forest (191 t/ha). Moreover, humus-rich soils store more water and can thus survive longer periods of drought.

Tangential SDG

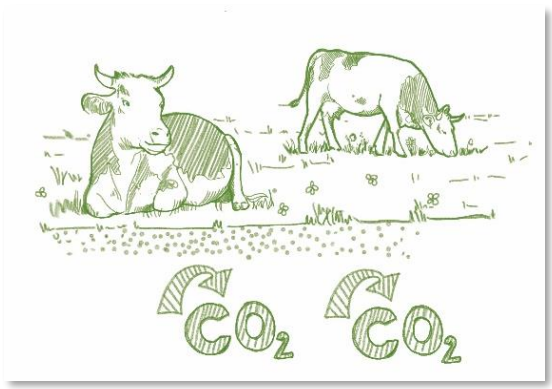


Figure 12
Permanent grassland stores more carbon than arable land and commercial forest.

High animal welfare standards

Aspects of animal welfare are not explicitly addressed in the very anthropocentric approach of the SDGs. In a production system where animals play a central role, their welfare must be given high priority. Ultimately, a high standard of animal welfare can also ensure the sustainability of food production systems and the resilience of agricultural practices. Hay farming makes an important

[38] Zollitsch et.al., 2019

contribution to animal welfare. Ruminant-friendly feeding and species-appropriate husbandry contribute significantly to the health and vitality of the animals.

In the case of hay farming, combined husbandry is obligatory and permanent tethering is prohibited. Open stalls, outdoor exercise or pasture/Alpine grazing are required for at least 120 days. Since cows spend half of the day resting and lying down, overcrowding in the stalls is prohibited. A lying area (1:1) must be available for each dam. Bedding with common agents such as straw is to be used for the lying areas and/or soft bedding is to be provided for the animals. From an animal health point of view, the solids of the manure separation are not allowed as bedding. Dehorning may only be performed only with effective anesthesia administered by a veterinarian. In calves, docking the tail is prohibited. Growth- and performance-promoting substances must not be used. Professional care by a veterinarian (Animal Health Service membership) is mandatory for farms.[39]

All hay-milk farmers are looked after by contracted veterinarians of the animal health service. With professional advice from veterinarians, the well-being of the hay-milk cows is checked preventively during regular inspections and advice is given on the subject of keeping them healthy. Homeopathy is also being used on more and more farms.

Figure 13
Hay farming also contributes to excellent animal welfare.

High herd efficiency is not measured in terms of hay milk due to the limited amount of concentrated feed. In Germany, the average lactation performance of a cow was about 8000 kg on average for all breeds. A herd efficiency of 10000 kg or more is not uncommon here.[40] In intensive milk production with a high milk yield, the rations for dairy cows contain proportions of up to 50% concentrate. In addition, as concentrate intake increases, the intake of basic ration decreases. The reasons for this decrease are the increased acid production from the fermentation of the non-fibre carbohydrates of the concentrate, which damages the very rumen microbes that specialise in the breakdown of the skeletal substances, thus preventing both digestibility and feed intake of the basic ration.[41]

The milk yield of cows has increased steadily in recent decades due to selection for milk quantity, appropriate feeding, veterinary care and successful management, and it is likely that this trend will

[39] Hay-milk regulations of ARGE Heumilch Österreich, January 2022
[40] Martens, Holger (Institut für Veterinär-Physiologie der Freien Universität Berlin): Leistung und Gesundheit von Milchkühen: Bedeutung von Genetik (Ursache) und Management (Wirkung); in Tierärztliche Praxis Großtiere; 4/2016
[41] Gruber, Leonhard (In: Institut für Nutztierforschung, HBLFA Raumberg-Gumpenstein. 24. Viehwirtschaftliche Fachtagung): Einfluss der Kraftfuttermenge auf Futteraufnahme und Leistung von Milchkühen; 2007

continue. However, as milk yield has increased, disease rates have increased and useful life has decreased. Extensive animal breeding studies revealed genetic correlations between milk yield and diseases such as ketosis/fatty liver degeneration, mastitis, hoof diseases, metritis (all inflammatory forms) and decrease in fertility, the pathogenesis of which is essentially causally determined by the negative energy balance as a consequence of selection for high milk yield.[42] Out of all the forms of utilization, green fodder has the best feed value followed by modern produced hay. Green fodder and all types of hay are superior to silage because they retain a number of beneficial plant constituents. All of them lack the undesirable fermentation products of silage. From an animal health standpoint, hay is an alternative to one-way silage feeding, especially with high-risk grass and legume silages.[43]. In addition to feeding according to needs, the health status must also be taken into account: dairy cows would generally be fed rapidly digestible and poorly structured substrates, which would not suit the physiological digestive processes of ruminants. [44]

Figure 14
Small herds ensure high animal welfare.

Since hay milk farms are not in the high performance range, it can be assumed that this is generally a good starting point for health status and fertility parameters. [45] The relationship between milk yield, negative energy balance, decreased immunosuppression, and increased susceptibility to infection and disease are well established in the literature.[46]

Tangential SDGs

[42] Martens, H; 4/2016
[43] Hoffmann, Manfred (Sächsischer Landeskontrollverband): in agrarheute RIND; Mai 2022
[44] Zebeli, Quendrim; Khol-Parisini, Annabella: Strukturversorgung und Leistung der Milchkuh: zwei Seiten einer Medaille. In: Reiko Rackwitz (Pub.): LBH: 7. Leipziger Tierärztekongress – Tagungsband 1; 2014
[45] Zollitsch Werner et al., 2019
[46] Brade, Wilfried; Brade, Erwin (In: Berichte über Landwirtschaft. Zeitschrift für Agrarpolitik und Landwirtschaft 93 (2)): Vor- und Nachteile einer sehr intensiven Milcherzeugung aus der Blickrichtung des Kraftfuttereinsatzes und der Tiergesundheit; 2015

Strengthening rural areas

Hay farming enables farmers to achieve higher yields, thereby helping to strengthen rural areas in the grassland-mountain region. Subsequent generations are more likely to remain in agriculture if they see the process from an economic and social perspective. The processing plants also tie jobs to rural regions.

In addition, many hay milk farms are operated on a part-time basis, with farmers often acting as farm managers. Through sustainable agriculture, they also have the positive perspective of being able to combine work and family life well.

The share of female farmers with an off-farm occupation increased significantly in Austria from 2006 to 2016 from 22% to 37%. There is no separate data on hay-milk farms.

Figure 15
Extent of off-the-job employment (2006/2016)[47]

The off-farm occupations are widely spread: 22% work in offices/banking, 14% in education/training, 12% in sales, 11% in gastronomy or tourism, 10% in the health sector.

16% of the women farmers who work outside the farm do so for more than 20 hours per week. This share has doubled from 2006 to 2016. There is no data on the share of off-farm income in farm income.

A per capita income of hay-milk farms is not available, as the income of hay-milk farms is not surveyed separately. However, the Green Report of the Federal Ministry of Agriculture, Forestry, Environment and Water Management provides information on the income of mountain farms. Since 88% of the hay-milk farms are located in the mountain area, the comparison of mountain farms and non-mountain farms allows conclusions to be drawn about hay farming, since the hay-milk farms can be equated with the mountain farms.

[47] keyQuest Survey: Situation of women farmers in Austria 2016, p. 67

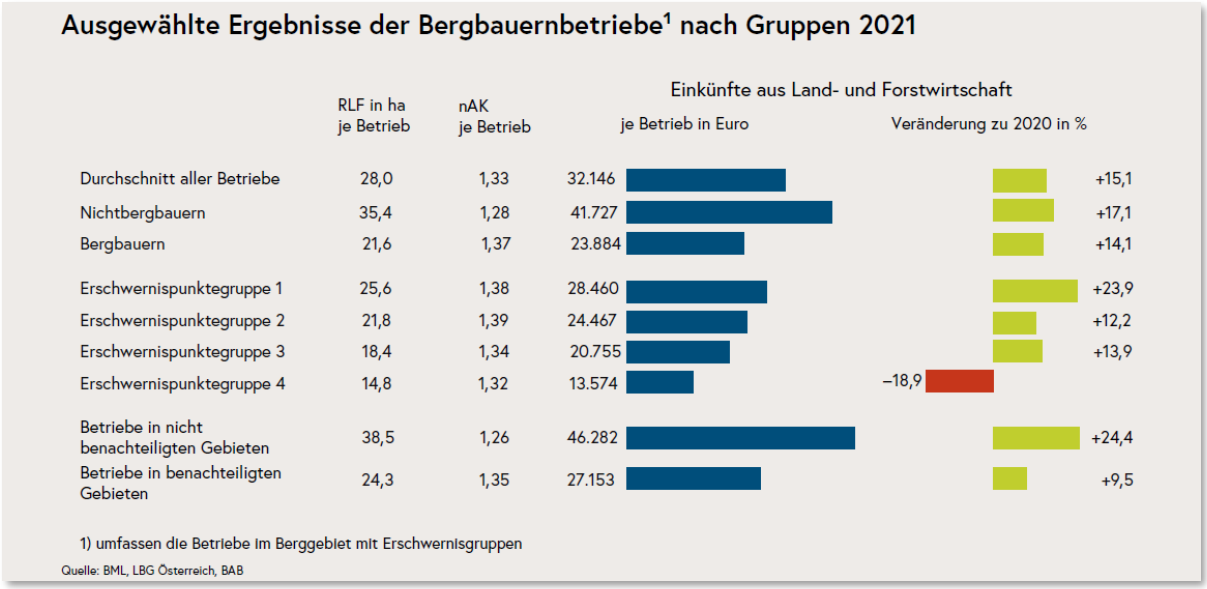
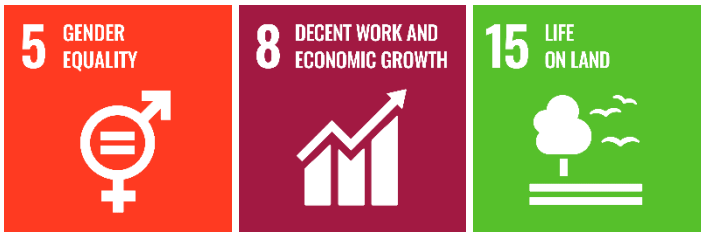


Figure 16
Income of agricultural holdings by mountain farmers (severity point groups) and non-mountain farmers; from: Green Report 2022

Tangential SDGs



Protection against erosion, scrub encroachment and forestation

Permanent ground cover with grasses provides natural erosion control and, unlike cropland, also offers less potential for soil degradation[48]. Therefore, milk production based on meadow forage, such as hay farming, is the more sustainable farming method compared to "intensive milk production" with a high amount of concentrated feed.

In addition, the hay milk farmers' maintenance measures protect against scrub encroachment and forestation, thereby preserving the Alpine cultural landscape as well as tourist and local recreation areas. Especially in the mountainous regions and their foothills, many areas are not suitable for modern agriculture due to the wet climate. Here, hay farming represents regional food production that conserves resources.

Tangential SDGs

Positive food conversion efficiency (plate-trough debate).

In industrialised agriculture in Europe, farm animals are increasingly becoming direct food competitors for humans, as more than a third of the world's arable land is already used for the production of animal feed such as soy or corn. However, grains are also popular in the human diet. Therefore, in the context of resource-saving milk production, primarily regional feeds should be used that do not compete with human nutrition. Through limited grain rationing, as well as through the farming of permanent grassland, hay milk farmers therefore make a sustainable contribution to the plate-trough debate.

In industrialised agriculture, one cow eats the amount of grain that can feed three people. Hay farming, on the other hand, relies on species-appropriate feeding.

Tangential SDGs

3.3. Conventional and organic haymaking

Hay farming is in itself already a very sustainable form of milk production. In Austria, conventional hay farming means that producers and processors adhere to the hay-milk regulations of ARGE Heumilch (see annex to the proposal). This includes, among other things, limiting the use of concentrated feed to a maximum of 25% of the annual ration and specifies what the concentrated feed may consist of.

[48] Soil degradation is the deterioration of the ecosystem services of the soil. This leads to significantly reduced soil fertility.

Fertiliser regulations are also part of the hay-milk regulation, as are animal welfare measures. The hay-milk regulations are regularly adapted to the requirements of the market.

Furthermore, 38% of hay-milk is produced organically. This means that these hay-milk farmers additionally comply with organic regulations. In the case of organic hay-milk, the proportion of concentrated feed may only be 15% of the annual ration, which is much stricter than in the EU organic regulation. (for comparison: in the EU organic regulation, up to 40% is possible). The regulations on free stall and pasture are also stricter for organic hay-milk. Organic hay-milk is the highest quality type of milk on the Austrian market and is also rewarded with the highest producer milk price.

Figure 17
Whether organic or conventional: a high proportion of basic fodder characterises hay farming

4. COMPARATIVE ANALYSES

4.1. Differences to other dairy farming systems with hay as basic fodder

Hay farming also exists in other regions where winters are cold and snowy. Throughout Europe, about 3% of milk is still produced as hay milk, especially in the alpine regions of Italy, France, Slovenia and Switzerland. The EU quality label "TSG - Traditional Speciality Guaranteed" (see IV.4.4.) has made it possible to achieve a minimum standard throughout Europe.

Hay-milk regulative and "TSG - Traditional Speciality Guaranteed”

In order to have a certain product protection throughout Europe, ARGE Heumilch applied for the EU protection "TSG - traditional speciality guaranteed" and received it in 2016 (2019 for sheep's and goat's hay milk). This seal of quality is a minimum standard that applies uniformly throughout Europe.

However, the hay-milk regulation (see Annex 1), according to which the hay-milk farmers in the Austrian Alpine arc farm, goes further than this minimum standard. It is the only region in which hay farming is practised both on a whole-farm and year-round basis.

- Whole-farm means that there must be no silage on the entire hay-milk farm. While in some other systems only the dairy cattle are fed silage-free, in the proposed region also no young cattle may be fed silage and silage may not be prepared or stored on individual areas - for example for sale.
  The reason for this lies in the clostridia spores, which are ubiquitous and are increasingly found in silage. If these get into the milk - e.g. via the air - long-maturing cheeses can no longer be produced without chemical or mechanical treatment. In the Austrian cheese tradition, it was therefore important to do without silage throughout the year.
- Year-round means that the renunciation of silage is valid in summer as well as in winter. At no time may silage be produced, fed or even stored.

In addition to the whole-farm and year-round silage renunciation, the hay-milk regulation also prescribes animal welfare standards, which are completely missing in the EU standard.

Pasture and/or outdoor exercise

Pasture and outdoor exercise are also not regulated in other hay systems. According to the hay-milk regulation, permanent tethering is prohibited and at least 120 days of pasture and/or outdoor exercise per year are required.

4.2. Comparison with silo farming

With a 15% share of the Austrian dairy market, hay farming is a niche with some regional importance. Internationally, this niche is very small with a market share of less than 3% in Europe. It is therefore worthwhile to compare the system of hay farming with the system of silo farming for a better understanding.

Firstly, it is worth remembering that the region was originally dominated by hay farming. It was only through the industrialisation of agriculture that silo farming became established, where large and flat areas allow for an industrial form of agriculture.

While green fodder is preserved by drying in hay farming, silage is preserved by fermentation. In this process, a silo is filled with grass and sealed airtight. Due to the lack of oxygen, lactic acid bacteria multiply at the right temperatures and ferment the sugar content in the plant mass into lactic acid. This is responsible for the typical sour smell and pH value of less than 4. If there is too much oxygen or the temperature is too high, fermentation pests such as yeasts, moulds, putrefactive bacteria, butter or acetic acid bacteria displace the lactic acid bacteria and prevent the fermentation process.

If the process is flawless, the mixture eventually becomes too acidic even for the lactic acid bacteria and fermentation comes to a halt. The silage is now ready and the feed can be kept for a long time. However, care must be taken to ensure that as little air as possible enters the system when the silage is removed, as too much oxygen will spoil the silage.

While there are strict feeding regulations in hay farming with the hay-milk regulation, almost everything is allowed in industrialised agriculture. It relies mainly on maize in basic fodder production, which requires the use of high amounts of fertilisers and the use of synthetic pesticides. Neither of these is provided for in hay farming.

In silage farming - as in hay farming - grassland fodder is also used. However, this is usually produced from arable green fodder. In its cultivation, seed mixtures for field fodder are used, which have only a limited species diversity and a high fertiliser requirement. These grassland forage crops are necessary to achieve an appropriate silage quality.

In hay farming, on the other hand, the plant stand on permanent grassland is merely mown - and only when a large number of the plants are in full bloom and have been able to reproduce themselves. Re-seeding is therefore only necessary in rare cases. For this purpose, seed mixtures with a high species diversity are used to maintain the quality of the grassland forage. Fertilisers are used only to a very limited extent and mainly the manure from dairy farming.

In silage farming, field fodder is also produced from arable land, which is repeatedly turned over. This ploughing releases the carbon bound in the soil, which combines with oxygen in the air to form CO2 and becomes climate-relevant. In hay farming, on the other hand, the carbon remains bound in the soil because the permanent grassland is not turned over.

Both systems - hay farming and conventional dairy farming (silage farming) - therefore use permanent grassland. However, while in hay farming it is the basis for fodder throughout the year, in silage farming it is only part of the fodder ration. In silage farming, mixed rations are usually fed, in which grass silage, maize silage and concentrated and protein feeds are mixed.

In hay farming, the cows are essentially fed what the permanent grassland has in store for them - in summer in the form of pasture, mountain pasture and fresh grass feeding and in winter in the form of hay. The roughage content must be at least 75% for hay-milk, and as high as 85% for organic hay-milk.

4.2.1. History of silo farming

Silage production has a history similar to that of hay farming. This is already indicated in the word "silo", which is derived from the Greek word "siros", meaning an underground, airtight feed store. These storage containers were known as a granary back in around 7000 B C. However, it is not known from when the silos were used for fermenting feed.

In the 19th century, there were repeated attempts to develop new methods of ensiling, but they were not very successful. It was not until 1877 that the first manual on silage appeared in France. The production method finally caught on in England, Ireland and Scandinavia from the 1920s onwards.

In Central Europe, silo farming began its triumphant advance during the Second World War and in particular from the "economic miracle" of the 1950s and 1960s onwards. First of all, the decisive advantage of silo farming is that the forage harvest is less dependent on the weather. The grass is only dried before being ensiled in a variety of ways. This increases the effectiveness of the operations and large areas can be mowed at the same time. The grass is also mown earlier, which increases the number of cuts per year.

In the long term, however, both high impact and large area mowing and early cutting reduce species diversity in meadows. Silo meadows must therefore be fertilised and reseeded more intensively than hay milk meadows.

4.2.2. From upright silo to silo bales

Similar to hay farming, there are different systems for ensiling grass in silo farming, where the basic principle remains the same, but the method of storage and sealing differs.

Until well into the 1980s, upright silos were mainly used in Austria to ensile the grass. The grass, which is still damp, is placed in the upright silo and must be compacted inside to remove as much air as possible. The upright silos are usually made of concrete, wood or plastic. Upright silos have the advantage of requiring little floor space and are therefore especially popular in mountainous regions.

Filling and removal of an upright silo is relatively complex and due to falling and fermentation gases, the risk of accidents is also high. In addition, upright silos are very dominant in the landscape due to their height, which is disadvantageous in tourist areas.

Farms with higher livestock numbers and larger areas often have a bunker silo or flat silo. Here, the cut material is placed on a laterally limited base plate and covered airtight with a film. Compaction is done with a roller tractor.

Figure 18
Upright silo, image: landwirt.com

Figure 19
Bunker silo, image: www.fahrsilo.at

In the region today, the most widespread method is ensiling by means of round bales. In this process, the dried grass is pressed into bales while still on the meadow and the bales are then pressed into films. The bales can be easily stored and transported. For smaller farms, it pays to organise the machines for pressing and wrapping the bales on an inter-farm basis. The silo bales can generally be stored anywhere, which simplifies the operation, but often disturbs the landscape.

With all variants, the airtight sealing of the fermentation material is absolutely essential. If the film on the bunker silo or round bale is damaged or not properly secured, the silage will spoil and can no longer be used.

Figure 20
Silo bales, image:
www.bluehendesoesterreich.at

As with hay, there are also different quality levels for silage. Quality silage can only be produced with professional knowledge, personal commitment and appropriate care.

4.2.3. Silo milk and cheese production

In the hay milk regions, there are still many small alpine dairies and cheese factories that practice traditional cheesemaking. The master cheesemakers pay particular attention to gentle processing of the milk. For example, many farms still process raw milk into cheese, or the milk is only thermised, i.e. heated very gently. This preserves the milk flavor better and the cheeses taste more pronounced and complex. Traditional calf rennet, which has better protein coagulation, is still used to thicken the milk. For cheeses such as traditional mountain cheese or Emmental in natural rind, this is a prerequisite for maintaining the cheese for a long period until its peak of maturity. Long-matured cheese specialties made from hay milk represent a distinctive cheese culture in the Austrian Alpine region.

In addition, master cheesemakers depend on excellent quality raw milk. Clostridia spores in particular are feared in cheese production because they not only puncture the cheese with unsightly holes, but also provide a bitter taste. Silage is particularly susceptible to Clostridia spores[49], which, under the right conditions, spread throughout the farm and especially in the barn. These anaerobic bacteria are very resistant and survive both the digestive tract of the dairy animals and conventional heating processes of the milk.

Advantages of cheese production

In the production of hard and semi-hard cheeses from standard milk, these Clostridia spores must therefore be removed by centrifugal sterilisation or bactofuge, or their formation must be prevented by the addition of preservatives such as lysozyme. Cheesemakers therefore rely mainly on hay milk instead of silo milk, especially for long-ripening cheeses.

For the production of hard and semi-hard cheese, hay farming offers significant advantages over silo farming: Clostridia spores are not killed even by pasteurisation. They cause butyric acid fermentation

[49] Ginzinger W., Eliskases-Lechner F., Osl F.: Einfluss der Silage auf die Milch, in: Fachgruppe Lebensmittel, ALVA_Jahrestagung 2001

in semi-hard and hard cheeses, or so-called "late blowing" (see pictures below). The cheeses contain racks as well as misshapen holes and taste bitter.

Figure 21
Clostridia spores cause cracks and misshapen holes.

The quality and purity of the milk is particularly important for longer-matured cheeses, which is why silo milk is much less suitable here than hay milk.

Silage milk has fewer good characteristics than hay milk not only for cheese ripening but also for the taste of the cheese. Due to the special feeding method and the biodiversity of hay milk meadows, hay milk has a particularly complex taste, which also has a positive effect on the end product: cheese.

Fatty acid spectrum of milk

In terms of the fatty acid spectrum of milk, the balance is also more positive for hay milk than for silo milk. According to a study by the University of Natural Resources and Life Sciences[50], hay milk products have on average about twice the amount of omega-3 fatty acids and conjugated linoleic acids (CLA) than conventional dairy products. As unsaturated fatty acids, omega-3 fatty acids are vital for the human organism and fulfill important tasks, such as for the metabolism and immune system.

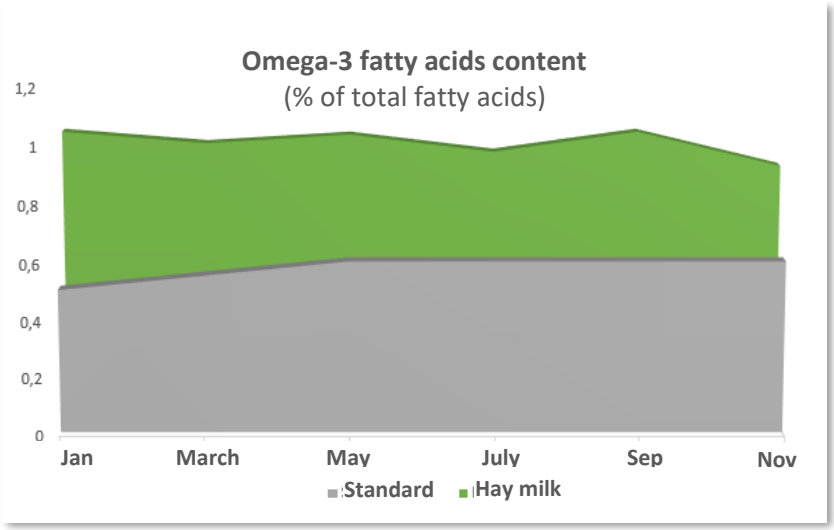


Figure 22
Fatty acid spectrum of hay milk and hay milk products with a focus on CLA and omega-3 fatty acids.

[50] Seiz, Michaela; Fettsäureverteilung in österreichischer Heumilch – Einfluss der silagefreien Fütterung im Jahresverlauf; Vienna, 2012; p. 65

4.2.4. Silo farming and sustainability

Biodiversity
For the grass to be ensiled to a high quality, it must not exceed a certain maturity. Specifically, this means that grasses should be mowed before panicle shoots, i.e. at the pre-flowering stage to achieve optimum silage. For clovers, this is the bud stage to no later than the beginning of flowering, and for green grains, no later than the beginning of panicle shoots. If the grass is cut too late, the crude fiber content is too high and the risk of faulty fermentation increases. Early pruning, however, has a negative effect on reproduction and biodiversity.
Farms are larger on average than in hay farming and larger areas are mowed at one time. The work is completed with a high proportion of machines, which are sometimes rented. This adds to the pressure to process large areas in the shortest possible time. For insects and small game, this means that they lose their livelihood over a large area within a few hours and have hardly any means of escape.

A study conducted by Suske Consulting 2020 shows that both the later timing of the first mowing and the subsequent spaced-out mowing in hay farming have a positive effect on the preservation of biodiversity in plants and insects.[51]

Cultural landscapes
Small, lower-yielding areas are counterproductive in silo farming and are no longer farmed. As a result, the cultural landscape in the Alpine region would be lost because within a few decades less productive meadows and pastures would become overgrown with shrubbery and forest, while elsewhere large areas would change the landscape.

However, this also means that, especially in the mountainous regions, silo farming has less opportunity than in the lowlands. This is because there are hardly any large areas that can be farmed once in this region.

Economic yield
A farming method must be profitable for the farmers, otherwise it is doomed to failure. In the 1970s and 1980s, silo farming was considered progressive and a large proportion of farmers in Austria converted their production. After all, if they had suitable land for it, they could earn more using silo farming with less personal labour input.

In the last two decades, hay farming has been able to catch up economically. Modern drying systems reduce the amount of work somewhat, and compensation payments and a hay milk premium made possible through marketing as a special milk variety have improved the economic situation of hay milk farms. However, since they are more small-scale than the average dairy farms in Austria, there is still a competitive disadvantage compared to the large and powerful silo farms.

Plate-trough debate
The plate-trough debate is about competition between human nutrition and animal feed. In silo farming, the question of whether land used for feed production is in competition with human nutrition cannot be answered easily.

[51] Suske W. et al., 2020, p. 112ff.

Permanent grassland seemingly does not play a role in the plate-trough debate: grass is not suitable for human nutrition and therefore is not a competitor. However, because silo farming is primarily done on large, flat areas, these areas would often be suitable for cropland and thus for human nutrition.

In addition to grass, corn and grains are also grown for silage production. In this case, there is a direct competitive relationship with human nutrition.

Foils

Ensiling using foil bales produces large quantities of plastic foil (mostly polyethylene). These foils cannot be reused, so they are recycled in the best case and simply disposed of in the worst case. Back in 2006, more than 5,000 tons of silage foil were sold in Austria.[52] The quantity may have increased many times over by now, but unfortunately current figures are not known.

Eutrophication potential

Pronounced grazing periods combined with feeding hay is more beneficial than silage feeding in terms of low eutrophication potential.[53] This means that hay farming reduces phosphorus and nitrogen losses in the soil. Nitrogen leaching and surface runoff in the form of nitrate are only 2.7% for permanent grassland and are much more favourable than for cropland, where they are 10 times higher at 27.7%.[54]

The fact that hay milk cows are fed significantly less concentrate (grain) also has a positive effect on eutrophication potential.

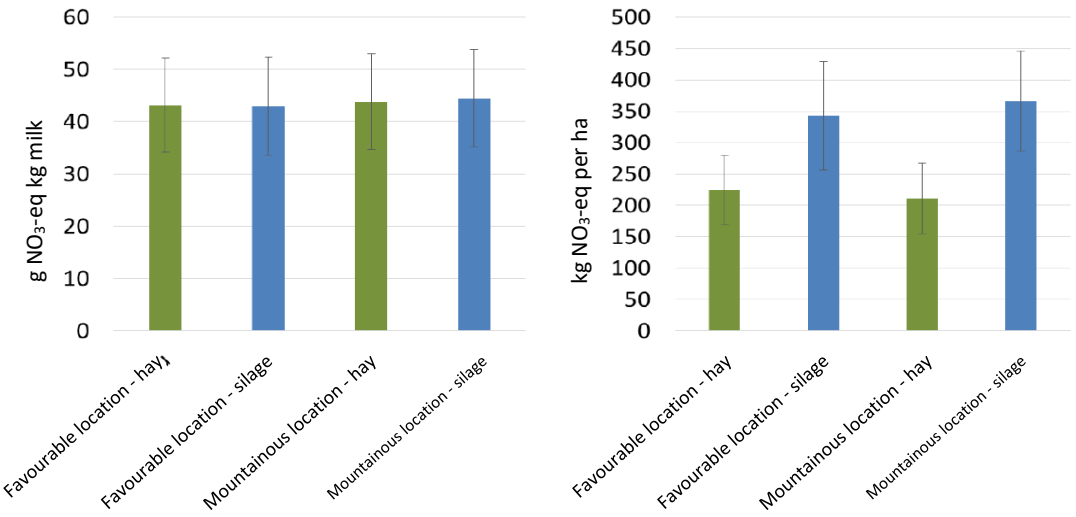


Figure 23
Eutrophication potentials of hay milk farms and conventional farms ("silage" farms) per kg of product and per hectare (acc. to Zollitsch, 2019).

Looking at the eutrophication potential per kg of milk, no difference can be seen between hay farming and industrialised agriculture, which is mainly due to the much higher milk yield per cow on silo farms.

[52] https://www.bluehendesoesterreich.at/bauernlexikon/siloballen-silageballen-rundballen
[53] Zollitsch W., 2019, p. 31ff
[54] Zollitsch W., 2019, p. 32

However, when eutrophication is considered according to area, the eutrophication potential per hectare of cropland is much lower for hay farming.

Renowned Alpine researcher Werner Bätzing states in his book "Das Landleben": *"Whereas all farming communities anticipate the future at present and organise all their economic activities and actions so that they can be carried out over the long term, industrial society merely operates in the short term and in an individualistic manner, postponing the solution to all the problems that arise from it until the future."*[55]

Hay farming reflects precisely these traditional farming communities, which operate sustainably and on a generational basis, while industrialised agriculture is more like industrial society, the consequences of which will be borne in the future.

Haymaking and silage farming in comparison

Hay farming	**Silo farming**
Permanent grassland as fodder basis, 85% for organic hay-milk and 75% for hay-milk	Besides permanent grassland, mainly arable green fodder and maize are used as fodder basis
The feeding of silage is prohibited - on the whole farm (not even for young cattle) and all year round.	Silage from grass and maize as well as arable green fodder is the feed basis.
Permanent grassland is not turned over. This means that the stored carbon remains bound in the soil.	Production of arable green fodder. The soil is turned over and releases carbon, which becomes CO2 and thus climate-relevant.
Strict feeding rules in the hay-milk regulation	Hardly any feeding regulations
Limited use of concentrated feed, 15% for organic hay milk and 25% for hay milk	No limitation of concentrated feed
Strict fertiliser regulations, essentially farm manure is used.	High amounts of fertiliser required, especially in maize cultivation.
Mosaic management, spatially and temporally staggered.	Large areas are cultivated and harvested at once.
Insects and small game always have refuges.	Insects and small game have no refuges during mowing.
Mowing only takes place when many grasses and herbs are in full bloom and have been able to reproduce themselves.	Mowing takes place 1-2 times more often than with hay farming. The plants cannot reproduce themselves and must be resown.
Hardly any reseeding necessary. If it is necessary, adapt it to the site with species-rich seed mixtures.	Sowing field forage mixtures with low biodiversity

[55] *Bätzing W., 2020, p. 122*

Low-yielding areas continue to be cultivated and provide special composition of nutrients.	Low-yield land is abandoned or converted.

4.3. Comparison with Mountains of León

The GIAHS Mountains of León region is about a way of life that has been preserved in the region. This does not only concern a production method (e.g. in dairy farming), but the whole way of doing business in the region. Even though hay-milk farmers also usually have several farm bases, they are specialized in milk production. The farmers in the Mountains of León, on the other hand, practice a kind of subsistence farming, in that each family produces a wide range of products. The Mountains of León region has its own social and political structures, ranging from the joint management of public goods to the parliamentary assembly of the families of the region.

In the case of hay farming, on the other hand, although the ARGE Heumilch is a structural framework for hay-milk farmers that monitors compliance with the guidelines, sets the direction for further development, and acts as an advocacy group vis-à-vis politicians. Beyond that, however, the hay farming community has no social or political structures of its own.

Hay milk farming in the Austrian Alpine arc	**Mountains of León**
Densely populated (in the inhabited valleys)	Sparsely populated
Mountainous area and foothills of the Alps	Mountainous area and high plateau
Small-structured, family-run farms	Small-structured, family-run farms
Mosaic-like cultivation of permanent grassland	Mosaic-like cultivation of all farmland
Dairy farming as the main economic pillar; forestry, tourism, etc. serve as supplements	Subsistence way of life, farms produce much themselves
Mixture of livestock housing, free range and pasture (not shepherded), as well as alpine pasture farming	Sheperded (forest) pasture
No joint management of public goods	Joint management of public goods
ARGE Heumilch as representation of interests and control body, organized as an association (voluntary membership)	Own political system with parliamentary assembly (Concejos) of the families

4.4. Comparison with GIAHS Barroso

The GIAHS Barroso seems to be very similar to the one in the mountains of León. This is also a subsistence economic system in a closed mountain area.

The Barroso region also focuses on livestock. This is grazed, for which forest pastures are also used. Since there is also snow and seasons with little vegetation in this region, hay is also used in Barroso. However, unlike hay farming, this is not the main focus of the farming system. In general, subsistence farming is practiced in Barroso, consisting not only of dairy farming but also of arable farming (rye and potatoes).

The society is different from that of the surrounding area in that Barroso has developed its own dialect and the people live in a kind of self-government. In contrast, the hay-milk farmers in the Austrian Alpine arc are not fundamentally different from the population in other Austrian regions.

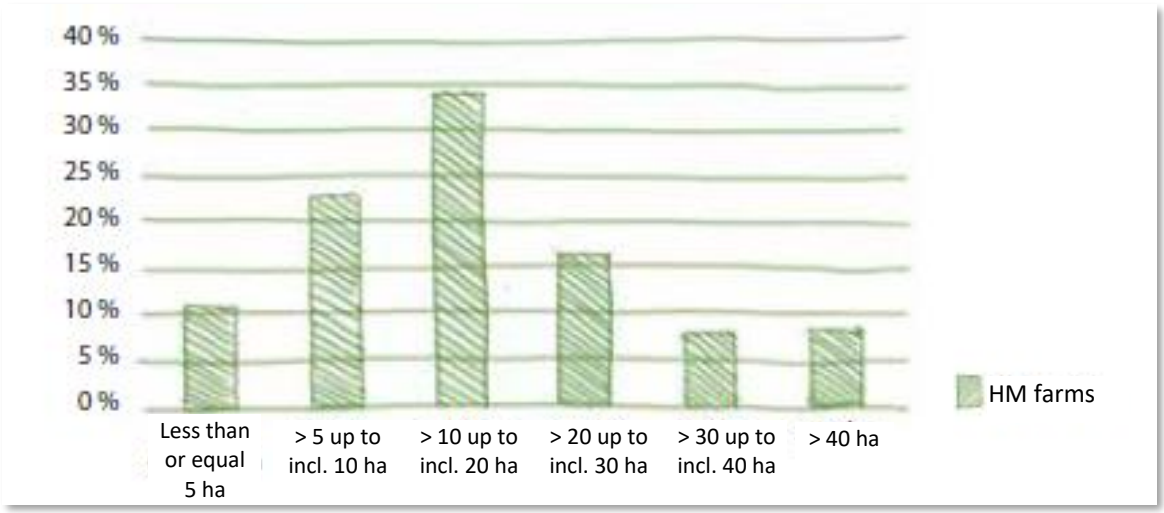
Hay milk farming in the Austrian Alpine arc	**Barroso**
Densely populated (in the inhabited valleys)	Sparsely populated
Mountainous area and foothills of the Alps	Mountainous area and high plateau
Small-structured, family-run farms	Small-structured, family-run farms
Mosaic-like cultivation of permanent grassland	Mosaic-like cultivation of all farmland
Dairy farming as the main economic pillar; forestry, tourism, etc. serve as supplements	Subsistence lifestyle, farms produce much themselves, especially rye and potatoes; arable farming with crop rotation
Mixture of livestock housing, free range and pasture (not shepherded), as well as alpine pasture farming	(Forest) pasture
No joint management of public goods	No common management of public goods
ARGE Heumilch as representation of interests and control body, organized as an association (voluntary membership)	Culture and language differ from surrounding regions

IV. GIAHS SELECTION CRITERIA

1. FOOD AND LIVELIHOOD SECURITY

1.1. Preservation of small-scale farms

While the trend in agriculture is toward fewer and larger farms, hay farming promotes the preservation of small-scale farms. Despite progressive structural change, there is a large proportion of small farms in hay farming: almost 70% of hay milk farmers cultivate less than 20 ha of farmland.



