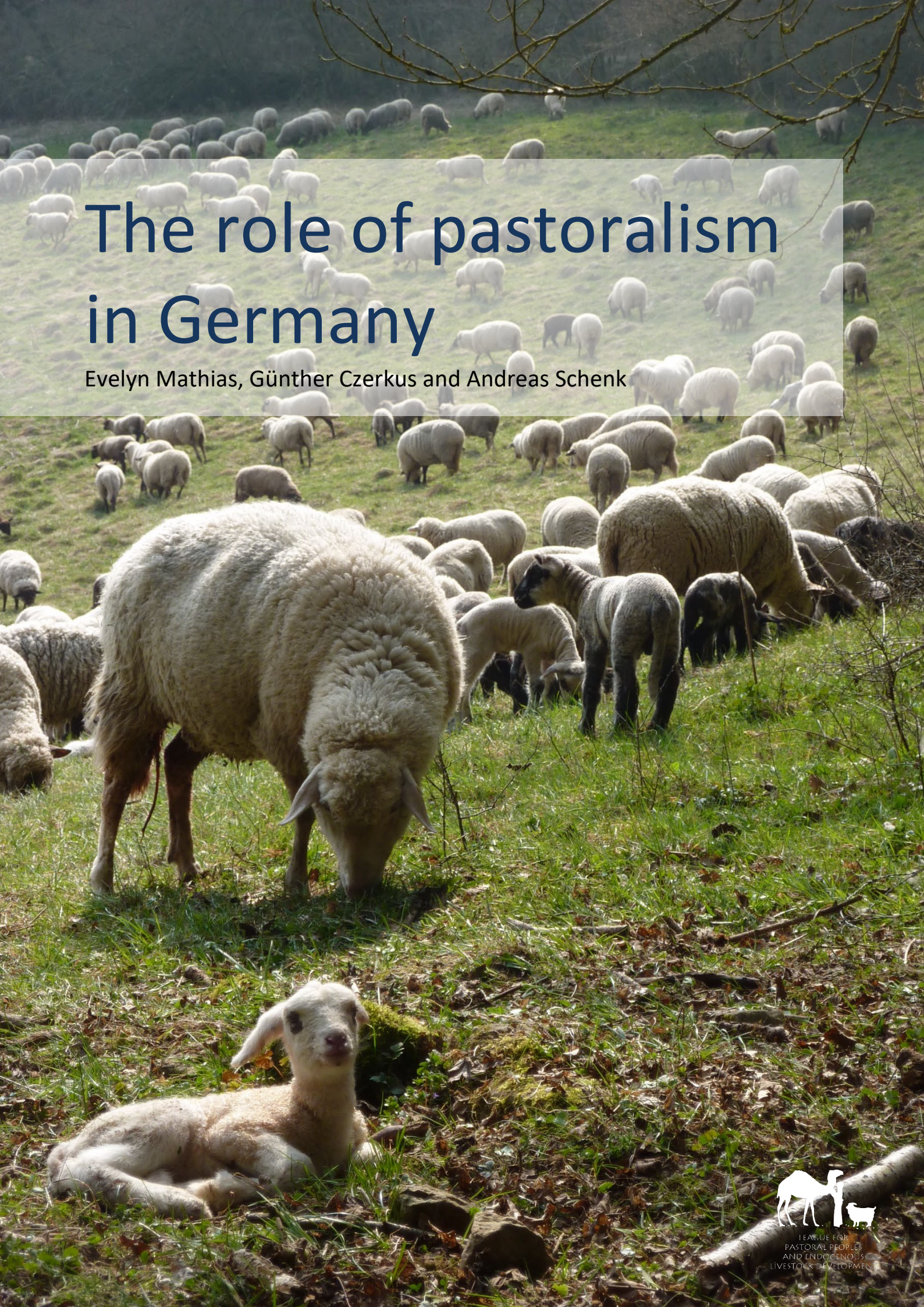
The role of pastoralism in Germany

Evelyn Mathias, Günther Czerkus and Andreas Schenk



LEAGUE FOR PASTORAL PEOPLES AND ENDOGENOUS LIVESTOCK DEVELOPMENT

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Evelyn Mathias
League for Pastoral Peoples and Endogenous Livestock Development

Günther Czerkus
League for Pastoral Peoples and Endogenous Livestock Development

Andreas Schenk
Bundesverband Berufsschäfer e.V.

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Cover photo: Paul Mundy

LEAGUE FOR PASTORAL PEOPLES AND ENDOGENOUS LIVESTOCK DEVELOPMENT

Contents

Summary

This study investigates the situation of pastoralism in Germany. It gives an overview of the data sources on livestock and pastoralism in Germany, the pastoralist systems and the definitions of pastoralism used. Germany has three main types of pastoralism: sheep transhumance (*Wanderschäferei*, the long-distance movement of mobile shepherds and their flocks between winter and summer pastures), location-bound herding (*standortgebundene Hütehaltung,* where pastoralists graze their sheep and goats in a more or less wide radius around the homestead), and mountain farming (*Almwirtschaft*, where cattle, plus some sheep, goats and horses, stay with their herder on mountain pastures during the summer months, returning to the valleys in the autumn).

The definitions of the various forms of pastoralism vary from state to state within Germany. There are an estimated 1,000 full-time shepherds in Germany, most of whom are mobile. Smaller enterprises with fewer sheep are less likely to be mobile and more likely to run part-time or hobby operations, or as part of a mixed farm. The 1,000 large, mobile operations graze perhaps 3.4% of Germany's permanent grasslands.

Livestock products include meat, milk, cheese and wool. These are worth a total of EUR 83.9 million per year for the 1,000 large operations. Environmental services include enhanced biodiversity through seed and insect dispersal, pasture fertilization by the animals' manure, a dense grass cover, and moderate soil compaction compared to the use of machinery. Taken together, these environmental services are worth between EUR 207 and 347 million – more than the income derived from the sale of products. Other benefits include landscape maintenance for tourism and recreation, improved groundwater quality, and control of erosion, flood and wildfires. It is hard to put an economic value on these benefits.

Mobile herding is declining because of low profitability, a growing shortage of suitable grazing land, attacks by wolves, and excessive bureaucracy. Even though the number of pastoralists in Germany is small, they make a disproportionate contribution to Germany's economy and environment. More reliable data focusing on pastoralism is needed to obtain a better picture of the status of pastoralism and to provide a basis for efforts to support it.

Introduction

> *"Pastoralism is practised by millions of people worldwide and represents an intimate relationship between people, the animals they care for and the landscape. Yet despite existing for millenniums, little is known about pastoralist societies and the interlinkages between their practices and the rangelands on which these depend."*
> (Johnsen et al. 2019)

So concluded a report published by GRID-Arendal and UN Environment in 2019. It encourages the study of pastoral systems to fill data gaps and improve the visibility of pastoralists. It also calls for developing methods to improve information gathering on the situation and valuable contributions of pastoralists.

This study takes up these recommendations and investigates the situation of pastoralism in Germany. It has three goals:

(1) To give an overview over the data sources on livestock and pastoralism in Germany.

(2) To add to the methodology on studying pastoralism.

(3) To describe Germany's pastoralism and its practitioners.

After a general overview of data sources and types, systems and definitions of pastoralism, our study provides data and estimates on pastoralist numbers and contributions.

The study is part of a series of studies of pastoralists coordinated by the League for Pastoral Peoples and Endogenous Livestock Development on four continents.[1]

[1] See www.pastoralpeoples.org/thematic/accounting-for-pastoralists-studies/

Methodology

This study has been developed in two stages. The bulk of the data was collected and analysed between July 2019 and September 2020. The methods included:

- Literature search in libraries and online.
- Search for and analysis of data freely accessible in online databases about Germany run by the German government, the federal states and the European Union.
- Compilation of information from websites and materials of shepherd associations.
- Personal communications with shepherds; in addition, one of us (Günther Czerkus) was a mobile shepherd until 2021; the other two have been working with and for shepherds in Germany for over 10 years.
- Analysis of messages by shepherds in social media.
- Estimates of numbers and contributions of mobile herders.

The outcome has been a first comprehensive draft of this document. Its key findings were published in a 6-page summary in September 2020 (Czerkus et al. 2020). The data mostly cover the period 2016–2018.

Since then, more recent statistics have become available. However, when finalizing the draft for publication over the past six months, we decided against updating all the calculations because the differences are not marked enough to alter the trends evident from our original calculations. The section "Future of pastoralism" highlights some of the changes that have taken place since September 2020. It also points out some new opportunities for pastoralism in Germany and what needs to be done for its preservation.

Figure 1 shows the locations of places and regions mentioned in the text.

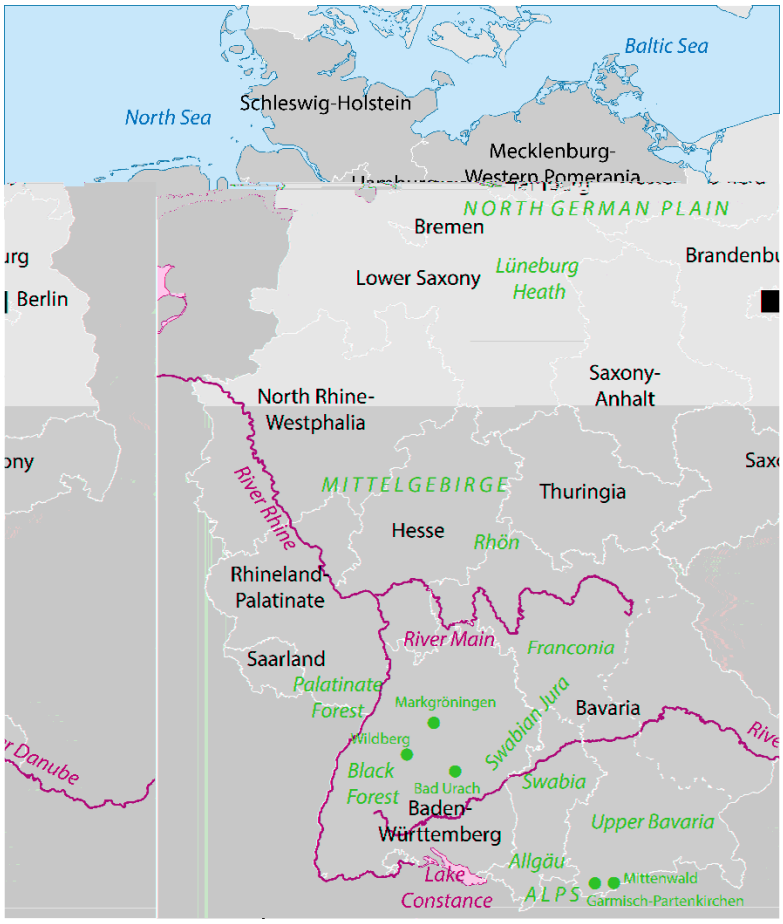

Figure 1. Locations in Germany mentioned in the text

Landscapes, land use and livestock in Germany

Germany covers nearly 357,582 km^2 and has (in 2016) about 82.5 million residents, or about 231 persons/km^2 (Destatis 2018a, table 1.1.2, BLE 2019, table 8). The country has three main physiographic regions: the flat or gently undulating North German Plain, the central hills and valleys known as the *Mittelgebirge*, and the rugged mountains and valleys of the Alps in the far south (Figure 2). Precipitation averages 570 mm a year. It is lowest in the east and highest in the mountains of central and southern Germany.

Photos: Top: Creative Commons, CC0 1.0 Universal. pxhere.com
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Bottom: By Gewetz, CC BY-SA 3.0, en.wikipedia.org/wiki/Bavarian_Alps#/media/File:Koenigssee_Watzmann.jpg

Figure 2. Physiographic regions of Germany

Land use

About 33% of Germany are used for crops and permanent cultures, 13% are permanent grassland (German "*Dauergrünland*") and 32% forest, leaving some 22% for other uses (housing, infrastructure, lakes, rivers and barren land) (Figure 3 and 4) (BLE 2019, tables 45 and 47, Destatis 2018a, tables 19.1.1 und 19.1.2). Permanent grassland refers to "*land used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or more…*" (EU 2013: Article 4(1)(h)). All in all, some 46% of Germany are used for agriculture, managed by 275,400 farm operations in 2016. About 185,200 of them kept livestock (BLE 2019, tables 2 and 84).

