

Grassland and grazers - What Swiss mountain farming does for the environment FiBL Study



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In mountain regions there is a considerable amount of grassland – both meadow and pasture - and in addition there is forest. There are only a few crop fields due to topography and climate often making cropping difficult. Mountain farming is therefore entirely geared towards, and dependent on, the use of grassland. Grassland can be used for human consumption mainly with the help of ruminants such as cattle, sheep and goats.

Ruminants can feed on grass and provide valuable food for humans. They make plants that are inedible for us - such as grass, herbs, and leaves - accessible for human consumption. Mountain farming with ruminants generates high-quality milk and meat products. They are produced locally and strengthen the value chains there.

About forty percent of Switzerland's agricultural land is located in mountainous areas. An even larger area is located in the summering regions, the Alps, where ruminants are kept for around 100 days in summer (1). Mountain farmers contribute to the decentralised settlement in Switzerland and to the preservation of numerous cultural assets and the know-how and skills of agricultural craftsmen. Their work forms the basis for attractive soft tourism in the mountains. All this only works in conjunction with ruminants.

From the point of view of climate protection however, the keeping of ruminants in particular is strongly criticised due to the emissions of large quantities of the climate-damaging methane gas during their digestive process (2). Would it not therefore make ecological sense to abandon livestock farming in the mountains and leave today's agricultural land to nature? The answer is no. Firstly, as already mentioned, mountain farming provides numerous important services for society and the environment. Secondly, more recent scientific studies show that, also from the point of view of climate protection, management of grassland in mountain areas with ruminants performs significantly better than previously assumed.

I. In mountain areas, ruminants maintain the grassland, the best agricultural use

Permanent grasslands are, along with forests and moors, the most important terrestrial carbon storages on earth (rocks excluded) (3). They store especially large amounts of carbon in the soil in the form of humus and other organic material. This is almost two-fold higher in mountainous areas compared to lowland regions (4) and often more than in forest soils (3, 5). During the vegetation period, grass continuously absorbs the gas carbon dioxide (CO₂) from the air and then fixes the carbon in its leaf and root masses. This is an amount of one to six tons of carbon per hectare and year (4). Using, maintaining and preserving grasslands is therefore protecting the climate. And for this we need ruminants.

If the mountain regions - especially the Alps - were no longer farmed with ruminants, forests would not appear everywhere. Most areas would be overgrown by green alder bushes, which assimilate nitrogen from the air with the help of microorganisms and emit

the climate gas N₂O (nitrous oxide) from the soil. This is also known as laughing gas and is 300 times more harmful to the climate than CO₂; the output of green alders is 1200 kilograms CO₂ equivalents (see below) per hectare and summer half-year (6).

Only ruminants can control green alders. Only goats and Engadine sheep can drive them back by peeling off the bark with their teeth. Avoiding green alders is important for the climate, the nitrogen balance, nutrient pollution and biodiversity. Avoidance is equally important for tourism - as green alder bushes create impassable areas - and for protection against avalanches, as they easily glide over the recumbent alders (7).

2. Manure stabilizes the soil, promotes plant growth and fixes carbon

The manure of goats, sheep and cattle is a valuable natural fertilizer. Manure stabilizes the soil, promotes plant growth and fixes carbon - it offers soil building and biodiversity enhancing fertilization. If the winter manure is stored correctly and spread professionally at the right time, it promotes humus formation and thus carbon sequestration in the soil more than any other fertilizer.

Up to 1200 kilograms of carbon can be fixed in the soil per year by the well-rotten manure of a cow (8). In this way the dung stabilizes the soil (9) and, at the same time, promotes plant growth. It does not have to be transported far and its production does not require any additional energy. In the mountain zones 2 to 4, the dung of one cow or seven goats usually fertilises around one hectare of permanent grassland (10).

If one did not have the manure of ruminants, artificial fertilizers would be used. However, these reduce the stability of the soil and are produced with a high energy input: when fertilizing with artificial fertilizer, energy input is more than twice as high as when fertilizing with ruminant manure (9).

3. Ruminants in mountain areas and climate protection - adjusting stocking densities and species selection

In principle, it makes sense to keep fewer ruminants in order to protect the climate. However, a complete renunciation would not make sense in view of the benefit the animals have. In particular, ruminants should be reduced where they are fed with concentrated feed as well as maize and imported arable feed or even temporary grassland.

On the other hand, in mountain areas, ruminants should be retained and used for grassland management and conservation. With regard to stocking densities and the choice of species, care should be taken to ensure that these are optimally adapted to the grassland areas concerned. For example, only smaller, light animals should graze on steep, often damp areas and the number of grazing animals must match the grass growth.