Around 88% of hay milk farms are located in mountainous regions, where the farm size is naturally smaller due to the limited area. The average herd size is only 17 cows. The use of machinery is also limited in mountainous regions. Therefore, to make efficient use of the locally available resources, Alpine grazing has become established, with the animals being moved to mountain pastures during the summer months. With the help of cows, sheep or goats, the steep slopes and high altitudes are managed sustainably, where usually either cows or sheep or goats are kept.

Hay milk farmers accept more effort and a reduced milk volume for their sustainable farming methods. Many consumers appreciate sustainable dairy products and high-quality cheese and are therefore increasingly turning to products made from hay milk. This puts Alpine dairies, cheese factories and dairies in a position to pay their hay milk farmers a premium to compensate for the higher expense. In this way, hay milk farmers benefit from an annual added value of around 30 million euros, meaning that the continued existence of agricultural farms can be ensured.

Figure 24
Family-run, small-structured farms

About 3/4 of the hay-milk farms only produce milk that is delivered to one of the processing companies.

Those that also use other distribution channels sell their milk or processed products mainly from the farm (approx. 15%). Only a very small proportion use sales channels such as the food trade, weekly markets or food co-ops.

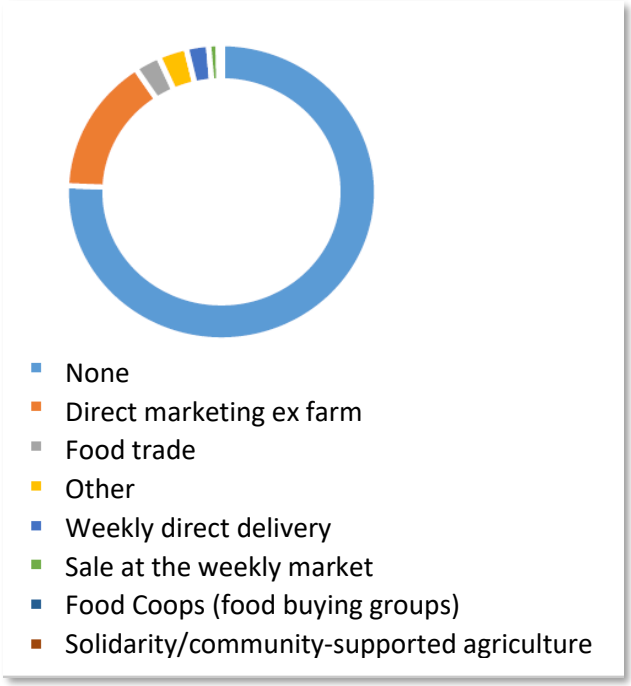


Figure 25
Alternative marketing channels (besides the purchase of milk by dairies)[56]

[56] Zollitsch et al., 2019, p. 19

Figure 26
female hay milk farmer in the lakeland region

Moreover, hay farming has always been traditionally practiced in the foothills of the Alps as well as in the lakeland regions. Here, the high water quality in the lakes in particular testifies to the sustainable farming practices of the hay milk farmers.

Other economic sectors

Milk production is the main source of income for hay-milk farmers. However, many farmers also engage in other economic activities and diversify their farms:

- **Forestry:** Depending on the location, many farms also have forest areas in addition to permanent grassland, which are managed with varying degrees of intensity. Wood is often produced primarily for own use (from heating to building). However, wood is also traded.
- **Agricultural contract work**
- **Tourism:** “Farm holidays" in particular are a popular source of income that many farms use; but alpine pastures also profit from catering for excursionists.
- **Direct sale:** Milk, simple dairy products such as yoghurt and cream cheese, as well as meat and sausage, but also other self-produced products (bread, eggs, jams, soap, etc.) are marketed from the farm. Vending machines where products can be purchased 24/7 are very popular and simplify sales.
- **Selling of renewable energy:** Photovoltaic systems are used to operate hay drying systems. This is ideal because the peaks of energy demand and yield are covered in summer. Energy that is not consumed on the farm is traded. Since this is becoming increasingly lucrative, the PV systems are also being successively expanded.
- **Education:** Especially female hay-milk farmers often get involved by passing on their knowledge in seminars or by teaching schoolchildren about school on the farm.
- **Green Care**: Child care and care for the elderly are other mainstays that are mainly run by women farmers; however, the number of green care farms is relatively small.

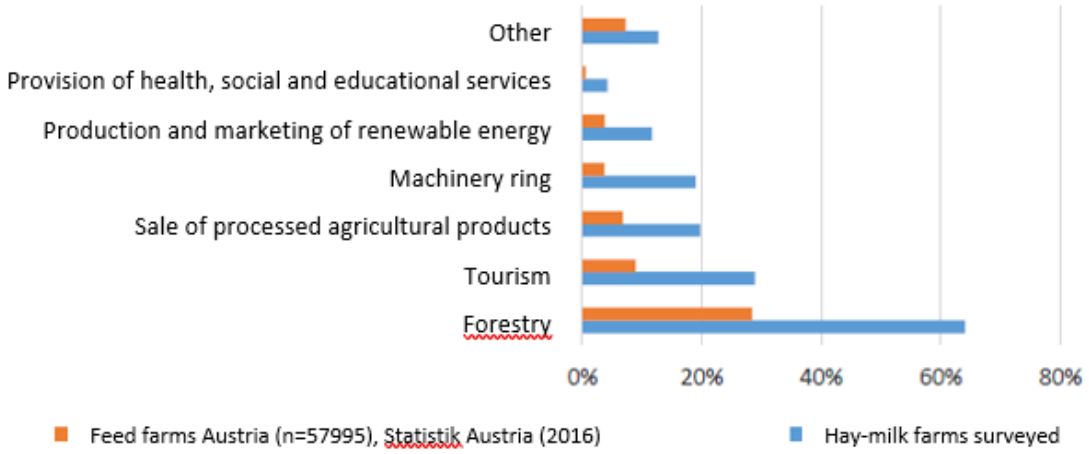


Figure 27
Proportion of farms with secondary agricultural activity (multiple answers possible)[57]

Often it is mainly the women farmers who are responsible for diversification. This is especially true in tourism, direct marketing, education and green care. The share of diversification is also higher on hay-milk farms than the national average.

In addition to the hay-milk farmers and their families, the processing companies with their employees are also involved in the "hay farming" system. The food trade also benefits from the system.

1.2. Processing plants

All the raw hay milk material is processed into high-quality food in the region. This creates jobs in the plants and the plants therefore also contribute to the infrastructure in the respective region. In this way, not only do the hay milk farmers benefit from the added value of hay farming, but also the entire region as a result.

ARGE Heumilch Österreich unites all major processors of hay milk in Austria. Among roughly 60 farms, there are farms with varying structures:

Direct marketers

Direct marketing of farm products is becoming increasingly popular. Consumers are paying more and more attention to regionality and want to know where their food comes from. This encourages more and more farmers to process and distribute their products themselves.

Cooperatives
The cooperative dairy/cheese factory is an association of several farmers. The milk is collected centrally and processed and marketed together, lowering the business risk for the individual. Members of the cooperative are given the right, but also the obligation, to deliver their milk to the cooperative.

The cooperative itself decides on the milk price, taking into account the market situation.

[57] Zollitsch, 2019, S. 18

Private companies

In addition to self-marketing by farmers in direct marketing or cooperatives, private dairies and cheese factories of various sizes have developed in hay milk areas. In some cases, these farms have been processing the milk supplied to them by hay milk farmers into milk and cheese specialties for generations.

1.3. Contribution to food safety

The crisis surrounding the Covid 19 pandemic in 2020 in particular, but also the current Ukraine war, have shown how important the supply of regionally produced food is. In their daily work, hay milk farmers make a significant contribution to this. Every day, they produce milk from the region for the region and, with their special farming method, also secure the living and economic space for future generations.

The paradigm shift toward sustainability and regionality is also reflected in the demand for food. There is an increasing demand for food that is healthy, sustainably produced and from the region. Hay milk and products made from hay milk meet these requirements perfectly and thus contribute to sustainable food security and food safety in the region.

Compliance with the TSG standard and the even stricter hay milk regulation is regularly checked by independent control institutes. This not only guarantees food safety, but also ensures the welfare of the dairy animals.

1.4. Product diversity

Naturally, the products produced and marketed within the framework of hay farming are predominantly milk and dairy products. These are wide-ranging and feature regional specialties. What they all have in common is extremely high quality of the raw material, which results from the feeding method, the high biodiversity of the basic ration and the species-appropriate husbandry of the dairy animals.

Hard cheese

Traditionally produced hard cheese is made exclusively from hay milk because this raw material is a prerequisite for long cheese ripening. In the process, it develops its malty, toasty flavours. With increasing maturation in the natural rind, which can last from three to twelve months and more, the typical aroma and taste gain intensity.

Mountain and Alpine cheeses are traditional here (Vorarlberger Bergkäse PDO, Vorarlberger Alpkäse PDO, Tiroler Bergkäse PDO, Tiroler Almkäse PDO). They are ripened with red culture, which means that the rind is maintained not only with salt water but also with red culture. Cheeses such as Emmental are only treated with salt water during the ripening process. Both processes favour the formation of the rind and serve to naturally preserve the cheese.

Semi-hard cheese

This group of cheeses has the highest variety, with flavours ranging from mild to spicy and punchy. Semi-hard cheese is mostly produced from pasteurised milk. Its curd may be closed or have a break perforation. Large holes, as Emmental is known for, are also often typical for this variety.

Strong semi-hard cheeses are maintained with red cultures during the ripening process and usually ripen for several weeks. It develops malty, toasty notes reminiscent of light caramel or cookie. Mild varieties ripen in a special film for only a few weeks and have a slightly sour, milky-creamy character.

Soft cheese

Soft cheese with white noble mould is produced by adding noble mould cultures to the milk or by spraying the surface of the cheese with these cultures. This group of cheeses is known for its mushroom-like flavors and they often resemble young wood or moss.

Soft cheese with red culture is maintained during ripening with brine and red culture bacteria, which turns the surface orange-red to brownish and gives the specific taste. The more mature the cheese, the more it develops creamy, malty flavours.

The ripening period of soft cheese is between three and six weeks. Young cheese initially has a pot-like curd and with age, the cheese acquires a creamy texture.

Cream cheese and curd

Cream cheese is the only cheese that does not require a ripening period and can be enjoyed immediately after its production. Its texture is very soft and creamy. Fine yogurt or buttermilk flavors are typical and varieties with an increased fat level have a creamy characteristic. Cream cheese is easy to make:

milk is coagulated through the addition of lactic acid bacteria, sometimes also rennet. After cutting the curd into walnut-sized pieces, the mixture is poured into moulds and the whey drains off. It is often refined with fresh herbs or even flowers.

Sour milk cheese

Sour milk cheese is the earliest form of cheese making. and is produced from quark. Its maturation is carried out with yeast and milk mould cultures from the outside to the inside. After about two weeks, the crumbly curd becomes more and more glassy and elastic in consistency.

Fresh yeast and buttermilk are clearly detectable on the palate and with age, these cheeses develop a complex flavour. Traditional varieties are Tyrolean gray cheese or Sura cheese. Sour milk cheeses are almost fat-free.

Drinking milk

Drinking milk is a particularly valuable foodstuff because it contains many vital nutrients and is an important source of calcium for the formation of healthy bones and teeth. It also provides the body with sufficient protein, B12 and B2 vitamins. During production, drinking milk is centrifuged to set the desired fat content.

The milk is then homogenised to prevent fat particles from accumulating on the surface of the milk and pasteurised to ensure appropriate shelf life. It has a slightly sweet, creamy characteristic with subtle vanilla and almond flavours.

Yoghurt

Yogurt is one of the oldest dairy products. Freshly pasteurised milk is enriched with lactic acid bacteria and fermentation transforms part of the lactose into lactic acid. This is how the typical mildly sour taste is created.

A distinction is made between plain and stirred, creamier yogurt. On the one hand, the firmness results from ripening in the cup, and on the other, because the yogurt is not stirred after it has been thickened.

Butter

In the production of sweet cream butter, butter cultures are added to the cream and beaten until the fat lumps - called butter granules - separate from the buttermilk. These are then kneaded to further reduce the water content. It has a mild creamy taste.

In small alpine dairies and cheese factories, sour cream butter is often traditionally produced from thermised milk or raw milk. In this process, the cream is pre-ripened overnight with special acidifying cultures and only then whipped into butter. The flavour of this butter is usually more complex with fresh acid notes.

Byproducts of cheese production

Cheesemaking produces whey as a by-product. This can still be processed into whey cheese. These lean cheeses were traditionally the cheeses of poor people: while the fat cheeses were sold, the farm family itself ate the whey cheese. Traditional whey cheeses are, for example, the Ziger in Tyrol or the Almschotten, which is common in Pinzgau and Pongau. The Sig from the Bregenz Forest in Vorarlberg is also a whey cheese.

However, whey is also marketed as a beverage and is especially popular as a fruit whey.

1.1. Cultural landscape and tourism

Hay farming, which has been cultivated and developed over centuries in the Austrian Alpine arc, has created a characteristic cultural landscape. This characterises the region and makes a decisive contribution to its success as a tourist region. Without the permanent grassland of the hay-milk farmers and without the cultivated alpine pastures, the region would not be so successful in tourism.

Figure 28
Haymaking creates a cultural landscape that is a basic prerequisite for tourism.

2. AGRO-BIODIVERSITY

More than two thirds of the agricultural land in the hay-milk regions is grassland. Here, unique cultural landscapes are found that are home to a variety of different grass and herb species. The sustainable management of permanent grassland represents the central core of hay farming. **The mowing is staggered in time and space.** This preserves refuge areas for zoological species and promotes their existence. In addition, a later first cut as well as fewer cuts promotes species diversity.

On average, hay farms have a lower frequency of use than silage farms. The predominantly lower frequency of use can be attributed to the fact that the farms are more dependent on suitable weather conditions (longer periods of good weather) for haymaking and that hay drying is only possible to a limited extent in May and from mid-September. This is also reflected in the timing of the first cut - most hay farms mow one to four weeks later than comparable silage farms.[58]

Figure 29
Staggered mowing in terms of time and space has a positive effect on the preservation of biodiversity.

The first time of use has a decisive influence on the height of the vegetation and thus also on the living conditions of invertebrates (more or longer available habitat)[59]. From a nature conservation perspective, grassland intensification (use of fertilisers and pesticides) is largely responsible for the progressive decline in species. Increasing silo farming, also in the uplands, leads to a significant advance of the first mowing (depending on weather and location, already from the end of April) and to a homogenisation and trivialisation of the botanical and zoological species assemblages on the areas.

The time of the first mowing was originally (historically-traditionally) between mid to late June (planar and colline stage) or early to mid to late July (submontane to montane stage), depending on altitude, whereby less productive areas such as rough and wet sites were often mown even later. In contrast, for the production of high-quality forage, cutting is required about 6-8 weeks earlier, while the above-mentioned "historical" mowing dates are still quite suitable for hay use today.[60] In addition, silage

[58] Suske W., Depisch B., Huber J., Frieß T., Holzinger W., Derbuch G., Kahapka J., Huber E., Gunczy W.L.: Analyse der Zielerfüllung der ÖPUL-Maßnahme „Silageverzicht“ in Bezug auf Biodiversität; Vienna, 2020
[59] Brabant D.: Naturindikatoren, Entwicklung eines Instruments zur Erfassung von Naturschutzleistungen im landwirtschaftlichen Betrieb. Dissertation Universität Kassel, 2006
[60] Schröder S., Wider J.: Agrobiodiversität im Grünland – nutzen und schützen; Schriftenreihe des Informations- und Koordinationszentrums für Biologische Vielfalt, Band 34; 2013

allows more frequent cutting and therefore also leads to more fertilisation in grassland and on arable forage areas, which has negative effects on biodiversity.

According to the Environmental Ombudsman Board Tyrol (2009), good grass silage requires young, protein-rich grass ("ear- panicle pushing"), i.e. that mowing is done earlier and more often than for hay production. This intensive form of management has a side effect on the species composition. Typical meadow flowers, such as lesser meadow-grass and meadow sage, do not reach seed maturity and cannot reproduce. Only a few meadow plants, mostly fast-growing and/or vegetatively reproducible grasses, can withstand the intensification. As a result of silaging, food chains are destroyed. Many forage plants and the insects that specialise in them, such as grasshoppers, butterflies, etc., disappear from once species-rich meadows.

A report by the International Lake Constance Foundation in Radolfzell[61] on biodiversity criteria in standards and quality seals of the food industry states that haymaking with site-adapted and less intensive grassland use contributes to the preservation of biological species diversity.

A study by the Institute Suske Consulting Vienna[62], in which hay management was analysed in relation to the preservation of biodiversity, also confirms positive effects. Due to a later first cutting date and a lower intensity of use, it is shown that the hay meadows were on average higher than the silage meadows in June and the growth height was more diverse in the hay meadows in the course of the vegetation period. Thus, a positive effect of the mowing mosaic and a later first cut can be proven for biodiversity.

These results clearly show that the prerequisites for serving as a habitat for insects are met to a greater extent on the hay farms than on the comparison farms. The study also analysed mowing data from 2019 and 2020. In six out of nine farm pairs, hay farms mowed on average a significantly smaller proportion of the meadows at one time than silage farms.

[61] Internationale Bodensee-Stiftung Radolfzell: Baselinereport, Biodiversitätskriterien in Standards und Qualitätssiegeln der Lebensmittelbranche; 2013.
[62] Suske W. et al. 2020

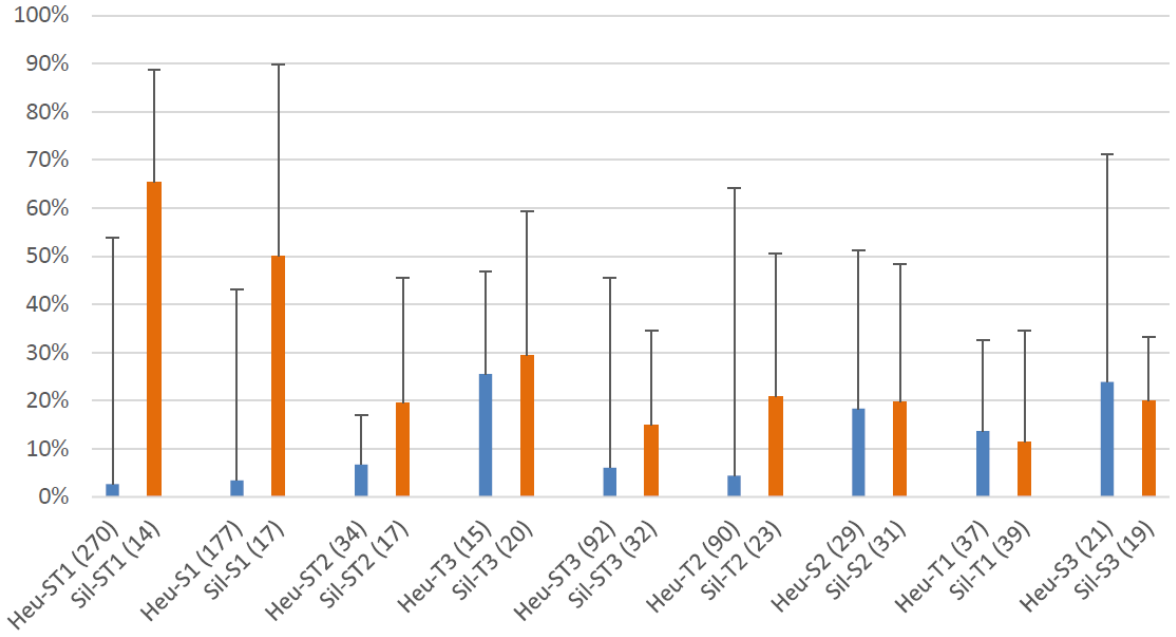


Figure 30
Average share of mown area on mowing days in relation to the total grassland area (incl. temporary grassland used as grassland, excl. arable land and temporary grassland used as arable land) in 2019 and 2020. The error bar indicates the maximum share of mown area. The numbers in brackets indicate the number of mowing days used for the calculation.

In the course of these ecological investigations, the vegetation height of the investigated areas was also measured using Pasture Disc and by farmers themselves on selected areas. Figure 31 *Average meadow height in cm on the direct comparison plots with 6 measurements.*shows the vegetation height over the course of the year. The hay plots (blue) reached higher average values from mid-June and through midsummer. This is an indication of the later mowing of the hay meadows and supports the results presented above, according to which the hay farms tend to have a larger mowing mosaic.

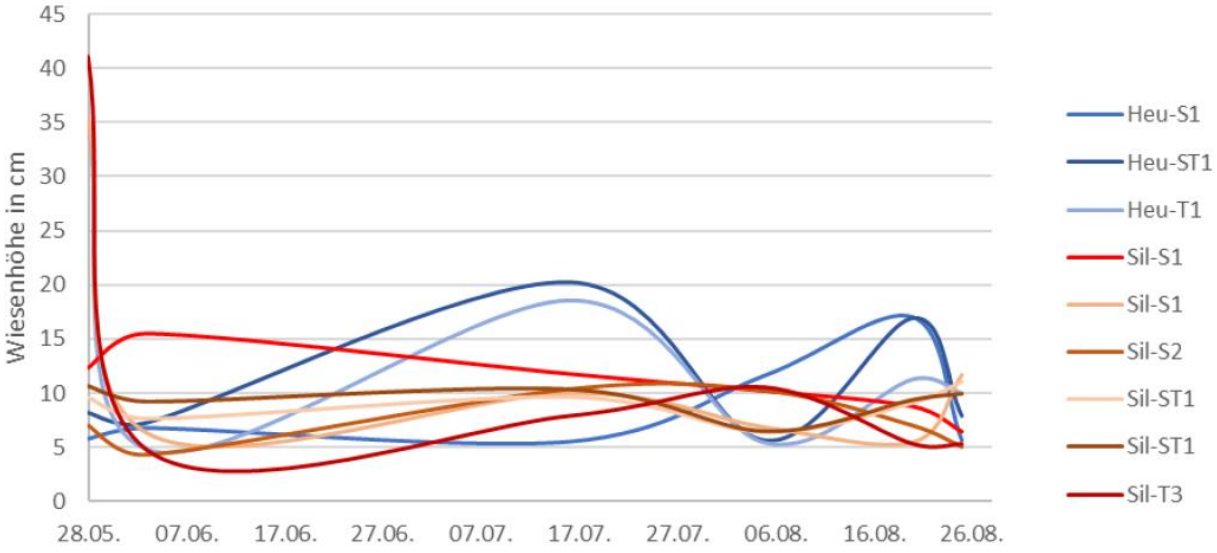


Figure 31
Average meadow height in cm on the direct comparison plots with 6 measurements.

The mowing times on hay farms are more staggered in terms of time and space. This means that not all grassland is mown at once and important food sources and refuges for bees, butterflies or small game are preserved.

Figure 32
Areas are mown in staggered time and space, creating a mowing mosaic

The higher field size of silage farming also has a negative impact on biodiversity. The Environmental Ombudsman's Office Tyrol (2009) states that the production of silo bales makes it possible to mow large areas of meadows within one day. For many animal species there is no possibility of retreat in this case, small animals are packed in with the silo bale production. Staggered cutting is necessary from the point of view of biodiversity protection. Furthermore, hay drying on the field ensures that seeds mature and fall out, thus renewing the seed supply in the soil. Small animals are able to leave the cuttings.

Haymaking, with its traditional farming methods, helps to reduce the decline in species and to preserve the valuable cultural landscapes in the long term. In this way, different types of meadows, pastures and alpine pastures are preserved and provide important habitats for flora and fauna.

Subarctic-subalpine tall shrublands *Mulgedio Aconitetea*	Subalpine-alpine hayfields *Rumicetalia alpini*
Arid, semi-arid grasslands and basophilic calcareous grasslands *Festuco Brometea*	Continental dry grasslands and eastern European steppes *Festucetalia valesiacae*
	Semi-arid grassland *Brometalia erecti*
Subalpine-alpine calcareous grassland *Seslerieta albicantis*	Calcareous grassland *Seslerietalia caeruleae*
Subalpine-alpine acid soil grasslands *Caricetea curvulae, Nardetea strictae*	Acid soil high mountain steppes of the Alps *Caricetalia curvulae*
	Acid soil windheum harvester *Festucetalia spadiceae*
Nutrient-rich mowed and litter meadows, pastures, floodplain and turf grasses *Molinio Arrhenatheretae*	Fertilised fresh meadows and pastures *Arrhenatheretalia elatioris*

	Alpine meadows and pastures *Poo alpinae-Trisetalia*
	Wet meadows and tall herbaceous vegetation *Molinietalia*
Larch meadows *Vaccinio Piceetea*	Larch meadows *Vaccinio Piceetea*

Table 1
The different types of meadows, pastures and alpine pastures

A list of the plants that are usually found in hay-milk meadows can be found in Appendix 3 to this application.

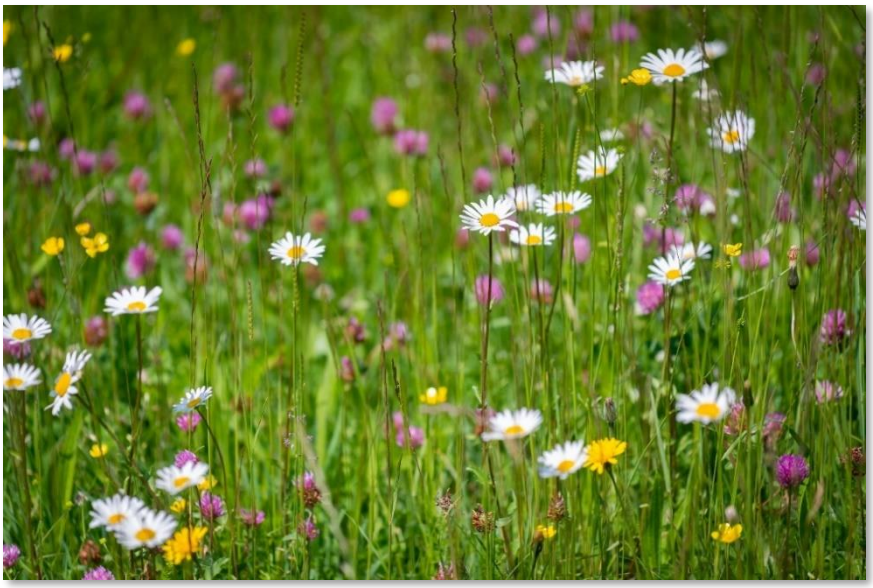


Figure 33
Meadows can mature and are only mown when a variety of grasses and herbs are in flower.

Biodiversity in the Alpine region

About 88 % of hay-milk farms are located in mountain areas. In order to make efficient use of the locally available resources, alpine pasturing with the removal of the animals to the mountain pastures during the summer months has become established in these regions.

In these areas, the loss of species is due to the abandonment of the use of low-yielding areas such as rough pastures, dry grasslands or wet meadows. Hard-to-farm, steep slopes are primarily affected. The end of grassland use here often means afforestation[63], scrub encroachment and reforestation, or the invasion of alien species that form permanent mass stands. In any case, it leads to the loss of characteristic species, some of which are threatened with extinction.

Plants typically found on these areas:

Poa alpina	Alpine bluegrass
Crepis aurea	Golden Pippa
Nardus stricta	Borstgrass

[63] Bätzing, Werner: Die Alpen. Geschichte und Zukunft einer europäischen Kulturlandschaft; München 2015, p. 264ff

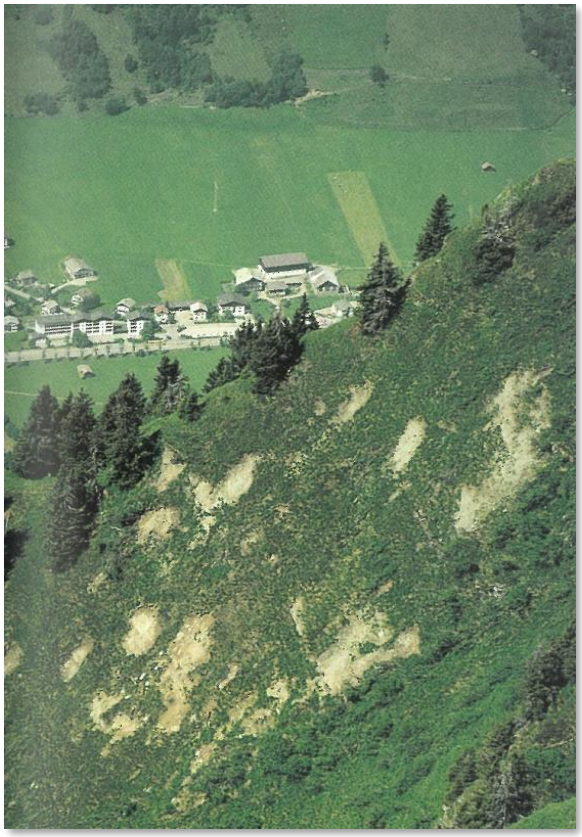
Crocus albiflorus	Spring crocus
Veratrum album	hellebore
Geum montanum	Mountain carnation-wort
Festuca nigrescens	Horst red fescue
Galium anisophyllon	Odd-leaved bedstraw
Leontodon hispidus	Stiff-haired dandelion
Rumex alpinus	Alpine buttercup
Ranunculus acris	Sharp buttercup
Ajuga pyramidalis	Pyramid Goosegrass
Antennaria dioica	Common cat's foot
Arnica montana	Mountain arnica
Carlina acaulis	Silver thistle
Deschampsia cespitosa	Lawn Sedge
Gentiana acaulis	Cook's gentian, stemless gentian
Lotus corniculatus	Common Horn Clover
Myosotis alpestris	Alpine Forget-me-not
Potentilla aurea	Golden cinquefoil
Pulsatilla alpina	Alpine cow parsley
Rumex alpestris	Mountain Sorrel
Trifolium badium	Brown Clover
Tussilago farfara	Coltsfoot

Table 2
Source: Peter Schönswetter, University Innsbruck

In most cases, alpine pastures are cultivated areas that have been created through decades - sometimes centuries - of cultivation. Through alpine pasture management and the grazing of hay farms, these areas remain open.

"A typical alpine meadow is home to up to 100 different plant species (in comparison: in the valleys there are on average only 20), from grasses and spring flowers to medicinal herbs and shrubs. However, the exact composition of the vegetation varies from alpine pasture to alpine pasture and depends on factors such as the altitude, the subsoil, the slope and the management of the alpine pasture. Without active management of the alpine pastures, most of the terrain up to about 1,500 metres would be continuously forested, the lush meadows and pastures would not exist and many rare plants would have no habitat.

Alpine meadows are not only relevant for their beauty and biodiversity, but of course also as a source of fodder. Particularly valuable - nutrient-rich - alpine pastures can be recognised by the presence of meadow golden oat, meadow fescue, red fescue, red bunchgrass, meadow crested wheatgrass, alpine bluegrass, alpine timothy, golden pippa, rough dandelion, alpine motherwort, alpine plantain, red clover, white clover and brown clover, among others. This species-rich composition of the forage pastures on the alpine pastures are decisive factors that guarantee the alpine pasture products, such as meat, milk and cheese, a particularly high quality."[64]



In addition, managed pastures and alpine meadows provide a deep-rooted carpet of grass that can withstand adverse weather conditions and better resist landslides. Regular mowing and grazing creates well-kept meadows with short vegetation that hold snow better. If the areas are not cultivated, long, unmown grasses are pressed to the ground by the snow load and form ideal slide ramps on which snow slabs can easily detach and become an unpredictable avalanche hazard.

So-called "blaiks" (extensive soil erosion) also occur: *"The long grass lies down in autumn and then freezes into the snow. When the creeping snow then slowly pushes down the slope, the grasses are torn out of the ground along with their roots. The rain in summer then washes away more soil and these blaiks enlarge."*[65]

Figure 34
"Blaiks", from: Bätzing W., p. 281

Fewer cuts require less fertilizer

Meadows are grassland used for agricultural purposes by mowing. This form of land use on large areas is very young from a historical perspective (Bunzel-Drüke et al. 2019). Motorisation is about 100 years old, intensification to 4 or more cuts per year, combined with multiple fertilisation, only began in the 1960s (Kapfer 2010). Besides the start and frequency of cutting, the fertilisation intensity of the areas is an important factor for the biodiversity that accompanies the intensification of land use.

Modern intensive dairy production drives intensification of use, as it requires a high quality of grassland silage and thus also a higher, withdrawal-oriented fertilisation level. Therefore, early cutting for silage production is now required for intensive dairy farms in both conventional and organic farming.[66] Earlier mowing has become widespread in practice due to the increasing production of grass silage instead of hay.[67]

[64] https://www.unsere-almen.at/natur/flora/wald-und-wiese
[65] Bätzing, W., 2015; p. 281
[66] Schröder et. al., 2013
[67] Gerowitt B., Schröder S., Dempfle L., Engels E.-M., Feindt P.H., Graner A., Hamm U., Heißenhuber A., Schulte-Coerne H., Wolters V.: Wissenschaftlicher Beirat für Biodiversität und Genetische Ressourcen beim BMELV

According to the Tyrolean Chamber of Agriculture (Dr. Kutny, Plant Production), the meadow type English ryegrass mowing pasture is a frequently occurring, intensively used permanent meadow whose cut is mainly used as silage. As silage is cut more often, there is a risk that the grassland will also be fertilised more frequently. This also has an impact on the species composition.

In order to compensate for the constant nutrient removal through more frequent mowing, the areas are fertilised more intensively, adapted to the removal. Since nutrients introduced through fertilisation are available more quickly than those that first have to be converted in the soil from dead plants, the external supply favours those species that have a good nutrient suitability capacity and that can thus develop into dominant species. If these are species with beneficial ingredients, this process increases the quality of the fodder produced from an agricultural perspective[68], while the biodiversity and nature conservation value of the land decreases as a result.

Austrian Environmental Programme

Hay-milk farms have to participate in the Austrian Agri-environmental Programme (ÖPUL – Österreichisches Programm für umweltgerechte Landwirtschaft), which is established within the framework of the Common European Agricultural Policy. It is mandatory to implement the guidelines of the measures "hay management" and "environmentally sound and biodiversity-promoting management".

In the measure "Hay Management", in addition to the renunciation of silage preparation and feeding on the entire farm, a mosaic-like use (mowing mosaic) of the land by combining hay management with green fodder in the form of grazing or pasture must be ensured for all roughage-consuming animals on the farm during the major part of the vegetation period.

In the measure "Environmentally sound and biodiversity-promoting management", 7% biodiversity areas are mandatory, up from 5% until 2022. As a result, from 2023 onwards, around 30 percent more biodiversity areas will be managed by hay-milk farmers.

Furthermore, 83% of hay-milk farms participate in the animal welfare measure "pasture" and 88% in the measure "ban of yield-increasing inputs (mineral fertiliser, synthetic pesticides) in grassland". Hay-milk farms have 28% HNVF areas (high nature value farmland). This is more than twice as much as on silage farms with 13%. Pasture farming in particular will become even more important in the future because, in addition to the benefits for animal welfare, it also makes a significant contribution to reducing emissions, as the excreta of the animals are directly returned to the soil as natural fertiliser. Moreover, pasture farming promotes biodiversity, provides a natural habitat for numerous life forms, especially insects, and ensures high soil fertility through humus build-up. Agricultural monocultures are at a clear disadvantage here.

The reduction of concentrated feed and the thus potentially reduced nitrate input, the small field sizes, the generally more environmentally friendly management and the low use of yield-increasing inputs as well as the management of alpine areas and extensively managed pastures and HNVF areas are important biodiversity indicators of hay farming in Austria.

(2013): Biodiversität im Grünland – unverzichtbar für Landwirtschaft und Gesellschaft. Stellungnahme des wissenschaftlichen Beirats für Biodiversität und Genetische Ressourcen beim Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz

[68] Gerowitt et al, 2013

Breeds of cattle

Since the end of the 19th century, there have been efforts to systematically improve cattle breeding in the region.[69] However, this has led to a standardisation of the breeds. Some local breeds have been pushed back and were only systematically bred and preserved again from the end of the 20th century.

The Fleckvieh is the most widespread breed of cattle in the Alps and the Alpine foothills. Their distribution range extends from the lowlands of eastern Austria to west Switzerland, i.e. across the entire hay milk region. After the Fleckvieh, the Braunvieh is the most important breed for milk production, which, according to its original breeding area, is very well established in west Austria. The breed is found mainly in regions where hard cheese is traditionally produced.

Figure 35
The Fleckvieh is the most common breed of cattle in the Alps.

In addition to milk yield and meat quality in the Alpine region, a certain cross-country capability also plays a major role in the distribution of the breeds. Not all breeds are equally suitable for Alpine grazing. The breed typically found in the mountainous regions of the Eastern Alps is the Tyrol Grey, while the Pinzgauer is mainly distributed across the Hohe Tauern National Park region.

It is also interesting to note that different breeds of cattle are kept on hay milk farms compared to silo farms. This is evidenced by the Invekos Data Pool 2018[70] of the Federal Ministry of Agriculture, Forestry, Regions and Water Management. The much higher proportion of brown cattle on hay milk farms is significant. Breeds raised in small-scale hay farming also appear to be more resistant to climate change-induced higher temperatures.[71]

[69] Wopfner, S., 1997, p. 188f
[70] Zit. Nach Zollitsch W., 2019, p. 20
[71] Zollitsch W., 2019, p. 20f

Figure 36
Brown cattle are particularly widespread on hay milk farms.