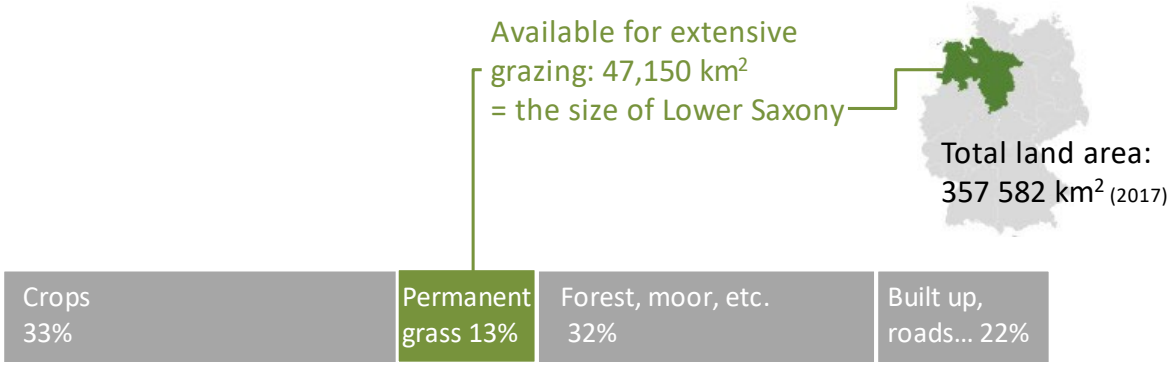


Figure 3. Land use in Germany (Sources: BLE 2019, tables 45 and 47, Destatis 2018a, tables 19.1.1 und 19.2.2)

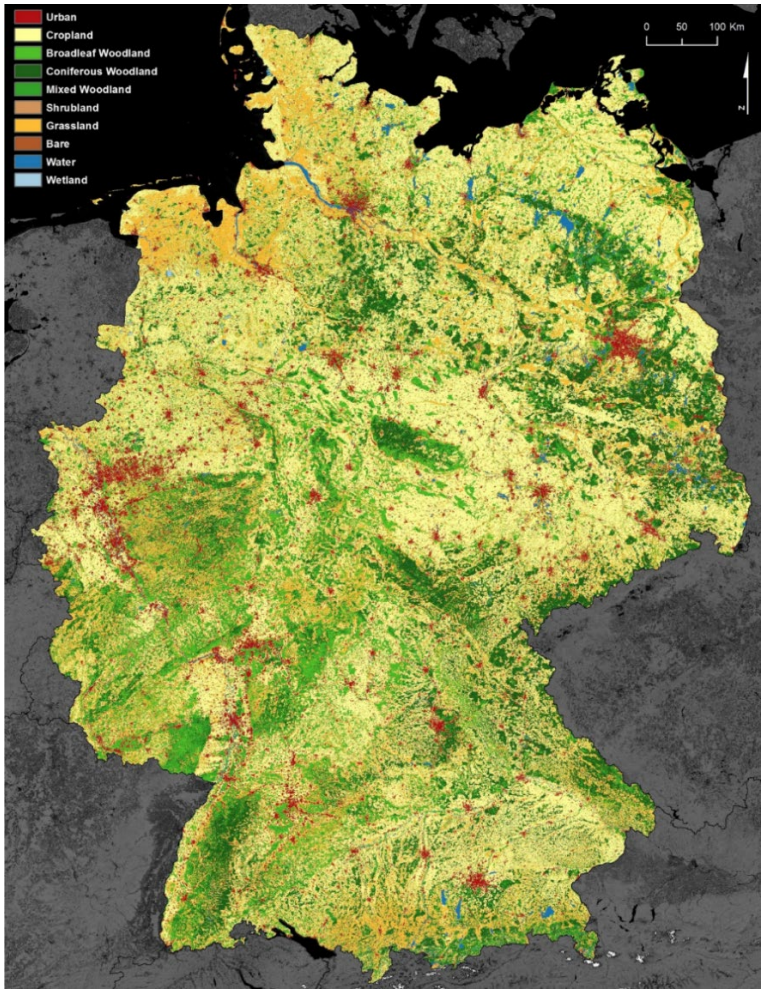


Figure 4. Map of land use in Germany, 2014. Grassland is in orange. (Source: DLR 2016)

Livestock numbers

In 2016, Germany had a livestock density of 1.1 livestock units (LSU, where 1 LSU is the equivalent of an adult dairy cow) per hectare of utilized agricultural area (EU 2019). The most numerous livestock are chickens (173.5 million, or two chickens for every human inhabitant), and pigs (27.3 million). There are 12.4 million cattle (4.2 million of them kept for dairying), and 1.6 million sheep; plus about 139,000 goats, the bulk of which are in southern Germany (BLE 2019, tables 2 and 81). The numbers capture only those pigs kept in holdings with 50

and more pigs, and sheep in holdings with 20 or more sheep (Destatis 2018b:511). Including sheep kept in smaller holdings, their population would be a little over 1.8 million (BLE 2019, table 97, Figure 5).

Germany also has about 442,000 horses (BLE 2018, table 81). They are mostly kept for hobby purposes. Horse-riding establishments have spread as farms have switched business models or have closed. Some horses are used in agriculture, forestry and landscape management (LUBW undated, Herold et al. 2009).

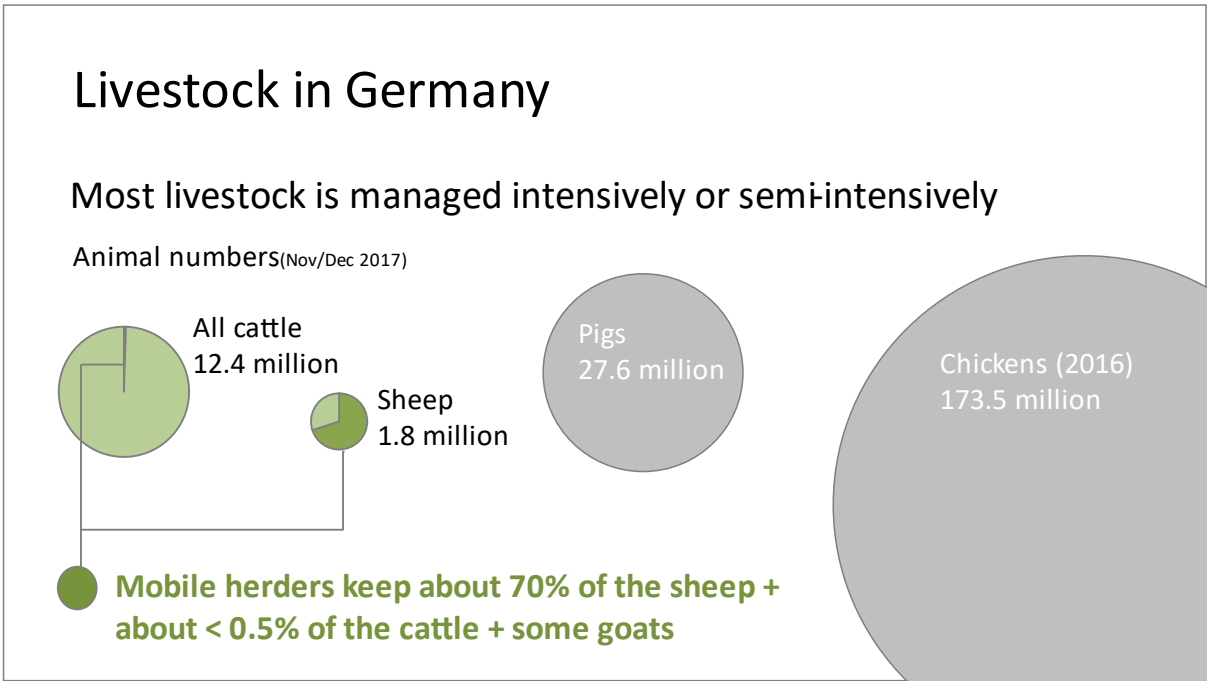
Livestock management systems

Germany's livestock management systems can be divided into three main categories: extensive, semi-intensive and intensive.

- **Intensive systems.** Based on the number of animals kept, these systems prevail. Nearly all commercial chickens and pigs, growing numbers of dairy cattle and some beef cattle are kept indoors, where they are intensively fed with grain as well as with hay or silage mown from grassland fertilized with manure slurry.
- **Semi-intensive systems.** Some dairy and beef cattle are grazed on fenced, improved pastures. They are given additional feed. Most are stall-fed in winter. However, grazing animals are gradually disappearing from grasslands: the animals are increasingly kept indoors as management becomes more intensive.
- **Extensive systems.** A small part of Germany's livestock – some of the beef cattle, most of the goats and nearly all the sheep – are kept in extensive systems, staying mostly outdoors and getting a large proportion of their fodder from grazing.

  Some 15 years ago, a form of extensive grazing known as *wilde Weide* ("wild pasture") emerged. This is keeping animals (mostly cattle and horses) at very low stocking rates on largely unmanaged grazing land for extended periods, sometimes all year long. This approach is used to restore and maintain biodiverse grassland habitats (Bunzel-Drüke, M., et al. 2009).

  With few exceptions, only shepherds and alpine farmers practise **mobile** forms of herding.



[1] BLE 2018, table2 (only holdings with more than 10 cattle, 50 and more pigs, and space for over 1,000 poultry).
[2] BLE 2018, table 97 (total population).

Figure 5. Numbers of livestock in Germany in 2016

Sources of data

Responsibilities for governing agriculture are divided among the European Union, the German federal government, and the 16 federal states. The EU is responsible for setting the policy framework for financial support and market organization. Implementation and administration are the responsibility of the federal government and the federal states.

As a result of this division of responsibilities, Germany has several official data-collection systems, with each level gathering and managing its own set of statistics. While some data exchange occurs between some systems in some areas, a systematic interlinkage between the different systems seems to be lacking.

In addition to government sources, there is a wealth of other publications relating directly or indirectly to livestock.

Government sources

All owners of the most important livestock species, whether intensive or extensive, must register and report their animals in at least two databases: the HI-Tier (or HIT) database and the "*Tierseuchenkassen*" (livestock insurance funds). The various statistical offices draw on the data of these two databases as well as conducting their own surveys.

The HI-Tier database

HI-Tier stands for *Herkunftssicherungs- und Informationssystem für Tiere* (Traceability and Information System for Animals). This database is managed by the state Ministry for Food, Agriculture and Forests of Bavaria (*Bayerische Staatsministerium für Ernährung, Landwirtschaft und Forsten*) on behalf of all 16 states. Since 1999, it has recorded information on all cattle, sheep, goats and pigs. In 2010 this system was extended to equids (horses, donkeys, etc.). The database captures the identity of every animal, along with its movements between farms and its exposure to antibiotics (HI-Tier 2019).

For cattle, the reporting requirements are especially comprehensive: Owners – whether herders, farmers, hobby keepers, pet owners, livestock traders or slaughterhouses – must report their calves to this database within seven days after birth. Each animal needs two ear tags indicating from which EU member state, federal state, administrative district, county, municipality and farm it originates. It is also allocated a master data sheet that contains the following data: ear tag number, date of birth, breed, sex, sire and dam. The reporting can be done by mail or internet. When the animal leaves the farm holding, the type of departure (sale, death, slaughter) and the date of departure must be reported. Imports and exports must also be registered.

For other species the reporting and tagging requirements are less stringent. For example, owners of sheep and goats have to report only the day of tagging and the change of location or farm including death.

Those who do not properly tag their animals run the risk of getting a fine as this is a violation of regulatory law.

Livestock insurance funds

The *Tierseuchenkassen* are mostly state-based livestock insurance funds. Among other things they are responsible for determining and financing compensation for animal losses resulting from certain diseases and official culling orders. The *Tierseuchenkassen* are funded by the state government, municipalities and mandatory contributions from the animal owners (Wikipedia undated a).

Tierseuchenkassen cover a wider range of livestock than the HIT database. In addition to the species documented in HIT, owners must report the number of camelids, farmed game, poultry, chicken, turkeys, doves and other non-commercial poultry, and bees. Reporting dates are 1 January of each year for all species, and depending on the species and numbers kept, also February 15 (based on personal experience of the authors).

In contrast to the HIT database, where each animal must be registered individually, the *Tierseuchenkassen* record the size of the herd on certain key dates. The data reflect animal numbers at certain points of the year and do not capture fluctuations that occur during the year through births, etc.

The Federal Statistical Office

The German Federal Statistical Office (Destatis) collects and analyses statistical information on the economy, society and the environment. It also carries out agricultural surveys at regular intervals. Major surveys include (Destatis undated, 2021a):

- **The agricultural census.** This is part of the global agricultural census initiated by the Food and Agriculture Organization of the United Nations (FAO). It takes place every 10 years.
- In the intervening years, Destatis conducts **agricultural structure surveys** every 3–4 years.

Data collection combines general surveys with representative samples. The bulk of the surveys capture only farms above a certain size, omitting those that have less than 5 hectares of farmland or fewer than 10 cattle, 50 pigs or 20 sheep or goats (Destatis 2017a, 2021a).

Destatis publishes the findings via its databank portal, the Genesis Online-Datenbank (www-genesis.destatis.de/genesis/online) and in special reports (Destatis 2022). The reports provide among other things "*information on the number and size of farms, land use, livestock, the legal form, ownership and lease relationships, organic farming, the employment structure and the profit character of the companies*" (Destatis 2017a:6, own translation). The information is also used in the statistical yearbooks published annually by the Federal Ministry of Food and Agriculture on nutrition, agriculture and forestry (e.g., BLE 2018).

While the data are generally useful, the outcome can sometimes be confusing. Because of the different data collection methods, the Statistical Yearbook on Food, Agriculture and Forestry 2018 provides for 2016 two different figures for the numbers of sheep: tables 2 and 96 cite 1,574,000 sheep, while table 97 indicates 1,834,300 sheep (BLE 20219). To find the reason for this, one has to read through the accompanying quality reports providing details of the data collection methods used in the respective year (e.g., Destatis 2021a).

Databases of ministries and state-level offices

Some federal ministries maintain their own databases. For example, the Federal Office of Consumer Protection and Food Safety collects data on enterprises allowed to slaughter livestock and produce and trade with livestock products. The data are publicly accessible in the BLtU-Database (BVL 2019). BLtU stands for *Betriebe für den Handel mit Lebensmitteln tierischen Ursprungs in Deutschland* ("enterprises for trade in food of animal origin in Germany").

There are 14 statistical offices at the state level that collaborate with the Federal Statistical Office. The offices of Berlin and Brandenburg are combined, as are those of Hamburg and Schleswig-Holstein (Wikipedia undated b). Each office publishes data in its own format, hindering collation and comparisons. The data report on livestock numbers but not the systems under which the animals are managed, making it impossible to determine the numbers maintained in the different management systems.

Eurostat

Eurostat, the statistical office of the European Union, maintains databases on a wide range of topics, including agriculture. It does not gather data itself, but relies instead on information submitted by the EU's member countries.