Comparing climate gases

In order to be able to compare the global warming potential of greenhouse gases, the unit of CO₂ equivalent (CO₂ eq.) was created. This unit of measurement makes the greenhouse gases comparable in terms of their impact on the climate (11). Carbon dioxide (CO₂) is assigned the value 1 and all other gases are assigned a number that corresponds to their global warming potential compared to CO₂. Methane (CH₄) is usually assigned a potential of 28, although this can be up to 30 depending on its origin (11), while nitrous oxide (N₂O) is assigned a factor of 300 (11). The fact that these three most important greenhouse gases (carbon dioxide, methane and nitrous oxide) among many others, behave differently in the atmosphere is not yet taken into account in most calculations. There are, however, new studies that take this aspect into account (11, 12).

In the case of methane (CH₄), the heating force is strong shortly after the gas has been expelled. After ten years this potential decreases relatively sharply and after fifty years is practically zero. With CO₂ it is quite different. This gas has a lower warming potential than methane. However, it is not decomposed and remains in the atmosphere: any CO₂ that is added increases the warming potential even further. If the gas CH₄ is emitted by the same number of ruminants over the years, the concentration of methane in the atmosphere remains constant. This means that methane is emitted here and the methane that was emitted in the past is decomposed there to the same extent (12). A constant number of ruminants therefore does not lead to increasing warming, unlike a constant number of fossil-fuelled cars.

In addition, there is a difference between the so-called biogenic methane produced by ruminants, other animals or plants and that which comes from fossil sources. Ruminant methane is produced by the decomposition of plant substances in the animals' stomachs. Those living plants have recently absorbed and fixed carbon from the atmosphere. On the other hand, methane and carbon dioxide from fossil sources are carbon that was fixed in the soil for thousands of years and is now being released anew. Since fossil sources do not grow back, the fossil carbon enters the atmosphere additionally. This is partly taken into account in the CO₂ equivalents, as a slightly lower conversion factor to CO₂ equivalents can be used for biogenic methane, although this is not always done. Because of the two aspects of biogenic methane as a greenhouse gas, the comparison often made between ruminants and cars, which both emit greenhouse gases, is not adequate (12).

4. Grazing and organic farming promote biodiversity

When assessing the environmental impact of ruminants, it is important not only to take into account their potential climate impact, but also to duly consider their role in comprehensive sustainable food systems. This includes more than just the criterion "climate-friendly". For example, the biodiversity of grassland can only be well preserved by grazing animals (13). Grazing increases the biodiversity of plant species in grasslands compared to ungrazed grasslands, as a large-scale research project involving forty participating countries showed (13).

Due to the increased exposure of the ground level areas of the grassland to light from the animals' bite, plant species appear that could not thrive in a non-bitten area. In the Swiss mountain area, the grasslands in mountain zones 3 and 4 and in the summering areas already fulfil many environmental objectives due to the careful, mostly extensive cultivation. In the mountain areas, the proportion of valuable grassland is ten times higher in mountain zone 2 compared to the lowlands, and up to forty times higher in the summering areas (14). In addition, a quarter of the holdings in mountain areas farm organically; in lowland regions the figure is only five percent (1). The renunciation of artificial fertilizers and pesticides in organic farming is good for the environment, for biodiversity and last but not least, for health.

5. Grassland based mountain ruminant husbandry - one of the most animal-friendly farming methods

Grassland-based ruminant husbandry in mountain areas is also one of the most animal-friendly farming methods. The animals enjoy a good, free life in the mountain regions: almost ninety percent of the Swiss mountain farms take part in the federal animal welfare programmes, letting the animals graze in summer and giving them outdoor exercise in winter as well (15). Animals that graze a lot and eat little concentrated feed are healthier and also enable economically efficient production (16).

6. Healthy ruminant products from mountain areas

Dairy and meat products from animals that graze on grassland in the Alps contain more unsaturated fatty acids that are healthy for us humans than those from animals fed on maize and other cereals, as well as those fed on grassland with higher energy density and reduced grazing frequency (17 a,b).

7. Ruminants and grassland - an important pillar in sustainable food systems

Model calculations by the Research Institute of Organic Agriculture FiBL show that with the suggested grassland use and the abandonment of feeding arable crops such as cereals, protein concentrate and fodder maize to animals, all people can be well fed by 2050. At the same time, almost all important environmental parameters, including the greenhouse effect, can be improved (18, 19). The prerequisites for this are less food waste and lower proportions of animal products in the human diet (about one third of the current amount).

The complete renunciation of animal products is not a reasonable option: the vast expanses of grasslands worldwide must be used adequately for food production, especially with ruminants. In Switzerland, this applies particularly to mountain regions (20).

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