Alpine pasture farming makes different demands on the physiognomy of dairy animals than keeping them on the plain. Smaller and lighter breeds that can make good use of the fodder on the alpine pasture and that also have hard hooves and a certain cross-country mobility are more suitable for alpine pasture. Regionally, different breeds are used, some of which belong to the endangered cattle breeds. In Tyrol, for example, in addition to the generally widespread breeds, the Tyrolean Grey cattle (76.92% of the Grey cattle in Austria are kept in Tyrol) and the endangered breeds Tux-Zillertaler (60.95% of the Tuxer in Austria are kept in Tyrol) and Original Braunvieh are found. Pinzgauer, on the other hand, are kept with preference in the province of Salzburg (48.97% of Pinzgauer in Austria).

Figure 37
Tyrolean Grey Cattle...

…and Pinzgauer are particularly cross-country capable breeds of cattle
and are therefore readily used and put out for grazing in mountainous regions.

Some endangered breeds are deliberately bred on in the hay farming industry. They are usually particularly robust, which is an advantage for hay farming. These include, for example, the Tux-Zillertals, which are particularly good off-road performers, but also excellent feed converters on extensive areas. This makes them particularly suitable for Alpine grazing.

Similarly robust is the Ennstaler Bergscheck, which finds its distribution mainly in Styria. They are considered to be particularly durable.

The calm and robust Carinthian Blondvieh is also well suited to Alpine grazing.

Figure 38
Ennstaler Bergschecken

Figure 39
Tux-Zillertaler

Figure 40
Carinthian Blondvieh

The original Pinzgauer is equally hardy and capable of off-road use, and is also said to have a high temperature tolerance and be less sensitive to UV radiation. This makes them particularly suitable for use at higher altitudes.

A distinction is made here between a chestnut-brown, genetically hornless "Jochberger Hummeln" breed and the black and white "Glückskühe".

Figure 41
Original Pinzgauer as "Jochberger Hummeln".

...and the black and white "Glückskühe"

It should also be noted that dual-purpose breeds are used in hay production (milk and meat), above all the Fleckvieh. Considered as a system, this is particularly sustainable because not only the milk is

utilised, but the whole animal. There are also local marketing initiatives for the meat of the animals (e.g. for alpine beef).

Sheep and goats

Besides cattle, sheep and goats also play a role in hay farming. As ruminants, they also convert biomass that cannot be used by humans into valuable foodstuffs, and since 2019, sheep's and goat's milk has also carried the EU TSG quality seal - "traditional speciality guaranteed".

The share of sheep's and goat's milk as well as lamb meat is very small compared to cow's milk and beef. In Tyrol, however, it is significantly higher than average.

Product	Bgld.	Ktn.	NO	OO	Sbg	Stmk.	T	Vbg	W	Austria
Cattle	2.1	17.6	7.9	13.3	17.5	10.2	17.0	16.0	0.1	10.8
Pigs	2.9	8.7	9.5	18.6	1.2	16.6	0.7	0.7	0.1	11.4
Sheep and goats	0.1	1.1	0.3	0.4	0.8	0.4	1.7	0.7	0.0	0.5

Figure 42
Share of agricultural production by federal state in %.[72]

In hay farming, both the sheep and goats used are mainly pure dairy breeds. In terms of goats, these are predominantly the Saanen goat and the chamois-coloured mountain goat. Occasionally, however, Toggenburg goats are also used.

Figure 43
Saanen goat

[72] Statistik Austria: Landwirtschaftliche Gesamtrechnung 2019, p. 14

Figure 44
Chamois-coloured mountain goat

Figure 45
Toggenburg goat

In terms of sheep, it is predominantly the Lacaune sheep that is used as a dairy sheep in hay farming.

Figure 46
Laucaune sheep

3. LOCAL AND TRADITIONAL KNOWLEDGE SYSTEMS

Throughout the centuries of hay farming, a lot of local and traditional knowledge has been accumulated, which ARGE Heumilch tries to preserve. Modern hay farming also transfers old technologies into the new era and makes the farming method attractive and even more sustainable for young and modern farmers.

3.1. Hay harvest and hay quality

Hay harvesting is a definitive part of hay farming. Particularly in mountainous regions, numerous slopes do not permit machines due to their steep descent - they are mowed by hand with great effort. Harvesting quality hay requires expertise, up-to-date technology and good weather conditions - only then can high-quality hay be harvested for the winter season. The animals are usually given a mixture of the different hay cuttings to be able to guarantee nutrient-rich feeds. The grass and hay cuttings given provide a little insight into the "craft" of haymaking.

Figure 47
High quality hay is the basis for winter feeding

- **First cut:**
  The first cut provides 30 to 40% of the year's forage and is also much richer in structure than subsequent cuts. Structure-rich grass and hay is important for the ruminant activity of the animals. This first cut is harvested in several batches through pasture farming, green grass feeding and hay mowing. The first cut already delivers different qualities of hay:
  a. Young, high protein and energy-rich quality hay for dairy cows.
  b. Quality hay mowed 1 to 3 weeks later for good yields.
  c. A little later: hay in full bloom for pregnant cows and larger young cattle.
- **Second cut:**
  From the second cut, the structure in the feed decreases, while the herb content increases significantly. Hay from the second cut is therefore finer, has a very pronounced flavour and provides a very good protein yield.

- **Third cut:**
  The third cut is already much lower in quantity, but delivers very high crude protein yields. This allows purchased protein feeds such as grains to be replaced for the most part. This cut ensures a high yield from the proprietary herb-rich permanent grassland stocks.
- **Fourth cut:**
  A fourth cut is no longer possible in many hay milk regions as altitude increases. Instead, a valuable autumn pasture for hay milk cows takes place on the land.

3.2. Development of haymaking

For thousands of years, grass has been dried in the region in summer to be fed to ruminants as hay in the winter when there is no vegetation. However, the technique of harvesting and drying the grass has evolved in recent years and also shows regional differences. The result, however, is always hay that serves as basic fodder for the winter months.

Traditionally, the hay is already dried in the meadow - so-called "ground hay". The effort in muscle power and time was very high and the dependence on the weather enormous, because the weather had to be dry for several days. Both the workload and the stress of the weather placed great burdens on farming families.

Figure 48
The cut grass was turned by hand.

Figure 49
So-called "Heumandl" were used to bring the wet hay away from the ground to dry.

In addition, there is a higher crumble loss with ground hay than with under-roof drying. The drier the hay, the more brittle it becomes. When it is then harvested dry, valuable plant parts break off and remain on the meadow. For this reason, the basic forage quality of ground hay is lower than that of hay dried under roof.

Hay is still harvested from the ground on hay-milk farms. In contrast to the past, this is now done with machinery. However, the hay is hardly ever hung up anymore, but turned several times on the ground until it is dry enough for harvesting. Wherever possible, turning is done mechanically with a rotary harvester attached to a tractor. The use of machinery means that haymaking is no longer as laborious and physically demanding as it used to be. Nevertheless, the amount of work involved in this haymaking method is still very high and the dependence on the weather is greatest. Crumble losses are also still an important factor.

The different techniques are also used in parallel, depending on the nature of the grassland and forage requirements.

Figure 50
Today, the Kreisler usually does the turning. (Source ©Pöttinger)

A survey in 2016 showed that only slightly more than a quarter (28%) of farms still harvest hay exclusively as ground hay. The trend is towards drying systems, which help to make hay farming more efficient and higher-yielding without changing the basic principle of the farming method.

Drying systems/Under-roof drying

Today, however, more often than dried in the meadow, the hay in the meadow is only pre-dried and then brought into a drying plant while still damp (residual moisture approx. 30%), where it is finish-dried in a controlled manner. This method has two main advantages over ground hay:

- For one thing, there is less dependence on the weather, as the time window in which it is not allowed to rain is much smaller. This leads to less stress for the farmers. The harvest time can be chosen more flexibly and better adapted to the degree of maturity of the meadows.
- On the other hand, this controlled drying under cover increases the quality of the forage and thus the yield. There is less crumble loss in the meadow because the grass is more elastic while it is still damp. Valuable components are preserved, the harvest yield increases by up to 30% compared to ground hay, which significantly improves the economic situation of hay-milk farms.

Due to the dehydration, the living conditions for bacteria and fungi deteriorate to such an extent that they can no longer work. This happens from about 13 % residual moisture or 87 % dry matter. This ensures that the hay can be stored well. With simple forms of hay drying such as ground hay, these values are very rarely achieved in practice, which means a loss of quality when storing the forage. With under-roof drying, these values are achieved, which is important for a lasting high quality of the hay.

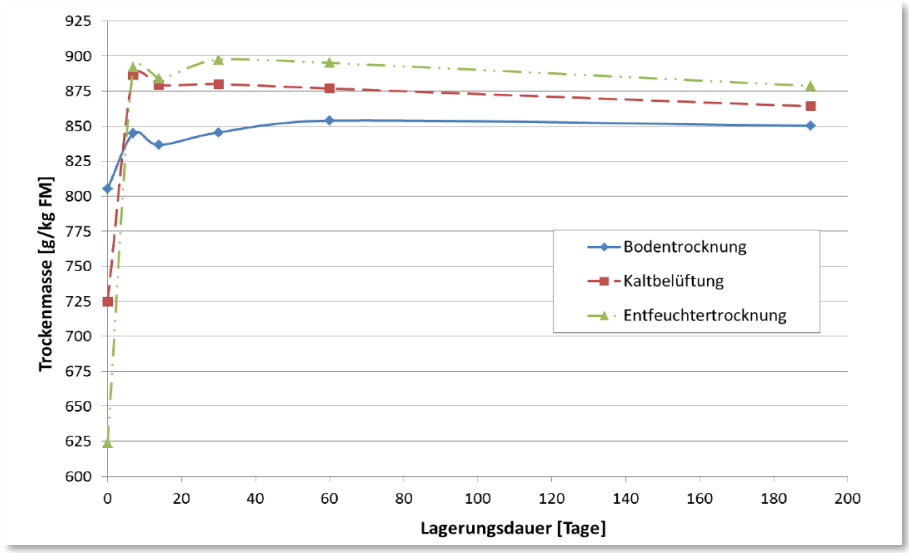


Figure 51
Course of the dry matter content during hay preservation[73]

Various systems are available for under-roof drying, which are now operated with renewable energy systems (photovoltaics, wood chips).

Technical drying requires at least one ventilator that blows air into the loose or baled fodder. If the air sucked in by the ventilator is processed by a heat generator or an air dehumidifier, the drying performance increases enormously. For high fodder quality, rapid drying to the point of storability is a prerequisite.

The largest share of under-roof drying is accounted for by loose drying in hay boxes, bale drying plays a smaller role. The share of under-roof drying is steadily increasing, but there are no more recent data than those from 2016. In the meantime, the share of hay dried under roof is likely to be much higher.

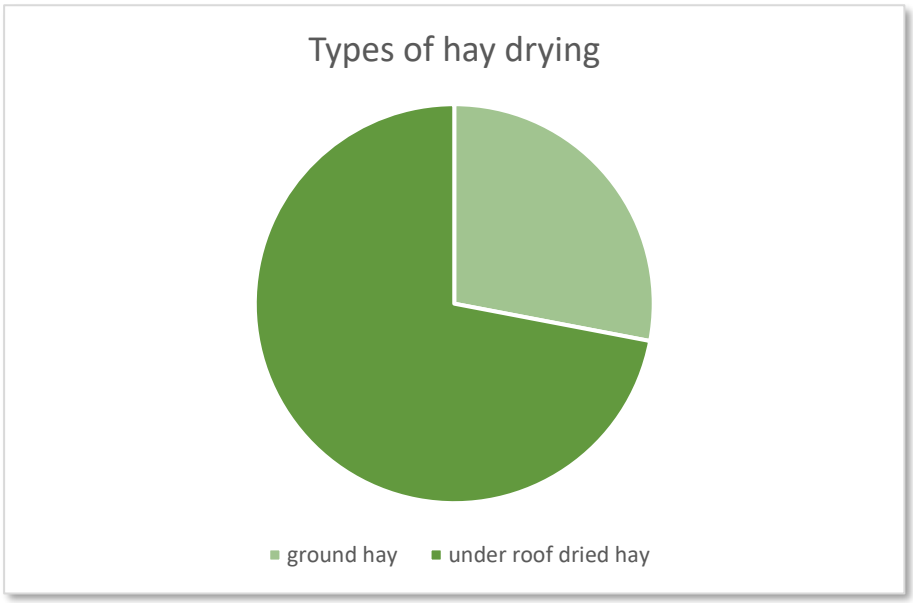


Figure 52
Drying types, source: own survey 2016

[73] Lindner, Gerhard; Kittl; Matthias: Heumilchproduktion in Österreich. Bestandserhebung und Implikationen für die Weiterbildung und Beratung; Vienna 2016, p. 21

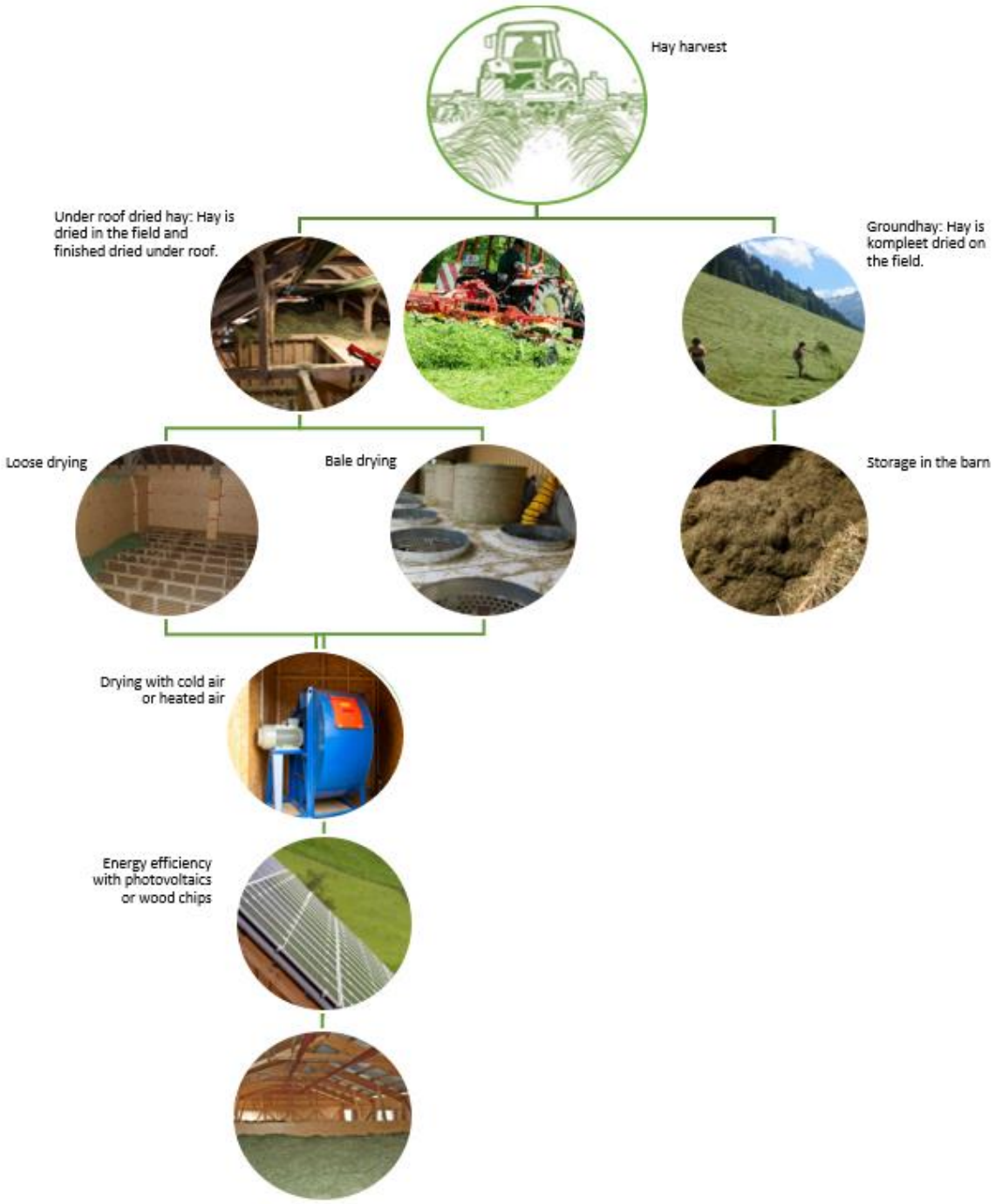


Figure 53
Drying types and systems

Types of underroof drying in detail

a) Loose drying

In loose drying, the hay is finished in large boxes lying on a grid, for which there are various methods. Depending on the location and needs, the loose hay is dried with cold air, heated air, dehumidifiers or a combination of these.

Figure 54
In hay boxes, the hay is placed on a simple grid under which the air is blown in.

The forage quality can thus be decisively increased and the proportion of concentrated feed in the feeding can be further reduced. Since the energy required for aeration is often covered by photovoltaics, these systems are operated in an extremely environmentally friendly way. Farmers benefit from hay drying systems through simplified hay harvesting, less dependence on the weather and higher profitability through increased forage yields.

Loose drying is the most common form of drying.

Figure 55
The hay is placed loosely in large boxes and finished drying in them.

Figure 56
A ventilator blows (warm) air into the hay.

b) Bale drying

Another form of under-roof drying is bale drying. In this process, the still moist hay is pressed into bales and ventilated and dried in this form. There are different variants of how the air is blown through the bales. Bale drying is more expensive than bulk drying, but it has the advantages that storage does not have to take place close to the barn and the hay can be stored and transported more easily and, if necessary, also traded. However, bale drying has not really caught on and the proportion of farms that dry their hay in the form of bales is in the single-digit percentage range.

Figure 57
In bale drying, the moist hay is pressed into bales and the bales are aerated.

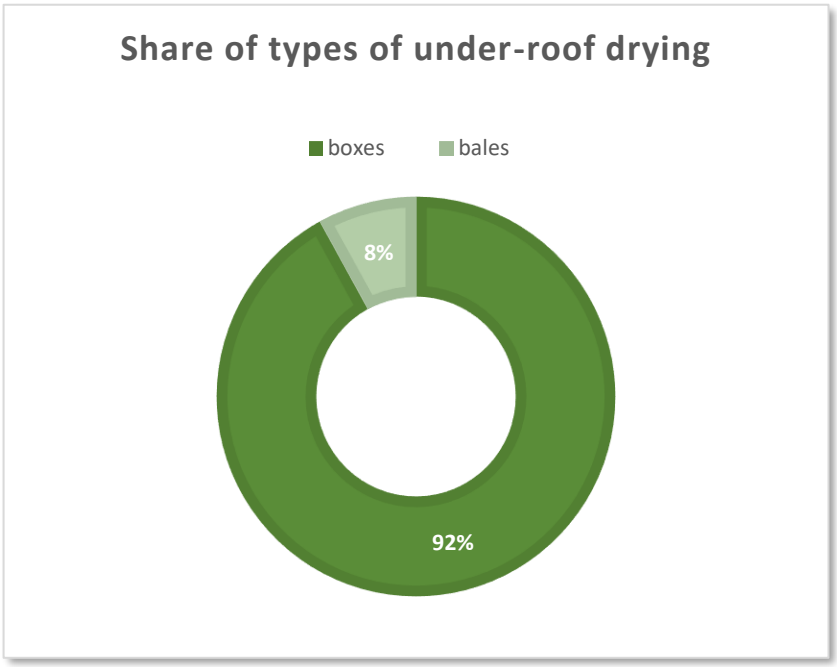


Figure 58
Proportions of drying types for under-roof drying[74]

[74]Source: Kittl, Lindner, 2016; p. 67, own calculation

Higher basic forage output through under-roof drying

Although under-roof drying systems require energy and incur costs, they are much more efficient than soil drying and pay off for the farms not only in terms of time, but above all economically. Better drying performance and the minimisation of crumble losses during harvesting lead to a higher basic forage yield.

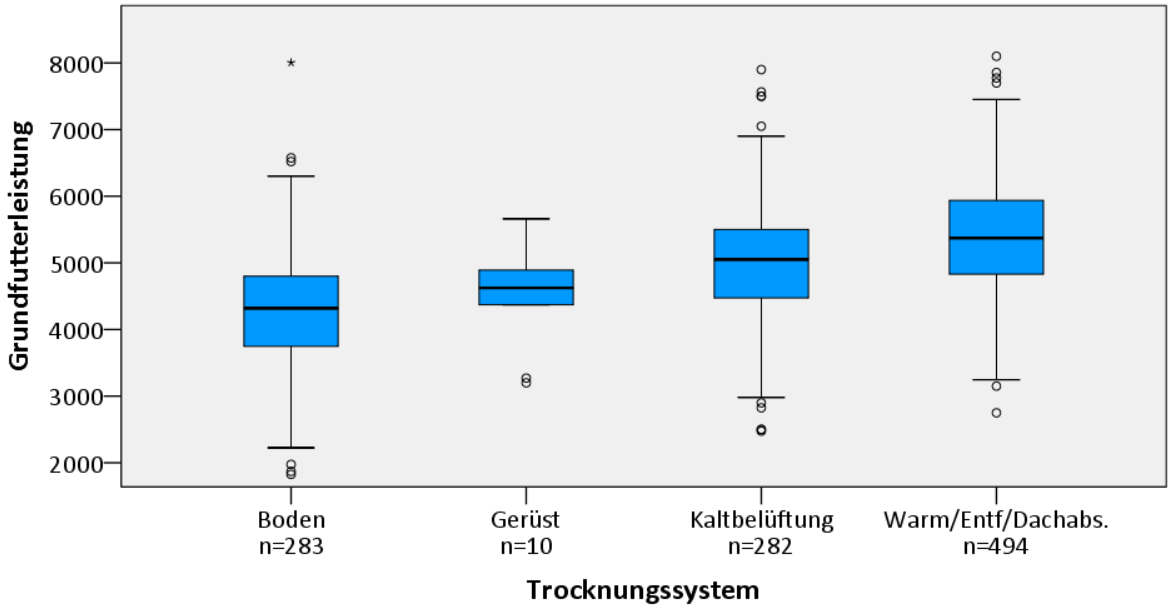


Figure 59
Basic feed performance according to drying system[75]

The basic feed yield per cow and year was calculated from the barn average (milk yield per cow and year), adjusted by the amount of concentrated feed per cow and year:

Basic feed yield = Milk per cow-(concentrated feed∗1,5)

This increased basic fodder yield has a positive effect on the profitability of hay-milk farms and contributes to the continuity of the farming method.

The hay-milk regulation of ARGE Heumilch stipulate that the proportion of basic fodder in the annual ration must be at least 75%, for organic hay-milk even 85%. In order to be able to guarantee this proportion, the hay-milk farms need particularly high-quality hay, which is guaranteed by the drying facilities. Furthermore, the small amount of concentrated feed used in addition to the hay must also be GMO-free and come from Europe.

The low proportion of concentrated feed also sets land that would otherwise be needed for the cultivation of feed grain free for human nutrition. This aspect also contributes to the ecological sustainability of the system.

[75] Kittl, Lindner, 2016; p. 118

Energy sources for drying plants

An important contribution to the ecological sustainability of the system is the use of renewable energy for the drying facilities. Since hay drying falls in the sunny summer months and stables and hay storage facilities have large roof areas, photovoltaics are an ideal source of energy.

Just as the ground hay was dried by the sun in the past, the hay is dried today with the help of solar energy. The traditional way of farming is thus transferred into a contemporary form without changing its core.

Figure 60
The energy required for hay drying is often covered by photovoltaics.

Ideally, the photovoltaic system is supported by a so-called roof suction system. The warm air that accumulates under the roof is sucked by the system and blown into the hay from below by a ventilator. In the process, the air cools down and then arrives again under the roof, where it is reheated by the ambient heat. On the one hand, this cycle makes ideal use of the heat, and on the other hand, it also increases the performance of the PV collectors because they are cooled and word more efficiently in a cool state. [76]

[76] s. Obermaier, Sabine: Vollkostenrechnung der Erzeugung von Unterdachtrocknungsheu bei gleichzeitiger Kühlung der Photovoltaikelemente; TU München, 2013

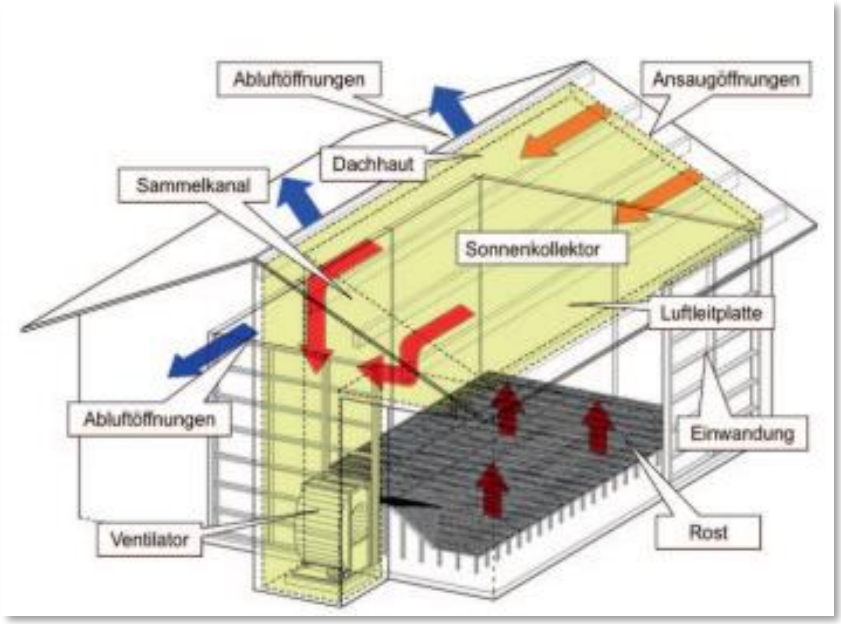


Figure 61
Roof suction with PV system integrated in the roof[77]

One variant is drying with a dehumidifier. Here, the moisture is extracted from the air using the heat pump principle before it is blown through the hay. The systems (roof suction, dehumidifier) are sometimes also combined with each other.

3.3. Haymaking during the year

Winter feeding with hay is practised from about November to April. As soon as weather conditions permit, grazing begins in April.

The first mowing for hay preparation takes place from May, in higher altitudes also later. This is followed by further cuts spread over the summer. In favourable locations, mowing can be done about 4 times per summer, other areas are mowed only 2 - 3 times per summer.

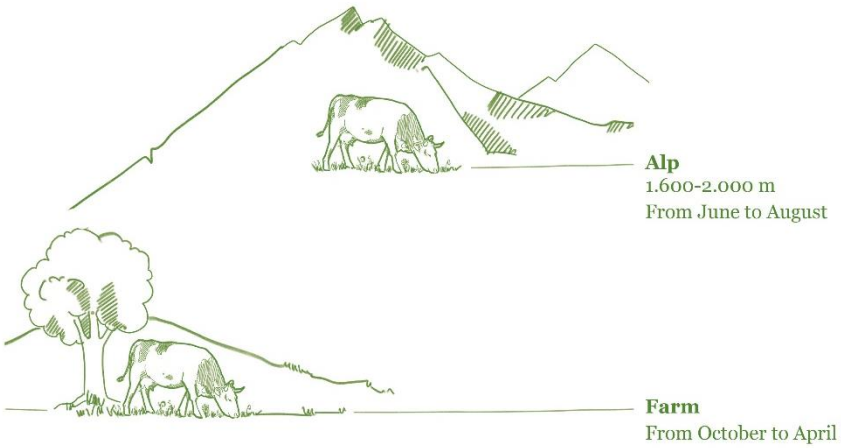
Haymaking during the year	January	February	March	April	May	June	July	August	September	October	November	December
Hay for winter feeding	■	■	■	■							■	■
Soils are prepared			■	■								
Start of grazing season				■								
Pasture season				■	■	■	■	■	■	■	■	
"Almauftrieb" - cattle go to the alp					■							
Animals on the alpine pasture					■	■	■	■	■			
1. Mowing					■							
2., 3. and partly 4. Mowing						■	■	■	■			
"Almabtrieb" - cattle come back from the alp									■			
Last grazing days											■	

In the mountain area, alpine pasture farming is practised in parallel. Animals that are calved are driven to the alpine pastures from mid-May onwards. This varies according to the weather and the altitude of the mountain pasture. At higher alpine pastures there is often snow for longer, which can delay the

[77] Source: Agroscope Transfer 38/2014

drive. In particularly favourable conditions, it is also possible to drive up the alpine pastures as early as the beginning of May.

Likewise, the driving down of the alpine pastures in autumn can vary depending on the weather and often takes place earlier on particularly high-altitude alpine pastures than on lower-lying ones. Even after the summer grazing season, grazing often continues in the valley for some time, as long as the condition of the soil (wetness, frost) allows it.



3.4. Milk collection management

Milk collection is handled differently depending on local conditions. Due to the high number of processors, this results in short transport distances. In recent decades, it has become common practice to collect the milk directly from the farm or alpine pasture using milk collection trucks. For the most part this happens daily, occasionally every two days.

Figure 62
The milk is collected directly from the farm by a milk collection truck every day or two. (Pictured: Zillertal, Tyrol)

Only in a few cases is the milk brought from the farm to the cheese dairy. There are still alpine dairies, mainly in Vorarlberg, but also in Tyrol. On these alpine dairies, the milk is processed into cheese directly on the alpine pasture.

Figure 63
Cheese production at the alp

3.5. Traditional cheesemaking

In the hay milk regions, there are still many small Alpine dairies and cheese factories that practice traditional cheesemaking. The master cheesemakers pay particular attention to gentle processing of the milk. For example, many farms still process raw milk into cheese, or the milk is only thermised, i.e. heated very gently. This preserves the milk flavor better and the cheeses taste more pronounced and complex. To thicken the milk, traditional rennet from the calf's stomach is usually still used, which has very good protein coagulation properties. For cheese varieties such as Tyrolean or Vorarlberg mountain cheese and Austrian Emmental, this is a prerequisite for nurturing them to their flavorful peak during a long ripening period. These cheese specialties made from hay milk represent a distinctive cheese culture in the Austrian Alpine region.

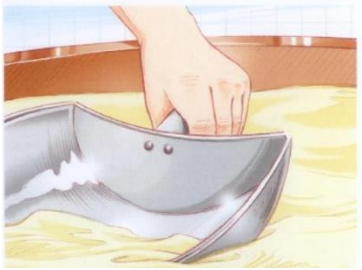
Figure 64
Production of Zillertal gray cheese in the Zillertal Alpine dairy

Making natural hay milk into fine cheese specialties

Depending on the type of cheese, the milk is heated, on average to about 30°C.

Lactic acid cultures are added at the desired temperature, which convert the lactose into lactic acid.

Once the milk is sufficiently soured, rennet diluted with water is added. This initiates the process of thickening the milk.



After about 30 to 40 minutes, this is inspected to see whether the milk has thickened. A ladle is used to poke diagonally into the thickened mass, revealing the already liquid part - the whey.

When the thickening process is complete, cutting of the thickened milk into curd begins. Depending on the type of cheese, the curd is cut into walnut-sized to wheat-grain-sized pieces.

The whey is then separated and the curd is poured into moulds.

The cheese gets its compact shape in special presses.

After pressing, the cheese goes into the salt bath, which is used for rind formation and natural preservation. This also intensifies the taste.

The cheese is then carefully cared for in special ripening cellars until it has completed its ripening period. This can take three weeks, but also up to 24 months.

4. CULTURE, VALUE SYSTEM AND SOCIAL ORGANISATIONS

4.1. ARGE Heumilch Österreich

Since the beginning of the 21st century, hay-milk has been actively marketed. Since then, the share of hay-milk in the milk delivered in Austria has remained stable at 15%.

ARGE Heumilch was founded in 2004 and has been a registered association since 2009. All hay-milk farmers in Austria as well as 60 processing companies such as alpine dairies, cheese dairies and dairies in the region are united under the umbrella of ARGE. The most important goals are to preserve hay farming, to increase the added value for the farmers by decoupling them from the international milk markets and to offer products with high added value for the consumers.

To achieve these goals, ARGE Heumilch represents the interests of hay-milk producers and processors in politics. Among other things, it works to ensure that hay farming is maintained or expanded in the support measures of the ÖPUL programme.

However, the organisation's task is also to communicate the advantages of this sustainable hay farming on the market so that hay-milk farmers receive a fair producer milk price.

4.2. Hay milk regulation

Hay milk farmers and our processing plants produce according to the strict hay milk regulation, compliance with which is checked by independent, state-certified inspection bodies.

The regulation contains **provisions on feeding**, which stipulates that hay milk cows, goats and sheep are fed with fresh grasses, herbs and hay according to the species. Roughage such as green rapeseed, green corn, green rye or fodder beets may be fed in addition. Wheat, barley, oats, triticale, rye and corn in marketable form are allowed, as are field beans, forage peas, lupin, oilseeds and extraction meal. However, the roughage portion in the annual ration must be at least 75% of the dry matter, and 85% for organic hay milk.

All fermented feeds, as well as wet hay and fermented hay are completely prohibited. By-products of breweries, distilleries as well as other residues from the food industry are also prohibited. This also applies to feed of animal origin with the exception of milk and whey for young cattle.

All feed must originate from Europe and have been produced without the use of genetic engineering.

Regulations on fertilisers are also included in the hay milk regulation: for example, sewage sludge from municipal treatment plants must not be spread. Compost with green cuttings, shrub cuttings and organic waste is subject to special requirements, as is biogas slurry.

Animal welfare provisions, such as 120 days of outdoor exercise and/or pasture or Alpine grazing, are also important. Permanent tethering is prohibited under the hay milk regulation.
A lying area must be available for each dam. Dehorning of calves is allowed only after effective anesthesia, tail docking is prohibited.

4.3. EU quality label TSG - traditional speciality guaranteed

To be able to guarantee a uniform standard throughout Europe, ARGE Heumilch applied for EU protection label "TSG - Traditional Speciality Guaranteed" for hay milk. In 2016, the European Union awarded the seal of approval. As a result, only those products that meet these standards may be labeled as hay milk throughout Europe. Since 2019, sheep's hay milk and goat's hay milk may also carry the EU protection label TSG - traditional speciality guaranteed.

It should be noted at this point that the EU quality label is a minimum standard that applies uniformly throughout Europe. The hay milk regulation standard is much stricter, requiring, for example, no silage on the whole farm and setting animal welfare standards that are not included in EU protection.

4.4. Identity, sense of place, customs

Thanks to the activities of ARGE Heumilch, hay milk has been established on the market as a separate type of milk, which has made it possible to pay higher milk producer prices and enable hay milk farms to survive economically.

A survey of hay milk farmers revealed that, in addition to raising awareness of the hay milk product and the higher prices, the strengthening of their own identity as hay milk producers in particular is perceived as an advantage resulting from the work of ARGE Heumilch. While hay milk farmers were considered retrograde just a few decades ago, they are now pioneers of sustainable agriculture.

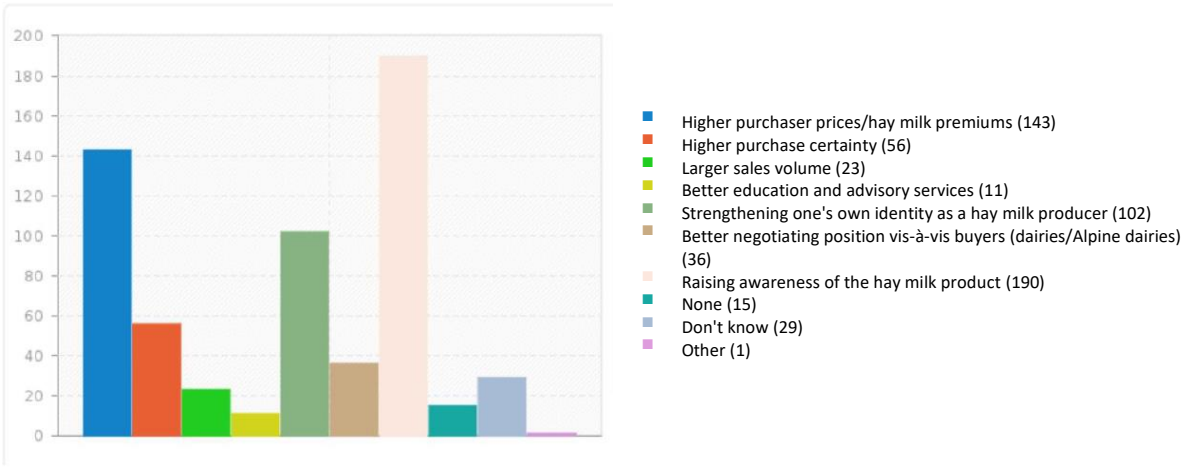


Figure 65
Benefits through ARGE Heumilch, survey of farmers, Zollitsch, p. 65

Due to the small-scale farms, hay milk farmers have a special connection to their land and their dairy animals. Even though both are fundamental for the economic survival of farms, they are less perceived as operating resources.

4.5. Departure to and return from Alpine pasture

Historically, hay farming has been associated with many rituals and traditions, most of which have been forgotten and/or have become obsolete due to changing conditions. Mowing and haymaking

were historically associated with many rituals that were lost from collective memory with the professions of farmhand and maid.