Examples of data available relevant to livestock include the numbers of various types of livestock, farm enterprises by size, the labour force, the area of various land types, prices of land and animals, organic farming, and so on.

Depending on the variable, data can be downloaded for Germany as a whole, or for 38 statistical regions within the country (corresponding to a federal state or subdivision of a larger state).

Surveys, studies and reports

For a few of the German states, more detailed data and estimates relating directly or indirectly to pastoralism are available. This is especially true for the states in the south and east.

- **Baden-Württemberg.** In 2009, the state Ministry for Rural Areas and Consumer Protection, along with the state's sheep-breeding association and other organizations, launched a project to develop sustainable sheep-raising. In 2011 the project published the first "sheep report" – an economic analysis of farms with 500 and more sheep prepared by a consulting firm (Over et al. 2011). In 2015, a second report followed (Wagner and Partner 2015, 2016). In the surveys for these reports, shepherds and farms keeping more than 400 sheep could participate for a fee. In return, they received an economic analysis of their farm. In 2012, the ministry published a guide on sheep-keeping in Baden-Württemberg that contains some information and estimates on mobile herders (MLRV 2012).
- **Bavaria.** In 2017, the Bavarian government announced that it would also produce a similar analysis. The first Bavarian Sheep Report was published in 2019 (Wagner and Partner 2019).
- **Other states.** A collective report on the economic situation and structure of specialized sheep farms is published annually by a growing number of states. In 2020, the issues for 2016/2017 and 2017/2018 were available. They analysed 62 farms from eight states (LfULG 2018, TLL 2019).

The German association *Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.* (KTBL) (Board of Trustees for Technology and Construction in Agriculture) has done a number of studies on specific aspects of sheep-keeping, such as on the costs of herd-protection measures (Schroers 2018).

A number of organizations concerned with landscape, natural resource management and climate change have initiated projects and studies that focus (or touch) on pastoralists and the services they provide. Their publications contain numerous data on the impacts of grazing of various species in different regions and habitats.

A substantial literature exists on landscape ecology and management, dyke grazing and mountain farming. Many studies focus on aspects such as the effects of grazing on ecosystems, plants, or specific insect types such as grasshoppers. Much of the landscape-management literature (especially that from Bavaria) addresses the use of cattle to manage landscapes. Summary reviews with data for the whole of Germany are scarce.

Other information sources

The *Verein für Schäfereigeschichte* (Association for the History of Shepherding) has compiled a comprehensive, 250-page bibliography of literature on German sheep keeping up to 2015 (Schormayer 2015). Unfortunately, many of the titles listed are not available online or are otherwise hard to find. Few sources seem to focus on the history of sheep keeping in the eastern part of Germany,

The Bavarian State Institute for Agriculture (*Bayerische Landesanstalt für Landwirtschaft*) provides a form that enables users to estimate the costs, income and profits from various types of sheep farming (LfL 2020). Users can enter their sheep type (economic breed, landrace or extensive breed) and choose between different levels of intensity (intensive, semi-intensive, and meadow) and types of management (paddock keeping or mobile herding). Users enter data on various aspects of their enterprise and calculate their profit margins. The form also calculates the shadow values of livestock products, such as dung, that currently do not have a market in Germany.

In the last decades a number of books have been published that focus or include information on mobile shepherds and alpine farmers (e.g., Clifflard und Reinhardt 2013, Häckh 2018, Mayer 1999, Mendel 2008, Offenhäußers 1996, von Korn 2016). Some of these books have been written by the pastoralists themselves, others by scientists.

The Germany-wide journal "*Schafzucht*" ("sheep breeding", SZ undated) features all kinds of information on sheep-keeping, from practice and science, written in easily understandable German. It is published by Verlag Eugen Ulmer, a commercial publisher, together with the Association of German State Sheep Breeding Associations (VDL undated).

Overview of pastoralism in Germany

The German word for pastoralism is "*Hirtentum*". A "*Hirte*" ("herder") refers to a person who herds (guards) and looks after a herd of farm animals.

Historically there were several different types of herders, depending on the species they took care of, their degree of mobility or the location they grazed their animals (Box 1).

Box 1. Types of pastoralists in Germany

Hirte, the German word for pastoralist, stems from the 8th century Old High German word *hirti, which* refers to a person taking care of a herd (Wiktionary undated). Herding or taking care of a herd is called *hüten*.

Hirten are classified according to:

- **The species they herd.** A *Kuhhirte* guards cattle; a *Schafhirte* or *Schäfer*, sheep; a *Ziegenhirte*, goats; a *Pferdehirte*, horses; a *Schweinehirte*, pigs; a *Gänsehirte*, geese. Often the animals belonged to different owners or the community. Horses, pigs and geese are no longer herded in Germany.
- **The forms and degree of mobility.** Pastoralists practising seasonal movements or "transhumance" are called *Wanderhirten,* which means "migratory pastoralists". *Wanderschäfer* are *Wanderhirten* who keep sheep.
- **The location where they herd.** The *Alm-* or *Alphirte*n graze their animals on pastures called *Alm* in the Alps mountains. In English they are referred to as mountain herders.

Nowadays only three main mobile livestock systems remain in Germany: *Wanderschäferei* or sheep transhumance, location-bound herding, and the alpine system, also referred to as mountain farming. The livestock involved are mostly sheep and to a lesser degree goats and cattle (von Korn 2016).

Wanderschäferei or sheep transhumance

Wanderschäferei is the long-distance movement of mobile shepherds and their flocks between winter and summer pastures. The animals herded are sheep, sometimes mixed with a few goats. As the summer and winter locations may be 200 km or more apart, the shepherds may take along a special wagon in which they live when away from home. This form of pastoralism occurs mainly south of the River Main (Figure 2).

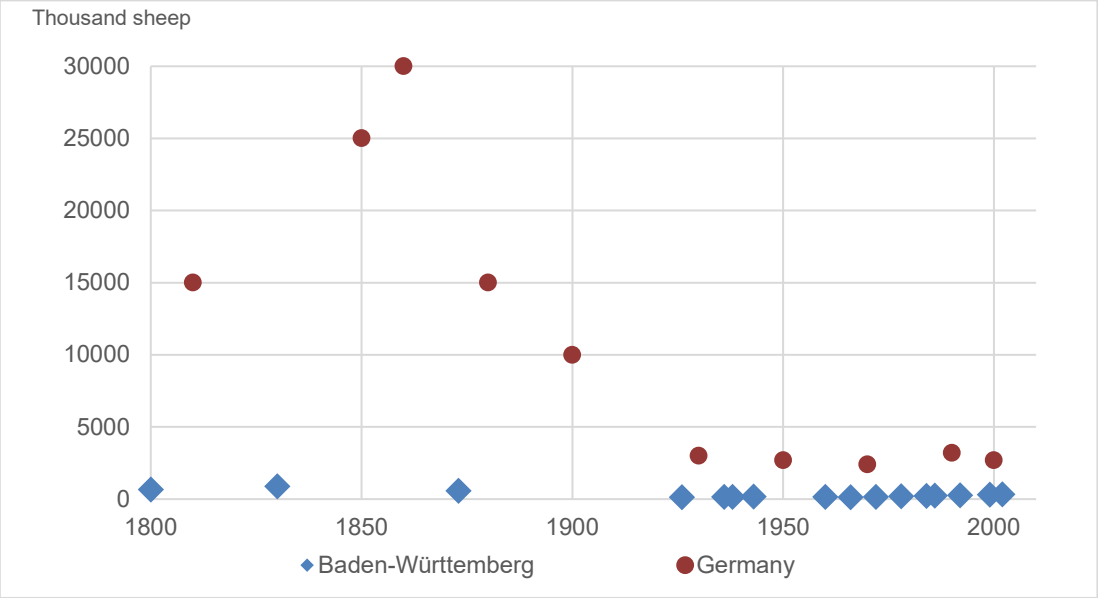
However, only few long-distant transhumant shepherds have remained as movements are getting more and more cumbersome (see below). Besides, long-distance transhumance is now rarely economically viable in current global market conditions and under the area-based financial support system of the Common Agricultural Policy of the European Union.

Perhaps the best-studied sheep transhumance is the Swabian-Franconian transhumance in the southern states of Baden-Württemberg and Bavaria (Box 2) – according to Luick (2004) the only genuine form of transhumance in Germany. Here, the shepherds graze their flocks on the poor-quality uplands of the Swabian Jura during the summer and move them down to the surrounding lowlands of the Rhine, Danube and Main rivers and the Lake Constance basin for the winter (Luick 2004). In 2019, UNESCO Germany recognized the South German transhumance and mobile herding as immaterial heritage (UNESCO 2019; see below for a list of other recognized pastoral traditions).

Box 2. Swabian-Franconian transhumance

The Swabian-Franconian transhumance developed after 1785, when the Duke of Württemberg was allowed to purchase 30 Merino rams and 10 Merino ewes in Spain. These had better-quality wool than the local breeds and were also able to walk long distances. At the same time, political changes made it possible for shepherds to cross previously watertight inter-state borders, and they were able to gain the right to graze their animals in winter in suitable regions. This made long-distance transhumance in southern Germany possible (Clifflard and Reinhardt 2013, Luick 2004).

Through crossing the Spanish Merino with local breeds, the German Merino landrace developed within a few decades. The huge demand for wool led to a massive growth in sheep numbers in the first half of the 19th century (Figure 6). In southern Germany (though not in the rest of the country) most of the animals were kept in transhumant systems. But after 1860, the demand for wool declined rapidly as it was replaced by cotton and cheap imported wool. The numbers of sheep in Germany collapsed from around 30 million in 1860 to only 3 million by 1930. Sheep production shifted from being focused on wool (which only sheep can produce) to meat (where sheep compete with other forms of livestock, especially pigs, chickens and cattle). The number of shepherds has declined as a result.



Source: adapted from Luick 2004, tables 1 and 2.

Figure 6. Numbers of sheep in Germany and Baden-Württemberg between 1800 and 2000

However, shepherds themselves say there are some transhumant shepherds in other parts of Germany too.

Unlike transhumance in Provence, Spain or West Africa, where groups of herders move large numbers of animals along common routes, transhumance in Germany is the movement by individual flocks along separate routes (Luick 2004). Figure 7 illustrates this for the Swabian-Franconian transhumance. However, in general the same applies to all mobile shepherds in Germany.

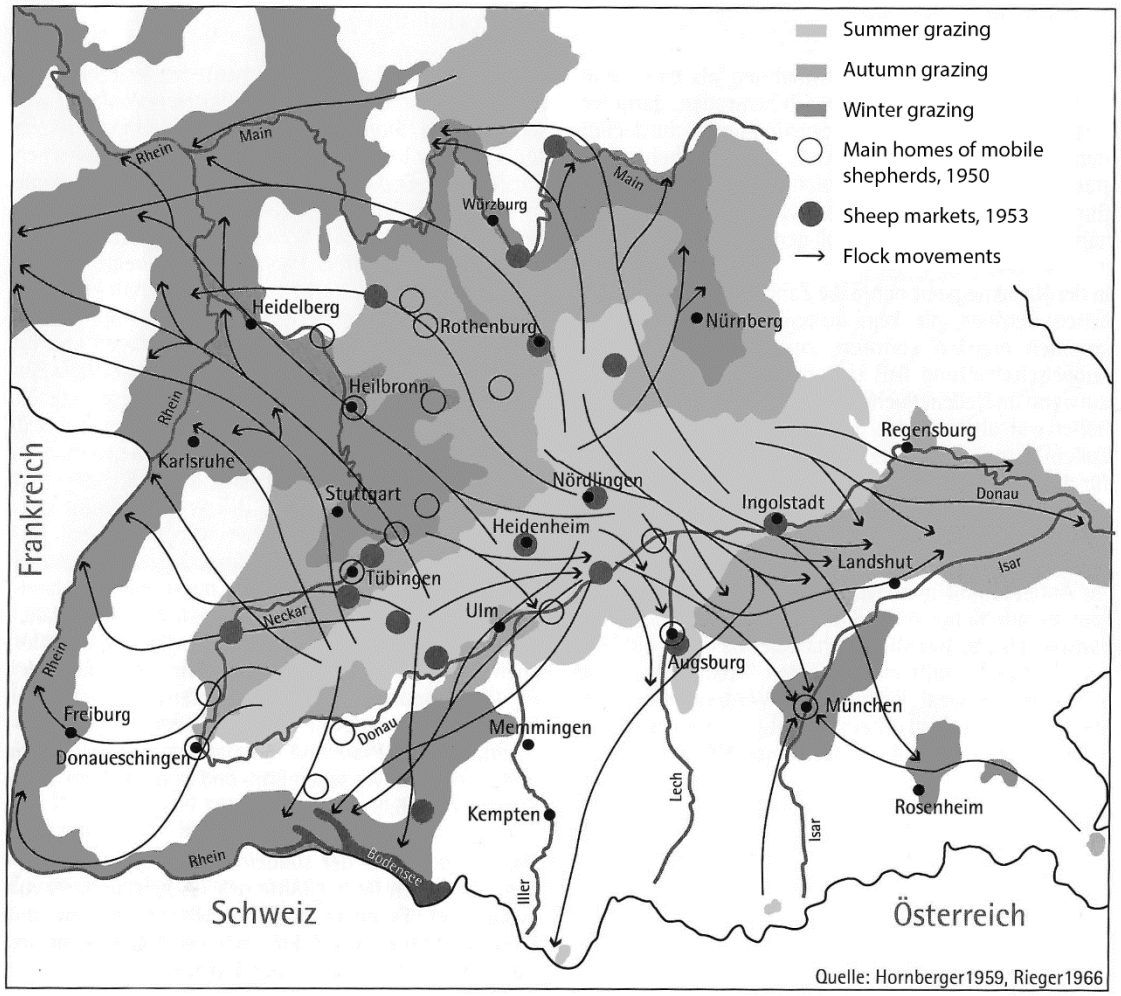


Figure 7. Routes used by individual transhumant shepherds in southern Germany (Mayer 1999:30)

Location-bound herding

Location-bound herding (*standortgebundene* or *stationäre Hütehaltung*, Mendel 2008, von Korn 2016) is a form of agropastoral mobile herding prevailing in the northern and eastern part of Germany. Shepherds with their sheep or mixed flocks and a few goatherds with their goats graze their animals in a more or less wide radius around the homestead. But still, they may have specific winter and summer grazing grounds or routes. Winter grazing is often on harvested fields, to which the herder must negotiate access anew every year with the landowners.

The *Wanderschäfer*, who are giving up their long-distance movements, often turn to a more location-bound keeping of their animals. The distinction between these forms of pastoralism has always been rather blurred and is becoming even more so. Therefore the following sections no longer differentiate between “transhumant” and “location-bound” shepherds, but group them together under the term “mobile shepherds”.

Mountain farming

Alpine or mountain farming (German: *Almwirtschaft*) refers to a type of extensive agriculture in the South of Germany whereby the animals stay with their herder on mountain pastures (known as “alps”) during the summer months. The mountain pastures are called *Almen* in Upper Bavaria, and *Alpen* in Allgäu, the southern part of Bavarian Swabia (Figure 1) (Ringler 2010).

In early autumn the animals are driven back to their main location in the lowlands, where they graze or are kept indoors until the next mountain season. In late spring or the beginning of summer, all the animals destined for the same part of the mountains are driven up together to their alpine pastures. This is a cultural event and tourist attraction, accompanied with festivities. Germans call this event the *Almauftrieb*; in Switzerland it is known as the *Sömmerung*.

The bulk of the alpine herd consists of young cattle. The rest are cows, sheep, goats and a few horses. The cows (and sometimes goats) are housed in a shed and are milked regularly. The milk is either processed on site into cheese and other products or boiled and sold as fresh milk to tourists stopping in the mountain huts and restaurants. During the day the animals are let out to graze, returning on their own in the evening. The remaining animals are herded or graze on their own.

Sheep and goats especially play a role in landscape management as they can graze on steeper slopes than cattle.

Horses are used in the mountains for tourism, transport, logging, or are brought up for grazing. Sometimes sport and racing horses are brought up to high altitudes to boost the haemoglobin concentration in their blood before competitions.

Definitions

Until recently there were no official Germany-wide definitions of *Hirte, Wanderschäfer* or *Almhirte.*

In July 2019, the Federal Ministry of Nutrition and Agriculture (BMEL) came up with a definition of *Wanderschäfer* (Box 3) when it set up a small fund to support herd-protection measures for migratory shepherds against wolves and other predators. But as the funds were very limited: only farms that fulfilled certain conditions could apply, including having more than 200 adult sheep and owning less than 40 ha of land eligible for area payments of the European Union (BLE undated). Therefore the definition was contested and is not widely accepted.

Box 3. Definition of sheep transhumance (*Wanderschafhaltung*)

"Sheep transhumance is a form of mobile livestock keeping whereby shepherds move their animals seasonally from one pasture to another. In addition to the main pastures, their grazing land includes areas not used by other livestock (e.g., wasteland, grazing of harvested arable crops or catch crops, grazing grassland, but also dykes, military training areas or similar)" (Bundesprogramm Wolf 2019, own translation).

Some of the federal states have come up with their own definitions. These vary from state to state, as do the criteria on which they are based. Examples of such criteria are:

- Location where animals graze during the main vegetation period.
- Livestock numbers and size of land grazed.

Such definitions can have implications for the shepherds' pension and insurance arrangements. For example, in some states mobile shepherds have to pay higher liability insurance premiums than non-mobile herders.

The shepherds' own definitions (from personal discussions) include:

- "Someone who migrates or moves with his or her herd, grazing on 'foreign' land for a significant part of the year."
- "If someone has neither own nor leased space, this is a landless operation. The current form of agriculture allows migration during the main vegetation period only if the shepherd grazes on ecological agricultural land (paid or unpaid). We are on the move from October to April (during the autumn and wintertime when the vegetation rests)."
- "Those who are permanently on the move, no location-bound herding nor keeping in paddocks."
- "In summer on dykes, in autumn and winter on the move."
- "Moving mostly on leased and sometimes own land all year around."

While there is no common definition for the different types of pastoralists in Germany, all the just cited definitions, whether official or those used by the shepherds themselves, stress the mobility of the herd and the

grazing on “foreign” land: land not owned by the herder; although landless operations that do not own or lease any land are extremely rare among specialized sheep farms practising mobile herding.

It may be better to use a more general definition because of the unexpected political and financial consequences that precise definitions of *Wanderschäfer* can have for some shepherds.

Traditions and regions recognized by UNESCO

Besides the south German transhumance mentioned above, UNESCO Germany has recognized the “shepherds’ runs” of the towns of Markgröningen, Bad Urach und Wildberg in Baden-Wuerttemberg as immaterial cultural heritage (UNESCO undated). The runs, or races, date back to the decree of a Shepherd’s Guild by Duke Eberhard III von Württemberg in 1651. The shepherds had to attend an annual guild meeting in the city of Markgröningen (then still called Gröningen), where legal and regulatory matters relating to the shepherd’s guild were negotiated. To make attendance more attractive, the meeting was combined with a folk festival that is celebrated each year up to this day. About 70 years later similar festivals were organized in the other two towns in order to save the shepherds long journeys to the guild meetings. In 1930, Wildberg added a herding competition to the festival programme (Schäferlauf Wildberg undated).

In addition to the cultural traditions, Germany has a number of UNESCO-recognized biosphere reserves which were created or influenced by shepherds and their animals (UNESCO undated): the Palatinate Forest-North Vosges Biosphere Reserve, Swabian Jura, Black Forest, and Rhön.

Constraints to mobility

In many areas of Germany, whether in the lowlands, hills or mountains, the herding practices described above are undergoing rapid change. Migration routes are interrupted by roads, railways and urban development, and the bureaucratic constraints to herd movements are growing. Herding sheep along roads is hazardous. Many areas traditionally used for grazing are now used for other, more profitable purposes: arable fields (including for biogas crops), pastures fertilized with manure slurry and mown for hay or silage. Cereal stubble once used for grazing is now ploughed under and reseeded after harvest.

Growing numbers of tourists and dog walkers, and the spread of wolves and other predators, also threaten the viability of mobile herding. Herders must especially step up their herd-protection measures in regions with wolves. An example of such measures is increasing the height of the mobile electric fences used to fence night pens and grazing areas. The higher fences cost more and require more time to put up and take down again. This means more labour and higher costs.

Basic data on German pastoralism

Despite the plethora of statistics, hard data on pastoralists in Germany are difficult to find. The categories "herders", "shepherds" etc. are largely absent from government statistics, and figures on goats are scarce. As a result, the numbers of mobile livestock keepers in Germany and their contributions to the economy, ecology and society are not covered in official statistics except in some state-level databases.

Up to 2009 the statistics of the Federal Statistical Office still contained some information on grazing animals and alpine pastures. But management systems are no longer reflected in the 2016 Agricultural Structure Survey, except for some information on cattle: whether they are tethered or free to move around in their stables, and whether they produce dung or manure slurry.

The methodology of the 2016 survey does mention the farms of mobile shepherds (*Wanderschäfereien*), but only to state that they count as "agricultural operations" (*landwirtschaftliche Betriebe*). According to the federal government, "transhumance cannot be clearly distinguished from other forms of sheep farming on the basis of the farm characteristics available from agricultural statistics" (Destatis 2017a).

Even though the number of mobile herders is not captured in the statistics, it is possible to estimate this by combining data from the official statistics with information from other sources. The analysis of further characteristics and attributes of mobile shepherds is complicated through the fact that some publications report herd size as the total number of sheep (e.g., BLE 2018-2022) while others base their calculations on the number of ewes (e.g., Wagner and Partner 2015, 2016). For this reason, in the following sections we indicate the unit of analysis used in our own calculations or in the studies we cited.

Estimating the numbers is more difficult with alpine farmers or herders as they are not covered in the federal statistics. Therefore we had to draw on reports, press releases and research studies for information on this type of pastoralists.

All in all, the data in the following sections had to be pieced together from a wide range of sources.

Mobile sheep-keeping

In 2016, Germany had about 20,000 sheep-keeping enterprises, and slightly more than 1.8 million sheep (Table 11 and Figure 8) (BLE 2019, table 97).

Table 1. Holdings with sheep production by herd size 2016[1]

Flock size (sheep)	Probable type of enterprise	No. of holdings	% of holdings	No. of sheep (000)	% of sheep
1–19	Small-scale	8,900	45.8	66.3	3.6
20–199	Part-timers	8,700	44.3	497.9	27.2
200–499	Mostly part-timers, some mobile	900	4.8	304.0	16.6
500+	Full-timers, many mobile	1,000	5.1	966.1	52.7
Total		**19,600**	**100**	**1,834.3**	**100**

[1] Adapted from BLE 2019, table 97, own categorization of enterprises

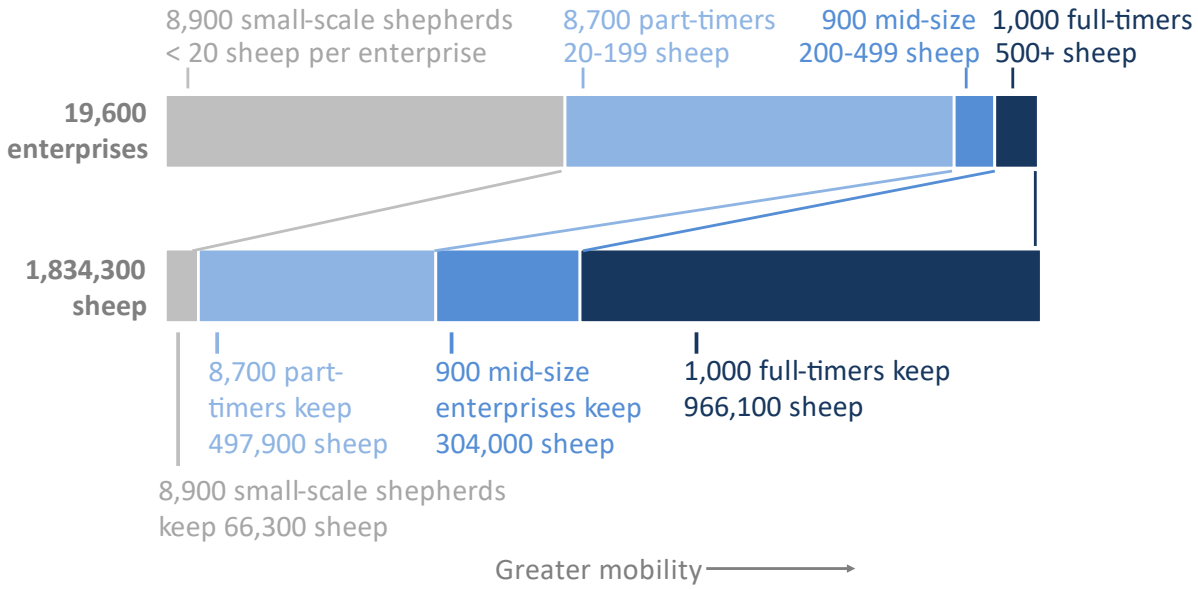


Figure 8. Numbers of sheep by size of farm enterprise, 2016 (Adapted from BLE 2019, table 97, data from 2016)

Nearly half the enterprises (8,900) were small-scale, with fewer than 20 sheep each. Most of the rest (10,700) were slightly larger or mid-sized, with between 20 and 499 sheep; about 900 of them had between 200 and 499 sheep. Only 1,000 enterprises had 500 or more animals.

Enterprises with fewer than 20 sheep include hobby shepherds as well as farms that keep a few animals as a side-enterprise, for example to control vegetation or to exploit leftover agricultural land.

Enterprises with between 20 and 199 animals can be described as "part-time" shepherds. It is hardly possible to earn enough income to maintain a household purely from shepherding this few sheep. The same is true of the ca. 900 mid-sized farms with 200–499 animals. Such enterprises commonly rely on other sources of income: other farm enterprises, a part- or full-time job, or a spouse who has an outside job. The mid-sized farms with between 200 and 499 sheep likely practise at least some form of mobile herding.

The 1,000 enterprises with over 500 sheep account for slightly more than half (about 53%) of Germany's 1.8 million sheep. Many of these are full-time shepherds; they often involve family members or paid employees to manage their flocks. Most (but not all) are mobile pastoralists.

Counting the mid-sized (200–499 animals) and large enterprises (500+), about 70% of the sheep in Germany are likely to be kept in management systems that are at least partially mobile. This fits well with the statement of the German government institutions BLE and BZL (undated) that most sheep are kept in location-bound herding or transhumant management systems.

As most of the data available in the studies and country reports are on holdings with more than 400 or 500 ewes, most of the calculations in the following sections are based on the approximately 1,000 largest specialized sheep farms with more than 500 sheep. As a rule of thumb, 500 sheep correspond to approximately 350 ewes.

Area grazed by mobile shepherds

According to the German government (Deutscher Bundestag 2019), 1,126 sheep-keeping enterprises with more than 300 ewes (or about 400 sheep) managed 286 ha on average in 2016. However, their data also include some holdings that have several production branches, making it difficult to estimate how much of the land the enterprises actually use for their sheep.