The tradition of departure to and from Alpine pasture has been preserved in many regions. The departure to Alpine pasture is celebrated less, even though animals and farmers often long for it at least as much as the return in the autumn. Even today, the dairy animals are often taken on foot to the mountain pastures, where they spend the summer.

Return from Alpine pasture

The return from Alpine pasture is still celebrated as a festival in many places today. This has its origins in the fact that after the work was done, the Alpine pasture staff received their wages when they returned from the Alpine pasture. However, they also wanted to celebrate an accident-free or at least accident-free summer on the mountain pasture after all their toil and trouble.

Figure 66
Homecoming of the animals in the Stanzer Valley[78]

A headdress is made for the animals from the last flowers days before the return from Alpine pasture. The form of the headdress varies from region to region and ranges from eye-catching, tall arrangements to simple flower wreaths. The return from Alpine pasture also includes the ringing of large bells that the animals wear around their necks. They announce the return of the dairy cattle in the valley from afar.

[78] Wopfner, p. 436

Figure 67
Return from Alpine pasture, www.heumilch.at

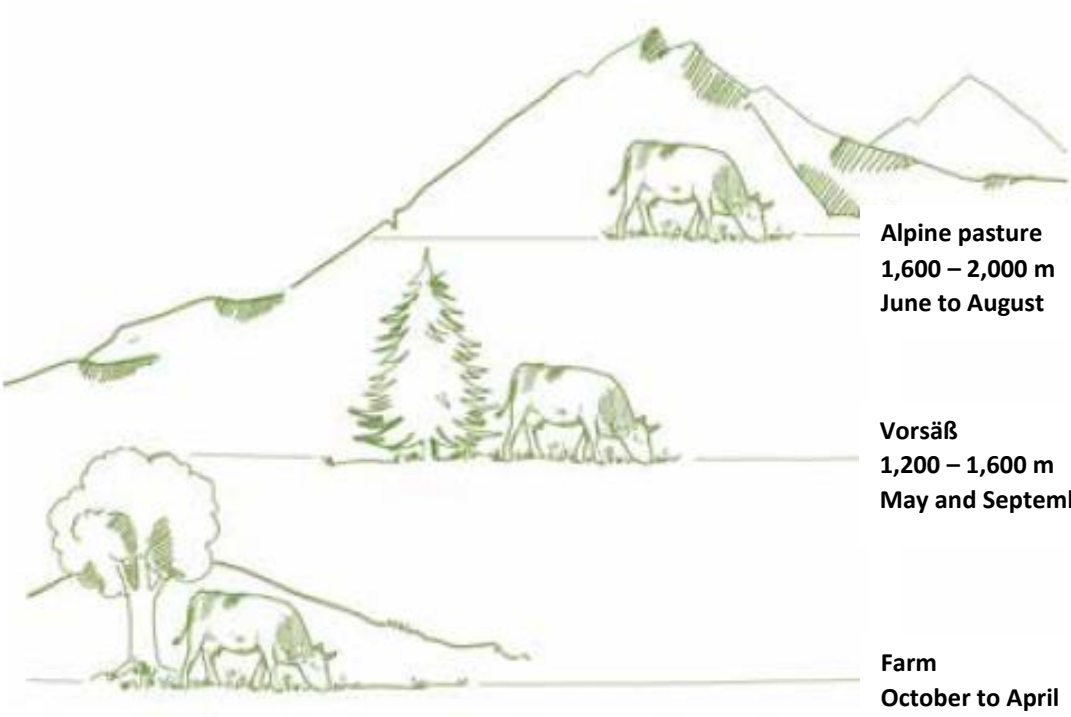
In the valley, the procession of cows is already expected. The farmers take the cows back into their care and this is often combined with a celebration on the farm. Today, the return from Alpine pasture is a spectacle not only for locals, but also for tourists and contributes to the cheerful and original image of the Alpine region.

Figure 68
To celebrate the Alpine summer, the cattle are decorated for their return journey.

4.6. Three-stage agriculture

In order to be able to use the alpine pastures optimally, so-called three-stage farming is practised in some areas: Here, the families first move with their animals from the farm to a low-lying alpine pasture - the so-called Vorsäß or Niederleger at about 1,200 to 1,600 metres. In July, they move on to the Alpe or Hochleger, which is between 1,600 and 2,000 metres. There they spend the summer, before returning to the Vorsäß and then to the valley in September. This mobility between three altitudes allows the animals to be fed with fresh grass and hay all year round.

In the Bregenzerwald, traditional three-stage farming is even considered an intangible UNESCO World Heritage Site.



Alpine pasture
1,600 – 2,000 m
June to August

Vorsäß
1,200 – 1,600 m
May and September

Farm
October to April

3

As soon as climatic conditions allow, the animals are taken to the alpine pasture at about 1,600 - 2,000 metres.

Here in the alpine level they spend the warmest months grazing. This level is not forested and offers a high diversity of species as fodder.

2

In spring, the animals are moved to a higher area - "Vorsäß" - at about 1,200 - 1,600 metres. The montan stage is forested, but historically has glades created by cultivation and clearing, which are used as intermediate pasture.

1

The hay-milk farms are located at approx. 500 - max. 1,200 metres above sea level in the valleys and along the colline level. They are surrounded by permanent grassland. Here the animals graze in autumn and spring. In summer, the hay for the winter is harvested here.

4.7. Customs

Some elements of agriculture and Alpine farming have found their way into the regions' customs. The bells that the animals wear on the mountain pasture so that they can be found play a role in various traditions. This is the case with the beating of bells, for example, which is a tradition in many Tyrolean towns during Fasnacht - the time before Lent. Men tie the largest bells around their waists and move rhythmically through the village, so that the winter is driven out by the loud ringing.

This is similar to grass awakening, which is usually done by the boys. They parade through the village with bells in mid to late April to "wake up" the grass to usher in spring.

4.8. Costume

The traditional Alpine costume is also characterised by the farming communities of centuries past. The word "costume" simply means "what is worn" and so the traditional costume is based on the everyday clothing of the farming community. After all, in the period when the costume existed as special regional clothing at the beginning of the 19th century, farm life was considered to be pure and original. The clothing worn by farmhands and maids on the farms was therefore stylised and standardised, entering folk culture as traditional costumes. This process took place mainly from the Napoleonic wars onwards.

Figure 69
Traditional costume[79]

Even though traditional costumes in the Alpine region can differ greatly from region to region, they all have their rural origins in common. It should be noted that what we understand today as a traditional costume is based on the festive clothing of the farming population. However, wearing the traditional costume is always an expression of a certain lifestyle that appreciates country life. While the costumes lost a great deal of their importance in the second half of the 20th century, they have been experiencing a real renaissance again since the turn of the millennium. The paradigm shift towards regionality and originality, which has already been mentioned several times, certainly plays a major role here.

The leather trousers, for example, can be considered especially exemplary for the traditional costumes in general. Since leather as a material is particularly durable, it had already been commonly used for trousers for centuries. While the bourgeois population in the city preferred long trousers from around

[79] Source: https://www.uibk.ac.at/de/newsroom/2017/auf-tuchfuehlung/

the French Revolution, the farmers in the countryside wore short leather trousers, which eventually entered popular culture as Lederhosen.

Figure 70
Leather trousers are part of the traditional costume in the Alpine region. (Photo: © TMN/Spiegel.de)

Traditional costume associations exist throughout the Alpine Arc that work to preserve the traditional costume and customs. Traditional costumes and customs are also of great importance for tourism, as they are typical of the Alpine region along with the landscape and support the image of the region. This is evidenced, for example, in "Tyrolean evenings", where traditional dances and costumes are demonstrated, especially for guests. Since traditional costumes vary greatly from region to region, differing from valley to valley in the Alpine region, for example, they also contribute to the identity of the regions and the identification of the rural population.

4.9. Traditional recipes

In the course of hay farming, recipes have developed regionally that showcase the products of the farms and Alpine pastures. Under the conditions provided by the simple cooking stoves, as well as with the meager yields of their own agriculture, tasty dishes were created. Many of the formerly poor people's dishes are now part of regional food culture.

Here are some examples:

- **Melchermuas**
  A type of pancake cooked using just butter, flour and milk, which is baked in an iron pan until golden brown. Served with cranberries, this classic is especially well known and popular in Zillertal.

- **Schliachternudeln**
  Ribbon noodles served with a hearty sauce of gray cheese, Tilsiter and cream.

- **Zerggln**
  Potato patties, curd cheese and gray cheese.

- **Kässpätzle**
  … auch Käsknöpfle genannt. Weiße Spätzle aus Milch, Mehl und Eiern werden mit Käse gemischt und im Ofen überbacken.

- **Zillertaler Krapfen**
  Crepes with a filling of potatoes and cheese are baked floating in fat.

- **Millisuppn**
  Spiced milk is heated and enjoyed with rye bread cubes as a soup.

- **Käsfladen**
  Eine Art Tarte mit Germteig und einer Mischung aus Käse, Zwiebeln, Mehl und Ei gefüllt.

- **Kaspressknödel**
  The epitome of Alpine cuisine today. Flat dumplings made of bread cubes, eggs, onion and cheese, roasted until golden brown and served in soup or with salad.

- **Breznsuppe**
  With this dish, old pretzel and bread leftovers processed into pretzel pieces soaked in soup are baked with cheese and onion.

5. FEATURES OF THE LANDSCAPE

5.1. Soil

The parent material in the region is mainly alluvial and moraine material, as well as colluvial material in the foothills of the Alps. The humus content is medium humus to strong humus with predominantly finished humus as the humus form.

The soil can be classified mainly as brown earth. Occasionally, Gleysols are also found, as well as mountain black earth and Eurendsina in the mountainous regions.

5.2. Climate

The hay milk region is characterised by the Alpine climate, which features warm summers as well as radiation weather (high-pressure weather with little cloud cover) and cold-air pools in winter. Precipitation is evenly distributed throughout the year and falls as snow in winter.

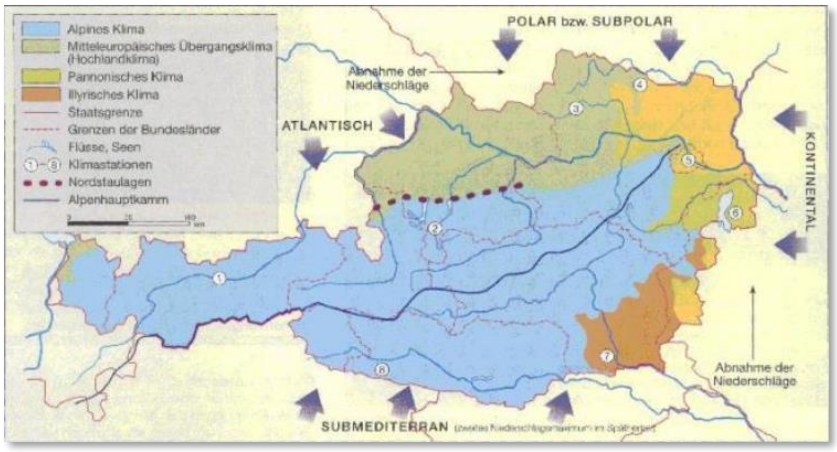


Figure 71
Climate provinces in Austria[80]

There are 4 seasons with pronounced temperature differences between summer and winter. There is sufficient precipitation and, in the summer, sufficient periods of good weather for hay farming.

Spring

January is the coldest month, while from mid-February temperatures start to rise again and become relatively mild as early as March and April. As early as April, 15 to 20°C are often reached.

Summer

Summers in Austria are mild to hot. In June, temperatures of 20 to 25°C are recorded, while in July, the hottest month, more and more tropical days are recorded at 30 to 35°C. From August, the temperatures are milder again.

[80] Source: https://www.yaclass.at/p/geografie-und-wirtschaftskunde/11-schulstufe/oesterreich-raum-gesellschaft-wirtschaft-19273/naturraeumliche-chancen-und-risiken-19089/re-23f1fdc4-b3a6-4806-9742-cd4136336650

Autumn

Autumn often turns out to be very stable, especially in mountainous regions. Until October, mild temperatures of up to 20°C are often recorded. From November, temperatures drop noticeably.

Winter

Winters are cold with temperatures below 10°C, often at or below freezing. In addition, snow often falls in winter, sometimes in large quantities.

Climate change is already making itself felt through rising temperatures and falling precipitation. In years with particularly low precipitation, such as 2018, agriculture comes under increasing pressure.

5.3. Cultural landscape

Dairy farming, which has been cultivated and developed over centuries in the Austrian Alpine arc as hay farming, has created a characteristic cultural landscape. This characterises the region and makes a decisive contribution to its success as a tourist region.

Figure 72
Haymaking keeps natural areas open and thus also contributes to the success of the region as a tourist destination.

The characteristic picture of the mountain region is characterised by more or less narrow valleys in which the settlement areas are densely populated. Around the settlement areas, in the colline stage, are the grassland areas where the dairy animals graze or the grass is harvested as fodder. Since the last ice age, these areas were often forested with deciduous forest/floodplain forest and were only gradually cleared by the (agricultural) use of the ancestors.[81]

From about 800-1000 metres above sea level, the montane stage begins, which is still forested today. Here, coniferous forest predominates, which in the region is very spruce-emphasised. The forest is extensively managed in the region and, among others, maintained by hay-milk farmers. Non-forested areas in this stage are mainly areas where avalanches or mudflows frequently occur.

[81] Bätzing, 2015; S. 41f

At an altitude of 2000 metres above sea level, the upper timberline is located and the alpine stage begins. How high the timberline is depends on the respective topography. In the Alpine arc, it is about 2000 metres and above in the inner Alps, and about 1800 metres at the edge of the Alpine arc. At this altitude, trees can no longer grow for climatic reasons. The temperatures are too cold and the vegetation period is too short, so that the seeds of the trees cannot mature. Therefore, the forest here is replaced by alpine mats. The upper tree line was successively lowered by grazing and slash-and-burn at the beginning of settlement. Alpine researcher Werner Bätzing estimates that the tree line was lowered by about 300 metres throughout the Alps.[82]

There have always been primeval meadows here, which have been used as alpine pastures since the Bronze Age[83]. These have developed into the alpine pastures that are still characteristic of the hay-milk region today. In this zone, pasture is the only possible agricultural use. Arable farming would not be possible due to the climatic conditions and the vegetation is also too sparse for hay making.

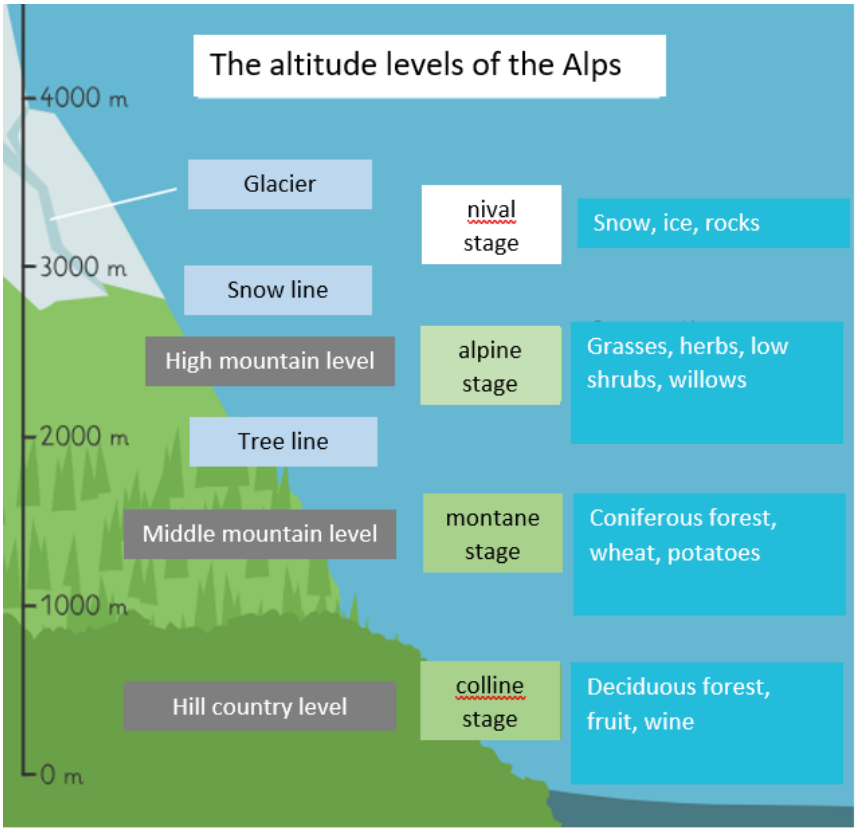


Figure 73
Altitude levels of the Alps[84]

Importance of the forest in the cultural landscape of the hay-milk region

The forest is also inextricably linked to this cultural landscape. The areas that are used for haymaking today were originally mostly forests and were cleared by the ancestors to make them suitable for agriculture. This applies both to the areas in the valley, where there were originally riparian forests, and to the areas in the alpine region.

[82] Bätzing, 2015; p. 88ff
[83] https://de.wikipedia.org/wiki/Urwiese
[84] Source: https://www.sofatutor.com/scahunterricht/videos/die-alpen#die-hoehenstufen-der-alpen

How closely the forest is linked to the way of farming becomes visible wherever areas are no longer cultivated. Within a few years, these areas become overgrown, only to revert to forest within a few decades. Haymaking keeps open precisely those areas that are too unprofitable for other farming methods (especially alpine pastures).

The forests in the region are mostly coniferous forests with a dominance of spruce, which is replaced by pine at higher altitudes. However, as spruce is not very drought-resistant, there are already efforts to bring more diversity into the forests in order to prepare them for climate change.

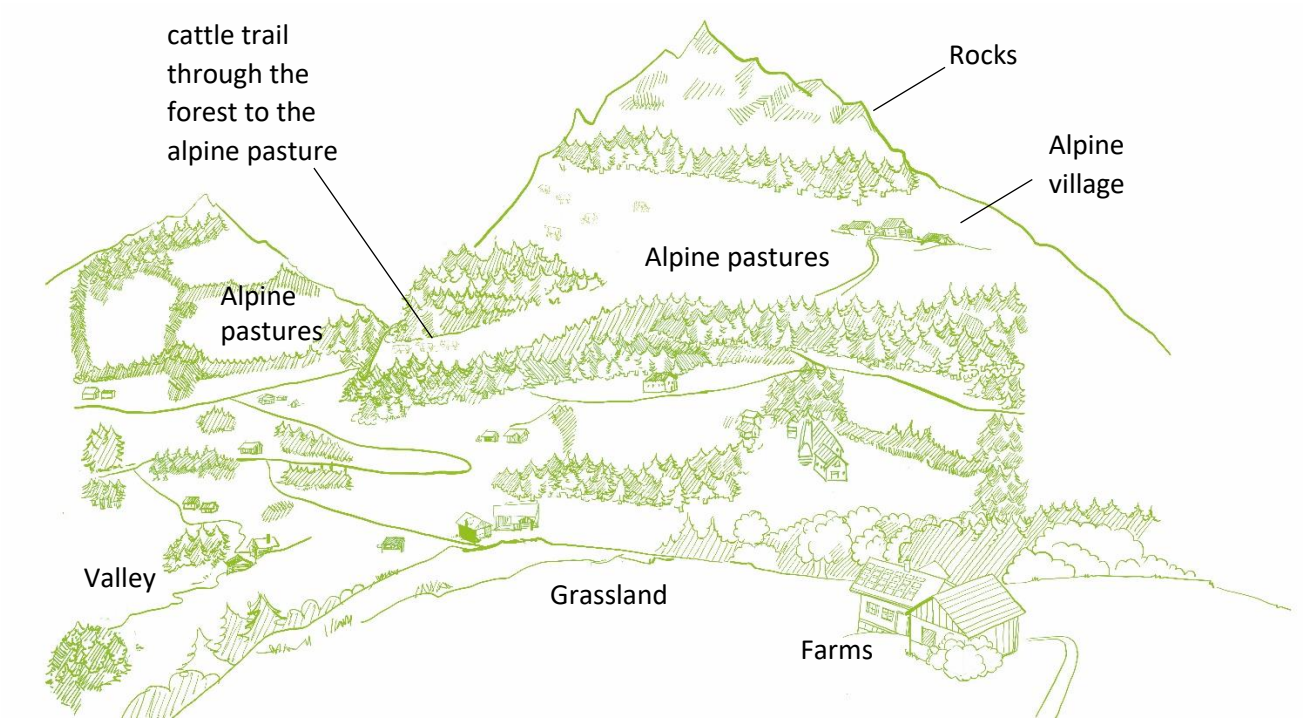


Figure 74
The forest plays an important role in the system between permanent grassland in the valley and alpine pasture at altitude.

Figure 75
Forest and permanent grassland complement each other in the region. (The photo was taken during the field visit in August 2023).

In mountain regions, the forest not only fulfils the function of carbon and water storage, but also protects against avalanches and mudslides.

The ownership of the forests in the region varies - similar to the alpine pastures. A large part of the forest is in public hands (Austrian Federal Forests, municipalities). However, a considerable part is also in private hands. This has been inherited over the centuries and is partly divided into very small parcels. Regardless of the individual ownership structure, the forest is in any case directly or indirectly linked to the way it is managed.

In the region, there is an interaction between forests and pastures, which "compete" for the same soil in some parts of the system. The landscape cannot decouple grassland, pasture and forests as they are part of the same landscape and ecosystem picture. Where grassland and pasture are abandoned, forests take their place. The overall picture is the result of a historical dialogue between humans and nature.

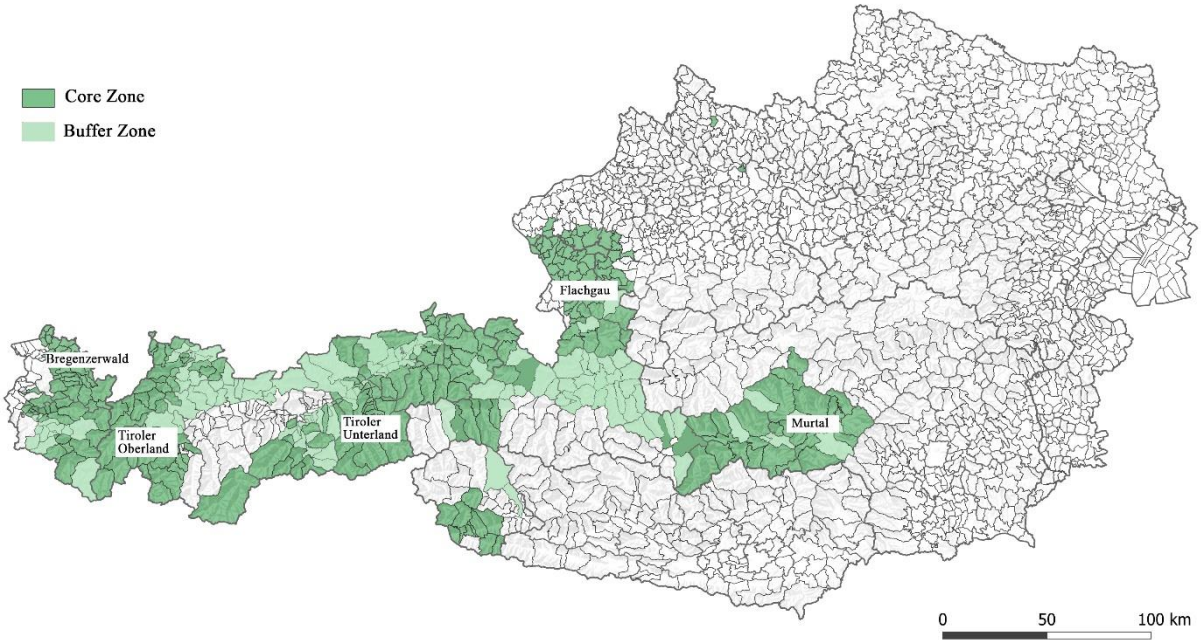
The wood harvested from the forests is often important for the hay industry and the region:

- Firewood for cheese boilers on the alpine dairies
- Wood chips for cheese dairies, hay drying plants and heating of farms.
- Wood is also an important building material for the houses, stables and barns.
- Wooden boards (mainly spruce) play a major role as shelves in the cheese maturing process[85]

Figure 76
The wood harvested in the forest has many functions in the haymaking system and in the region.

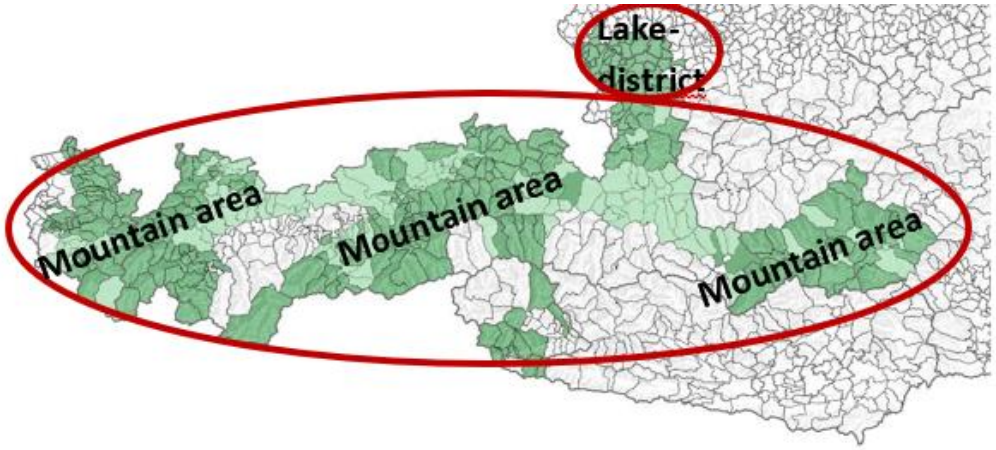
[85] see IDF Germany, Faktencheck „Verwendung von Holz bei der Käsereifung“: https://idf-germany.com/wp-content/uploads/2018/02/2016.11_IDF-Faktencheck-Verwendung-von-Holz-in-der-K%C3%A4sereifung.pdf

5.4. Overview of the region



The core areas are distinct hay-milk areas. In the buffer zones, hay farming is also practised, but there is also silage farming. It is not possible to quantify exactly how high the shares are in each case.

The region is characterised by mountainous, alpine landscapes in the west and east and by the Alpine foothills in the north (Flachgau), where rolling hills and lakes dominate the landscape.



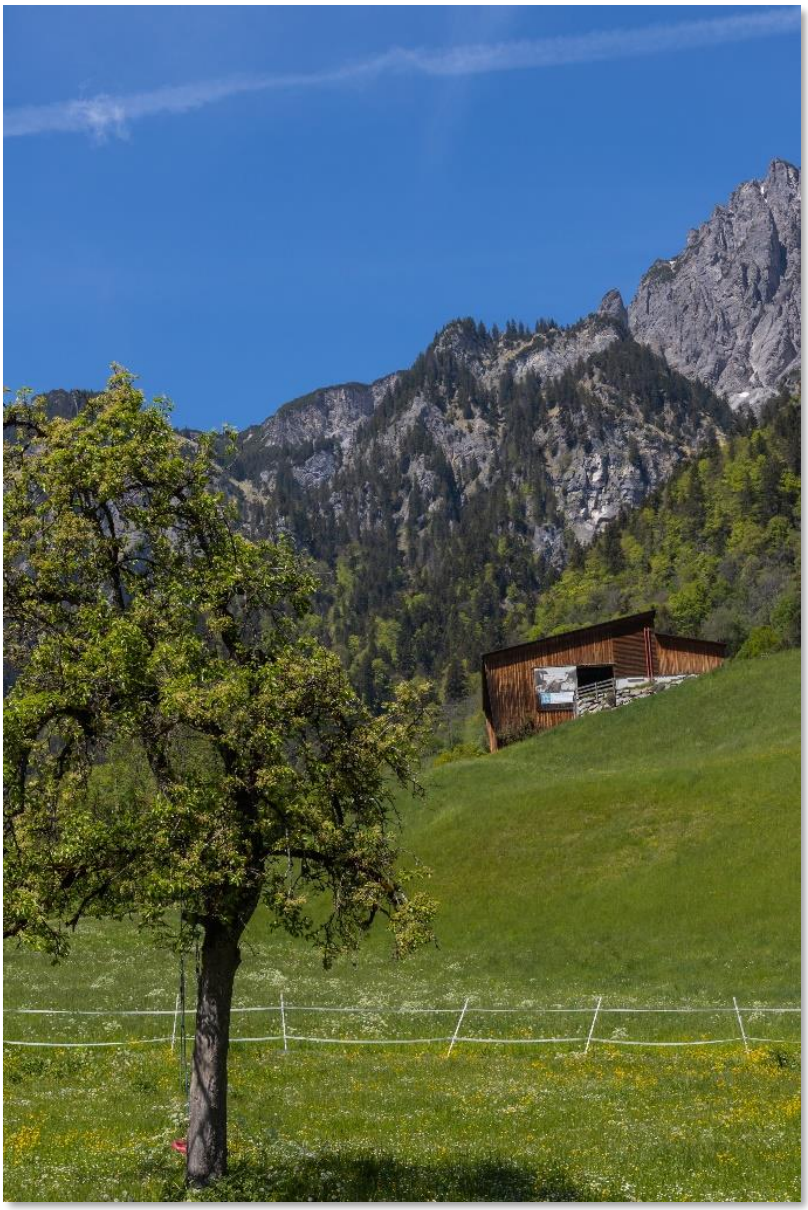
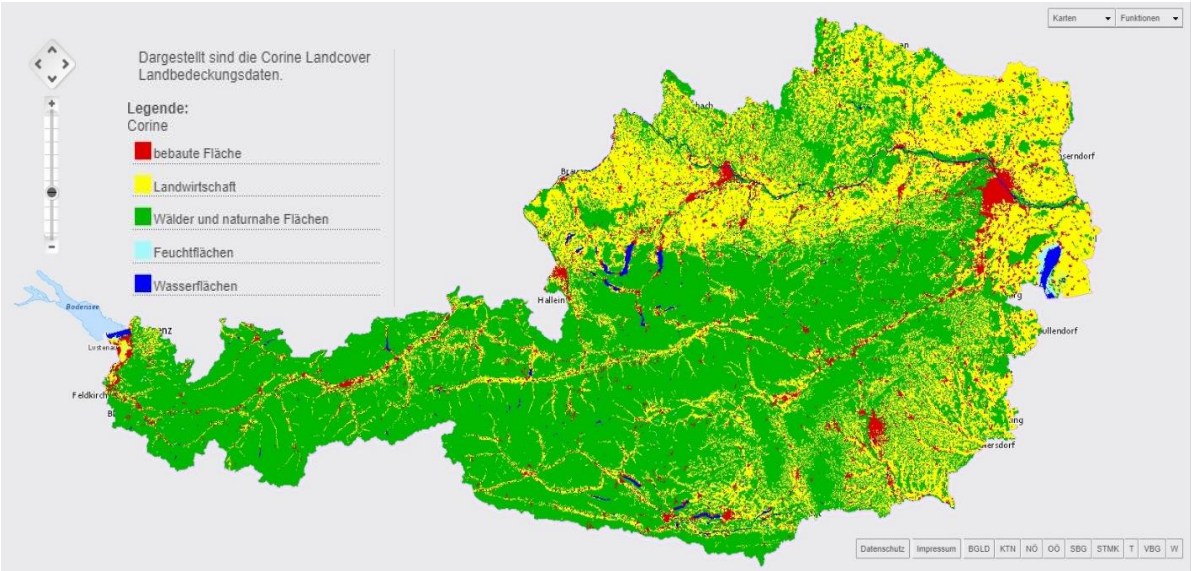


Figure 77
In the mountain areas, the flat areas in the valley locations are limited.

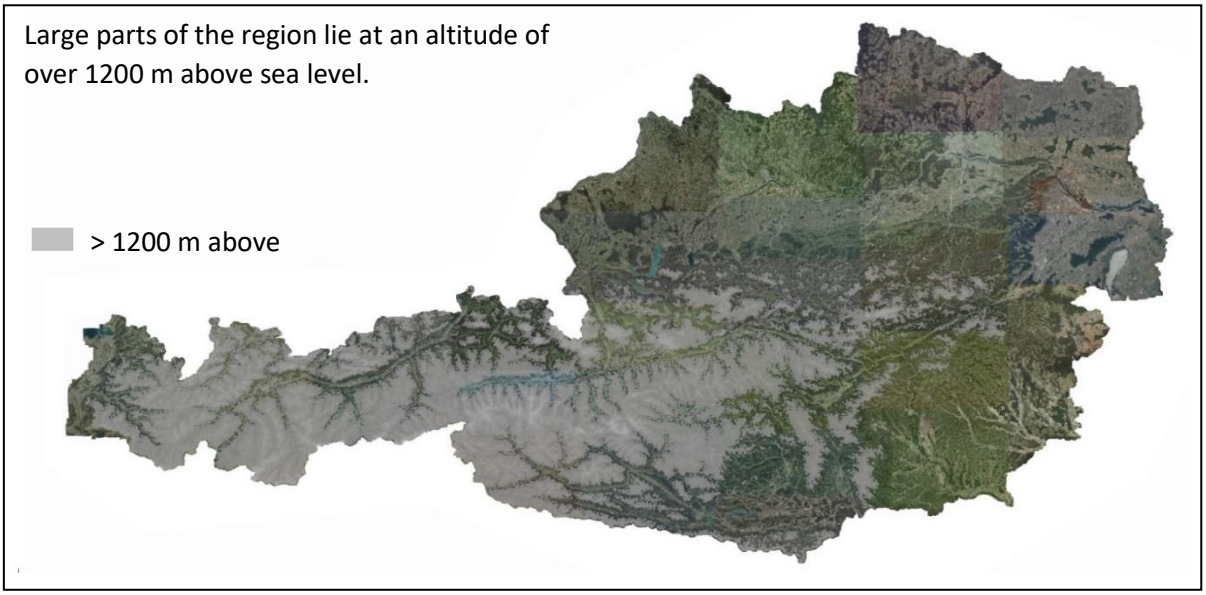
Figure 78
Therefore, some of the animals are sent to the alpine pastures in the summer.

Figure 79
In the favourable locations in the lake district, gentle hills and lakes dominate the landscape.

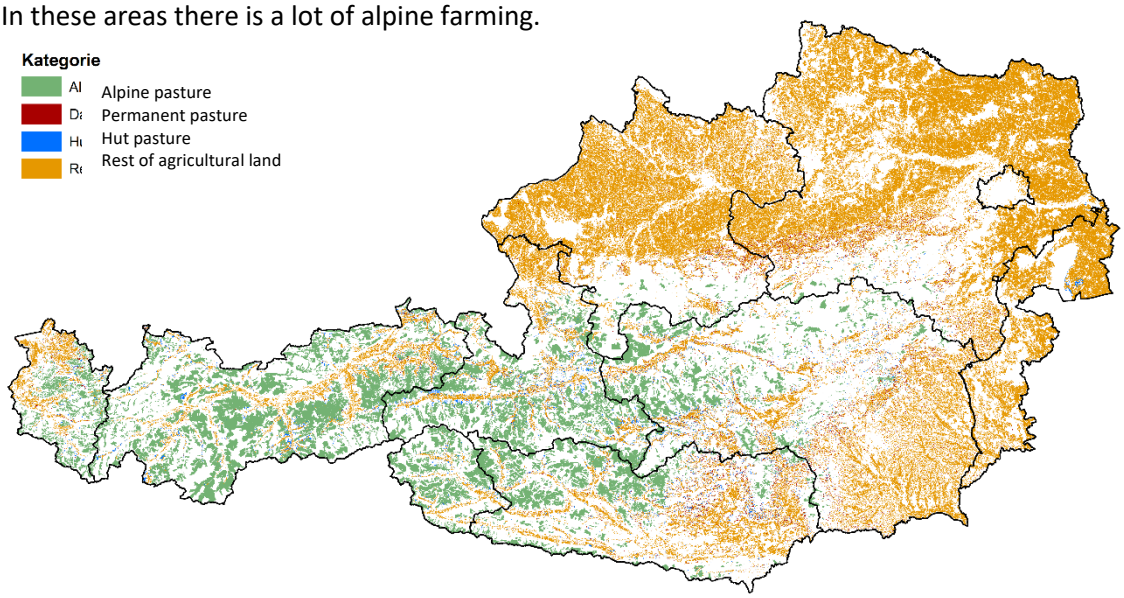
In the mountain areas, the land that can be used for agriculture is severely limited.



Large parts of the region lie at an altitude of over 1200 m above sea level.