The average area used by sheep enterprises with over 320 ewes ranges from 149 to 186 hectares in western Germany (though in Lower Saxony it is 262 ha). In eastern Germany holdings tend to be much larger, averaging from 372 to 789 ha (Schenk unpublished, based on Destatis 2017b, tables 0201.1 T and 0238 T).

Schenk suggests that it is more realistic to use the findings of an annual survey of selected sheep farms in eight federal states throughout the country for the period July 2016 to June 2017 (LfULG 2018). The 62 specialized sheep farms analysed in this survey used an average of about 174 ha, 90% of which (or roughly 160 ha) were permanent grassland. This figure comes close to the findings of a recent metastudy by von Korn and Völl. Their analysis used data collected by different institutions between 2013 and 2019 on more than 700 sheep holdings. These kept 611 ewes on average and managed on average 167 ha (von Korn and Völl, table 2).

This means that the 1,000 large (and largely mobile) shepherds which make up 0.4% of all German farms manage a total of 1,000 × 160 hectares = 160,000 hectares, or 3.4% of Germany's permanent grasslands. If shepherds with smaller holdings are also included, Schenk estimates that the coverage would be around 6% of the country's grassland.

Germany has 8,833 nature reserves of various types and sizes. As of December 2017, they covered 2,627,510 ha, or 6.3% of the country's area (BfN undated). However, it is difficult to discern how far they add to the area grazed by pastoralists for two reasons. First, there are many different types of protected areas. In some, grazing is allowed; in others it is forbidden; in still more it is required to maintain the area's characteristics. Second, the area of the reserves overlaps with the permanent pastures and other land types (BfN undated, BfN 2014).

Land ownership

A substantial share of Germany's agricultural land (including permanent grassland) is leased. The data of Destatis for 2016 reflect the annual lease payments of about 179,100 farm enterprises. About 60% of the land they used was leased (Destatis 2019, table 19.3.1). For sheep farms, the percentage of leased land is likely to be much higher; for example, the land basis of sheep holdings in Baden-Württemberg often rests almost exclusively on leased land (MLRV 2012, p.58). According to von Korn and Völl (2021, table 2), sheep holdings lease on average about 88% of the land they use.

Breeds raised by mobile shepherds

Around 50 sheep breeds are recorded in Germany. Pastoralists commonly keep those breeds that are classified as "extensive" or "semi-intensive" in Table 2, or crosses with these breeds. *Landschafe* and extensive breeds are mostly local breeds.

Table 2. Classification of German sheep breeds: Selected examples

Breeds	Federal government[1]	Bavarian State Research Centre for Agriculture[2]
Intensive ("economic" in Bavaria)	East Frisian milk sheep Suffolk Texel	German black-headed meat sheep Merino Suffolk Texel
Semi-intensive (*Landschafe*)	German black-headed meat sheep Merino	Coburger Fuchsschaf Mountain sheep Rhön
Extensive	Bentheimer Landschaf Bergschaf Coburger Fuchsschaf German Grey Heath (Graue Gehörnte Heidschnucke)	Heidschnucke

1 BLE and BZL undated
2 LfL 2020

Bavaria uses a slightly different categorization from that used by the federal government: for example, it includes the Merino in the intensive category. Still, the German Merino is a well-adapted hardy type of sheep

also used by many mobile shepherds. In 2012, about 35% of the 17,000 sheep registered in Bavaria's flockbook (used for pedigree breeding) were Merinos (StMELF 2016).

The alpine system

In 2008, there were 1,388 alpine pastures maintained with livestock: 710 (51%) in the Upper Bavaria administrative district and 678 (49%) in the neighbouring Allgäu. There were about 114,000 ha with pasture rights, some 40,100 ha of which were largely treeless. Some 50,000 cattle (mostly young cattle and 4,400 dairy cows), 3,360 sheep, a few goats and around 1,000 horses were driven to the mountains for summer grazing. Cheese was produced on nearly 50 of the alpine pastures in the Allgäu. In Upper Bavaria, cheese is produced only in small quantities and mainly for own consumption. The emphasis was (and still is) very much on keeping young cattle on the *Alms*. These are often left to graze on their own with limited supervision (see next paragraph) – which is ecologically less advantageous for alpine pastures than the careful grazing management on *Alms* where cheese production is more important (Ringler 2010, Streifeneder et al. 2018, Wessely and Güthler 2004).

In 2001, some 900 mountain farmers and herders regularly looked after 660 of the 1,384 alpine pastures in Bavaria. They visited the remainder of the pastures only occasionally. In the Allgäu, most of the pastures were managed by herders based in the lowlands who did not stay in the mountains all summer long but regularly visited the animals (various authors cited in Wessely and Güthler 2004). There are no actual figures on the number of alpine farmers and herders. But they may not have changed much during the first decade of this century. Ringler reported in 2010 that financial support from the EU and the Bavarian government had helped to stabilize the number of *Alm* personnel and herders. He emphasized that in order to preserve alpine pastures with their unique biodiversity and species composition, the grazing of animals and the expert care by shepherds and other herders are indispensable.

Breeds kept in the mountains

In the mountainous regions of Bavaria, over 90% of the cattle belong to the Fleckvieh breed. The remainder include endangered Murnau-Werdenfelser, Pinzgau and Braunvieh (StEMLF undated).

The sheep breeds in the Alps are mostly of the rare breeds Braunes Bergschaf and Weisses Bergschaf, some 2,000 of which are concentrated in the district of Garmisch-Partenkirchen. Other mountain sheep breeds are Geschecktes Bergschaf, Alpines Steinschaf, Brillenschaf and Krainer Steinschaf. Goats are only occasionally kept in the Alps and the *Mittelgebirge*. A large goat pasture with the colourful German Edelziegen goat breed is a traditional feature of Mittenwald, in the Alps of Upper Bavaria (StEMLF undated). A hardy, dual-purpose goat breed kept in German alpine regions is the Thüringer Waldziege (alpinetgheep undated).

Contributions to society

> *"Keeping sheep has a centuries-old tradition in Germany. But compared to other agricultural production branches, sheep farming plays only a minor role. It makes an important contribution to keeping our cultural landscape open and preserving it."*
> (BLE and BZL undated, own translation).

This statement on the website of the Bundesanstalt für Landwirtschaft und Ernährung (Federal Agency for Agriculture and Food) and the Bundesinformationszentrum Landwirtschaft (Federal Information Centre for Agriculture) summarizes the situation of German shepherds. It likely also applies to alpine farmers.

But the quote is misleading. While livestock products from mobile shepherds and alpine agropastoralists contribute relatively little to Germany's gross domestic product, the herders have a much larger indirect impact on the economy through the services they provide farmers and to the environment (BLE and BZL undated, Wessely and Güthler 2004).

Nevertheless, it is very difficult to find quantitative data on any of their contributions – either products or services.

Livestock products

The products from mobile shepherding comprise of meat, wool, milk and dung, those from alpine farmers mostly of milk, cheese and dairy products. However, both types of pastoralism are barely profitable and largely depend on subsidies and payments for their environmental services. Wool has lost its value (the cost of shearing is higher than the value of the wool); the sale of animals for meat hardly covers the costs of production.

According to economic studies of sheep farms, livestock products roughly contribute about 40% of the income of mobile shepherds, the remaining 60% come from subsidies and payments for their services (e.g., Wagner and Partner 2016, 2019).

Sheep meat

Meat is the only sheep-based product that appears as a separate category in German statistics and can be largely attributed to mobile herds. But its contribution to the German GDP is very small. In 2017, of the 8,857,000 tonnes of meat produced by German producers, only about 32,000 tonnes (about 0.4%) came from sheep and goats. These species contributed €154 million or about 0.5– 0.6% to the total meat production value of €28,664 million (BLE 2019, tables 106 and 115). Based on the numbers of sheep kept by the largest 1,000 herders, we can estimate that some 53% or €82 million of these €154 million come from these farms (Table 3).

Table 3. Estimated annual production and value of sheep and goat meat in Germany

	Volume	Value (€)
Total sheep and goat meat produced in Germany[1]	32,000 tonnes	€154 million
Production by 1,000 largest herders (53% of total)[2]	16,960 tonnes	€82 million

1 Source: BLE 2019, tables 97,106 and 115
2 The largest herders keep 53% of all sheep in Germany (see Figure 8)

Germans eat little lamb and mutton. Of the 60 kg of meat the average Germans consumed in 2019, only about 0.7 kg came from sheep. The overall use of sheep meat is a little higher: about 1 kg/per person per year. The difference is because the larger figure includes other uses – such as for pet food (AgE 2019a, BLE 2019:xx).

In 2018, domestic production covered about 40% of the sheep meat used in Germany (AgE 2019a). The other 60% came from imports from Australia, New Zealand and the United Kingdom.

Milk and cheese

Milk is Germany's most important livestock product overall. The vast majority comes from intensive dairying.

Milk, cheese and other processed dairy products from alpine cows and pastoral sheep and goats are of high quality. They are produced in small quantities and are mostly niche products, forming an important aspect of mountain farming and play a role in tourism. No figures on production volumes and the income they generate are readily available.

Wool

German sheep roughly produce about 3–4 kg of wool per animal, depending on the breed and management system; in some breeds like the Merino the harvest might be even around 5 kg per animal. There are no statistics on wool produced in Germany, neither on the amount, nor on its value or its contribution to GDP.

But we can get a rough estimate by multiplying an estimated average wool harvest of 4 kg/sheep and year with the number of sheep in Germany, excluding animals below the age of one (which make up roughly 27% of all sheep, own calculation based on Destatis undated, table 41311-0001).

The wool is currently of little economic value, and the income from it hardly covers the shearing costs of around €3.50/animal (for a shepherd with a lot of animals) (BLE and BZL undated). For an owner of only a few sheep, shearing can be even more costly. Sometimes shepherds cannot sell their wool at all. This is especially true for the extensive breeds and sometimes also for landraces.

The fine wool of the Merino sheep commonly brings more. This type of sheep is especially kept by mobile herders and shepherds in southern Germany. Some of them have founded a wool marketing coop and have been able to obtain better prices for their wool than can shepherds selling their wool on their own.

As with the amount of wool, there are no data in the official federal statistics on the wool's value. According to the data of 62 specialized sheep farms in eight states in 2016/2017, the sheep farms obtained around €0.70/kg for their wool (LfULG 2018). Multiplying this with an estimated average wool output of 4 kg/animal and year gives an income from wool of about €2.80/animal/year. The calculations of profit margins for sheep production by the Bavarian State Institute for Agriculture (LfL 2020) give a slightly lower average income from wool of €2.60 per ewe and year for sheep kept on pastures (Table 4; figures for paddock keeping and mobile herding are the same).

Table 4. Estimated income for wool from sheep kept on pastures (*Weidemast*) under different management regimes[1]

	Economic ewe (live weight 85 kg)	**Landrace ewe** (65 kg)	**Extensive ewe** (45 kg)	**Average[2]**
	€ per ewe per year			
Mobile herding (*Hütehaltung*)	6.80	1.10	0	2.60
Paddock keeping	6.80	1.10	0	2.60

1 Based on the calculations of the Bavarian State Institute for Agriculture (LfL 2020, status as of February 2020).
2 Assumes that there are equal numbers of economic, landrace and extensive ewes.

Taking the average of €2.60 and €2.80, the estimated annual income is €2.70 per ewe for wool. Multiplying this by the number of sheep kept by the largest 1,000 enterprises, we can estimate the annual value of their wool production at €1.9 million (Table 5).

Table 5. Estimated annual production and value of wool in Germany[1]

		Value (€)
Number of sheep	1.83 million	
Adult sheep (73%)	1.34 million	
Annual wool production per adult sheep	4 kg	€2.70
Total annual wool production	5.4 million kg	€3.6 million
Total annual production by 1,000 largest herders (53%)	2.8 million kg	€1.9 million

1 Calculated from data in BLE 2019, table 97; Destatis undated, table 41311-0001; LfL 2020, status as of February 2020; LfULG 2018.

To improve their income from wool, shepherds are exploring alternatives such as using wool as a fertilizer and insulation material (Mackwitz and Reinberg 2006). Another option is to sell the wool directly to customers in markets, in farm shops, or via the Internet, where sellers can get much higher prices from hobby knitters and felters.

Dung and manure

In Germany, dung is regarded more as a waste product than a fertilizer – except perhaps among gardeners. The reasons for this include:

- **Large amounts of slurry** from intensive farms in northwest Germany and the Netherlands are spread on fields and pastures, especially in western and northwestern Germany. This, and the overuse of artificial fertilizer on agricultural land, have in many locations led to increased nitrate concentrations in groundwater. For this reason, in 2017 the EU released a new fertilizer regulation restricting the disposal of slurry and other fertilizers. Germany has only recently begun to implement these regulations. Extensive herders fear that they may lose more grazing areas as farmers may no longer allow them to graze their harvested fields in order to avoid exceeding the nitrate limits. This may happen unless policymakers exempt the dung of mobile herds from the nitrate "accounts" of the famers.
- **In landscape management,** sheep and other extensive grazers are used mainly to restore and maintain calcareous grassland and other habitats with low fertility. Many of these areas are protected, and the use of fertilizer is forbidden. Short-term grazing is allowed, but the night pens of the animals have to be set up outside of the protected area (Brenner et al. 2002).

As a result, despite its potential value, dung hardly plays a role in the income calculations of mobile livestock keepers. The Bavarian State Institute for Agriculture (LfL 2020) provides some calculations on the kilograms of nitrate, phosphate (P_2O_5) and potassium (K_2O) that a ewe excretes per year in her dung, and how much of these nutrients end up as fertilizer on pastures. Paddock-keeping results in higher values for dung than does mobile herding. Based on these figures, the value of the dung of mobile herds ranges around €13 per ewe and year (Table 6; LfL 2020).

Table 6. Estimated value of dung from sheep kept on pastures (*Weidemast*) under different management regimes[1]

	Economic ewe (live weight 85 kg)	**Landrace ewe** (65 kg)	**Extensive ewe** (45 kg)	**Average**[2]
	€ per ewe per year			
Mobile herding (*Hütehaltung*)	13.20	13.30	12.50	13.00
Paddock keeping	26.00	26.50	24.50	25.60

1 Based on the calculations of the Bavarian State Institute for Agriculture (LfL 2020, status as of February 2020).
2 Assumes that there are equal numbers of economic, landrace and extensive ewes.

Based on the sheep numbers and estimates of mobile herding for Germany, we can calculate the shadow value of the dung of the 1,000 largest sheep farms (Table 7).

Table 7. Estimated annual production and value of sheep dung in Germany

	No. of sheep	Value (€)
Number of sheep	1.83 million	
Adult sheep (73%)	1.34 million	
Adult sheep kept by 1,000 largest herders (53%)	0.71 million	
Annual dung production per adult sheep under mobile herding (see Table 6)		€13.00
Total annual dung production by 1,000 largest herders		€9.2 million

Environmental services

Through their mobile grazing, pastoralists provide a wide range of environmental services in various types of landscapes such as nature conservation areas, military bases, rangelands, pastures in mountains, floodplains and dykes.

The outcomes of the services depend on the way the grazing is managed. Cows, sheep and goats all differ in their preferences of plants and the way they feed on them. Beside the type of animals, their numbers, body condition and how hungry they are, the duration of grazing in a location, the frequency and timing of the grazing, and the weather conditions – all these factors and their interaction determine whether a grazed area becomes degraded or rehabilitated, maintained or enriched (Woike and Zimmermann 1997). For example,

- Clearing weeds and brush on land that has become overgrown helps to rehabilitate the land.
- Grazing at certain times of the year is necessary to maintain the existing character of landscapes that have originally been created through grazing. Examples are the Lüneburg heathlands in northern Germany, the open grassland of the Rhön in the centre, the juniper heaths in southern Germany, and the mountain pastures that attract tourists in the Alps. As these landscapes are commonly on nutrient-poor soils, the night enclosures of the herd or flock have to be outside of the serviced area to avoid overfertilization.
- Previously, farmers were happy when livestock herds grazed on crop residues after harvest as this improves the fertility, removes weeds and speeds up the breakdown of organic matter in preparation for the next crop. This has ceased in some regions because of the large amounts of manure slurry from intensive livestock farms that have to be disposed of. Owners of orchards may still welcome livestock as a source of fertilizer and as a way to enrich biodiversity (see below).

Direct effects of grazing

In addition to the services listed above, grazing has a number of other direct effects.

Enhanced biodiversity through microhabitats

Extensive grazing is crucial for the conservation of a biodiverse flora and fauna. For example, nutrient-poor grasslands created over centuries by grazing harbour some 500 plant species, or about 15% of Germany's flora (Deutscher Bundestag 2019). According to Ringler (2010:73), over 250 different vegetation types, also called plant communities, have been documented for the areas with pasture rights in the Bavarian Alps.

The literature on landscape management provides many details on the impacts of grazing on specific habitats, but a comprehensive analysis is beyond the scope of this paper.

One important mechanism behind the enhanced biodiversity is the creation of microhabitats. Because grazing does not remove the vegetation cover as evenly as mechanical removal methods, it creates numerous habitats where different plant species, amphibians, insects and birds can find their preferred niches (Bauschmann 2014, 2015, 2021, Boggia and Schneider 2012, Deutscher Bundestag 2019, LLUR 2010, Nickel 2019a, Ringler 2010; Woike and Zimmermann 1997). For example:

- Different livestock types prefer different plants. Some plants are more heavily grazed than others; others are not eaten at all. Thus little islands of different vegetation types and densities form.

- Old and matted grass is broken up or removed, making space for the seeds of flowering plants. The animals leave behind hoofprints, breaking up the soil surface and – depending on the size of the animal – making small holes in the ground where puddles can form.
- Seeds that have fallen on the ground are worked in by the hooves.
- Irregularly dispersed dung provides pockets of nourishment and habitats for a myriad of insects and other arthropods.

Connecting biotopes through seed and insect dispersal

When walking from one pasture to another, livestock can transport seeds, fruits, spores and other plant parts in their coats. Sheep, with their dense, long fleeces, are especially suited as "seed taxis". Preliminary findings from studies by the University of Regensburg under the guidance of Peter Poschlod in collaboration with shepherds indicate that a herd of 500 sheep can transport and disperse up to 2 million seeds (and possibly more) in a 226–day growing season (Institute of Agroecology undated, Trapp et al. undated). According to Eichberg and Wessels-De Wit (2012), 800 animals can transport more than 300,000 diaspores per day in their fleece and hooves and about 0.5-2.5 million diaspores in their guts (diaspores are seeds and other plant parts that further the dispersal of plants).

Sheep can even carry along small animals such as lizards, snails, beetles and grasshoppers. Warkus et al. (1997, cited in Nickel 2019a: Slide 37) identified 15–19 cricket species transported in the fleeces of sheep. Nickel (2019b) regards the widespread loss of the extensive pastures in central Europe since the end of the 18th century and their replacement by the technically more and more perfect mowing as a major reason for the loss of biodiversity in the grasslands in the region.

Dense grass cover and root biomass

Carefully managed grazing helps to keep soils alive (Mathias 2018). It stimulates both the growth of grass and the activity of organisms in the rhizosphere (the layer of soil that contains the roots). The grass converts carbon dioxide from the atmosphere into biomass: leaves and stems above the ground and roots below it. The denser the grass grows, the faster it will recover after grazing – provided it has not been grazed too short (Idel 2015).

Moderate soil compaction

Unless large herds of heavy herbivores spend extended periods in a restricted area, trampling by livestock will disturb the soil less than the heavy machinery nowadays used for mowing and crop cultivation (LLUR 2010). Sheep, especially, have a "golden hoof". With their weight distributed over four hooves they have a similar effect to a heavy roller weighing 3,000 kg per metre (Leucht et al. 1990 cited in Förster and Müller 2015). Because of these characteristics, sheep are especially suited for grazing on dykes (see below).

Grazing versus mowing and other landscape management methods

The extensive grazing of nature conservation areas is both economically and ecologically attractive. It is economically more advantageous the more difficult it is to maintain an area by machine or manually.

Grazed areas are much richer in biodiversity than mown ones, which are relatively homogeneous (LLUR 2010). Mowing "decapitates" the grass, killing 5–80% of amphibians, grasshoppers, insects, spiders and some other species per mowing (Humbert et al. 2009 cited in Nickel 2019a: Slide 39).

Grazing is often more cost-effective than other methods of controlling vegetation. According to Waltz (2019), landscape management by sheep and goats is often cheaper and better for the pasture than manual mowing and clearance. Bleisteiner (2019) compared the costs of grazing suckler cows on land parcels of different types with using chainsaws and strimmers, to maintaining similar parcels by hand. He found that grazing was cheaper – except for small parcels of high, flat land, where manual maintenance was cheaper (Figure 9). However, under certain conditions, the grazing of high flat areas could also be cheaper than mowing depending on the nature of the area and the costs of fencing and labour (Bleisteiner 2019). The situation is probably similar for sheep.

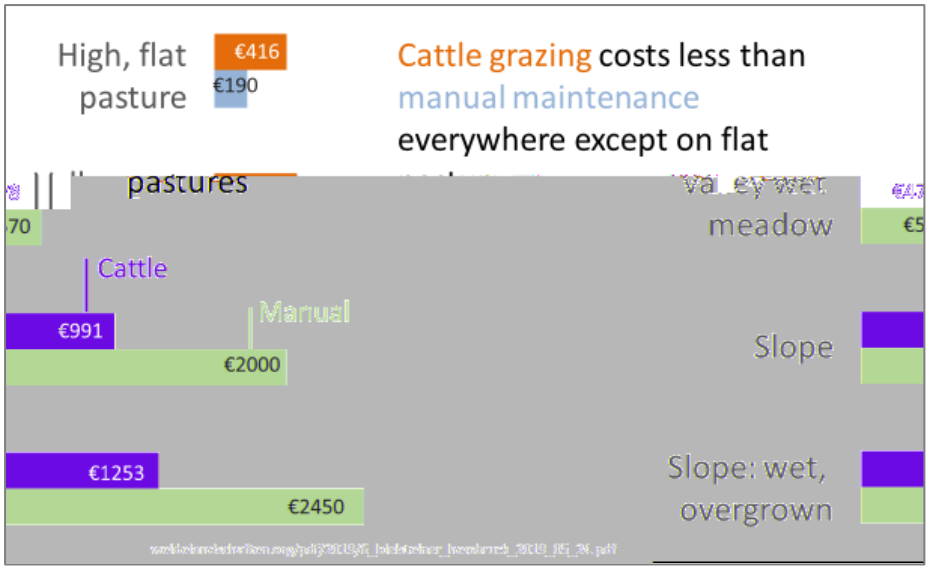


Figure 9. Costs of controlling vegetation on different types of landscape (adapted from Bleisteiner 2019, own translation)

Grazing may need to be complemented with other management methods. For examples, heather (*Calluna vulgaris*) may need to be rejuvenated from time to time through burning or through the removal of the upper soil layer (called *plaggen* in German) (Woike and Zimmermann 1997:13). Some contracts for landscape management require shepherds to remove weeds not grazed by the sheep at the end of the season. Some even require mulching the whole area – which does not make sense from an ecological perspective. Unfortunately the European Union still recognizes mulching as a management practice for areas eligible for financial support.

Indirect outcomes

Indirect outcomes result from improvements that arise through grazing. They may be influenced by many other factors, so it is difficult to separate the contribution of pastoralists from other factors and express it in monetary terms.

Tourism and recreation

Tourism contributed 8.6% of Germany's gross domestic product of €3,386 billion in 2018 (Destatis 2019, Statista 2020). Tourist attractions include not just cities, but also local recreational areas, nature reserves and other attractive landscapes. Many of these are grasslands or grazing areas that would become overgrown and turn into scrubland and forest if they were not grazed. That would harm tourism (Streifeneder et al. 2018). Some farms earn income by providing accommodation for tourists.

Because of the many other factors affecting tourism, it is impossible to isolate the impact of pastoralism. However, one thing is sure: without grazing animals, the alpine regions and areas such as the Rhön and the Lüneburg Heath would look very different – and would attract fewer tourists.

The alpine pastures (including ski slopes) would become overgrown (Falkinger undated). Government sources stress the importance of mountain farmers and their livestock for maintaining a lively, attractive and sustainably managed cultural landscape and warn against underestimating the importance of grazing animals for tourism (BLE and BZL undated, StMELF 2018). According to Ringler, 80% of the ski slopes in the Bavarian part of the Alps lie at least partially in areas subject to grazing rights. Streifeneder et al. (2007) note a significant spatial correlation between the development of alpine farm numbers and tourism: regions where many alpine farmers and herders had ceased operations registered decreasing tourism intensities, while regions where farms continued to operate continued to have high tourism intensity.

The tourism industry in the Rhön mountains generates annual sales of around €113 million. This includes the expenditure of almost 500,000 holidaymakers and around 1.5 million day-visitors (Anonymous 2014). Tourism is the strongest economic sector in the Lüneburg Heath, with more than 5 million overnight stays per year, a gross turnover of €1.2 billion and over 32,000 jobs (Lüneburger Heide GmbH 2017).

It is not only the landscapes that attracts tourism. Herders are part of Germany's culture. In the Alps, droving the animals to the mountains in spring or early summer and bringing them down again in autumn are accompanied by festivals that attract spectators from near and far. In other areas, processions with animals, livestock markets and herding competitions are integral parts of rural life. The UNESCO listing of pastoralist events earlier mentioned underlines the cultural importance of such traditions.

Water quality

With their dense grass cover and deeply-rooted soils, grazed grasslands make an excellent water filter, sieving out contaminants and preventing them from entering wells, springs and the groundwater (Bauschman 2015, FAO 2009). Expressing this contribution in financial figures is difficult. Water-purification plants in Germany refuse to provide data of the costs for purifying drinking water, even though the water sector is subject to public authority (Wojtalla 2007). Therefore it is not possible to compare the purification costs between grazed areas and those under intensive management (Czerkus, personal experience).

Erosion control

Grass cover on extensively grazed areas protects the surface from raindrop impact, slowing runoff and trapping soil particles. The grass roots hold the soil in place, even on steep slopes. Without grazing, alpine pastures overgrow with matgrass (*Nardus stricta*), the long leaves of which lean downslope, encouraging water to run off rather than infiltrating into the soil. This can cause flooding and in winter facilitates the formation of avalanches (Falkinger undated).

Flood control

Dykes along Germany's coasts and major rivers protect the land behind from flooding. They must be kept free of unwanted vegetation to maintain their structural integrity. The dense grass cover and modest soil compaction by sheep stabilize these dykes. Grazing also reduces the numbers of voles, which burrow into and damage the dykes (Förster and Müller 2015, Riehl and Schöneman 2005). According to some reports, dykes that have been grazed resist floods better than dykes that have been mown, but we have been unable to find scientific evidence for this.