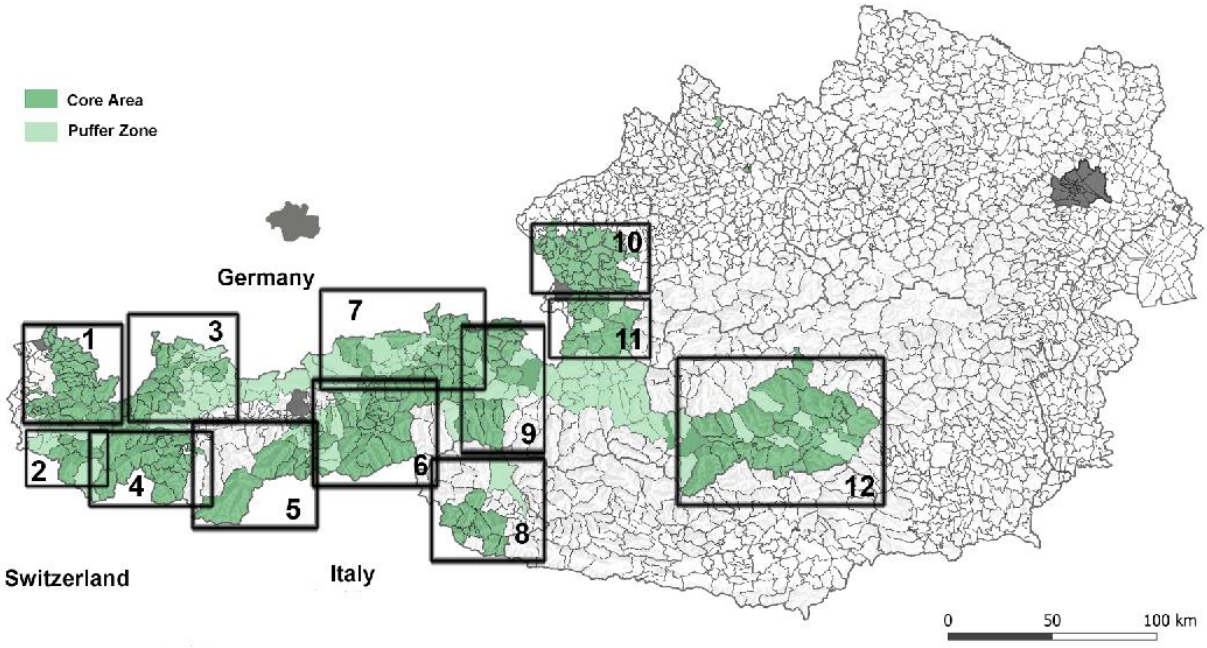


In these areas there is a lot of alpine farming.



The individual hay-milk areas

The proposed GIAHS region is spread over various valleys in the Austrian Alpine arc as well as the lake area in Salzburg's Flachgau region. In order to better represent the valleys, they were divided into individual detailed maps.



1 Bregenzerwald / Großes and Kleines Walsertal
2 Montafon
3 Außerfern
4 Tiroler Oberland
5 Wipptal and Stubaital
6 Zillertal – Gerlos
7 Kitzbühel Alps – Kaisergebirge
8 Osttirol
9 Western Pinzgau and Loferer Steinberge
10 Flachgau and Mondseeland
11 Tennengau
12 Murau and Murtal

Basic information about the maps

The detailed maps below are taken from the Corine Landcover Map of the Federal Ministry of Agriculture, Forestry, Regions and Water Management. These land use maps of the region show not only the areas directly connected with haymaking but also those areas that are only indirectly (forest, mountain railways) or not at all (industry and commerce) connected with haymaking. These land use maps show not only the areas directly connected with haymaking but also those areas that are only indirectly (forest, mountain railways) or not at all (industry and commerce) connected with haymaking.

■ Settlement areas (excluded)

Settlement areas are more or less densely built-up areas and are mostly located in the valleys. They are to be excluded from the region.

■ Leisure facilities (excluded)

The recreational facilities are mountain railroads and their associated areas, which serve as ski resorts in winter and are lifts for hikers and recreationists in summer. These are indirectly linked to the haymaking industry, as they live off the cultural landscape that produced them. In part, the ski slopes are also used as pastures in summer, which ensures the existence of the areas and protects the emergence of so-called Blaiken (see Chapter IV. 2).

■ Industrial, commercial und traffic areas (excluded)

Of course, there are industrial, commercial, and transportation sites in the region. These are to be excluded from the GIAHS region unless they are the processing operations of the hay industry.

■ Heterogeneous agricultural land (natural vegetation)

The small proportion of heterogeneous agricultural land is indirectly related to hay farming. It is mostly natural vegetation on areas that cannot be farmed, such as reed beds around lakes.

■ Grassland

Grassland is the core of haymaking. Here grass is harvested in summer and hay is prepared, which serves as fodder in winter, or from spring to autumn the grassland is also grazed. These areas also give the region its typical appearance.

■ Farmland

The mountainous regions of the hay-milk region are not suitable for arable land, which is why there is no arable land in the region, with very few exceptions. Only in Flachgau is there a little arable land, but this belongs to the region because hay-milk farmers grow field fodder here.

Forest

The forest in the region is directly linked to haymaking. The areas that are used for haymaking today were originally mostly forests and were cleared by the ancestors to make them suitable for agriculture. This applies both to the areas in the valley, where there were originally riparian forests, and to the areas in the alpine region.

How closely the forest is linked to the way it is farmed becomes visible wherever areas are no longer farmed. Within a few years, these areas become overgrown, only to become forest again within a few decades. Haymaking keeps open precisely those areas that are too unprofitable for other farming methods (especially alpine pastures).

The forests in the region are mostly coniferous forests with a dominance of spruce, which is replaced by pine at higher altitudes. However, as spruce is not very drought-resistant, there are already efforts to bring more diversity into the forests in order to prepare them for climate change.

In mountain regions, the forest not only fulfils the function of a carbon and water reservoir, but also protects against avalanches and mudslides.

For more information on the functions of the forest, but also on ownership, see chapter "Importance of the forest in the cultural landscape of the hay-milk region".

Alpine mats - alpine pasture

The natural grassland or the alpine meadows belong as alpine pastures quite integrally to haymaking. These areas can only be made usable by means of alpine pasture management. The ownership conditions are different. In addition to private alpine pastures, they can also be owned by municipalities or agricultural communities. (see section on alpine pasture management and grazing in the answers to the SAG meeting).

1 Bregenzerwald / Großes und Kleines Walsertal

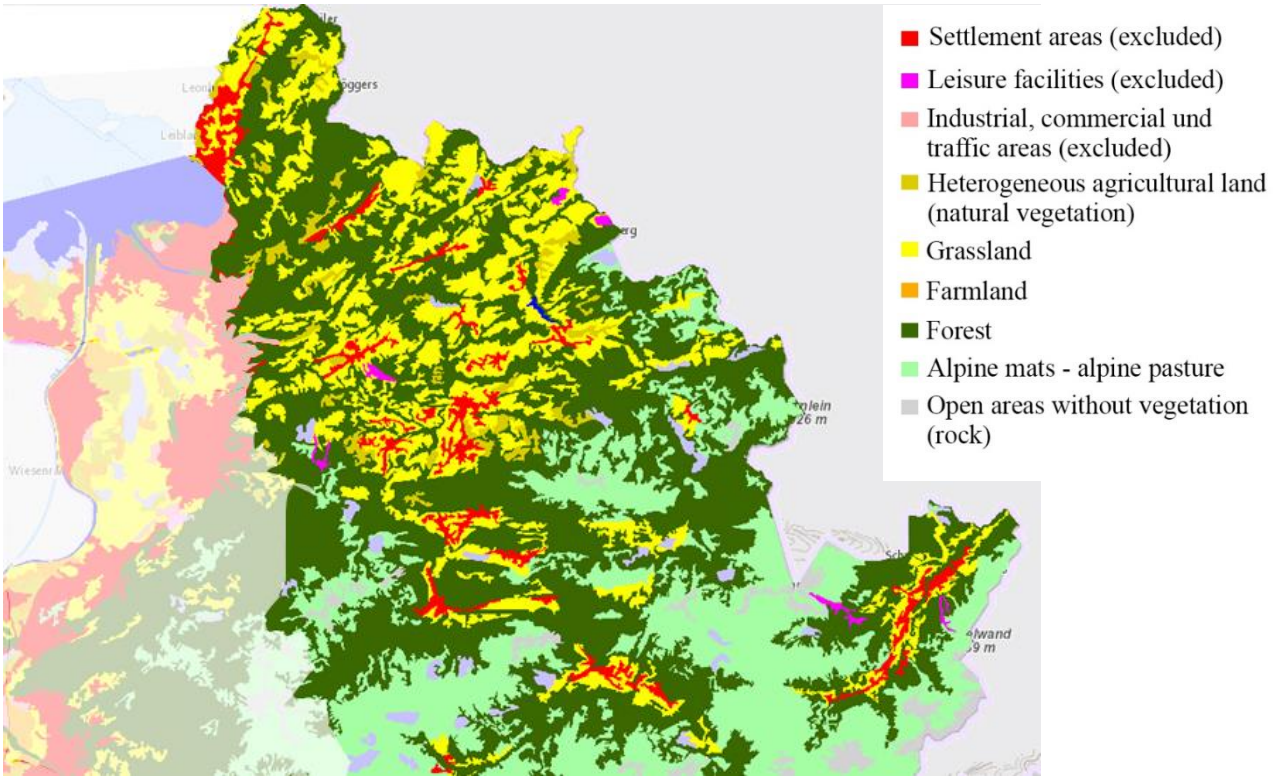


Figure 80
Bregenzerwald

Starting in the far west of Austria, the Bregenzerwald and the Great and Small Walser Valleys offer a typical alpine landscape with mountains up to 2100 metres high. The villages in the valleys are densely populated. Around the settlements there is natural vegetation in addition to permanent grassland.

Three-stage farming is practised here (see Chapter IV. 4.6). In spring, the pastured cattle are driven up to the forelocks and in summer to the high alpine pastures. In autumn they return to the valley in stages. Between the steps of the alpine pastures lies the forest, which gives the region its name and is inseparably linked to haymaking.

Besides haymaking, tourism is a main source of income in the Bregenzerwald. This is directly linked to the landscape that was created by hay farming. In addition, there is also a lively craft culture as well as its own architectural scene, which works primarily with the material wood, which is available in abundance in the region. The traditional building style is interpreted in a modern way and gives the region its own character. In this way, the landscape is used sustainably - the meadows and pastures for haymaking and the forest for crafts and construction.

Excluded are those areas that are designated as "artificially created areas not used for agriculture". These are ski areas that belong to tourism and are therefore only indirectly linked to haymaking.

Neighboring

In the west, the Bregenzerwald borders on the Rhine Valley. This is a settlement area that is one of the most densely populated in Europe. The provincial capital Bregenz gives the Bregenzerwald its name, but it does not belong to it and lies here in the Rhine Valley.

The Klostertal borders on the south. Here the conditions for agriculture are similar, but silo farming is also practised here, which is why this valley does not belong to the region.

2 Montafon

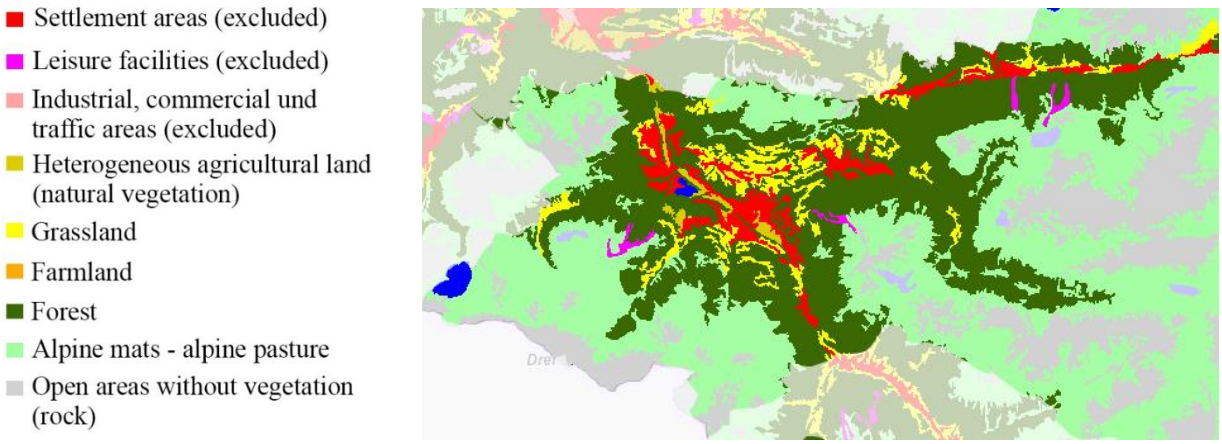


Figure 81
Montafon

In the south of the province of Vorarlberg lies the Montafon, which is also a classic hay-milk region. Here the mountains are higher than in the Bregenzerwald with up to 3,300 metres. The landscape is similar to the Bregenzerwald and equally characterised by dense settlement areas in the valley basins surrounded by permanent grassland (yellow), which is replaced by forest and finally extensive alpine pastures at higher altitudes.

In addition to the settlement areas (red), the mountain railways (pink) are also excluded here.

Neighbouring

To the north, the Montafon borders on the Klostertal, which is a mixed area between hay and silage farming. To the east, Montafon borders on the hay-milk areas of Stanzertal and Paznaun, which belong to the province of Tyrol. In the south, the Montafon borders on Switzerland.

3 Außerfern

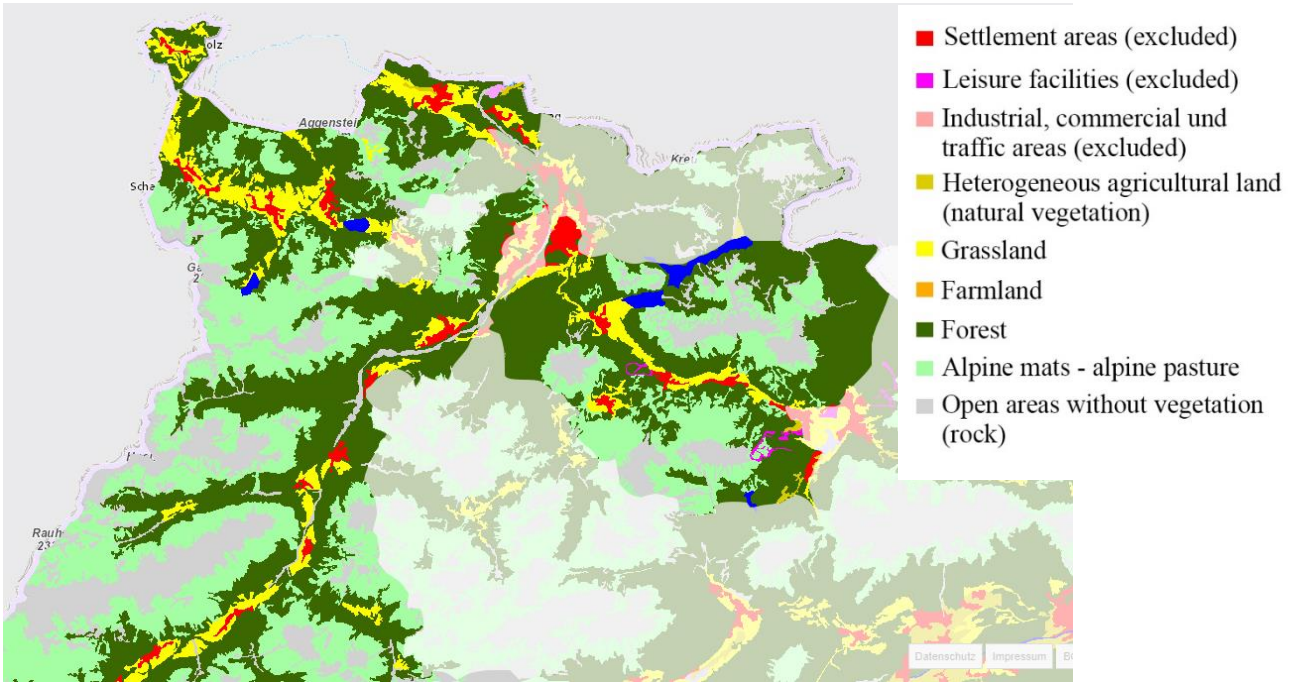


Figure 82
Außerfern

The Außerfern with Tannheim Valley and Lech Valley is dominated by high mountains with an altitude of up to 3000 metres. Reutte, the largest town in the Außerfern, is characterised by a leading industrial enterprise (Plansee) and is not part of the hay-milk region.

The hay-milk region includes the valleys of Tannheim valley and Lech valley, which have a distinct hay-milk characteristic. The valley called Zwischentoren to the south-east of Reutte also belongs to the region, even though tourism plays an even greater role here than in the other two valleys, as Zwischentoren has always been and still is an important travel route from the Allgäu in Germany to the Inn valley. All three valleys have densely populated villages on the valley floor, with permanent grassland of hay-milk farmers on their edges.

The Lech valley is home to one of the last riparian forests in the region, as they were found on almost all rivers until the Bronze Age. Today, this is a protected area, but it still belongs to the region, as haymaking and even forest grazing are practised here as well.

At higher altitudes, as in other valleys, coniferous forests can be found in the Außerfern, which are replaced higher up by alpine pastures before cultivation is no longer possible in the nival stage.

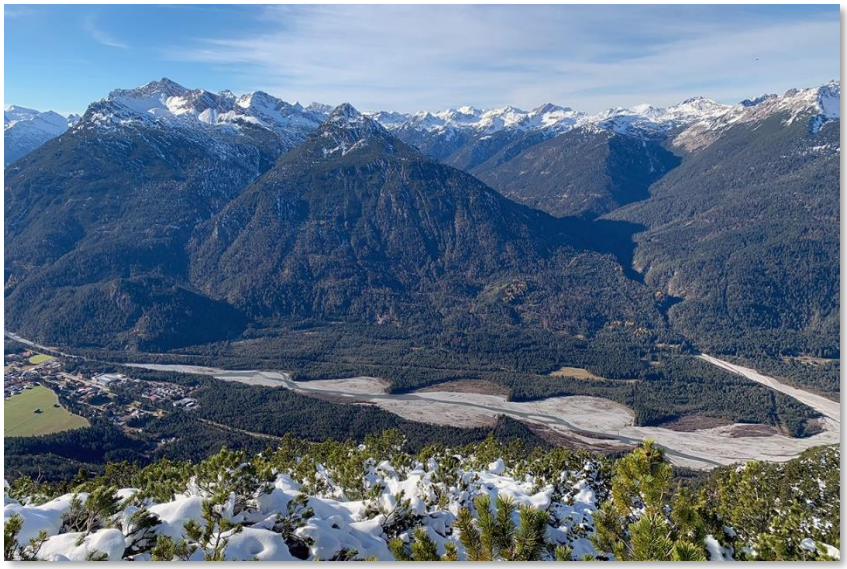


Figure 83
One of the last natural rivers is the Tyrolean Lech with the Lechauen. © Naturpark Tiroler Lech

Neighbouring

In the north, the Außerfern borders on Germany and in the south it is separated from the Inn Valley by the Lechtal Alps and the Mieminger Mountains. On the Mieminger Plateau bordering to the south, silage farming is practised in addition to haymaking, which is why this does not count as part of the region.

4 Tyrolean Oberland

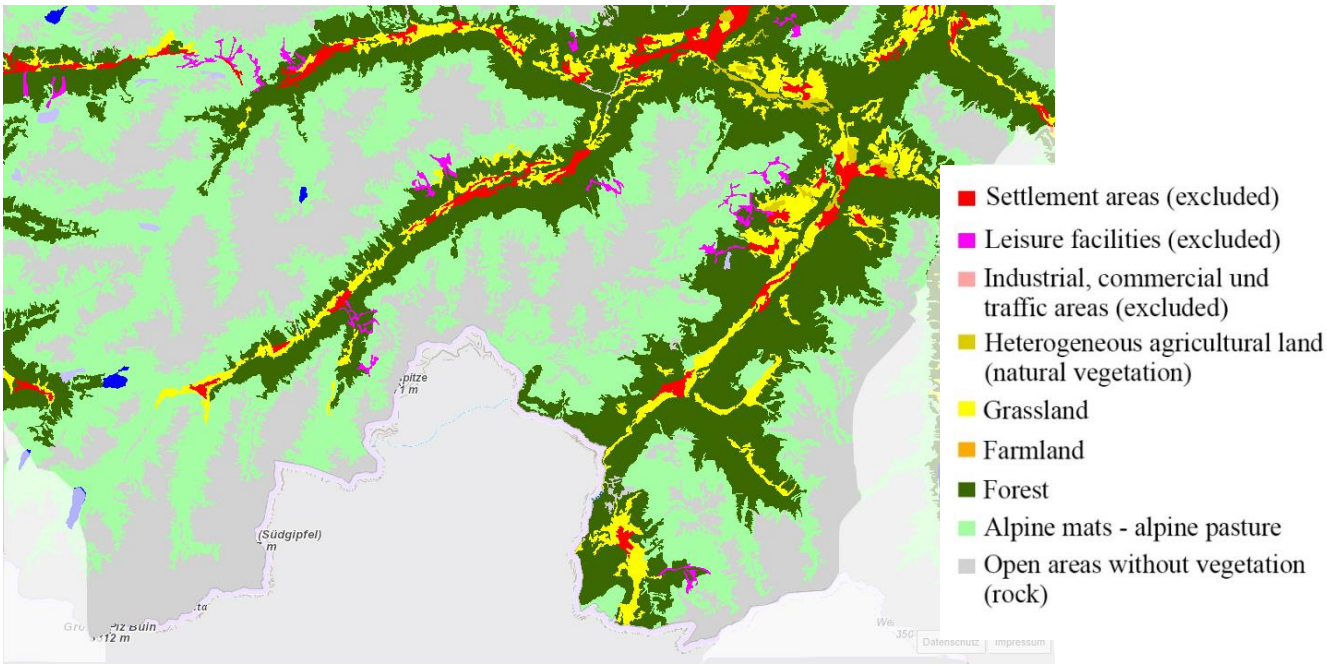


Figure 84
Tyrolean Oberland

The Tyrolean Oberland is characterised by narrow valleys - from west to east Stanzertal, Paznaun and Oberinntal - and high mountain peaks. The highest mountain is the Wildspitze at the head of the Pitztal

valley at 3770 metres. Outside the villages, which - like everywhere else in the region - are located on the valley floor, the valleys are characterised by narrow strips of grassland surrounded by forest. Above the forest line there are alpine pastures.

The valleys of the Tyrolean Oberland are also home to mountain railways, which must be excluded. These recreational facilities belong to the tourism industry. Although the economic sector is closely linked to haymaking and especially to alpine pasture management (see Chapter IV. 5.3), it is only indirectly related to it.

Neighbouring

In the south, the Tiroler Oberland borders on Switzerland and Italy, in the north on the Außerfern and in the west on the Montafon. The next valley to the east is the Ötztal, which is intensively farmed and therefore does not belong to the region.

5 Wipptal and Stubaital

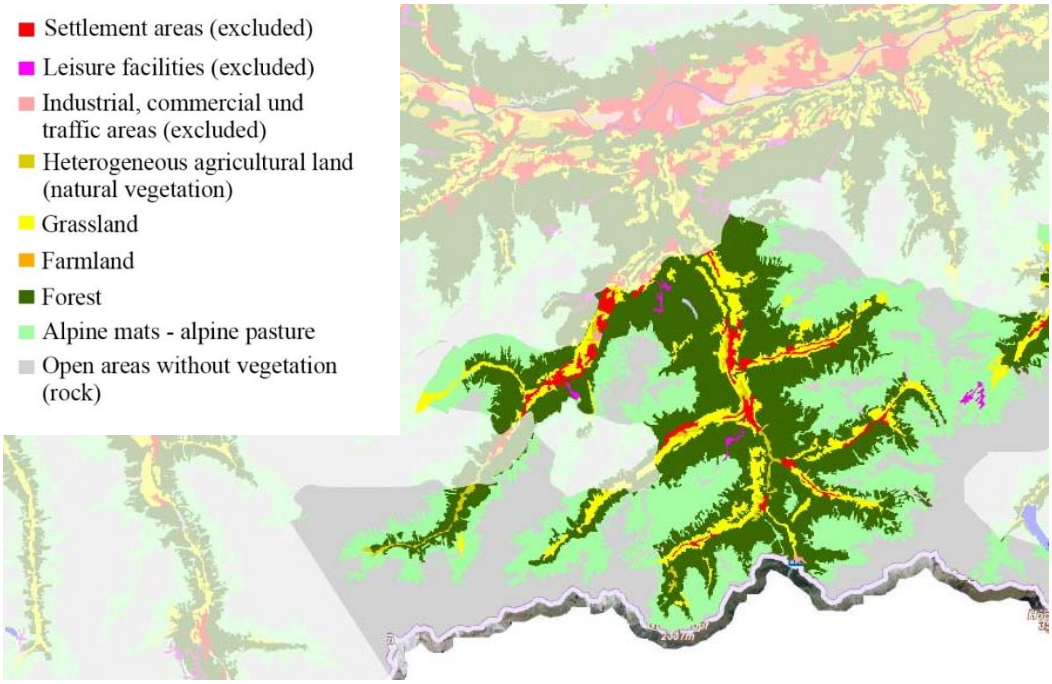


Figure 85
Wipptal with side valleys - the Stubaital is the north-western side valley

The Wipptal is one of the main traffic arteries through Tyrol, connecting north (Germany) and south (Italy). The Brenner motorway runs through the valley, which is of course excluded from the GIAHS region. In addition to this - and in part also below it - the Wipptal is also characterised by the grassland areas of hay farming, which are located around the settlement areas of the densely populated municipalities. At the higher altitudes above this, there is also forest here, which is a spruce-dominated coniferous forest. Above the forests, pasture and alpine pastures are also found here, as in the entire mountain area.

The side valleys of the Wipptal are for the most part quite narrow and only populated with small villages that are strongly characterised by agriculture and forestry. An exception to this is the Stubaital, which branches off from the Wipptal in the northwest and was developed for tourism early on. It has a dense infrastructure of leisure facilities (mountain railways, pink), which are of course excluded from the GIAHS region. The mountain railways (pink) in the Wipptal are also excluded from the region.

Neighbouring

In the north of the Wipptal valley, the middle Inntal valley extends in an east-west direction with the conurbation around the provincial capital Innsbruck. This area is not part of the hay-milk region, as the settlement area is extensive and the surrounding agricultural land is intensively farmed, partly also with arable farming.

The northern part of the Ötztal is farmed by a mixture of hay and silage farming, as already mentioned, and therefore does not belong to the region.

In the south, both valleys border on Italy.

6 Zillertal - Gerlos

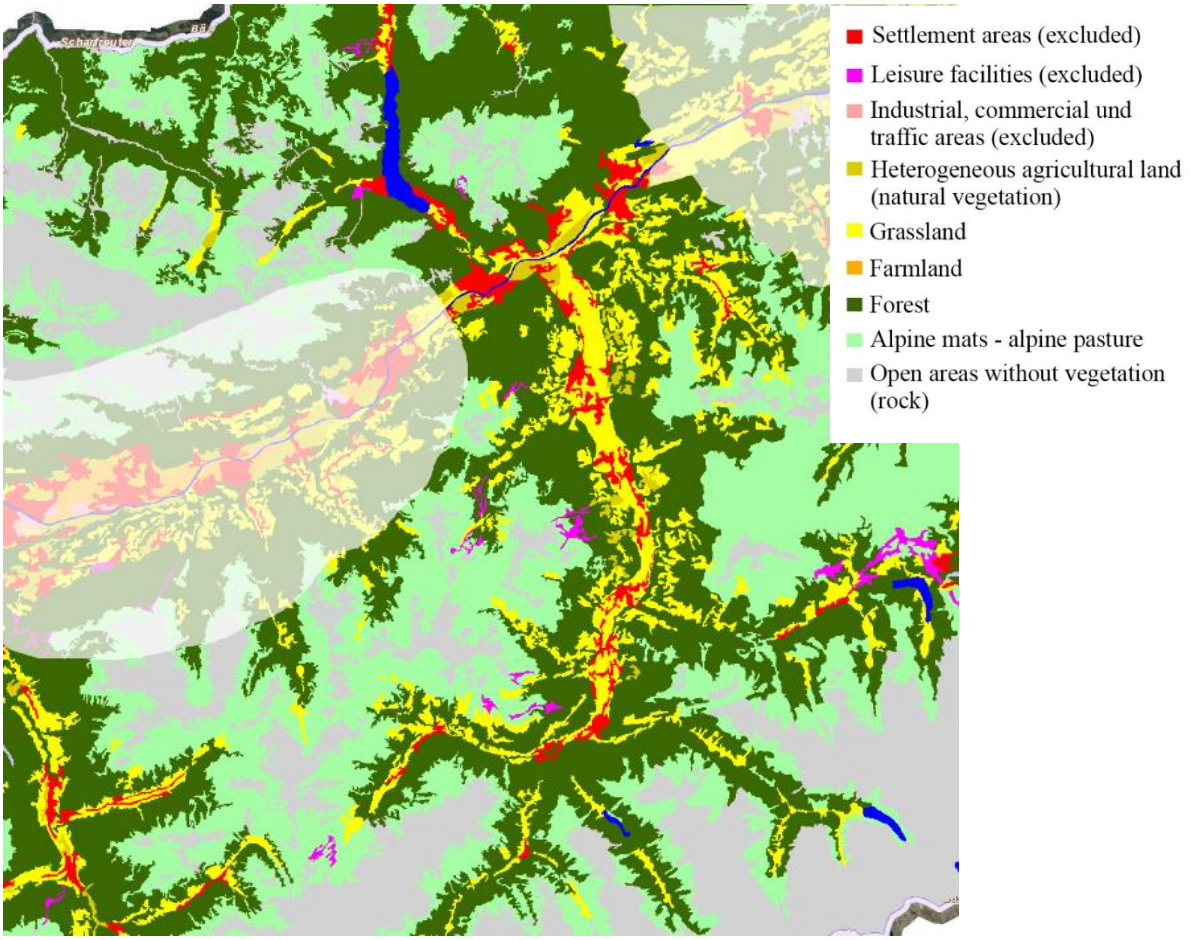


Figure 86
Zillertal - Gerlos

Like the other Alpine valleys in Tyrol, the Zillertal is also characterised by a mixture of tourism and hay farming. The landscape, which has been created by hay farming over centuries, has laid the foundation for the valley's tourism success and still ensures that guests feel comfortable in summer and winter.

The Zillertal's mountain railways are an expression of the valley's tourism success and are just as much an exclusion from the GIAHS region as the Stillup and Zillergrund reservoirs (dark blue) at the ends of the valley.

In the Zillertal, the villages (red) on the valley floor are strung together like pearls on a necklace. They are surrounded by permanent grassland, which is cultivated by hay-milk farmers. At higher altitudes, the forest follows and above it the alpine pastures.

To the west of the Zillertal, south of the Inntal, there are some alpine pastures.

In the north of the Zillertal, the hay-milk region crosses the Inntal at Jenbach, which runs in an east-west direction. North of Jenbach, a high plateau extends eastwards and the valley "Eng" in the west of the Achensee. Here there are some alpine pastures in the alpine level.

Neighbouring

The area is bordered in the south by the Zillertal Alps, which with 72 three-thousand-metre peaks close off the valley to Italy.

In the north-east and north-west, the Inn Valley is a zone that does not belong to the region. The Inn Valley is densely populated and an important traffic artery. Agriculture is very intensive in this zone, mostly arable farming, but also silage farming.

To the east and west of the Zillertal are other hay-milk areas in the Wipptal and Brixental valleys (see separate detailed maps).

7 Kitzbühel Alps – Kaisergebirge

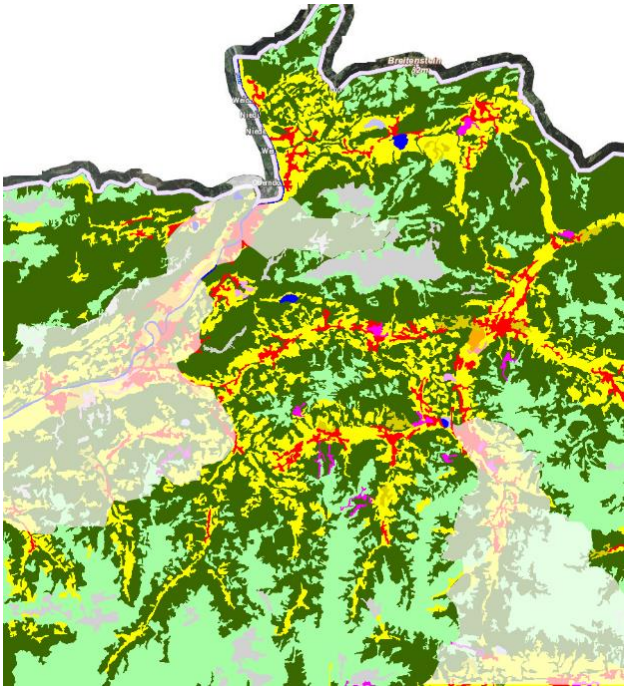


Figure 87
Kitzbühel Alps and Kaisergebirge

Around the Kaisergebirge (Wilder and Zahmer Kaiser), the Brixental and the Leoganger Steinberge is a classic hay-milk region. This region is also characterised by agriculture on the one hand and tourism on the other. Tourism has been able to develop particularly successfully here because not only the appealing cultural landscape characterised by hay farming attracts guests, but also the proximity to Germany and especially to the metropolitan region of Munich make the destination attractive. The density of mountain railways (pink) is due to this focus on tourism.

The villages also crowd the valley here and are to be excluded from the region as mixed-use settlement areas. They are surrounded by permanent grassland, which is replaced by a narrow strip of forest to finally change back to alpine pastures at higher altitudes.

Neighbouring

The Inn Valley borders the region in the west. The Inntal conurbation is not only particularly densely populated, but also a main European traffic artery for transit between Germany and Italy. Agriculture is intensively practised here, especially arable farming and dairy farming with silo farming.

8 Osttirol

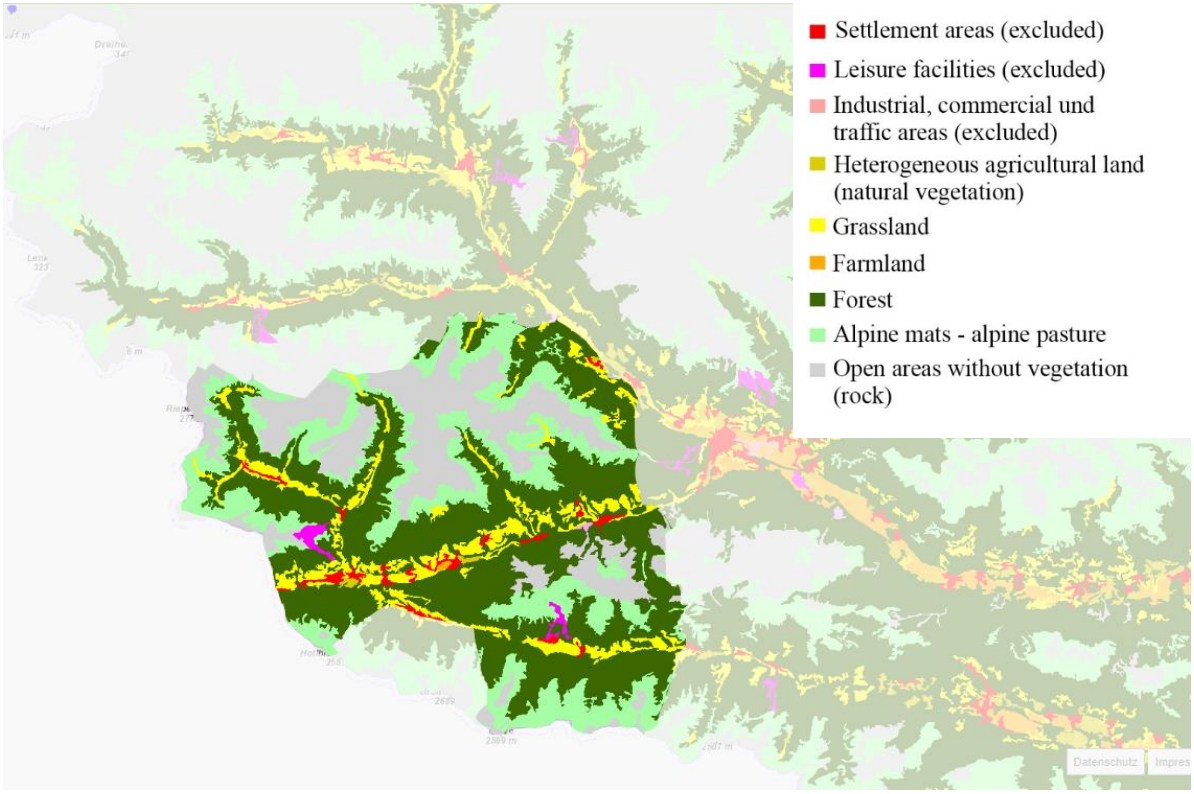


Figure 88
Osttirol

Hay farming has always been practised in the Pustertal valley in Osttirol. The comparatively wide valley is characterised by the permanent grassland areas of hay farming and the overlying forests and alpine pastures. The heterogeneous agricultural areas in this area are agroforestry areas and are not directly connected to hay farming.

Recreational areas (mountain railways/ski areas) are also to be excluded from the GIAHS region.

Neighbouring

In the west, the region borders on Italy, where dairy farming with hay is practised, but not according to the hay-milk regulation on which the region is based.

In the valleys to the north and east of the area, arable farming (especially in the Lienz basin) and silage farming are also practised. These valleys are therefore not to be counted as part of the region.