In several states, governmental or private dyke managers contract mobile shepherds to maintain substantial parts of their dyke:

- **Bavaria.** This southern state has some 1,315 km of dykes, about a third of which are regularly grazed (BLT 2014).
- **Brandenburg**. One-third of the dyke area (some 1,167 ha) of this eastern state is grazed by sheep. Of the 75 full-time and 150 part-time shepherds in Brandenburg, 28 (12%) are involved in dyke maintenance. The payment for grazing a dyke twice a year is €460 per hectare; if extra work to remove shrubs and weeds is needed, the rate is €715 per hectare (mlul-brandenburg 2019).
- **Mecklenburg-Western Pomerania.** Some 410 of the 892 km of dykes in this northeastern coastal region are state-owned. About 151 km (37% of the state-owned dykes) covering a total of 377.5 ha are grazed by sheep. The state government promotes shepherding by offering the dykes to shepherds before putting the dyke maintenance out to public tender (MV 2017).
- **Saxony-Anhalt.** About 25% of the 4,300 hectares of dyke area in this eastern state are grazed (Lukas 2014).

Fire control

Old dry grass and undergrowth presents a fire hazard. Using livestock to remove it can help reduce the danger of unwanted fires (LIFE Montserrat Project 2019). But so far this has not figured prominently in Germany. However, with the changing climate and after three very dry summers in 2018, 2019 and 2022, the advantages of grazing may be recognized more in the future. To reduce the enhanced danger of forest fires, the federal state of North Rhine-Westphalia recently announced that it would establish firebreaks. It is possible that the law will be adapted to allow grazing as one of the management tools, following the example of the Montserrat Project in Spain (LIFE Montserrat Project 2019).

Climate

Grassland is an important carbon store and may also function as a carbon sink until the soil is saturated, which will probably not happen for the next 100 years (Poeplau et al. 2011, cited in BfN 2014:5). Breaking the soil to permit cropping releases much of the stored carbon into the air as carbon dioxide. That makes it crucial to maintain grasslands in good condition. The denser and more biodiverse the grass cover, the better (BfN 2014, Wrage 2010).

Crops and fruits

The enhanced biodiversity on extensively grazed land means many more insects. This in turn helps farmers, as many crops and fruits need insects for their fertilization. The value of this is difficult to express in monetary figures. Furthermore, the more biodiversity, the better the balance between beneficial insects and pests.

Fulfilling legal requirements to conserve the environment

Germany has received funds from the EU to maintain and improve the condition of selected environmentally valuable areas. For some of these areas, mobile grazing is crucial to fulfil its commitments with the EU. However, Germany has failed to protect and restore its flower-rich grasslands. For this reason, the European Commission decided in December 2021 to initiate infringement proceedings against Germany (EU 2021).

Estimated value of ecosystem services of high nature value grassland

Based on Matzdorf et al. (2010), the Federal Agency for Nature Conservation (BfN 2014:9) estimated that the annual net value of conserving a hectare of high-natural-value grassland (compared to converting it to other, agricultural uses) is between €1,291 and €2,171, depending on the location and characteristics (Box 4).

BfN (2014:9) points out that its assessment of the economics of grassland conservation does not include factors such as flower pollinators, tourist attractiveness and related jobs in the region, as there are still no adequate methods for measuring such contributions. Therefore its figures probably underestimate the value of the ecosystem services.

Box 4. Estimating the net value of maintaining grassland

Greenhouse gases. Ploughing up species-rich grassland to make arable land (e.g., maize fields) results in greenhouse gas emissions. The quantity depends on the location. At a value of €80 per tonne CO_2, the harm caused by emissions is valued at between €686 and €1,486/ha/year, according to calculations by BfN (2014) based on Matzdorf et al. (2010).

Water pollution. Arable farming also results in higher emissions of nutrients that can pollute ground and surface water. Preventing such losses by sowing a catch crop over the winter would cost around €40 to €120/ha/year (Matzdorf et al. 2010).

Biodiversity loss. Converting grassland to arable use reduces the biodiversity. The value of this is difficult to estimate. A proxy is to ask people how much they would be willing to pay for species-rich habitats. According to a study by the Federal Agency for Nature Conservation (BfN 2014), this can be estimated at an average of €1,000/ha/year.

Loss of output. Species-rich grassland produces less sellable produce than arable land: BfN estimates this at up to minus €435/ha/year.

Taking all these effects into account, we can calculate the annual net value of maintaining a hectare of grassland with a high natural value compared to ploughing it up at:

Low estimate: €686 + €40 + €1,000 – €435 = €1,291

High estimate: €1,486 + €120 + €1,000 – €435 = €2,171,

depending on the location and characteristics.

Sources: Matzdorf et al. 2010:38, BfN 2014:9

On the other hand, BfN's assessment prices CO_2 at €80 per tonne (Box4). This is much higher than the €25 the German government introduced in 2021 for Germany's national CO_2-trading. However, the price per tonne is to

rise gradually every year up to a maximum of €65 per tonne in 2026 (Bundesregierung undated). Some analysts forecast that carbon prices on the EU carbon market will hit €90 per tonne in 2030 (Simon 2021).

This demonstrates how difficult it is to put price tags on the value of ecosystem services. BfN's assessment is at least a start. It indicates that the economic dimension of ecosystem services is quite substantial.

Value of ecosystem services of mobile shepherds

The 1,000 largest shepherding enterprises manage 160,000 ha (see *Area grazed by mobile shepherds*). Multiplying this with the range of net values of maintaining grassland, we can calculate the value of their ecosystem services of between €206 and €347 million per year for reduced CO_2-emissions, ground water protection and biodiversity (Table 8). While such estimates are admittedly very rough, they do show that the environmental and social contributions of the few pastoralists left in Germany is disproportionately high – and much higher than the value of the products from their animals.

Table 8. Estimated value of ecosystem services by mobile shepherds in Germany

		Value (€)
Area managed by 1,000 largest herders[1]	160,000 ha	
Environmental value, low estimate (see Box 4)	€1,291/ha	€207 million
Environmental value, high estimate (see Box 4)	€2,171/ha	€347 million

1 Schenk (unpublished), based on LfULG 2018; BfN 2014. See Box 4.

To get a better estimate of the contribution of these pastoralists, we need more data on the management systems of shepherds – especially on the smaller enterprises practising mobile herding and on alpine pastoralists. It is also necessary to develop methodologies to measure the contributions of mobile grazing to tourism, pollination, flood protection and other outcomes. This applies also to the cattle and other pastoralists maintaining the alpine pastures.

Payments for environmental services

Shepherds and mountain farmers do indeed receive some payment for the environmental services they perform. Much of the funds for farmers and pastoralists comes from the EU's Common Agricultural Policy (EU 2018). In the current funding period "active farmers" of agricultural land can apply for direct payments under the "first pillar" of the EU's budget for agriculture. The implementation of the direct payments widely differs between the member states of the EU, in some cases even among regions.

In Germany in 2018, all farmers received about €286/ha of their agricultural land on average as direct payments (Deutscher Bundestag 2019); young farmers generally qualify for a slightly higher premium than farmers above 40 years of age (EDJNet 2019).

The "second pillar" of the EU support for agriculture consists of a range of environmentally related measures. Currently, the funds in this pillar make up only about one-third of those in the first pillar and are tied to the provision of certain environmental services. The German government and the federal states are responsible for managing the funds and paying them to qualified applicants.

Some of the funds go to foundations and civil society organizations such as the Naturschutzbund Deutschland (NABU) to manage land on behalf of the government. They must fulfil certain requirements (such as the land must be grazed) and may contract a herder to do this.

State governments, local municipalities, water authorities and private landowners may also contract herders to graze their land. Contracts vary depending on who owns or administers the land.

As a result, the funding criteria and conditions may vary from one federal state to another. A herder in Bavaria, for example, may qualify for a different set of funding from one in neighbouring Thuringia. According to LfULG (2018), the sheep farms in their survey received an average of €646/ha in 2016/2017. As 29% of the farms in their sample were located in Thuringia, where the support to pastoralism tends to be higher than in other states, this figure cannot necessary be extrapolated to the whole of Germany. Ignoring this caveat, we

estimate that the 1,000 largest shepherds together receive €103.4 million in support payments (Table 9). The real figure is likely to be lower than this.

Table 9. Estimated support payments made to mobile shepherds in Germany

		Value (€)
Area managed by 1,000 largest herders	160,000 ha	
Support payments[1]	€646/ha	€103.4 million

1 LfULG (2018)

As the current Common Agricultural Policy has come to an end, the just described funding schemes are going to change in the coming funding period that will start in 2023. The two-pillar structure will be maintained. But under the first pillar, there will be fewer direct payments per hectare for "basic income support", and the payments are subject to stricter requirements for environmental and climate protection and good farm management. Voluntary services going beyond this in the areas of environmental and climate protection or biodiversity can be additionally rewarded if they fulfil one or several conditions of the newly developed "eco-schemes" (LfL undated).

Another new set of premiums under the first pillar will be coupled payments for cattle, sheep and goats. Only female animals are eligible – cattle if they belong to farms that do not sell milk and dairy products, and sheep and goats that are at least 10 months old on January 1 (LfL undated). This premium will greatly help mobile shepherds.

The second pillar to be designed by the federal states promotes area-related environmental and climate measures. Because some of the eco-schemes of the first pillar overlap with measures of the current second pillar programmes, the states had to come up with some additional or enhanced measures to avoid duplication. Depending on how the new programmes are formulated, shepherds may gain or lose money compared to the current funding period, as large parts of the land they manage is leased. In the past, shepherds benefited less than other farms from the direct payments of the first pillar, instead having to rely largely on landscape-management programmes for their income.

The next phase of the Common Agriculture Policy is still being finalized at the time of writing. It is therefore difficult to judge its exact impacts. Shepherds and other pastoralists hope it will not make them worse off, especially as the current payments for environmental services do not reflect the true value of their environmental or other indirect services. These payments compensate for costs and losses rather than adding to their income, as the production output of species-rich grassland is lower than that of arable land (Box 4).

Social services

A few sheep farms employ people with disabilities. This is known as *soziale Schäferei*, or social sheep farming; it is usually supported with government funds. The shepherd benefits from the subsidized labour; the disabled person from a decent workplace that accounts for his or her disability. Another form of social sheep farming takes on youth with social problems. The shepherd gets a contract with the youth welfare department and receives payments for the additional work he or she has to put in with the young people (Deutsche Arbeitsgemeinschaft Soziale Landwirtschaft 2012, Jugendhilfe Familie e.V. undated).

Shepherds also contribute to cultural life and education. Some host visits from school classes and even management-team-building exercises. Cultural events include herding and shearing demonstrations and competitions, events highlighting the role and value of extensive livestock keeping, agricultural fairs, participation in farmers' markets and other public events.

Total value of services by pastoralists

Based on the estimates above, we can calculate the total value of products and services produced by the 1,000 largest mobile shepherds in Germany (Table 10). They get a total of €83.9 million from selling meat (or animals) and wool. In addition, they receive support payments of perhaps €103.8 million from the EU, giving a total income of €187.2 million. Note that these are figures for gross income, and do not take the shepherds' costs into account.

Table 10 mentions the value of dung, but we excluded it from these calculations because it is rarely sold and not clear whether it should be classified as a benefit for the land manager or as an ecosystem service. In any event, the value of dung is relatively small compared to ecosystem services. This calculation also ignores the value of other services such as tourism and pollination.

Table 10. Estimated value of services of 1,000 largest shepherds in Germany

1,000 largest herders			Data source	Value[1]		
				Total (€ million)	Per adult sheep (€)	Per hectare managed (€/ha)
Adult sheep kept	705,000		Tables 1 and 5			
Area managed	160,000 ha		Schenk (unpublished)[2]			
Income						
Meat production		A	Table 3	82.0	116	513
Wool production		B	Table 4	1.9	3	12
Gross income from products		C	A+B	**83.9**	**119**	**525**
Support payments		D	Table 9	103.4	147	646
Gross income		E	C+D	**187.3**	**266[3]**	**1,171**
Value of ecosystem services						
Dung production (see text)			Table 7	9.2	13	59
Ecosystem services, low estimate		F	Box 4, Table 8	207.0	294	1,294
Ecosystem services, high estimate		G		347.0	492	2,169
Uncompensated value of services						
Low estimate			F–D	**103.6**	**147**	**648**
High estimate			G–D	**243.6**	**345**	**1,523**

1 Data stem from period 2014–2018. All figures rounded, so may differ slightly from those in the data sources given in the third column.
2 See *Area grazed by mobile shepherds*.

The sources of income in Table 10 fall way short of compensating the shepherds for the value of the ecosystem services they perform (between €206 and €347 million). The excess value to society (the difference between the value of services and the support payment received for these services) ranges from €102.6 to €243.6 million.

It also ignores:

- The contributions of the around 900 sheep enterprises with 200–500 sheep because of a lack of data on these holdings. However, many of these enterprises are also at least partly mobile; they produce meat and wool and do landscape management. This means that the estimates provided in Table 10 most likely underestimate the contributions of shepherds to the larger society.
- The important contributions of alpine herders: If adding the 40,329 ha of open alpine pastures to the 160,000 ha of permanent grasslands maintained by the 1,000 largest shepherds, the value of their environmental services of these groups together would roughly amount to €260–435 million.

This illustrates that pastoralists in Germany contribute more to society than they receive in support payments from the European Union and the German government.

Future of pastoralism

Since the completion of the first draft of this study in 2020, new census data have become available. Between 2016 and 2020, the German population has increased by 1%, while the number of farms decreased by 5%. Farms keeping livestock were especially affected. Their number fell by about 9% – with the exception of sheep (and chicken) farms. The number of the different types of livestock also decreased, except for goats, which increased by 11.5% (BLE 2019, 2022, Table 11).