9 Western Pinzgau and Loferer Steinberge

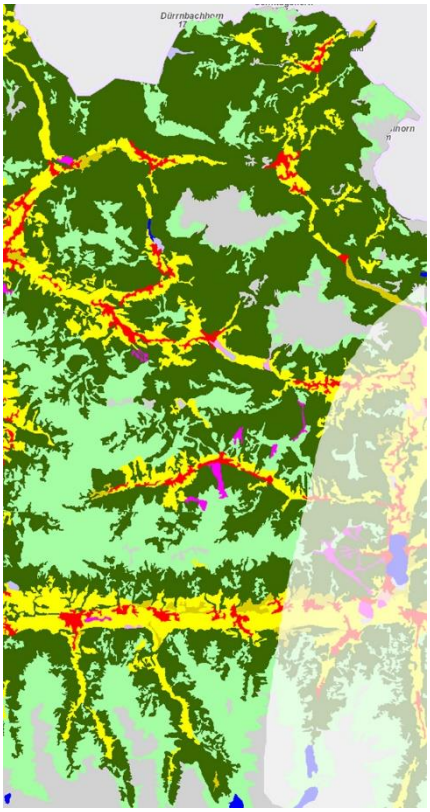


Figure 89
Western Pinzgau and Loferer Steinberge

The western Pinzgau is also characterised by mountains and valleys, whereby the settlement areas - as shown on the map - are located in the main valley. Here, too, the permanent grassland is fringed by forests. At higher altitudes there are alpine pastures until finally the vegetation ceases altogether.

To the south are the mountain groups of the Großglockner and the Großvenediger - Austria's highest and fifth highest mountains respectively. The landscape is correspondingly rugged and devoid of vegetation.

Neighbouring

The area to the east is mixed silage and hay milk and is therefore not part of the GIAHS region.

10 Flachgau and Mondseeland

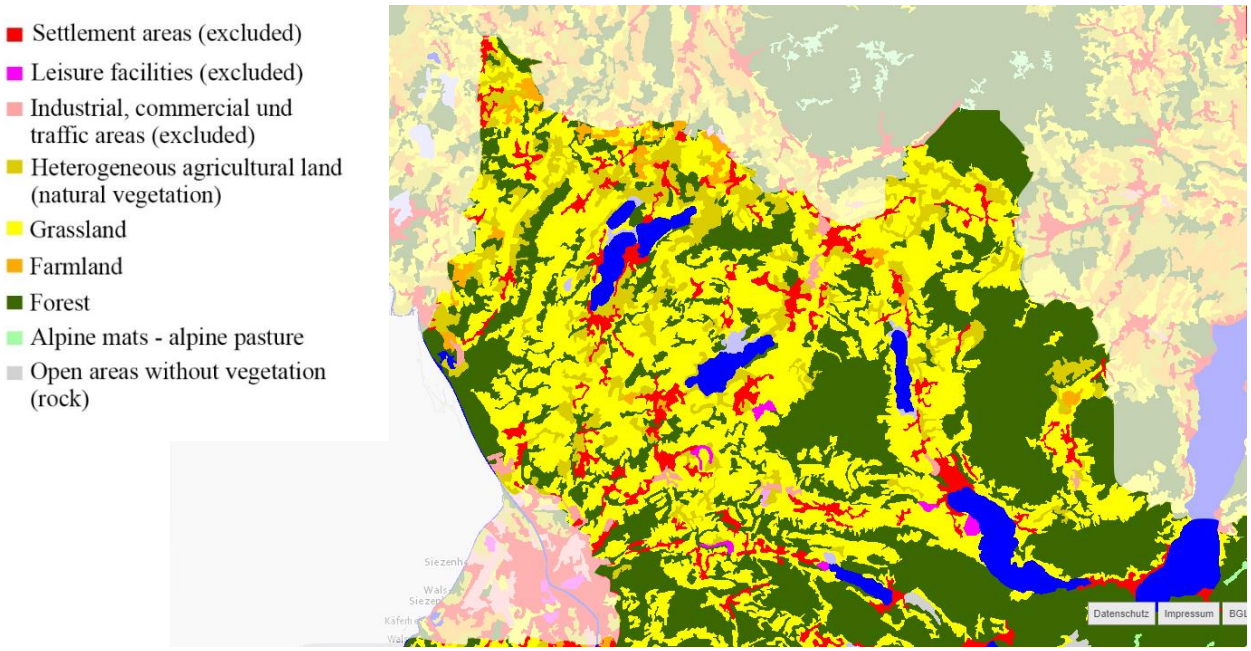


Figure 90
Flachgau and Mondseeland

The Salzburg region Flachgau and the neighboring Mondseeland are an exception among the hay-milk regions. This is the only region not characterised by high mountains, but by gentle hills. For this reason, there are no alpine mats here, but the meadows and pastures in the favourable areas are much more extensive than in other regions. Hay farming has been preserved in this favourable location because the cheese tradition of this region (Emmentaler) was dependent on a high-quality raw material until the 1990s and therefore set up silage restricted areas where no silage could be produced.

The areas designated as heterogeneous agricultural land consist of natural vegetation (bogs, reed belts) in the area of the lakes. They are to be excluded, as are the lakes that give the region its character. In the peripheral areas of the lowlands there are also fields where hay-milk farmers grow field fodder (fodder clover, lucerne).

Neighbouring

In the southwest is the provincial capital of Salzburg, which is not part of the region. To the west, north and east, the region merges into an arable farming region, which is no longer part of the hay-milk region.

To the northeast begins the Kobernaußerwald, one of the largest forest areas in Central Europe. However, this differs from the forests in the hay-milk region due to the topography and is no longer part of the region.

11 Tennengau

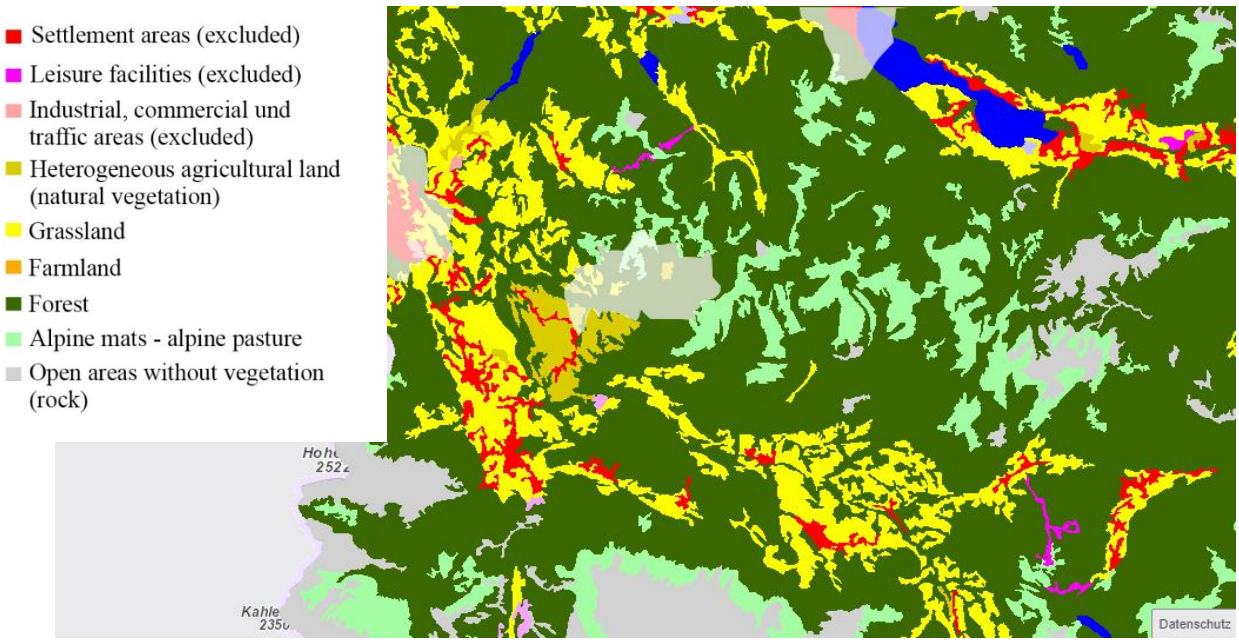


Figure 91
Tennengau

The Tennengau is a mountain region with a pronounced hay economy. In the more favourable valley locations are the settlement areas (to be excluded) and the grassland areas. Above this, as in other regions, are the forests and, to a lesser extent, the alpine pastures.

In the centre of the area is a larger area of grassland interspersed with forest islands and rows of bushes. This also belongs to the region.

Neighbouring

In the north-east, the area borders on the conurbation around the provincial capital of Salzburg, which already begins at Hallein. This does not belong to the region.

12 Murau and Murtal

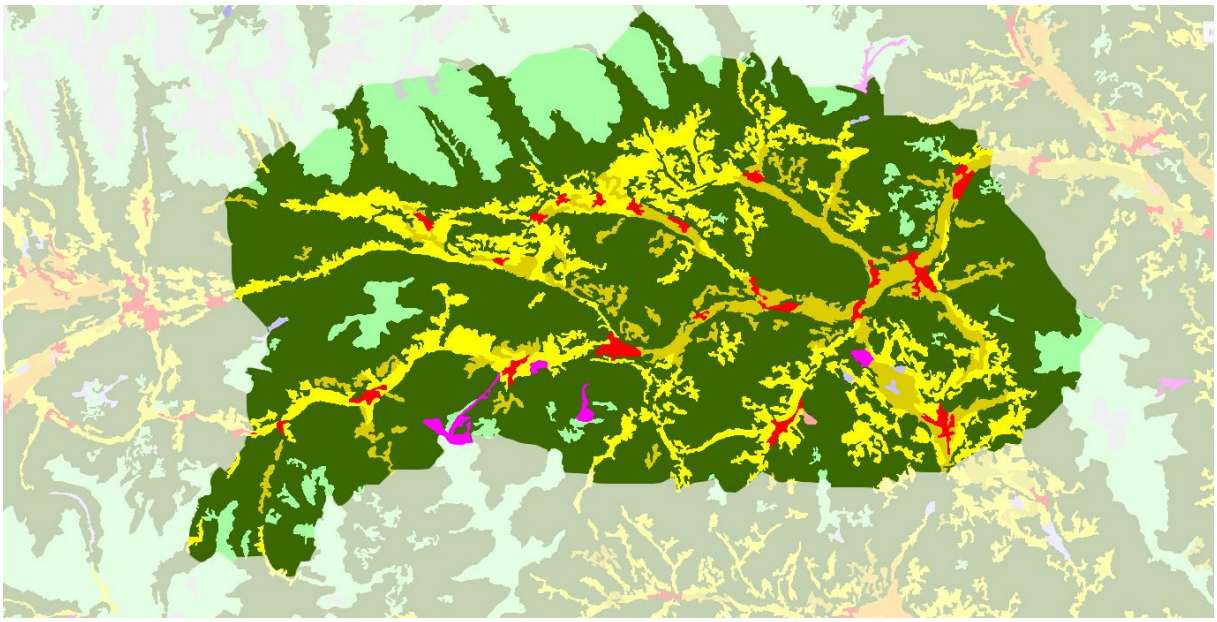


Figure 92
Murau and Murtal

The Murau - Murtal region in the province of Styria is also located in the mountainous area - the farms and permanent grassland lie between approx. 700 and 1400 metres above sea level and the area is relatively sparsely populated. Accordingly, hay farming is practised extensively here. Typical for Styria is a high proportion of forest, which can be attributed to the region. The structure of the region is comparable to other mountain regions of hay farming with settlement areas in the valley (to be excluded) surrounded by permanent grassland. The alpine pastures are located in the higher altitudes. Narrow valleys are found especially in the west of the area, comparable to the valleys in Tyrol and Vorarlberg with a very small-scale farm structure. Exceptions are, as in other areas, the mountain railways (pink), which are clearly visible as recreational facilities.

The heterogeneous agricultural areas (ochre) are located in the favourable locations of the area and are mixed with permanent grassland and arable land, with fodder and cereals being grown on the arable land by the hay-milk farmers.

Neighbouring

In the west, the area borders on the Salzburg Lungau, which is located in the mountains, but where the share of silo farming is higher. To the north follows the Enns Valley, which is wider and therefore also more intensively farmed with silage.

In the south and east, foothills of the Alps border the area. Here, arable land is already replacing permanent grassland.

5.5. Alpine areas and lakeland region

The western and southern part of the hay milk region is characterised by its Alpine location. Here, the flat areas on the valley floor are severely limited and were also only suitable for arable farming to a limited extent in the olden days, as the soil near the river was often marshy and regularly flooded.

The population therefore settled at higher altitudes early on, where they were protected from flooding. Farms in Alpine locations at 1,000 metres above sea level are not uncommon here; in individual cases farmers have also settled at up to 1,800 metres above sea level and higher[86]. Cattle and dairy farming are also possible in these Alpine locations.

Especially in these exposed locations, hay farming is a guarantee that cultivated areas are kept open and do not become overgrown. It also protects against erosion. The open meadows and Alpine pastures also benefit tourism, which is the most important economic sector in the Alpine regions today.[87]

Outside the main ridge of the Alps, hay farming has been able to survive, especially in the Flachgau region (province of Salzburg). This landscape features rolling hills and lakes and is much more accessible than the Alpine hay milk areas. The farming method of the hay farmers here therefore differs from that of the mountain farmers in the Alpine parts.

Figure 93
Hay mowing in the lakeland region

Instead of taking the animals to the Alpine pastures in summer, here they can spend a large part of the year on the pastures around the farms. However, even in this region the winters are cold and snowy, so in summer hay must be produced and stored for the cold season.

Originally, this region was shaped by agriculture. With the expansion of the railway lines towards the end of the 19th century, however, it became possible to transport cheaper grain from more remote areas of the Habsburg monarchy to the Austrian heartland. This deprived the market of domestic grain.

[86] One example is the Stableshof in Nauders at 1810 metres above sea level, which has been farmed for more than 400 years and where haymaking is still practised today.
https://www.nauders.com/de/ggv/bergbauernhof-stableshof-fur-selbstversorger?id=78435

[87] The share of direct value added of tourism in the GDP amounted to 5.5% in Austria in 2019, 13.8% in Tyrol as the most touristic federal province. The indirect value added was even 7.5% Austria-wide, in Tyrol 16.3%.

Farmers were forced to focus on another product and found an alternative in dairy farming. Cheese was a popular product that could also be sold to the larger cities, especially Vienna.

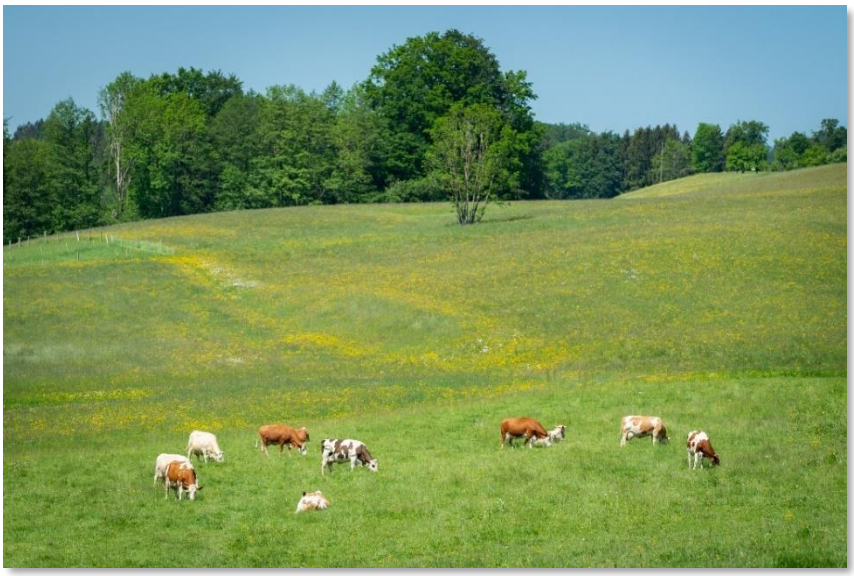


Figure 94
In the hilly lakeland region, the animals spend a large part of the year on the pastures near the farm.

Thus, a distinctive Emmental production developed in Flachgau, which still exists today. Since the production of Emmental requires a high-quality raw material, silo-free milk production was maintained in this region.

In addition, through the activities of ARGE Heumilch, other areas that are not traditionally hay regions have been won over to hay farming. Mention should be made here of farms in the Mühlviertel and Montafon, as well as farms in the districts of Klagenfurt, Spittal an der Drau and Bruck-Mürzzuschlag.

5.6. Alpine farming

Hay farming is practised both in the mountain area and in favourable locations (especially in the Salzburg lake area).

Alpine pasture farming is a special form of hay farming that is practised in the mountain area. Here, the cultivable land in the valley is very limited and is needed for haymaking in order to produce enough fodder for the winter. Therefore, the cattle (or part of them) are taken to more or less nearby mountain pastures (alpine pastures or alps) in summer. This has several advantages: On the one hand, the land and human resources in the valley can be used for hay production. On the other hand, the animals also benefit from the alpine pasture, because it offers them not only sufficient exercise, but also particularly species-rich food and cooler temperatures that are pleasant for cattle.

The areas on the alpine pastures are at an altitude of about 1000 to 2000 m above sea level and would not be suitable for cultivation as arable land, for example. (see "Cultural landscape of the region"). They developed from the primeval meadows, but were extended downwards by grazing and clearing.

Figure 95
Alpine pastures are mostly located at the transition from the montane to the alpine stage. The pastures are surrounded by forest on the one hand and rock on the other. The photo shows the Alpe Steris in the Great Walser Valley and was taken during the field visit in August 2023.

In addition to grazing, alpine pasture farming also fulfils other important functions for society in the mountain area:

- Keeping the landscape open: It is only through alpine pasture management that the characteristic cultural landscape has come into being. Without alpine pastures, the areas would become forested again within a few decades and would be inaccessible.

- Advance services for tourism/recreation: Mountain areas in particular live to a large extent from tourism. The alpine pastures make an important contribution to this, on the one hand by providing the areas and maintaining the paths, and on the other hand by being popular places of excursions themselves. More and more, the local population also uses the alpine pastures as leisure and recreation areas.
- Protection against natural disasters (avalanches, mudflows): The grazing of the alpine pastures creates a soil with dense vegetation that can protect against both mudflows in summer and avalanches in winter.

Figure 96
Alpe Erles Finne is one of the many alpine dairy farms in the Bregenzerwald.

Figure 97
Even today, the milk is often processed directly on the mountain pasture. Mountain cheese or Alpine cheese enjoys particular popularity in the market. The picture shows cheese production at Alpe Erles Finne.

5.6.1. The way from the valley to the alpine pasture

As already explained, between the colline level, where farms, permanent grassland and valley pastures are located, and the alpine level, where the alpine pastures are located, lies the forested montane level. Even though the forest is very dense in many places, it is criss-crossed by paths and roads that lead to the alpine pastures. They make use of the terrain and often run along streams where the forest is not so dense.

These roads vary in quality. Rarely are they still narrow paths or hollow ways, more often today they are gravelled forest roads that can also be driven on by tractor or small trucks. As in the past, the alpine animals are still often driven on foot along these roads and paths to the alpine pastures in spring and back to the valley in autumn.

Figure 98
Bringing down the cattles from the alpine pasture through the forest © Peter von Felbert / Tourismusverband Wilder Kaiser

In other cases, however, the cattle are brought to the mountain pasture by lorries or tractors with trailers.

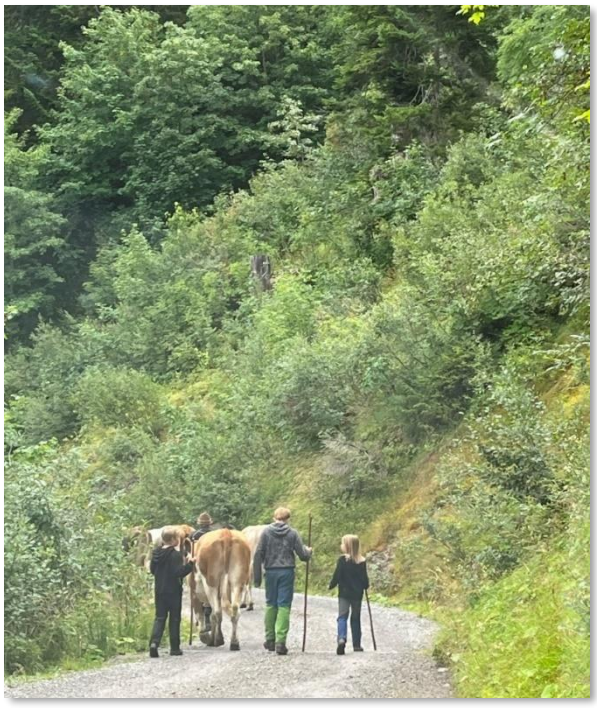


Figure 99
Children bring the animals together before bringing them down from the alpine pasture. (The photo was taken during the field visit in August 2023 at Alpe Steris).

The distance of the alpine pastures from the home farms can vary greatly, as the alpine pastures have developed differently historically. In most cases, the alpine pastures were at some point communal pastures that were managed in some form by the farmers of one or more villages. From this, agricultural communities have sometimes developed that still manage the alpine pastures collectively today. Some alpine pastures are privately owned and others are owned by the public sector (municipality). Today, which farms drive their cattle to which alpine pasture usually depends only on the distance, the costs and a certain preference for the area or the farmer.

Therefore, the distance for transport can also vary greatly. Often the mountain pasture is so close to the farm that the animals can be driven up on foot, even if this means a long and exhausting march for man and animal - sometimes even over 2 days. Small, vigorous breeds that are especially capable of crossing the terrain are advantageous. (see proposal chapter IV, 2)

On alpine pastures the milk is processed directly. Alpine cheese or alpine cheese (this is the name given to cheese produced directly on the alpine pasture) is therefore a rarity that is known and sought after beyond the region. (The whey produced during processing is often fed to alpine pigs, which are also a speciality among alpine foods and a by-product of alpine farming).

If the milk is not processed on site, it has to be brought down to the valley quickly. There are various systems for this. Either the mountain pastures themselves are responsible for the transport, in which case it is either done with their own vehicle (tractor) or also, for example, with a material ropeway.

Figure 100
Milk cans on a material ropeway © Rupp

However, as the alpine pastures are nowadays mostly accessible by forest roads, they are often also integrated into the milk collection system of the processing companies. Then every 1-2 days the milk collection truck comes - often in an adventurous drive over steep, narrow roads - to collect the milk.

Figure 101
The milk collection truck collects the milk from an alpine pasture.
© ARGE Heumilch

The buildings of a traditional mountain pasture are simple and functional. The focus is on work and not on comfort. Often there is no electricity, but running water is usually available - even if only cold.

On alpine pastures, in addition to the farm and living quarters, there is of course also a small cheese dairy and a cheese cellar where the alpine cheese is cared for.

Figure 102
Alpine dairy on the Steris alp in the Great Walser Valley – photos taken during the Field Visit in August 2023

Figure 103
Alpe Eris Finne in Bregenzerwald – photos taken 2022

Some alpine pastures are small mountain villages themselves, where each participating farm has its own alpine hut. These have evolved from communal alpine pastures where the animals were herded and looked after together, but each farm was responsible for its own milk.

Figure 104
Alpe Steris - a small village on the mountain © Helmut Düringer/Vorarlberg Tourismus

Hereditary farms

The farms in the valley are also mostly very traditionally designed and often very old. If a farm has been owned by the same family for at least 200 years, it can apply for the distinction "Erbhof".

Forms of hay farming: comparison of alpine pasture farming and pasture farming

Alpine pasture farming

- Favorable land in the valley limited
- Cattle (or parts of them) are moved to mountain pastures (alpine pastures) in summer
- An alpine pasture/alpine meadow refers to a fixed area of mountain pasture in summer, including farm buildings
- The number of alpine pastures declined sharply from 2000 to 2020, but has remained stable since then (about 8000 throughout Austria)
- However, fewer and fewer cattle are being calved (not every farmer sends his cattle to the alpine pastures, not all the livestock is calved)
- In addition to grazing, alpine pasture management fulfills other important functions:
- Keeping the landscape open
- Preliminary work for tourism/recreational economy
- Protection against natural disasters
- Alpine pastures can be privately owned, municipally owned, agricultural communities
    - Regionally there are also real alpine pasture villages
- On some alpine pastures the milk is processed directly into cheese, on others it is collected, still other alpine pastures are pure Galtviehalmen and have no milk
- alpine pastures are located at 1000-2000 m above sea level
    - A special form is the three-stage farming: explain; reference to UNESCO World Heritage Site in Bregenzerwald
- Transport to the alp mostly by foot, sometimes by tractor/truck - depending on how far the alp is from the home farm
- Standard of the alpine pastures particularly high

Pasture farming in favorable locations

- Cattle stay on the farm all year round
- Hay farming goes back to the hard cheese tradition (silo restricted areas)
- The animals graze near the farm instead of being sent to the mountain pastures.
- The grazing season starts as soon as the soil is dry enough, in March/April and ends in autumn (October/November)
- The haymaking is done in parallel on the other areas of the farm
- The grassland is owned by the farms, sometimes land is rented (e.g. from other farms or the municipality).
- The milk is collected daily or bi-daily from the dairy/cheese factory

V. ACTION PLAN

Studies[88] on which this application is based have shown that the traditional farming methods of hay milk farmers have a positive effect on the preservation of biodiversity and the protection of the climate, maintain jobs in rural areas and are the basis for the preservation of small, family-run farms.

Thus, the continuation of hay farming has positive impacts on all three dimensions of sustainability - environmental, economic and social. The measures that contribute to conservation should therefore also take all three dimensions into account.

In order to contribute to the preservation of the economy, it is important to know the biggest threats.

1. ANALYSIS OF THREATS AND CHALLENGES

The key threat facing the hay farming industry is a push back in farming practices as hay dairy farmers either convert their farms to other farming practices or abandon them completely.

The challenge, therefore, is to keep farms in hay farming and thereby strengthen small-scale farming structures in mountain areas.

In terms of the GIAHS criteria, the following threat scenarios emerge:

- **Food & livelihood security.**

Hay farming is more costly than other dairy farming systems and, in addition to costly hay promotion, comes with its own set of regulations (hay milk regulations, see Appendix 1) that hay milk farms must adhere to. Therefore, it may seem tempting for farms to switch to other farming practices (silage farming) or to exit dairy farming (switch to breeding operations, abandon the farm). If the small-structured hay farming industry with family-owned farms is to be maintained, the following challenges must be met in the future:

- The additional expense incurred by hay farming must be compensated by a higher milk price (hay milk surcharge).
- The self-confidence of hay-milk farmers must be maintained at a high level.

In order to be able to pay an adequate hay-milk surcharge, it is also important that the processors are able to earn this surcharge on the market. It is therefore important to raise awareness in the most important sales markets (Austria and Germany) of the special farming method and the advantages of hay-milk. Only then will consumers continue to be willing to pay a somewhat higher price for hay milk.

- **Agro-biodiversity**

It is precisely the small structures of hay farming that make a major contribution to the preservation of biodiversity. The mosaic-like management (see chapter IV 2), which in turn is caused by the small-scale structure of the areas and farms, as well as fewer cuts ensure the continuity of biodiversity on the meadows and pastures of hay-milk farms. Therefore, if hay

[88] Zollitsch et.al., 2019 / Suske et al., 2020

farming were to be discontinued and the land managed in other ways, biodiversity would suffer greatly.

If the cultivation of the areas in the mountain region were to be abandoned, they would become overgrown with bushes within a few years and become forested within a few decades. The cultural landscape, from which the region is characterized and from which the leading tourism industry strongly profits, would disappear.

However, the continued existence of cattle breeds typical of the region is also linked to haymaking. Old breeds with a moderate milk yield but ideal genetic makeup for the mountain area (see chapter IV 2 Cattle breeds) such as Tyrolean Grey cattle, Pinzgauer or Tux-Zillertaler as well as the Ennstaler Bergschecken would be endangered.

- **Local and traditional knowledge systems**

As described in chapter IV, 2, haymaking is accompanied by a profound knowledge of haymaking. This concerns both the traditional haymaking as ground hay, which goes hand in hand with a lot of experiential knowledge, especially in mountain areas, and the contemporary drying with the different drying systems.

Hay farming is also taught in agricultural training, and some of the training farms operated by the agricultural training institutes are even hay-milk farms. In addition, hay drying advice is provided by ARGE Heumilch and the Chambers of Agriculture to pass on up-to-date knowledge.

Because the land is very small-scale, the knowledge of how best to manage it is also very specific. One farm may have a wet meadow that is difficult to machine, while another farm nearby has more dry but particularly steep land. The moment a farm is abandoned, the specific knowledge that the family has acquired over generations about its land is lost.

In the case of cattle breeds, knowledge is less limited to individual farms, but even here the decline of hay-milk farms would mean a loss of knowledge about rare breeds. This mainly concerns regions where specific breeds are bred such as the Zillertal, the Tyrolean Oberland, the Pinzgau, etc.

Cheese dairies that process hay milk also have special knowledge. As described in Chapter III, 4.3, hay-milk has advantages especially for the production of long-maturing cheeses. Just as this cheese culture has contributed to the preservation of hay farming (silo restricted areas), a loss of hay farming would also lead to a loss of craft knowledge in the cheese dairies.

- **Culture, value system and social organizations**

A wealth of experience is also available to alpine farmers, who usually have to deal with very specific conditions (see chapter IV, 4.5). For this area, there are different courses offered by different agencies. These would quickly be abolished if the demand were to diminish. The continued existence of alpine pastures not only safeguards the cultural landscape, but also the knowledge of alpine pasture management.

In the case of three-step farming in the Bregenzerwald, this is an intangible UNESCO World Heritage Site that is closely linked to haymaking. The continued existence of hay farming therefore also safeguards this.

The customs mentioned in chapter IV, such as the driving up and down of mountain pastures, traditional costumes and traditional recipes, are probably only conditionally dependent on haymaking. Traditional costumes and recipes are also maintained independently of the hay farmers and even independently of agriculture. However, without haymaking and the alpine

farming associated with it, these traditions would lose their meaning and become more and more eroded. The ritual framework for a long agricultural tradition would become a fad that would be changed at will. Or, to paraphrase Benjamin Franklin, "Only the ashes would be preserved instead of passing on the fire."

- **Characteristics of the landscape**

  Since the cultural landscape in the region has been shaped by hay-milk farming, it would change dramatically within a few decades once hay farming was abandoned. A foretaste is already visible in the alpine pastures. Even though the number of alpine pastures is quite stable, fewer and fewer animals are being raised, which is leading to increasing scrub encroachment and forestation.

  Since the grazed areas help to protect against natural disasters such as avalanches and mudslides, these dangers would increase dramatically. In the event of a decline in hay management, other social/governmental measures would have to be taken to compensate for this protection.

The biggest challenge is to keep haymaking farmers in business. Therefore, all goals must be focused on maintaining or making hay farming environmentally, economically and socially sustainable. Only in this way can the main goal - the preservation of the farming method - be achieved.

All measures in the action plan are aimed at stabilizing the hay economy in a sustainable manner.

2. MEASURES

2.1. Ecological sustainability through hay farming

2.1.1. Austrian Agri-environmental Programme “hay farming” measure

To maintain and enhance the positive effects of hay farming on biodiversity and climate protection, participation in the Austrian Agri-environmental Programme "hay farming" measure is mandatory for all hay milk farmers and they have to fulfill the requirements.
Austrian Agri-environmental Programme is being launched by the Federal Ministry of Agriculture, Forestry, Regions and Water Management as part of rural development (Common Agricultural Policy) and is intended to ensure careful use of natural resources and long-term protection of the climate.

The "hay farming" measure includes:

- No silage preparation or silage feeding on the entire farm
- Ensuring mosaic land use by combining hay farming with green feeding in the form of grazing or pasture during most of the growing season for all roughage consuming animals on the farm.
- No storage of silage on the entire farm
- Delivery of cuttings to third parties only in the form of hay

Goal
The Austrian Agri-environmental Programme "hay farming" measure will be maintained beyond 2027 and will be further expanded.

2.1.2. Training measures for hay milk farmers on biodiversity

a. ARGE Heumilch regularly informs its hay milk farmers about the biodiversity services of hay farming and how important they are. This topic should be a permanent fixture in the journal "Urgut Leben" in particular, which is published twice a year, and in the e-mail newsletter.
b. Furthermore, these media highlight techniques that promote biodiversity on hay milk farms, such as particularly gentle mowing techniques or graded meadow cultivation.
c. Within the framework of information events (e.g. members' meetings of ARGE Heumilch), biodiversity and the techniques to preserve it are regularly addressed.

Goal
Biodiversity areas should be increased by 2% by 2028.

2.1.3. Communicating the benefits of hay farming in the region

a. The award of status as a GIAHS region will be widely communicated within the region. The communication channels of ARGE Heumilch are used for this purpose:
   i. Newsletter
   ii. Social Media
   iii. Website
   iv. Podcast
b. Press releases are also used to promote the GIAHS region within the region and nationally. Subsequently, the GIAHS region will be included in the standard text of ARGE Heumilch and will be included in every subsequent press release on any topic.

Goal
Awareness of the GIAHS region reaches 20% among the target audience (HHF ABC1) within the region. This value will be evaluated via a Consumer Connection Study, which will be conducted on a regular basis.

2.1.4. 50% organic hay milk farms by 2030

To further enhance the ecosystem services of hay farming, the already well above average organic share of 38% currently should be increased to 50% by 2035.
The demand for organic hay milk on the market currently exceeds the supply. This creates a pull effect that causes the organic share to increase further. With investments in drying technology and animal welfare, switching to organic hay farming is a good option to be able to obtain the higher producer milk price (organic premium).

Goal
By 2030, 50% of hay milk farms in the region will be farming organically. This share is measured via the reporting of milk volumes by processors.

2.2. Economic sustainability through hay farming

A farming method can only be sustained in the long term if its economic viability is ensured. Otherwise, farms are abandoned or turn to more profitable farming methods. Therefore, high quality basic ration is essential for maintaining hay farming, as it reduces dependence on the feed market. The higher the quality of the basic ration, the less concentrate has to be purchased.

2.2.1. Hay dryers

The highest basic ration quality can be achieved with hay dryers because with the help of this technology, the hay can be dried faster and more intensively than with soil drying. Investments in hay drying technology therefore make a decisive contribution to preserving the hay farming industry.

Overall, 5% of hay milk farms are expected to improve their drying situation each year. This means not only moving from soil drying to hay dryers, but also, for example, from cold ventilation to ventilation with a dehumidifier or warm ventilation.

Goal
The percentage of farms with hay dryers will increase to > 90% by 2030.
This will be evaluated through a survey of hay milk farms.

a. Consulting

To achieve the best possible basic ration quality and maximum economic efficiency in hay dryers, planning and implementation adapted to the individual situation is necessary. Independent advice is therefore provided for hay milk farmers wishing to invest in hay dryers. This is intended to provide information about the technical options and ensure that the most efficient solution is found for each individual operation.

The consultation is carried out by the Chamber of Agriculture and the costs for the initial consultation are borne by ARGE Heumilch.

Goal
By 2030, 80 to 100 initial consultations on new and expanded hay dryers will be conducted annually. This value will be evaluated by the advisory office.

b. Communication

The advantages of hay dryers are being increasingly communicated among hay milk farmers. For this purpose, the communication channels of ARGE Heumilch (journal "Urgut Leben", newsletter, separate section on the website), but also other target group-oriented media (e.g. farmers' newspaper) will be used.

Seminars on hay dryers will be offered in the region for interested farms.

Goal
At least 1 seminar on hay drying annually by 2030. This will be evaluated by the advisory office.

2.2.2. Photovoltaics

Hay dryers require energy for blowers and, if necessary, dehumidification and heating. This energy can be generated with photovoltaics not only in an environmentally friendly way, but also in a cost-saving way over the medium and long term. Photovoltaics (PV) also increases independence from fluctuating energy prices. PV is particularly suitable for hay dryers:

- Haymaking takes place in the summer when PV can generate the most energy.
- Farms have large roof areas on barns and stables that are ideally suited to PV.

The air that heats up under the PV system can be extracted and used for drying. This in turn cools the PV panels and makes them even more efficient.The aim is to make hay milk farms self-sufficient in terms of energy, as the energy generated can be used for the entire farm, in particular for cooling, milking technology, etc., in addition to hay drying.

a. The benefits of PV are communicated to farmers through ARGE Heumilch and the hay drying advisory service.
b. Political decision-makers are being convinced of the benefits, to further expand support measures for PV in this area.

Goal
By 2035, 75% of hay milk farms are equipped with PV systems or comparable renewable energy sources for hay drying. This value will be determined via a survey of hay milk farms.

2.2.3. Marketing of products

The activities of ARGE Heumilch have already contributed to the fact that hay milk is established as its own type of milk and that products made from hay milk enjoy a high level of recognition. This is also necessary to ensure the economic viability of the hay farming industry.

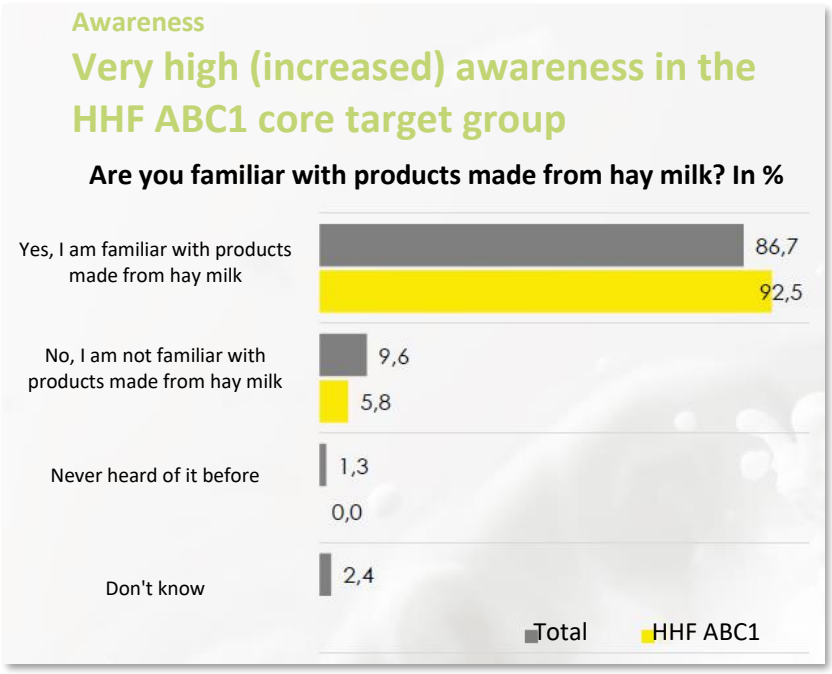


Figure 105
CCS Follow Up Study hay milk, 11/2021
Based on adult population 15-64 years

ARGE Heumilch is seeking funding from Austria and the EU to be able to continue on its chosen path with the marketing of products made from hay milk and to establish hay milk as a traditional and sustainable type of milk.

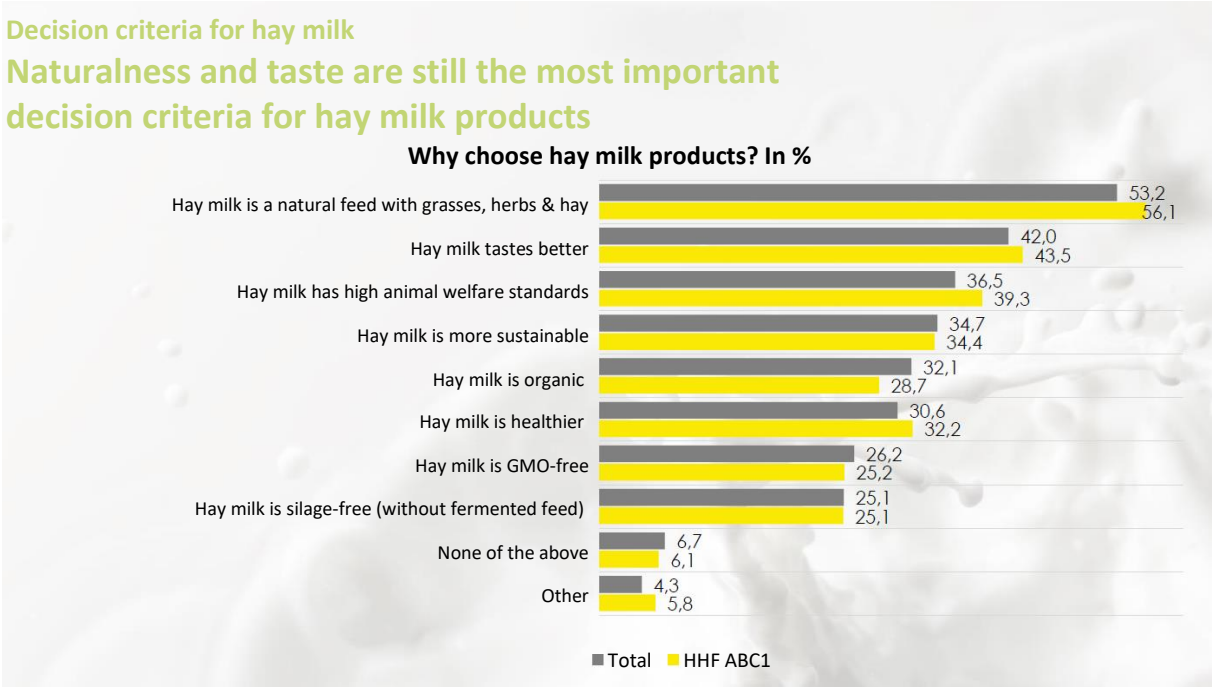


Figure 106
CCS Follow Up Study hay milk, 11/2021
Based on: Adult population 15-64 years

Hay milk products are already considered highly sustainable by 34% of the target group. However, to survive in a market where food sustainability is becoming increasingly important, this attribution must be increased further.

Goal
Association of the attribute "hay milk is more sustainable" for at least 80% of hay milk buyers by 2030. This value will be evaluated via a Consumer Connection Study, which will be conducted on a regular basis.

2.3. Social sustainability through hay farming

2.3.1. Actively maintaining farms

Agriculture in Austria has been undergoing structural change for decades, with more and more small family-run farms exiting the agricultural sector. The areas are being taken over by larger farms. This change is putting pressure on the hay farming industry because its essence lies in small-scale, family-run farms that practice site-appropriate grassland farming. To keep them in business, not only is the economic success of the farms (see Chap. V 2.2) decisive, but also the satisfaction of the farmers and the success of the generational change on the farms.

Satisfaction with living and working conditions in general is very high among hay milk farmers.

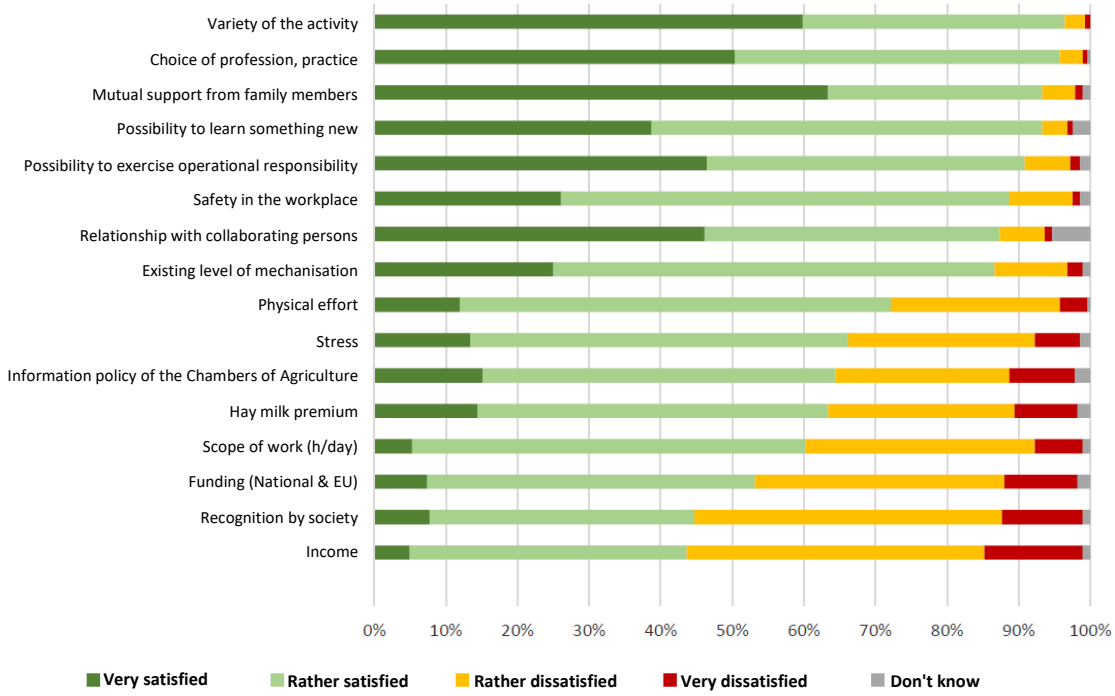


Figure 107
Survey of Austrian hay milk farmers on job satisfaction[89], n=284

[89] Zollitsch, 2019; p. 12

A survey[90] among hay milk farmers in 2019 revealed that farm succession was relatively secure (40%) or not yet an issue because the farm manager was still young. Only 11% stated that farm succession was not yet secured.

This suggests a high level of attachment of the younger generation to the region and its farming method.

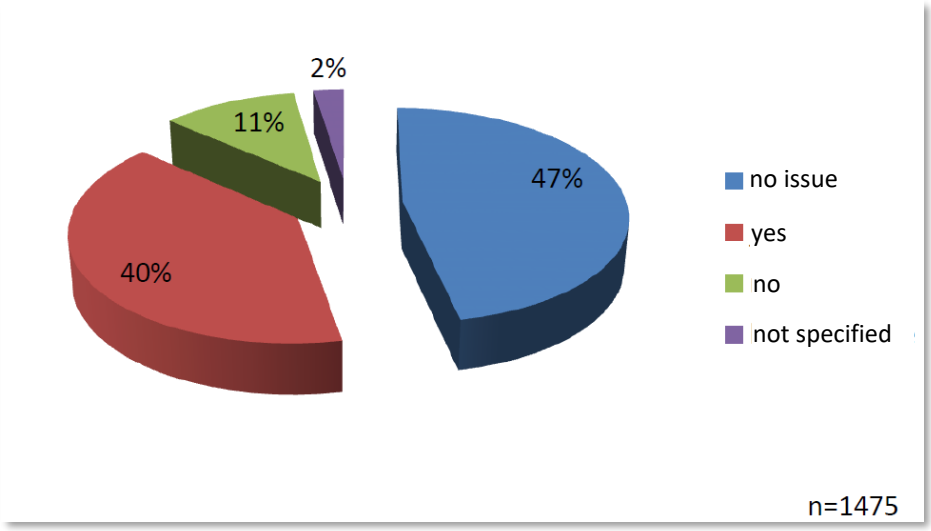


Figure 108
Is farm succession secured? Survey of hay milk farmers[91], n=1475

To secure this commitment, the next generation of farmers and their training must be targeted:

a. Highlighting the opportunities that hay farming provides in the volatile dairy market. Through active communication with hay milk farmers, the advantages and successes of the farming method are made clear.
b. Strengthening the self-confidence of young hay milk farmers through "hay milk ambassadors", events such as the "Hay Gala" and through the GIAHS region.
   Role models ("influencers") show the younger generation in particular that hay farming can be meaningful.
c. Advice for farm handover

Goal
Structural change cannot be stopped, but it should be slowed down. A maximum of 10% of hay milk farms should be phased out of hay farming by 2030. The number of establishments will be measured through the reporting of members.

4. BUDGET

The measures of the action plan are financed by the membership fees. Members are hay-milk farmers and processing companies. Both pay a contribution to ARGE Heumilch according to milk volume, which is used for the following measures.

[90] Lindner, Kittl, 2016; p. 47
[91] Lindner, Kittl 2016; p. 47

5. MONITORING AND EVALUATION

The tasks are distributed in a kick-off meeting in the ARGE Heumilch team. This is followed by a semi-annual team meeting to monitor progress. Every year, the measures are summarised in a short report.

The following measures are planned to review the targets:

- Survey on the development of hay-milk farms (PV systems, hay drying, farm succession).
- Awareness of the GIAHS region is surveyed as part of a biennial haymilk awareness study.

Objective	What	Who	How	2024	2025	2026	2027	2028	2029	2030	Budget
Ecological sustainability through hay farming											
ÖPUL-measure „Hay farming“	The ÖPUL measure "Hay farming" will remain in place beyond 2027 and will be further expanded.	ARGE Heumilch Österreich, Federal Ministry of Agriculture, Forestry, Regions and Water Management	ARGE Heumilch is lobbying the Federal Ministry to further expand the "hay farming" measure in the ÖPUL programme. To this end, the sustainable effects of not using silage are being further researched through scientific studies.	x	x	x	x				
				The current ÖPUL period runs until 2027 inclusive.				The ÖPUL period from 2028 onwards is also to include a "hay farming" measure that recognises environmental performance.			€ 150.000
Increase biodiversity areas by 2% by 2028	Inform hay-milk farmers about the biodiversity benefits of hay farming and how these are achieved.	ARGE Heumilch Österreich	Article in the Urgut Leben Journal about biodiversity on hay-milk farms (e.g. gentle mowing, graded meadow cultivation).	1	1	1	1	1	1	1	€ 7.000
			Information as part of the farmers' newsletter on biodiversity on hay-milk farms	1	1	1	1	1	1	1	€ 700
			Informing hay-milk farmers about biodiversity services at information events / members' meetings	1	1	1	1	1	1	1	€ 1.000
			Newsletter	x	x	x	x	x	x	x	€ 2.000

Awareness of the GIAHS region within the target group (HHF ABC1) is at least 20%.	Communicating the award of GIAHS status	ARGE Heumilch Österreich	Social Media	x	x	x	x	x	x	x	€ 2.000
			Website	x	x	x	x	x	x	x	€ 3.000
	Press releases on the GIAHS region	ARGE Heumilch Österreich	National and international press work incl. press releases on the GIAHS region	x	x	x	x	x	x	x	€ 5.000
			Status as a GIAHS region will be communicated with each subsequent national press release.	x	x	x	x	x	x	X	
	Stakeholder event	ARGE Heumilch Österreich	Launch event of the GIAHS for members, opinion leaders and media representatives	x							€ 150.000
Increase the share of organic hay-milk farms to 50%.	Information for hay-milk farms	ARGE Heumilch		38%	x	x	x	x	x	50%	€ 1.000
Ökonomische Nachhaltigkeit durch Heuwirtschaft											
Share of farms with hay drying systems to >90% by 2030.	Information and advice to farms on hay drying systems	ARGE Heumilch, Chamber of Agriculture	Initial advice for hay-milk farms on investments in hay-drying systems is provided	x	x	x	x	x	x	>90%	€ 50.000
			Annually 1 seminar on hay drying systems	1	1	1	1	1	1		€ 7.000

75% of hay-milk farms have photovoltaic systems or comparable renewable energies for hay drying by 2035	Information and advice for businesses on photovoltaics and comparable renewable energies	ARGE Heumilch	Informing hay-milk farmers about the advantages of renewable energy (especially PV)	x	1	1	1	1	1	1	€ 2.000
		ARGE Heumilch, Federal and state politics	Political decision-makers at the federal and state levels are persuaded to expand funding in this area	x	x	x	x	x	x	75%	
Social sustainability through haymaking											
A maximum of 10% of hay-milk farms will be phased out by 2030.	Training and information of hay-milk farmers, especially young farmers	ARGE Heumilch	Highlighting the opportunities for the hay industry in the volatile dairy market in its own communication media	x	x	x	x	x	x	x	€ 7.000
			Strengthening the self-confidence of the young generation through "hay-milk ambassadors", events and positive role models	x	x	x	x	x	x	x	€ 10.000

APPENDIX

1. Hay milk regulation of ARGE Heumilch Österreich

Hay milk regulation of ARGE Heumilch Österreich
Regulations for silo-free milk

Definition of hay milk

- Hay milk is milk from dams (cow, sheep, goat) produced by milk producers who comply with the criteria of the Austrian Environmental Program (the Austrian Agri-environmental Programme measure "no silage"), compliance with the Austrian hay milk regulation as well as compliance with the Implementing Regulation (EU) No. 304/2016 TSG Hay Milk, the Implementing Regulation (EU) No. 486/2019 for TSG sheep's hay milk as well as the Implementing Regulation (EU) No. 487/2019 for TSG goat's hay milk.
- Mountain/Alpine milk is hay milk if the criteria of the Austrian Agri-environmental Programme measure "Alpung und Behirtung" (Alpine grazing and herding) and the hay milk regulation are met on the mountain/alpine pasture.
- Organic hay milk also requires compliance with EU Organic Regulation 834/2007, as amended.
- AMA Quality Seal Guideline, Husbandry of Cows as amended or Sheep and Goat Husbandry as amended.
- Austrian Food Code: Guideline for the definition of "GMO-free production" of foodstuffs and their labelling as amended.
- Hay milk is produced through species-appropriate feeding. The health and well-being of the animals are essential elements of hay milk farming.

Hay milk farming

- To preserve the traditional basis of hay milk, no animals or feed may be used which must be labelled as genetically modified according to current legislation.
- The entire farm must be managed according to the rules of hay milk production.
- No production and feeding of silage on all premises of a hay milk producer. It is also illegal to sell directly from the field.
- No production and storage of round bales of any kind in film. Sale directly from the field is only permitted as hay.
- No production and feeding of wet hay or fermented hay on any farm of a hay milk producer.

Permitted feed

- Animals are fed mainly with fresh grasses and herbs during the green forage period and hay during the winter forage period.
- Supplemental roughage also includes green canola, green corn, green rye, and fodder beets, as well as hay, alfalfa, and corn pellets and similar feeds.
- Wheat, barley, oats, triticale, rye and corn in standard market form, e.g. bran, pellets, etc. are permitted.

- Field beans, forage peas, lupine, oilseeds and extraction meal or cake may be used in the feed ration.
- The proportion of roughage in the annual ration must be at least. 75% of the dry matter.

Prohibited feed

- Do not feed silage (fermented feed), wet hay or fermented hay.
- No feeding of by-products from breweries, distilleries, cideries, and other residues from the food industry such as wet brewers grains or wet cuts - Exception: dry cuttings as a by-product of sugar production and protein feed from grain processing in the dry state, as well as grape marc in the dried state as a supplement in mineral mixtures.
- No feeding of soaked feed to dams.
- No feeding of feed of animal origin (milk, whey, animal meal, etc.), with the exception of milk and whey for young cattle.
- Do not feed garden and fruit waste, potatoes and urea.
- No feeding of feed produced outside of Europe.

Fertilisation regulations

- No application of sewage sludge, sewage sludge products from municipal treatment plants to any agricultural land of the milk supplier.
- Adherence to a minimum waiting period of 3 weeks between the application of farm manure and use on all forage areas of the dairy supplier.
- Compost with green cuttings, shrub cuttings and organic waste can be applied if the compost producer participates in a quality assurance system and is certified. A minimum of compost quality A is a prerequisite.
- The use of biogas slurry is only permitted if it complies with the requirements of the Fertilizer Ordinance as amended for the raw materials of biogas slurry as fertiliser.

Use of chemical additives

- Only selective use of chemical synthetic pesticides is possible under expert guidance of agricultural advisors and spot control on all forage areas of the milk supplier.
- Use of approved sprays for fly control is permitted in dairy barns only when dams are absent.

Animal welfare

- Membership of the Animal Health Service (TGD) is mandatory.
- Dehorning of calves is allowed only after effective anesthesia and analgesia.
- Tail docking of calves is prohibited.
- A lying area is available for each dam.
- The cubicle and lying area are provided with straw bedding. This can be omitted if there is a soft bed. The solids of the manure separation are not permitted as bedding.
- Combination husbandry: in case of tethering, 120 days of outdoor exercise and or pasture/Alpine grazing are mandatory; permanent tethering (365d/24h) is prohibited.

Supply bans

- Delivery after calving at the earliest on the 10th day after calving has successfully taken place.

- When using cows that have been fed silage (fermented feed), a waiting period of at least 14 days must be observed.
- Pasture/Alpine animals that were fed silage on the home farm must either be converted to silage-free feeding 14 days before the start of the pasture/Alpine season or the milk can only be used as hay milk after 14 days on the pasture/Alpine pasture. Silage may neither be produced nor fed on the Alpine pasture.

2. Cattle breeds of hay farming

Type of use	Breed
Meat breed	Agnus
Meat breed	Blonde d'Aquitaine
Meat breed	Charolais
Meat breed	Galloway
Meat breed	Limousin
Meat breed	Scottish Highland Cattle
Meat breed	Belgian White-Blue
Endangered breed	Ennstaler Bergscheck
Endangered breed	Carinthian Blondvieh
Endangered breed	Original Braunvieh
Endangered breed	Original Pinzgauer
Endangered breed	Pustertaler Sprinzen
Endangered breed	Tux Zillertal
Endangered breed	Hungarian Steppe cattle
Endangered breed	Waldviertel Blondvieh
Milk production	Braunvieh
Milk production	Fleckvieh
Milk production	Holstein-Friesian
Milk production	Jersey
Milk production	Tyrolean Grey cattle
Milk production	Pinzgauer

3. Grasses and herbs in hay milk meadows

Latin name	English name	Soil moisture		
Achillea aspleniifolia	Fern-leaf yarrow			
Achillea collina (s. lat.)	Hill yarrow			
Achillea millefolium (s. str.)	Yarrow			
Achillea moschata	Musk yarrow			
Achillea pannonica	Pannonian real yarrow			
Achillea pratensis	Meadow True Yarrow			
Achillea roseoalba	Southern Alps yarrow			
Aconitum napellus s. str.	Blue monkshood			
Adenophora liliifolia	Lily cup bell			
Adonis vernalis	Spring Adonis Rose			
Aegopodium podagraria	Goat's Foot			
Agrimonia eupatoria	Common agrimony			
Agrimonia procera	Fragrant agrimony			
Agrostis alpina	Alpine bunchgrass			
Agrostis canina	Dog Ostrich Grass			
Agrostis gigantea	Giant bunchgrass			
Agrostis rupestris	Rock bunchgrass			
Agrostis stolonifera	Creeping bunchgrass			
Agrostis vinealis	Heather bunchgrass			
Ajuga genevensis	Shaggy bugle			
Ajuga pyramidalis	Pyramid Gooseberry			
Ajuga reptans	Creeping goutweed			
Alchemilla acutiloba	Pointe woman mantle			
Alchemilla alpina	Alpine Silver Coat			
Alchemilla connivens	Grassland lady’s mantle			
Alchemilla coriacea	Leather leaf woman coat			
Alchemilla crinita	Long hair woman mantle			
Alchemilla exigua	Weak lady's mantle			
Alchemilla flabellata	Fan woman coat			
Alchemilla glabra	Bald woman's mantle			
Alchemilla glaucescens	Felt woman coat			
Alchemilla micans	Petite woman mantle			
Alchemilla monticola	Mountain Meadow Lady's Mantle			
Alchemilla nitida	Shiny silver coat			
Alchemilla plicata	Wrinkles woman mantle			
Alchemilla straminea	Straw woman mantle			
Alchemilla subcrenata	Notched Tooth Lady's Mantle			
Alchemilla xanthochlora	Yellow green woman mantle			
Allium angulosum	Edge leeks			
Allium carinatum	Actual keel leek			
Allium carinatum	Beautiful keel leek			
Allium flavum	Yellow leek			
Allium lusitanicum	Mountain Leek			
Allium oleraceum	Bell leeks			
Allium rotundum	Round leek			
Allium schoenoprasum	Cut leeks			
Allium sphaerocephalon	Ball leek			
Allium victorialis	Allermann armor			
Allium vineale	Vineyard Leeks			

Alopecurus geniculatus	Bent foxtail grass			
Alopecurus pratensis	Meadow foxtail grass			
Alyssum alyssoides	Goblet Stonecrop			
Anacamptis coriophora (subsp. coriophora)	Bug orchid			
Anacamptis morio	Lesser marsh orchid			
Anacamptis pyramidalis	Pyramid Dogbane			
Anemonastrum narcissiflorum	Mountain Chicken			
Anemone nemorosa	Bush anemone			
Anemone sylvestris	Greater Anemone			
Anemone trifolia	Three-leaved anemone			
Angelica sylvestris	Wild angelica			
Antennaria dioica	Common cat paw			
Anthemis tinctoria (s. str.)	Dyer Dog Chamomile			
Anthericum liliago	Branchless fence lily			
Anthericum ramosum	Bough fence lily			
Anthoxanthum alpinum	Alpine Creeping Ryegrass			
Anthoxanthum odoratum	Common bentgrass			
Anthriscus nitidus	Glossy chervil			
Anthriscus sylvestris (s. str.)	Meadow chervil			
Anthyllis vulneraria	Alpine woundwort			
Anthyllis vulneraria	Carried over wound clover			
Anthyllis vulneraria	Carpathian Wound Clover			
Anthyllis vulneraria	Steppe Wound Clover			
Aquilegia vulgaris	Common columbine			
Arabidopsis halleri	Creeping foam cress			
Arabidopsis thaliana	Field cress			
Arabis ciliata	Pre-Alpine Goose Cress			
Arabis hirsuta (s. str.)	Rough-haired goosegrass			
Arabis nova	Rock Goose Cress			
Arabis sagittata	Arrow Goose Cress			
Arctostaphylos alpinus	Alpine bearberry			
Arctostaphylos uva-ursi	Real bearberry			
Arenaria leptoclados	Delicate sandwort			
Arenaria procera	Grass Leaf Sandwort			
Arenaria serpyllifolia	Quender sandwort			
Armeria alpina (s. str.)	Alpine grass carnation			
Armeria elongata	Sand-grass carnation			
Armoracia rusticana	Horseradish, horseradish			
Arnica montana	Arnika			
Arrhenatherum elatius	Glatthafer			
Artemisia absinthium	Real wormwood			
Artemisia campestris (s. str.)	Field Mugwort			
Artemisia pontica	Pontsch Wormwood			
Asparagus officinalis	Garden asparagus			
Asperula cynanchica (s. str.)	Squinancywort			
Asperula tinctoria	Dryer’s woodruff			
Aster alpinus	Alpine Aster			
Aster amellus	Mountain Aster			
Astragalus alpinus	Alpine Tragacanth			
Astragalus austriacus	Austria-Tragant			
Astragalus cicer	Giggle Tragacanth			
Astragalus frigidus	Cold tragacanth			

Astragalus leontinus	Tyrolean tragacanth			
Astragalus norvegicus	Norway Tragacanth			
Astragalus onobrychis	Sainfoin tragacanth			
Astragalus penduliflorus	Pendulous tragacanth			
Astrantia major	Große Sterndolde			
Avenula adsurgens	True Rising Meadow Oats			
Avenula adsurgens	South Tyrolean Rising Meadow Oats			
Avenula praeusta	Alpine Meadow Oats			
Avenula pratensis	Bald meadow oat			
Avenula versicolor (subsp. versicolor)	Bunthafer			
Bartsia alpina	Alpine helmet			
Bellidiastrum michelii	Alpenmaßliebchen			
Bellis perennis	Common daisy			
Berberis vulgaris	Common barberry			
Betonica alopecuros	Yellow concrete			
Betonica officinalis (subsp. officinalis)	Real concrete			
Biscutella laevigata	Smooth eyeglass cap			
Blysmus compressus	Source binary			
Bothriochloa ischaemum	Bartgras			
Botrychium lanceolatum (subsp. lanceolatum)	Lancet moonwort			
Botrychium lunaria	Common moon rue			
Botrychium matricariifolium	Boughy moon rue			
Botrychium multifidum	Multicolored moon rue			
Botrychium simplex	Simple moon rue			
Brachypodium pinnatum	Heath false brome			
Brachypodium rupestre	Tor-grass			
Briza media	Common quaking grass			
Bromus commutatus	Mixed up trespe			
Bromus condensatus (subsp. microtrichus)	Dense flowered trespe			
Bromus erectus	Upright trespe			
Bromus hordeaceus	Soft trespe			
Bromus inermis	Defenseless trespe			
Bromus racemosus (s. str.)	Knotted trespe			
Buphthalmum salicifolium	Genuine ox eye			
Bupleurum falcatum (subsp. falcatum)	Sickle Rabbit Ear			
Bupleurum longifolium (subsp. vapincense)	Long-leaved rabbit ear			
Calluna vulgaris	Broomheather			
Caltha palustris	Common marsh marigold			
Campanula alpina	Alpine bellflower			
Campanula barbata	Bearded bellflower			
Campanula bononiensis	Felt bell flower			
Campanula cervicaria	Bristle bellflower			
Campanula glomerata	Tangle bellflower			
Campanula patula	Meadow bellflower			
Campanula rotundifolia	Round-leaved bellflower			
Campanula scheuchzeri	Scheuchzer bellflower			
Campanula thyrsoides	Ostrich bellflower			
Campanula witasekiana	Witasek bellflower			
Capsella bursa-pastoris	Common shepherd's purse			
Cardamine dentata	Toothleaf Meadow Foamwort			
Cardamine matthioli	White meadow foamwort			
Cardamine pratensis (s. str.)	Common meadow foamwort			
Cardamine rivularis	Mountain Meadow Foamwort			

Carduus defloratus s. lat.	Alpine thistle			
Carduus nutans	Nodding ring thistle			
Carex aterrima	Cabbage black sedge			
Carex atrata	Black sedge			
Carex bicolor	Bicolor sedge			
Carex brizoides	Seaweed Sedge			
Carex brunnescens	Common Brown Sedge			
Carex buxbaumii	Buxbaum Sedge			
Carex canescens (subsp. canescens)	Gray Sedge			
Carex capillaris	Hairpin Sedge			
Carex caryophyllea	Spring Sedge			
Carex curvula	Crooked sedge			
Carex distans	Remote sedge			
Carex echinata	Hedgehog Sedge			
Carex ericetorum	Heath Sedge			
Carex ferruginea	Rust Sedge			
Carex firma	Cushion Sedge			
Carex flacca (subsp. flacca)	Blue green sedge			
Carex flava	Great yellow sedge			
Carex frigida	Ice Sedge			
Carex hartmanii	Hartmann's Sedge			
Carex hirta	Hairy sedge			
Carex hostiana	Hem Sedge			
Carex humilis	Earth Sedge			
Carex lepidocarpa	Medium yellow sedge			
Carex leporina	Rabbit Sedge			
Carex liparocarpos	Glossy sedge			
Carex michelii	Micheli Sedge			
Carex montana	Mountain Sedge			
Carex mucronata	Spiky sedge			
Carex nigra	Brown Sedge			
Carex oederi	Small yellow sedge			
Carex ornithopoda	Bird's-foot Sedge			
Carex otrubae	Hain sedge			
Carex pallescens	Pale Sedge			
Carex panicea	Millet Sedge			
Carex paniculata	Panicle Sedge			
Carex pilulifera	Pill Sedge			
Carex praecox	Early Sedge			
Carex riparia	Bank Sedge			
Carex sempervirens (subsp. sempervirens)	Horst Sedge			
Carex tomentosa	Felt sedge			
Carex tumidicarpa	Misunderstood yellow sedge			
Carex umbrosa	Shadow Sedge			
Carex vulpina	Fox Sedge			
Carex vulpinoidea	False Fox Sedge			
Carlina acaulis	Silver Thistle			
Carlina biebersteinii	Long-leaved golden thistle			
Carlina vulgaris	Common golden thistle			
Carum carvi	Real caraway			
Centaurea jacea	Fiddlestick meadow knapweed			
Centaurea jacea	Light scaled meadow knapweed			

Centaurea jacea	Crested scaly meadow knapweed			
Centaurea jacea	Common meadow knapweed			
Centaurea jacea	Narrow-leaved meadow knapweed			
Centaurea nigrescens	Blackish knapweed			
Centaurea pseudophrygia	Wig flake flower			
Centaurea scabiosa	Scabiosa knapweed			
Centaurea stoebe	Rhineland knapweed			
Cerastium arvense	Common Field Hornwort			
Cerastium arvense	Stiff field hornwort			
Cerastium arvense	Woody field hornwort			
Cerastium brachypetalum (s. str.)	Small flowered hornwort			
Cerastium glutinosum	Sticky hornwort			
Cerastium holosteoides	Common hornwort			
Cerastium pumilum	Low hornwort			
Cerastium semidecandrum	Sand-hornwort			
Cerastium tenoreanum	Tenore hornwort			
Cervaria rivini	Deerroot			
Chaerophyllum aureum	Gold calf crop			
Chaerophyllum hirsutum (s. str.)	Eyelash calf crop			
Chaerophyllum villarsii	Alpine calf crop			
Chamaecytisus austriacus	Austria dwarf goat's clover			
Chamaecytisus ratisbonensis	Regensburg Dwarf Goat Clover			
Chamorchis alpina	Dwarf stand			
Chenopodium bonus-henricus	Good Henry			
Chondrilla juncea	Rod Knotted Lettuce			
Cirsium acaule	Earth Thistle			
Cirsium arvense	Field Thistle			
Cirsium heterophyllum	Felt Thistle			
Cirsium oleraceum	Cabbage Thistle			
Cirsium palustre	Marsh Thistle			
Cirsium pannonicum	Hungarian thistle			
Cirsium rivulare	Brook Thistle			
Cirsium spinosissimum	Alpine Thistle			
Cirsium tuberosum	Thistle			
Cirsium vulgare	Spear Thistle			
Clinopodium acinos	Common stonecrop			
Clinopodium alpinum (subsp. alpinum)	Alpine Stonecrop			
Clinopodium vulgare (subsp. vulgare)	Whirligig			
Coeloglossum viride	Green Hollow Tongue			
Colchicum autumnale	Common autumn crocus			
Coronilla coronata	Mountain Crown Vetch			
Coronilla vaginalis	Sheath Crown Vetch			
Corydalis cava	Hollow larkspur			
Corydalis intermedia	Medium larkspur			
Crataegus laevigata agg.	Two-core Hawthorn			
Crataegus monogyna agg.	Mesh hawthorn			
Crepis alpestris	Pre-Alpine Pippa			
Crepis aurea	Gold Pippa			
Crepis biennis	Meadow Pippa			
Crepis capillaris	Hairy-stemmed Pippa			
Crepis conyzifolia	Large-headed Pippa			
Crepis mollis	Soft haired pippa			
Crepis paludosa	Marsh Pippa			

Crepis pontana	Mountain Pippa			
Crepis praemorsa	Grape Pippa			
Crocus albiflorus	Alpine Crocus			
Crocus exiguus	Illyrian crocus			
Crocus purpureus	Naples Crocus			
Cruciata glabra	Bald ragwort			
Cruciata laevipes	Common ragwort			
Cuscuta epithymum	Quendel devil's twine			
Cyanus triumfettii	Colorful knapweed			
Cynosurus cristatus	Common crested wheatgrass			
Cypripedium calceolus	Lady's slipper			
Dactylis glomerata	Meadow knapweed			
Dactylis glomerata	Reichenbach knotgrass			
Dactylis polygama	Forest knotgrass			
Dactylorhiza cruenta	Blood Red Fleshy Fingerroot			
Dactylorhiza incarnata	Actual flesh fingerroot			
Dactylorhiza maculata s. lat.	Spotted Fingerroot			
Dactylorhiza majalis	Broadleaf Fingerroot			
Dactylorhiza sambucina	Elderberry fingerroot			
Dactylorhiza traunsteineri	Traunsteiner fingerroot			
Danthonia decumbens	Lying three tooth grass			
Daucus carota	Wild carrot			
Deschampsia cespitosa	Common turfgrass			
Dianthus alpinus	Alpine pink			
Dianthus armeria (subsp. armeria)	Tufted carnation			
Dianthus barbatus	Bearded Carnation			
Dianthus carthusianorum	Carthusian carnation			
Dianthus deltoides	Heather Carnation			
Dianthus glacialis (subsp. glacialis)	Glacier Carnation			
Dianthus pontederae	Pannonian Carthusian Carnation			
Dianthus sternbergii	Dolomite Carnation			
Dianthus superbus	Large flowered magnificent carnation			
Dianthus superbus	Wet meadows magnificent carnation			
Dianthus sylvestris (subsp. sylvestris)	Wild carnation			
Draba boerhavii	Round fruit hunger flower			
Draba nemorosa	Bush Rockflower			
Draba praecox	Early hunger flower			
Draba verna s. str.	Common hungry flower			
Dracocephalum ruyschiana	Nordic scorpion fish			
Drymocallis rupestris	Rock cinquefoil			
Elymus hispidus	Blue-quill			
Elymus repens	Field quackgrass			
Empetrum hermaphroditum	Hermaphrodite crowberry			
Epilobium parviflorum	Downy Willowherb			
Epipactis atrorubens	Dark-red helleborine			
Epipactis palustris	Swamp stonewort			
Equisetum arvense	Field Horsetail			
Equisetum palustre	Marsh Horsetail			
Erica carnea	Snow heath, Erika			
Erigeron acris	Bitter fleabane			
Erigeron alpinus (s. str.)	Alpine fleabane			
Erigeron annuus	Annual fleabane			

Erigeron atticus	Greek fleabane			
Erigeron canadensis	Canadian fleabane			
Erigeron glabratus	Variable fleabane			
Erigeron neglectus	Neglected fleabane			
Eryngium campestre	Field Man Litter			
Erysimum odoratum	Pannonian gold varnish			
Erythronium dens-canis	Dogtooth			
Euphorbia carniolica	Krainer spurge			
Euphorbia cyparissias	Cypress spurge			
Euphorbia palustris	Swamp spurge			
Euphorbia polychroma	Variegated spurge			
Euphorbia verrucosa	Warty spurge			
Euphorbia villosa (s. str.)	Downy Spurge			
Euphorbia virgata	Rod spurge			
Euphrasia cuspidata	Carniola Eyebright			
Euphrasia kerneri	Kerner Eyebright			
Euphrasia minima s. str.	Dwarf Eyebright			
Euphrasia officinalis	Common Meadow Eyebright			
Euphrasia stricta	Stiff eyebright			
Falcaria vulgaris	Crescent			
Festuca "guestfalica" (sensu Fl. Eur. p. p., typo excl.)	Hard sheep fescue			
Festuca arundinacea	Cane fescue			
Festuca brevipila s. lat.	Rough-leaf fescue			
Festuca filiformis	Thread sheep fescue			
Festuca heteromalla	Many-flowered red fescue			
Festuca nigrescens	Horst Red Fescue			
Festuca nigricans	Blackish violet fescue			
Festuca norica	Noric violet fescue			
Festuca ovina s. str.	Actual sheep fescue			
Festuca pallens	Pale Sheep Fescue			
Festuca paniculata	Gold fescue			
Festuca picturata	Variegated violet fescue			
Festuca pratensis s. str.	Meadow fescue			
Festuca pseudovina	Salt Fescue			
Festuca pulchella	Ornamental fescue			
Festuca pumila	Dwarf Fescue			
Festuca rubra	Foothill red fescue			
Festuca rupicola	Actual furrow fescue			
Festuca supina	Small sheep fescue			
Festuca trichophylla	Hairy-leaf red fescue			
Festuca valesiaca s. str.	Wallis fescue			
Ficaria verna (subsp. verna)	Spring lesser celandine			
Filago lutescens	Yellow felt weed			
Filago minima	Dwarf felt weed			
Filago vulgaris	German felt weed			
Filipendula ulmaria	True meadowsweet			
Filipendula vulgaris	Tuberous Meadowsweet			
Fragaria viridis	Crisp Strawberry			
Frangula alnus	Common sloth tree			
Fumana procumbens	Lying anemone			
Gagea liotardii	Tubular yellowberry			
Gagea pratensis	Meadow yellowberry			

Gagea pusilla	Small yellow star			
Galatella linosyris	Goldaster			
Galium album s. str.	Big meadow ragwort			
Galium anisophyllon	Alpine ragwort			
Galium boreale (s.str.)	Nordic bedstraw			
Galium glaucum s. str.	Common blue-green ragwort			
Galium lucidum (s. str.)	Glossy cabbage			
Galium mollugo (s. str.)	Small meadow ragwort			
Galium noricum	Noric cabbage			
Galium palustre (s. str.)	Swamp ragwort			
Galium pumilum	Heather ragwort			
Galium pycnotrichum	Thick meadow ragwort			
Galium saxatile	Resin ragwort			
Galium verum (s. str.)	True bedstraw			
Galium wirtgenii	Wirtgen ragwort			
Genista germanica	German broom			
Genista pilosa	Heide-Ginster			
Genista sagittalis	Wing broom			
Genista tinctoria	Dyer broom			
Gentiana acaulis	Stemless gentian			
Gentiana asclepiadea	Swallow-wort gentian			
Gentiana bavarica (s. str.)	Bavarian gentian			
Gentiana clusii (subsp. clusii)	Clusius-Enzian			
Gentiana cruciata	Kreuz-Enzian			
Gentiana lutea	Yellow gentian			
Gentiana nivalis	Snow Gentian			
Gentiana orbicularis	Round-leaved gentian			
Gentiana pannonica	Ostalpen-Enzian			
Gentiana pneumonanthe	Lung gentian			
Gentiana prostrata	Lying gentian			
Gentiana punctata	Spotted Gentian			
Gentiana purpurea	Purpur-Enzian			
Gentiana utriculosa	Hose gentian			
Gentiana verna (s. str.)	Spring gentian			
Gentianella anisodonta	Calyx Cranberry			
Gentianella aspera	Rough wreath gentian			
Gentianella campestris	Field Cranberry			
Gentianella rhaetica	Rhaetian cranberry			
Gentianopsis ciliata	Common fringed gentian			
Geranium divaricatum	Spreading cranesbill			
Geranium molle (s. str.)	Soft cranesbill			
Geranium palustre	Marsh Cranesbill			
Geranium phaeum	Pale purple cranesbill			
Geranium pratense	Meadow Cranesbill			
Geranium pyrenaicum	Pyrenean Cranesbill			
Geranium sanguineum	Blood Cranesbill			
Geranium sylvaticum	Wood Cranesbill			
Geum montanum	Mountain carnation root			
Geum rivale	Brook carnation root			
Gladiolus palustris	Marsh Periwinkle			
Glechoma hederacea	Common ground ivy			
Globularia bisnagarica	High stem globe flower			

Globularia cordifolia	Heartleaf globe flower			
Globularia nudicaulis	Bare stem globe flower			
Glyceria declinata	Inclined swath grass			
Glyceria fluitans	Flooding swath grass			
Glyceria striata	Striped swath grass			
Gnaphalium norvegicum	Norwegian dysentery			
Gnaphalium sylvaticum	Forest clockwort			
Gnaphalium uliginosum	Swamp Duckweed			
Gymnadenia conopsea (s. lat)	Long spurred knapweed			
Gymnadenia odoratissima	Perfumed hellebore			
Hedysarum hedysaroides	Alpine Sweet Clover			
Helianthemum alpestre s. str.	Alpine sunflower			
Helianthemum canum	Gray sunflower			
Helianthemum nummularium	Bald sunflower			
Helianthemum nummularium	Bicolor sunflower			
Helianthemum nummularium	Cloudy green sunflower			
Helianthemum nummullarium	Large flowered sunflower			
Helleborus dumetorum (subsp. dumetorum)	Hedge hellebore			
Heracleum sphondylium	Mountain Meadow Hogweed			
Heracleum sphondylium	Actual meadow hogweed			
Herminium monorchis	Honey unicorn			
Hieracium alpinum (s. lat.)	Alpine Hawkweed			
Hieracium angustifolium	Glacial mouse-ear hawkweed			
Hieracium aurantiacum	Orange mouse-ear hawkweed			
Hieracium bauhini	Bauhin mouse-ear hawkweed			
Hieracium bifidum	Fork-hawkweed			
Hieracium caespitosum	Meadow mouse-ear hawkweed			
Hieracium cymosum	Cloud mouse-ear hawkweed			
Hieracium floribundum	Rich flower mouse-ear hawkweed			
Hieracium glanduliferum	Gray Scots Hawkweed			
Hieracium guthnickianum s. str.	Guthnik's mouse-ear hawkweed			
Hieracium hoppeanum	Hoppe Mouse-ear Hawkweed			
Hieracium lactucella	Mouse-ear Hawkweed			
Hieracium maculatum	Spotted Hawkweed			
Hieracium murorum	Forest Hawkweed			
Hieracium pilosella	Lesser mouse-ear hawkweed			
Hieracium pilosum	Wool Basket Hawkweed			
Hieracium praealtum	Tall Florence Mouse-ear Hawkweed			
Hieracium sparsiramum	Weitast Hawkweed			
Hieracium sphaerocephalum	Round-headed mouse-ear hawkweed			
Hieracium villosum	Villous Hawkweed			
Hippocrepis comosa	Common horseshoe clover			
Hippophae rhamnoides	Sanddorn			
Holcus lanatus	Wooly honey grass			
Holcus mollis	Soft honey grass			
Holosteum umbellatum	Umbrella chute			
Homalotrichon pubescens	Downy Oats			
Homogyne alpina	Green brandy lettuce			
Horminum pyrenaicum	Dragon Mouth			
Huperzia selago (subsp. selago)	Fir Devil Claw			
Hypericum dubium	Stump St. John's wort			
Hypericum humifusum	Couch St. John's wort			
Hypericum maculatum (s. str.)	Spotted St. John's wort			

Hypericum perforatum	Real St. John's wort			
Hypochoeris maculata	Spotted piglet weed			
Hypochoeris radicata	Common Piglet Weed			
Hypochoeris uniflora	One-headed piglet weed			
Inula britannica	Meadow Atlant			
Inula conyzae	Duerrwort			
Inula ensifolia	Sword Atlant			
Inula hirta	Rough hair elecampane			
Inula oculus-christi	Christ Eye Atlant			
Inula salicina	Willow Atlant			
Iris graminea	Grass Iris			
Iris pumila	Dwarf iris			
Iris sibirica	Siberian iris			
Iris variegata	Variegated iris			
Jasione montana	Mountain Sand Button			
Juncus acutiflorus	Pointed flowered cornices			
Juncus alpinoarticulatus	Alpine Simse			
Juncus articulatus	Limbs-Simse			
Juncus compressus	Compressed ledges			
Juncus conglomeratus	Tangle Siamese			
Juncus effusus	Flutter Simse			
Juncus filiformis	Thread Simse			
Juncus inflexus	Gray ledges			
Juncus jacquinii	Chamois Simms			
Juncus monanthos	Single flower ledge			
Juncus squarrosus	Sparse ledges			
Juncus subnodulosus	Knotted Siamese			
Juncus trifidus	Trifoliate cornice			
Juniperus communis	Upright juniper			
Juniperus communis	Dwarf juniper			
Jurinea mollis	Soft silvershark			
Knautia arvensis (s. str.)	Meadow Widowflower			
Knautia longifolia	Long-leaved widow flower			
Koeleria hirsuta	Rough crested wheatear			
Koeleria macrantha	Tumbleweed			
Koeleria pyramidata	Meadow ridgegrass			
Lactuca perennis	Blue lettuce			
Lactuca viminea	Rod lettuce			
Laserpitium halleri	Haller's laser herb			
Laserpitium krapfii (subsp. gaudinii)	Swiss Red-edged Laser Weed			
Laserpitium prutenicum	Prussian laser herb			
Lathyrus laevigatus	Yellow vetchling			
Lathyrus latifolius	Winged pea			
Lathyrus linifolius	Mountain Chickpea			
Lathyrus nissolia	Grass chickpea			
Lathyrus palustris	Marsh pea			
Lathyrus pratensis	Meadow vetchling			
Leontodon hispidus	Common luminous tooth			
Leontopodium alpinum (subsp. alpinum)	Alpine Edelweiss			
Leucanthemopsis alpina	Alpine daisy			
Leucanthemum adustum	Burnt daisy			
Leucanthemum gaudinii	Gaudin daisy			

Leucanthemum ircutianum	Fat Meadow Daisy			
Leucanthemum vulgare (s. str.)	Meadow daisy			
Leucojum vernum	Spring knot flower			
Lilium bulbiferum	Fire Lily			
Lilium martagon	Turk's Covenant Lily			
Limodorum abortivum	Purple thingy			
Linaria genistifolia (subsp. genistifolia)	Broom flax			
Linum alpinum	Alpine Linen			
Linum austriacum (subsp. austriacum)	Austrian flax			
Linum catharticum	Purgier Linen			
Linum flavum (s. str.)	Yellow flax			
Linum tenuifolium	Fine-leaved flax			
Linum viscosum	Sticky flax			
Listera ovata	Large two-leaf			
Lloydia serotina	Late wrinkled lily			
Loiseleuria procumbens	Gämsheide			
Lolium ×boucheanum	Bastard-Lolch			
Lolium multiflorum	Italy raygrass			
Lolium perenne	English ryegrass			
Lomatogonium carinthiacum	Carinthian hem scar			
Lotus corniculatus (s. str.)	Common horn clover			
Lotus maritimus (var. siliquosus)	Asparagus clover			
Lotus pedunculatus	Swamp Horned Clover			
Lotus tenuis	Salt Horn Clover			
Luzula alpina	Alpen-Hainsimse			
Luzula alpinopilosa	Braune Hainsimse			
Luzula campestris	Hill Grove			
Luzula glabrata	Bald grove			
Luzula lutea	Gold-Hainsimse			
Luzula luzuloides	White hairy cress			
Luzula multiflora s. str.	Many-flowered woodrush			
Luzula pilosa	Wimper-Hainsimse			
Luzula spicata	Spiky Hair Cone			
Luzula sudetica	Sudeten-Hainsimse			
Lychnis flos-cuculi	Cuckoo's light carnation			
Lythrum hyssopifolia	Hyssop loosestrife			
Lythrum salicaria	Common loosestrife			
Malva alcea	Pointed-leaved mallow			
Malva moschata	Musk mallow			
Marrubium vulgare	Common horehound			
Medicago carstiensis	Karst snail clover			
Medicago falcata	Sickle Lucerne			
Medicago falcata × M. sativa	Bastard alfalfa			
Medicago lupulina	Hop Clover			
Medicago minima	Dwarf snail clover			
Medicago sativa s. lat.	Blue alfalfa			
Melampyrum arvense	Field quail wheat			
Melampyrum barbatum	Bearded quail wheat			
Melica ciliata	Ciliated Pearl Grass			
Melica transsilvanica (subsp. transsilvanica)	Transylvanian Pearl Grass			
Mentha ×dumetorum	Bush Mint			
Mentha aquatica	Water Mint			
Mentha arvensis	Field mint			

Mentha longifolia	Horse Mint			
Mentha pulegium	Polei mint			
Meum athamanticum	Bärwurz			
Microthlaspi perfoliatum	Through-grown puffball cabbage			
Minuartia gerardii	Alps spring kidney			
Minuartia glaucina	Hill Spring Kidney			
Minuartia rubra	Tufted kidney			
Minuartia viscosa	Adhesive kidney			
Molinia caerulea	Blue Pipe Grass			
Muscari botryoides	Small grape hyacinth			
Muscari comosum	Crested Grape Hyacinth			
Muscari neglectum	Vineyard Grape Hyacinth			
Muscari tenuiflorum	Narrow-flowered grape hyacinth			
Mutellina adonidifolia	Alpine motherwort			
Myosotis alpestris	Alpine forget-me-not			
Myosotis discolor	Variegated Forget-Me-Not			
Myosotis laxa	Lawn forget-me-not			
Myosotis nemorosa	Grove Forget-me-not			
Myosotis ramosissima	Hill forget-me-not			
Myosotis scorpioides (subsp. scorpioides)	Marsh forget-me-not			
Myosotis stricta	Sand forget-me-not			
Myosotis sylvatica (s. str.)	Forest forget-me-not			
Narcissus radiiflorus	Star daffodil			
Nardus stricta	Bürstling			
Neotinea tridentata (subsp. tridentata)	Variegated orchid			
Neotinea ustulata	Burnt Orchid			
Nigritella miniata s. str.	Red cabbage floret			
Nigritella rhellicani	Common cabbage floret			
Nigritella widderi	Ram's Cabbage Patch			
Noccaea caerulescens s. lat.	Pre-Alpine bagwort			
Odontites luteus	Yellow tooth rust			
Onobrychis arenaria	Sand Saving Chain			
Onobrychis montana (subsp. montana)	Mountain Sainfoin			
Onobrychis viciifolia	Common sainfoin			
Ononis arvensis	Goat's hackle			
Ononis pusilla	Dwarf Horehound			
Ononis repens (subsp. procurrens)	Creeping knapweed			
Ononis spinosa	thorny knapweed			
Ononis spinosa	Austrian hackle			
Ophioglossum vulgatum	Common Adder Tongue			
Ophrys apifera	Bee Ragwort			
Ophrys holoserica (subsp. holoserica)	Bumblebee Ragwort			
Ophrys insectifera (subsp. insectifera)	Fly Ragwort			
Ophrys sphegodes (s. str.)	Spider Ragwort			
Orchis mascula (s. lat.)	Stately orchid			
Orchis militaris	Helmet orchid			
Orchis pallens	Pale orchid			
Ornithogalum kochii (s. lat.)	Narrow-leaved milk star			
Ornithogalum umbellatum s. str.	Conical Milk Star			
Ornithogalum vulgare	Common Milky Star			
Orobanche alba	Quendel Summerwort			
Orobanche caryophyllacea	Bedstraw Summerwort			

Orobanche gracilis	Blood Red Summer Root			
Orobanche lutea	Yellow summerroot			
Orobanche minor	Clover summerwort			
Orobanche reticulata	Net summerwort			
Orobanche teucrii	Gamander Summerwort			
Oxytropis campestris	Alpine pointed keel			
Oxytropis halleri s. str.	Haller-Spitzkiel			
Oxytropis neglecta	Pyrenees Pointed Keel			
Oxytropis pilosa	Shaggy pointed keel			
Oxytropis triflora	Three-flower pointed keel			
Pachypleurum mutellinoides	Dwarf motherwort			
Parnassia palustris	Swamp Heart Leaf			
Pastinaca sativa	Common parsnip			
Pedicularis elongata (s. str.)	Long-stemmed lousewort			
Pedicularis foliosa	Leafy lousewort			
Pedicularis oederi	Crimson-tipped lousewort			
Pedicularis recutita	Beakless red lousewort			
Pedicularis rostratocapitata (subsp. rostratocapitata)	Beaked lousewort			
Pedicularis rostratospicata	Flesh-pink lousewort			
Pedicularis sylvatica (subsp. sylvatica)	Forest lousewort			
Pedicularis tuberosa	Tuberous lousewort			
Pedicularis verticillata	Whorl Lousewort			
Persicaria bistorta	Snake Knotweed			
Persicaria vivipara	Knotweed			
Petrorhagia prolifera (s. str.)	Sprouting rock carnation			
Petrorhagia saxifraga	Saxifrage rock carnation			
Peucedanum carvifolia	Caraway hair strand			
Peucedanum oreoselinum	Berg-Haarstrang			
Peucedanum ostruthium	Masterwort			
Peucedanum palustre	Swamp Hair Strand			
Phalaris arundinacea	Reed glossy grass			
Phelipanche arenaria	Sand Blue Shrike			
Phelipanche bohemica	Bohemian Blue Shrike			
Phelipanche purpurea	Purple Blue Shrike			
Phleum commutatum	Snow Valley Bluegrass			
Phleum hirsutum	Rough-haired Timothy Grass			
Phleum nodosum	Tuberous bluegrass			
Phleum phleoides	Tumbleweed			
Phleum pratense	Meadow bluegrass			
Phleum rhaeticum	Ciliated Timothy Grass			
Phragmites australis	Reed			
Phyteuma betonicifolium	Betonia Devil's Claw			
Phyteuma hemisphaericum	Grass-leaved devil's claw			
Phyteuma nigrum	Black devil claw			
Phyteuma orbiculare	Round headed devil's claw			
Phyteuma ovatum	Egghead Devil's Claw			
Phyteuma persicifolium	Peach-leaved devil's claw			
Phyteuma scheuchzeri	Scheuchzer Devil's Claw			
Picris hieracioides	Common bittercress			
Pimpinella alpina	Alpineibernelle			
Pimpinella major	Large burnet			
Pimpinella saxifraga	Small burnet			

Pinguicula leptoceras	Thin-spurred butterwort			
Pinguicula vulgaris	Common butterwort			
Plantago alpina	Alpine plantain			
Plantago altissima	Tall stalk plantain			
Plantago atrata (subsp. atrata)	Mountain plantain			
Plantago lanceolata	Pointed plantain			
Plantago major s. lat.	Broad plantain			
Plantago media	Medium plantain			
Plantago strictissima	Snake Plantain			
Platanthera bifolia	White forest hyacinth			
Platanthera montana	Greenish forest hyacinth			
Pleurospermum austriacum	Austrian rib seed			
Poa alpina	Alpine bluegrass			
Poa angustifolia	Narrow-leaved meadow grass			
Poa annua (subsp. annua)	Annual meadow grass			
Poa badensis	Baden bluegrass			
Poa bulbosa	Onion bluegrass			
Poa chaixii	Broadleaf meadow grass			
Poa glauca	Blue green meadow grass			
Poa molinerii	Dry bluegrass			
Poa nemoralis	Wood bluegrass			
Poa palustris	Fowl bluegrass			
Poa pratensis	Meadow bluegrass			
Poa supina	Cudgel Ryegrass			
Poa trivialis s. lat.	Common bluegrass			
Poa variegata	Purple meadow grass			
Polemonium caeruleum	Jacob’s ladder			
Polygala alpestris (subsp. alpestris)	Pre-Alpine Cross Flower			
Polygala amara	Bitter crucifer			
Polygala amarella	Marsh crucifers			
Polygala chamaebuxus	Box cross flower			
Polygala comosa	Crested Cruciferous Flower			
Polygala major	Crested Cruciferous Flower			
Polygala serpyllifolia	Quendel cross flower			
Polygala vulgaris	Common milkwort			
Polygonatum odoratum	Genuine Solomon's seal			
Potentilla alba	White cinquefoil			
Potentilla argentea (s. lat.)	Silvery cinquefoil			
Potentilla aurea	Golden cinquefoil			
Potentilla collina agg.	Hill cinquefoil			
Potentilla crantzii	Crantz cinquefoil			
Potentilla erecta	Bloodroot			
Potentilla grandiflora	Large-flowered cinquefoil			
Potentilla heptaphylla	Reddish cinquefoil			
Potentilla incana	Sand cinquefoil			
Potentilla inclinata	Grey cinquefoil			
Potentilla micrantha	Small-flowered cinquefoil			
Potentilla neumanniana	Spring cinquefoil			
Potentilla pusilla	Downy cinquefoil			
Potentilla recta	Upright cinquefoil			
Potentilla reptans	Creeping cinquefoil			
Potentilla sterilis	Strawberry cinquefoil			

Primula elatior (s. str.)	High primrose			
Primula farinosa	Flour Primrose			
Primula halleri	Haller’s primrose			
Primula veris (subsp. veris)	Medicinal primrose			
Primula vulgaris (subsp. vulgaris)	Stemless primrose			
Prunella grandiflora	Large flowered brunelle			
Prunella laciniata	White brunelle			
Prunella vulgaris	Common Brunelle			
Prunus fruticosa	Dwarf drawbar			
Prunus mahaleb	Hollyhock			
Prunus spinosa (subsp. spinosa)	Blackthorn			
Pseudorchis albida	Common white tongue			
Pulicaria dysenterica	Common fleabane			
Pulmonaria australis	Southern Lungwort			
Pulmonaria mollis	Soft-haired lungwort			
Pulsatilla alpina	Austrian alpine kitchen cherry			
Pulsatilla alpina	Yellow alpine kitchen pasque flower			
Pulsatilla grandis	Large pasque flower			
Pulsatilla montana	Mountain Kitchen Clam			
Pulsatilla pratensis (subsp. nigricans)	Black pasque flower			
Pulsatilla vernalis	Spring kitchen cherry			
Pulsatilla vulgaris	Bavaria Kitchen Clamp			
Ranunculus acris agg.	Sharp buttercup			
Ranunculus auricomus agg.	Golden Crowfoot			
Ranunculus bulbosus	Bulbous buttercup			
Ranunculus illyricus	Illyrian buttercup			
Ranunculus montanus	Mountain Buttercup			
Ranunculus nemorosus	Forest buttercup			
Ranunculus polyanthemophyllus	Slit Leaf Ranunculus			
Ranunculus polyanthemos agg.	Many-flowered buttercup			
Ranunculus repens	Creeping Buttercup			
Ranunculus repens	Forest buttercup			
Ranunculus villarsii	Grenier Buttercup			
Rhamnus saxatilis agg.	Rock buckthorn			
Rhinanthus alectorolophus (s. lat.)	Shaggy Rattlehead			
Rhinanthus glacialis	Grannen rattle pot			
Rhinanthus minor	Small rattletrap			
Rhinanthus serotinus	Large rattle pot			
Rhododendron ferrugineum	Rusty alpine rose			
Rhododendron hirsutum	Ciliated alpine rose			
Rosa canina agg.	Dog Rose			
Rubus caesius	Floodplain Blackberry			
Rubus fruticosus agg.	Real blackberries			
Rubus idaeus	Raspberry			
Rumex acetosa (subsp. acetosa)	Meadow Sorrel			
Rumex acetosella (s. lat.)	Dwarf Sorrel			
Rumex alpestris	Mountain Amp			
Rumex alpinus	Alpine Amp			
Rumex conglomeratus	Knotted ampulla			
Rumex crispus	Curly dock			
Rumex obtusifolius	Blunt-leaf ampulla			
Rumex thyrsiflorus	Panicle ampulla			
Sagina nodosa	Knot mast weed			

Sagina procumbens	Lying mast weed			
Sagina saginoides	Alpine mast herb			
Salix cinerea (s. str.)	Ash Willow			
Salix mielichhoferi	Tauern Pasture			
Salix myrsinifolia	Black Willow			
Salix pentandra	Laurel Willow			
Salix purpurea	Purple willow			
Salix repens	Kriech-Weide			
Salvia austriaca	Austria sage			
Salvia nemorosa	Tumbleweed			
Salvia pratensis (subsp. pratensis)	Meadow Sage			
Salvia verticillata	Whisk Sage			
Sanguisorba minor	Small meadow buttercup			
Sanguisorba officinalis	Large meadow buttercup			
Saponaria pumila	Dwarf soapwort			
Saussurea alpina	Common alpine loophole			
Saussurea discolor	Felt alpine loophole			
Saussurea pygmaea	Dwarf alpine loophole			
Saxifraga bulbifera	Onion saxifrage			
Saxifraga granulata (subsp. granulata)	Knotted saxifrage			
Scabiosa canescens	Scented Kabiosa			
Scabiosa columbaria agg.	Pigeon Scabiosa			
Scabiosa lucida	Glossy scabiosa			
Scabiosa ochroleuca	Yellow scabiosa			
Scabiosa triandra	Southern scabiosa			
Scirpus sylvaticus	Common forest rush			
Scleranthus polycarpos	Wild knotweed			
Scorzonera austriaca	Austrian black salsify			
Scorzonera cana	Common stem seed			
Scorzonera humilis	Low black salsify			
Scorzonera purpurea	Purple Black Root			
Scorzonera rosea	Rose Black Root			
Scorzoneroides autumnalis	Autumn Scale Glow Tooth			
Scorzoneroides helvetica	Swiss Scaled Glow Tooth			
Scutellaria galericulata	Marsh hellebore			
Scutellaria hastifolia	Skewer hellebore			
Securigera varia	Variegated crown vetch			
Sedum acre	Pungent wall pepper			
Sedum album	White wall pepper			
Sedum sexangulare	Mild wall pepper			
Selaginella selaginoides	Thorny moss fern			
Selinum carvifolia	Caraway Sylt			
Sempervivum arachnoideum	Cobweb houseleek			
Sempervivum wulfenii	Wulfen houseleek			
Senecio abrotanifolius	Ragwort			
Senecio aquaticus s. str.	Water-Greenwort			
Senecio cacaliaster	Butterbur verbena			
Senecio cordatus	Alpine Greengage			
Senecio doronicum (s. str.)	Chamois Root Grassweed			
Senecio erraticus	Spreading Grass Weed			
Senecio erucifolius	Rauken-Greiskraut			
Senecio incanus agg.	Grey verbena			

Senecio jacobaea	Jacob's verbena			
Senecio ovatus	Fox Grouse			
Senecio subalpinus	Berg-Greissraut			
Serratula tinctoria	Färber-Scharte			
Seseli annuum	Steppe Mountain Fennel			
Seseli austriacum	Austrian mountain fennel			
Seseli hippomarathrum	Horse Mountain Fennel			
Seseli libanotis	Mountain hellebore			
Seseli pallasii	Variegated mountain fennel			
Sesleria caerulea (s. str.)	Lime bluegrass			
Sesleria sphaerocephala	Round headed blue grass			
Sesleria uliginosa	Bog bluegrass			
Sideritis montana	Mountain limb herb			
Silaum silaus	Europe meadow silge			
Silene acaulis	Silicate cushion cinquefoil			
Silene acaulis	Lime cushion cinquefoil			
Silene dioica	Red campion			
Silene latifolia	White campion			
Silene nemoralis	Grove Flax			
Silene nutans	Nodding toadflax			
Silene otites	Ear spoon cinquefoil			
Silene vulgaris	Eye blistered toadflax			
Solidago canadensis	Canadian goldenrod			
Solidago gigantea	Giant Goldenrod			
Solidago virgaurea	Goldenrod			
Spiranthes spiralis	Autumn rotation			
Stachys recta	Upright sweetgum			
Stellaria graminea	Common stitchwort			
Stellaria media (s. str.)	Bird's Chickweed			
Stellaria palustris	Marsh Stitchwort			
Stipa capillata	Feather grass			
Stipa eriocaulis	Ornamental feather grass			
Stipa pennata ss. orig.	Grey sheath feather grass			
Stipa pulcherrima (subsp. pulcherrima)	Big feather grass			
Succisa pratensis	Common devil sabbite			
Succisella inflexa	Bald Swamp Bite			
Symphytum officinale (s. str.)	Common comfrey			
Tanacetum corymbosum	Ostrich Rain Fern			
Taraxacum sect. Alpestria	Species group Blackish Dandelion			
Taraxacum sect. Alpina	Alpine dandelion species group			
Taraxacum sect. Cucullata	Species group hooded dandelion			
Taraxacum sect. Erythrosperma	Species group callus dandelion			
Taraxacum sect. Hamata	Species group hook.dandelion			
Taraxacum sect. Palustria	Species group marsh dandelion			
Taraxacum sect. Ruderalia	Species group meadow dandelion			
Tephroseris crispa	Bach ash herb			
Tephroseris helenitis	Elecampane ash herb			
Tephroseris integrifolia (s. lat.)	Steppe tumbleweed			
Tephroseris longifolia (s. str.)	Pre-Alpine Ash Weed			
Tephroseris tenuifolia	Swiss ash herb			
Teucrium botrys	Grape germander			
Teucrium chamaedrys (subsp. chamaedrys)	True germander			
Teucrium montanum	Mountain germander			

Teucrium scordium (s. str.)	Garlic germander			
Thalictrum aquilegiifolium	Columbine meadow rue			
Thalictrum flavum	Yellow meadow rue			
Thalictrum foetidum	Stinking meadow rue			
Thalictrum lucidum	Glossy meadow rue			
Thalictrum minus	Mountain meadow rue			
Thalictrum simplex (s. lat.)	Simple meadow rue			
Thesium alpinum	Alpine Mountain Flax			
Thesium bavarum	Big mountain flax			
Thesium linophyllon	Medium mountain flax			
Thesium pyrenaicum	Meadow Mountain Flax			
Thymus kosteleckyanus	Hungarian thyme			
Thymus odoratissimus	Austrian thyme			
Thymus praecox	Creeping thyme			
Thymus pulegioides	Medicinal thyme			
Thymus serpyllum (s. str.)	Breckland thyme			
Tofieldia calyculata	Common Siamese Lily			
Tragopogon dubius	Common salsify			
Tragopogon orientalis	Large flowered meadow goatsbeard			
Traunsteinera globosa	Kugelorchis			
Trifolium alpinum	Alpine Clover			
Trifolium arvense (subsp. arvense)	Rabbit Clover			
Trifolium badium	Brown Clover			
Trifolium campestre	Field Clover			
Trifolium dubium	Thread Clover			
Trifolium fragiferum (subsp. fragiferum)	Strawberry Clover			
Trifolium hybridum	Swedish clover			
Trifolium medium (subsp. medium)	Zigzag Clover			
Trifolium montanum (subsp. montanum)	Mountain Clover			
Trifolium ochroleucon	Pale yellow clover			
Trifolium patens	Switzerland-Clover			
Trifolium pratense	Meadow Clover			
Trifolium repens (subsp. repens)	Creeping Clover			
Trifolium spadiceum	Bog Clover			
Trifolium thalii	Thal’s Klee			
Triglochin palustre	Swamp Trident			
Trinia glauca (subsp. glauca)	Honewort			
Trisetum alpestre	Oatgrass			
Trisetum flavescens	Golden oatgrass			
Trollius europaeus	European troll flower			
Urtica dioica	Great nettle			
Vaccinium gaultherioides	Small-leaved dewberry			
Vaccinium myrtillus	Blueberry			
Vaccinium uliginosum (s. str.)	Bog bilberry			
Vaccinium vitis-idaea	Cranberry			
Valeriana celtica (subsp. norica)	Real spike			
Valeriana dioica (subsp. dioica)	Marsh valerian			
Valeriana officinalis	Vorarlberg medicinal valerian			
Valeriana officinalis	Actual medicinal valerian			
Valerianella carinata	Keel field salad			
Valerianella dentata	Tooth field salad			
Valerianella locusta	Common lamb's lettuce			

Valerianella rimosa	Furrow Field Lettuce			
Veratrum album	Actual white tanner			
Veratrum album	Green white tanner			
Verbascum alpinum	Wool King Candle			
Verbascum blattaria	Grape King Candle			
Verbascum chaixii	Austrian Chaix royal candle			
Verbascum densiflorum	Large flowered mullein			
Verbascum lychnitis	Flour royal candle			
Verbascum nigrum	Dark mullein			
Verbascum phlomoides	Common mullein			
Verbascum phoeniceum	Purple Royal Candle			
Verbena officinalis	Real verbena			
Veronica arvensis	Field Speedwell			
Veronica austriaca	Austrian Honorary Award			
Veronica bellidioides (subsp. bellidioides)	Maßlieb Speedwell			
Veronica chamaedrys (s. str.)	Germander speedwell			
Veronica dillenii	Dillenius Speedwell			
Veronica maritima	Long-leaved speedwell			
Veronica officinalis	Real speedwell			
Veronica persica	Persian speedwell			
Veronica praecox	Early Speedwell			
Veronica prostrata (s. str.)	Lying Speedwell			
Veronica serpyllifolia	Thyme Speedwell			
Veronica spicata (s. str.)	Spiked Speedwell			
Veronica teucrium	Large speedwell			
Veronica verna (s. str.)	Spring Speedwell			
Veronica vindobonensis	Vienna germander speedwell			
Vicia angustifolia	Narrow-leaved vetch			
Vicia cracca (s. strictiss.)	Bird Vetch			
Vicia hirsuta	Rough hairy vetch			
Vicia incana	Rough vetch			
Vicia lathyroides	Flat pea vetch			
Vicia pannonica	Hungarian vetch			
Vicia sativa	Seed Vetch			
Vicia sepium	Fence vetch			
Vicia tenuifolia	Fine-leaved vetch			
Vicia tetrasperma (s. str.)	Four seeded vetch			
Vincetoxicum hirundinaria (subsp. hirundinaria)	True swallowwort			
Viola ambigua	Tumbleweeds			
Viola canina	Schultz Dog Violet			
Viola canina	Actual dog violet			
Viola canina	Mountain Dog Violet			
Viola hirta	Meadow Violet			
Viola kitaibeliana	Steppe pansy			
Viola palustris	Marsh Violets			
Viola rupestris	Sand Violets			
Viola tricolor (s. str.)	Common pansy			
Viscaria alpina	Alpine Pechnel			
Viscaria vulgaris	Common Pechnel			
Willemetia stipitata (subsp. stipitata)	Crown lettuce			
Wulfenia carinthiaca (subsp. carinthiaca)	Cow's footprint			
Xeranthemum annuum	Annual everlasting			

	dry			
	fresh (moderately moist to moderately dry)			
	moist			
	wet			

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Bibliography

Bätzing, Werner: Die Alpen. Geschichte und Zukunft einer europäischen Kulturlandschaft; München 2015

Bätzing Werner: Landleben. Geschichte und Zukunft einer gefährdeten Lebensform; München 2020

Bracharz, Kurt: Von der Alp auf den Teller. Käsekultur in Vorarlberg; Innsbruck 2014

Brade, Wilfried; Brade, Erwin (In: Berichte über Landwirtschaft. Zeitschrift für Agrarpolitik und Landwirtschaft 93 (2)): Vor- und Nachteile einer sehr intensiven Milcherzeugung aus der Blickrichtung des Kraftfuttereinsatzes und der Tiergesundheit; 2015.

Ginzinger, Wolfgang; Eliskases-Lechner, Frieda; Osl, Franz: Einfluss der Silage auf die Milch, in: Fachgruppe Lebensmittel, ALVA_Jahrestagung 2001

Gruber, Leonhard (In: Institut für Nutztierforschung, HBLFA Raumberg-Gumpenstein. 24. Viehwirtschaftliche Fachtagung): Einfluss der Kraftfuttermenge auf Futteraufnahme und Leistung von Milchkühen; 2007.

Heumilch-Regulativ der ARGE Heumilch Österreich und Deutschland, Vorschriften für silofreie Milch; 2022: https://www.heumilch.com/heumilch/regulativ/

Hoffmann, Manfred (Sächsischer Landeskontrollverband): in agrarheute RIND; Mai 2022

Hörtenhuber Stefan; Zollitsch Werner (BOKU - Universität für Bodenkultur Wien, Institut für Nutztierwissenschaften): Ökobilanz von Milchvieh-Modellbetrieben; Wien 2013.

Internationale Bodensee-Stiftung Radolfzell: Baselinereport, Biodiversitätskriterien in Standards und Qualitätssiegeln der Lebensmittelbranche; Radolfzell, 2013.

Martens, Holger (Institut für Veterinär-Physiologie der Freien Universität Berlin): Leistung und Gesundheit von Milchkühen: Bedeutung von Genetik (Ursache) und Management (Wirkung); in Tierärztliche Praxis Großtiere; 4/2016.

Moser, Franz: Grüner Bericht des Landes Salzburg 2016-2018, Salzburg 2019

Lindner, Gerhard; Kittl; Matthias: Heumilchproduktion in Österreich. Bestandserhebung und Implikationen für die Weiterbildung und Beratung; Wien 2016

Ramminger Leopold: Unser Seekirchen – Aus vergangenen Tagen; Band 8: Die ehemaligen Seekirchner Käsereien, Seekirchen am Wallersee 2019

Seiz, Michaela: Fettsäureverteilung in österreichischer Heumilch – Einfluss der silagefreien Fütterung im Jahresverlauf; Wien 2012

Statistik Austria: Agrarstrukturerhebung 2010, Wien 2013

Statistik Austria: Landwirtschaftliche Gesamtrechnung 2019, Wien 2020

Suske, Wolfgang; Depisch, Barbara; Huber, Johanna; Frieß, Thomas; Holzinger, Werner; Derbuch Georg; Kahapka, Jördis; Huber, Elisabeth; Gunczy, Lorenz Wido (Suske Consulting): Analyse der Zielerfüllung der Austrian Agri-environmental Programme -Maßnahme „Silageverzicht“ in Bezug auf Biodiversität; Wien 2020

Wopfner. Hermann: Bergbauernhandbuch. Von Arbeit und Leben des Tiroler Bergbauern; 3. Band: Wirtschaftliches Leben; Hrsg. von Grass, Nikolaus; Innsbruck 1997

Zebeli, Quendrim; Khol-Parisini, Annabella: Strukturversorgung und Leistung der Milchkuh: zwei Seiten einer Medaille. In: Reiko Rackwitz (Hg.): LBH: 7. Leipziger Tierärztekongress – Tagungsband 1. Leipziger Tierärztekongress. Leipzig: Lehmanns (Leipziger blaue Hefte, Editoren: Reiko Rackwitz); 2014

Zollitsch Werner, Hörtenhuber Stefan., Lindenthal Thomas, Penicka Alexandra, Scheurich Anja (BOKU - Universität für Bodenkultur Wien, Zentrums für Globalen Wandel und Nachhaltigkeit): Heumilchproduktion im Kontext der Sustainable Development Goals; Wien 2019.