Table 11. Changes between 2016 and 2020

		2016	2020	% change
Population		82,522,000	83,155,000	+0.8
Farm operations	Total	275,400	262,800	–4.6
	With livestock	185,200	168,800	–8.9
	Sheep farms	19,600	19,900	+1.5
Livestock numbers	Cattle	12,467,000	11,275,000	–9.6
	Pigs	27,376,000	26,300,000	–3.9
	Sheep	1,834,300	1,809,300	–1.4
	Goats	139,000	155,000	+11.5
	Horses	173,574	173,148	–0.2
	Chickens	173,574,000	173,148,000	–0.2

Sources: BLE 2019 und 2022, tables 2, 81, 84 and 97 respectively

Changes in pastoralism

Shepherds

In the sheep sector, the number of farms increased by 1.5% between 2016 and 2020, mainly due to an increase of 6.7% in small-scale holdings with fewer than 20 sheep, while the number of part-timers keeping 20–199 sheep fell by 2.3%. More dramatic from a pastoralism point of view is the fact that between 2016 and 2020 some 100 (10%) of the full-time shepherds gave up their farms or reduced their number of sheep. At the same time, the number of part-timers with 200–499 animals increased by 11% (BLE 2022, table 97, Tables 11 and 12, Figure 10). These changes mean reduced mobility and capacity for landscape management, at a time when the need for ecosystem services is increasing and is recognized by many state governments.

Table 12. Change in number of holdings and sheep 2016–2020

Flock size (sheep)	Probable type of enterprise	No. of holdings		% change	No. of sheep		% change
		2016	2020		2016	2020	
1–19	Small-scale	8,900	9,500	+6.7	66.3	67.8	+2.3
20–199	Part-timers	8,700	8,500	-2.3	497.9	488.6	–1.9
200–499	Mostly part-timers, some mobile	900	1,000	+11.1	304.0	309.7	+1.9
500+	Full-timers, many mobile	1,000	900	-10.0	966.1	943.2	–2.4
Total		**19,600**	**19,900**	**+1.5**	**1,834.3**	**1,809.3**	**–1.4**

Source: adapted from BLE 2022, table 97

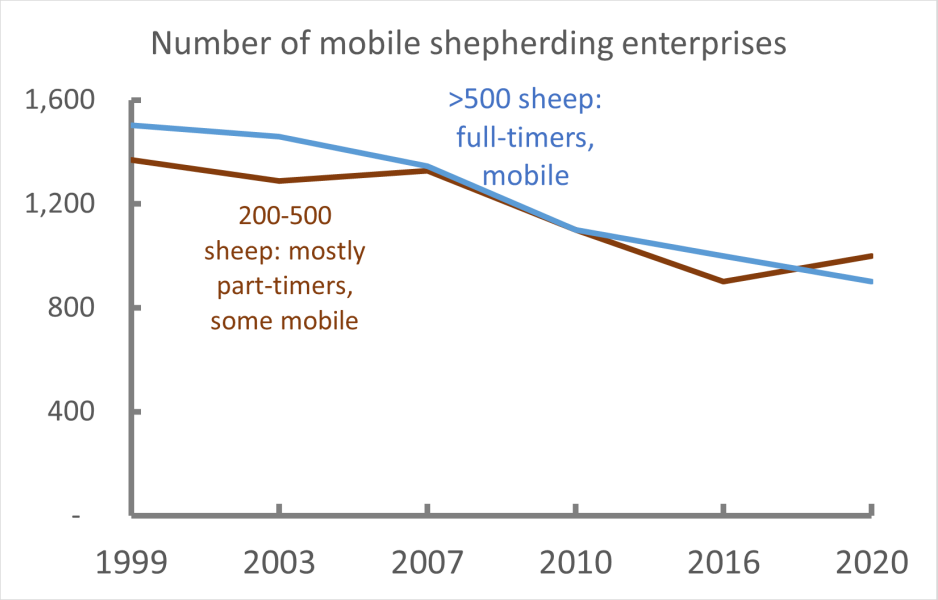


Figure 10. Numbers of mobile shepherds 1999–2020 (Source: BLE 2018–2022)

Alpine herders

According to a press release of the Bavarian State Ministry for Food, Agriculture and Forestry, in summer 2018 around 55,000 cattle, 4,500 sheep and goats and 800 horses were driven up into the mountains in Bavaria – slightly more animals than in 2001. The number of alpine pastures had remained stable (StMELF 2018). In fact, the latter has been relatively stable for the last seven decades, except for a temporary decline in the 1960s and 1970s (Ringler 2010).

But what has changed are the number and types of the animals driven to the alpine pastures. The overall herd size decreased by 11% between the 1950s and 2018. While the number of heifers and other young cattle increased by 9%, the number of adult cows declined by nearly 60% and that of sheep by 80% (Figure 11).

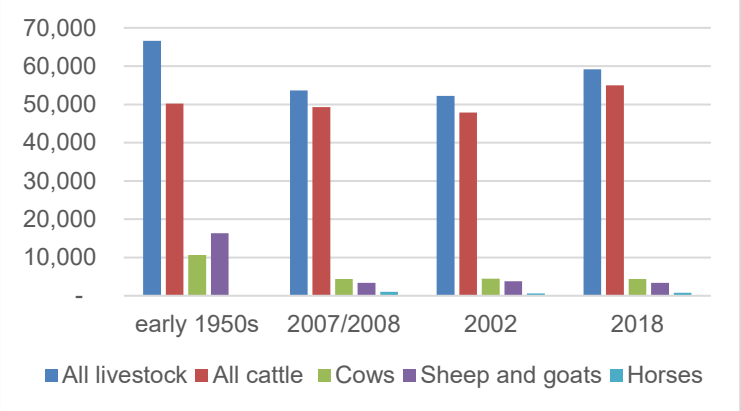


Figure 11. Changes in herd composition in the Bavarian Alps 1950-2018 (Ringler 2010, StMELF 2018, Wessely and Güthler 2004)

These developments have been accompanied by a shift away from the herder staying with the herd all summer in the mountains, to a more extensive form of management. A growing number of herders now stay in the valley but visit their herd regularly, letting the animals graze on their own between visits. But if there is plenty of fodder and the animals are not herded, they tend to eat only what they like. This leads to a loss in biodiversity as some of the less-preferred plants and scrub species spread. They overgrow unique habitats for a variety of animals and plants created over the years by the careful management of the pastures and meadows (Ringler 2010, LfL 2022).

Climate change is speeding up these processes. The vegetation period now starts earlier in the year, so when the snow is finally gone and the animals can return to their mountain pastures, there is more feed than they can eat – with the consequences just described. The Bavarian State Institute for Agriculture (Bayrische Landesanstalt für Landwirtschaft) states that rising temperatures, falling livestock numbers and lack of pasture management had caused 1,855 hectares of alpine pasture to disappear alone in the Upper Bavaria region between 2008 and 2021 (LfL 2022).

Changing or abandoning herding

The main reasons for becoming part-timers or dropping out of the sector are economic, according to both a document prepared for the German parliament (Deutscher Bundestag 2019), as well as in informal discussions with herders (Table 13). Mobile shepherds have difficulties in marketing their products and in selling them at adequate prices. Despite the support payments, when including all the costs in the calculations, the resulting income often only pays for part of the labour of the shepherds and their family (von Korn and Völl 2021, Wagner and Wagner 2013, 2016). As mobile herding and landscape management are labour-intensive, many herders do not even earn the minimum wage for the many hours they care for their sheep and the landscape (AgE 2019b). However, this varies vary between states and regions, as sheep farming and the income from it are influenced strongly by the location and the circumstances. Special burdens are the continuously rising costs of mobility, transport and labour, and the investments needed to secure pastures against the expanding population of wolves (Siersleben 2020, von Korn and Völl 2021).

Unfortunately, all of this makes the profession of a pastoralist unattractive to the following generations. Being a mobile shepherd is hard work, and in view of the poor economic outlook, it is difficult to find a successor to take over the enterprise. As the average shepherd in Germany is in their late 50s, it is urgent to make the profession more attractive to prevent a bigger exodus in the near future.

Table 13. Reasons to continue or abandon mobile shepherding

Government[1]	Shepherds[2]
Economic situation of the respective farms Aspects of generational succession General expectations for the future Non-agricultural employment opportunities Aspects of social acceptance	Economic situation Enormous bureaucracy to get payments for their environmental services, risk of falling foul of controls Aspects of generational succession Wolves and other predators

1 Deutscher Bundestag 2019
2 Pers. comm. of various shepherds

Another factor making the life difficult for herders is burgeoning bureaucracy. While the German government does not mention it, the shepherds themselves see it as one of the main difficulties (Table).

All livestock keepers in Europe need to comply with a plethora of paperwork: animal protection laws, livestock traffic ordinances (*Viehverkehrsordnung*), animal-health laws, municipal regulations, and cross-compliance regulations. They must keep a pile of records on breeding, ear tags and traceability. All that is on top of all the paperwork that a small business has to maintain as a matter of course, such as financial records, employment records and tax returns. To receive European Union subsidies, all must fill in a pile of detailed forms; if they fail to do so, or get a detail wrong, they may lose part of the funding (Benesch undated).

Mobile livestock keepers are faced with even more bureaucracy because they graze their animals on multiple, scattered, ever-changing parcels of land, often across several jurisdictions. Preparing an application for financial support for maintaining marginal grasslands, they must mark and deduct landscape elements from the area the funding is applied for. The left side of Figure 12 shows the grazing area for which a shepherd sought financial support some 7–8 years ago. On the right side, he has marked landscape elements (often an individual bush or tree) that can be either included or must be excluded from the area to qualify for financial support. But vegetation grows and changes. The risk of making mistakes and having to repay large sums after falling foul of an inspection is high.

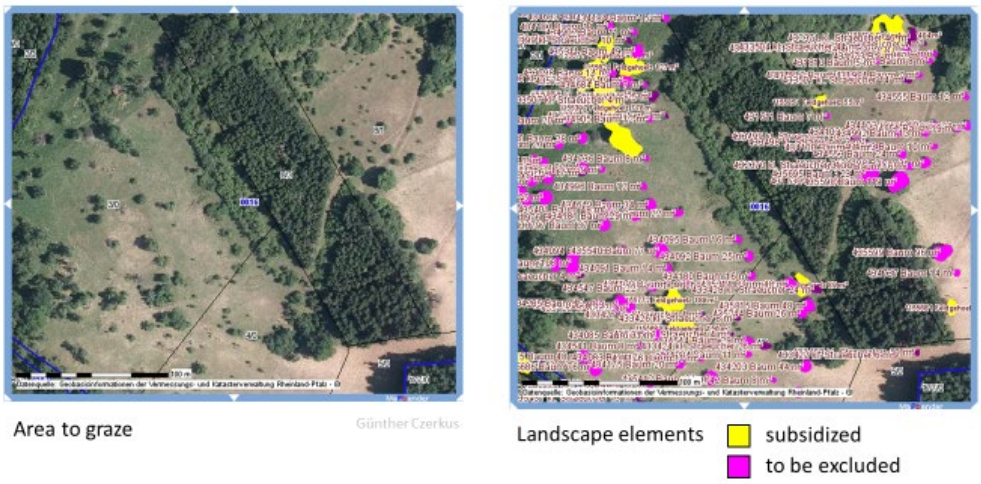


Figure 12. Preparing an application for financial support for maintaining marginal grasslands (explanations in the text, photos courtesy Günther Czerkus)

While the requirement to mark all such landscape elements have been eased for the forthcoming period of the Common Agricultural Policy, a plethora of new regulations has been added.

The section C*onstraints to mobility* above highlights the expansion of infrastructure as a further reason to give up mobility. Although this is a strong impetus for giving up long-distance mobility (e.g. Häckh 2018), it does not figure among the reasons mentioned either in the German parliament document or by the herders themselves.

Opportunities for pastoralists

Although the environment for mobile herding has deteriorated over the past decades and the competition for land has increased, there are some new opportunities.

Enhanced recognition. The number of government members, scientists and other stakeholders who recognize the contributions of herders has grown, and so has the support to shepherds, alpine herders and other extensive graziers. Another sign of the increased recognition is the fact that the year 2026 has been declared the International Year of Rangelands and Pastoralists.

Still the financial support to herders is far from adequate, and the bureaucratic mill grinds very slowly. It remains to be seen whether the measures will suffice to stop the exodus of mobile pastoralists and make the profession more attractive again for young people.

Rising demand for regional products. The proportion of German consumers who prefer regional products and attach importance to animal welfare and short transport distances is rising. Price also plays a role – but not in every case. Shepherds known to the authors say their direct sales of lamb meat have risen during the past few years, and were boosted further during the corona pandemic.

Unfortunately, no data is available on the number of shepherds and alpine herders involved in direct marketing. But data for all farms indicate that the share of farms practising direct marketing has nearly doubled during the past decade, rising from about 5% to 9% between 2013–2020. Organic products are also increasingly in demand. In 2020, about 13% of sheep, 33% of goats and 8% of cattle in Germany were kept on organic farms (BLE 2022, table 266, Destatis 2021b, 2021c).

It remains to be seen whether the inflation brought about by the war in Ukraine will destroy what progress has been achieved.

The spread of agri-photovoltaics (agri-PV or agrivoltaics). Until recently the installation of open-space agri-photovoltaics has been mostly restricted to conversion areas such as former military facilities and to a 200-meter-wide corridor along motorways and railway lines. A few herders have been making a living by grazing their sheep in such areas (Hahn 2021, LfL 2019). Due to new regulations and construction methods, it is now also possible to erect solar panels on agricultural and permanent grassland. Agri-PV panels are mounted on

higher stilts than in conventional solar parks, and are more widely spaced from each other, so allow the dual use for agriculture activities and power generation (Scharf et al. 2021, Wirth 2022).

Agrivoltaic parks now qualify for funds from the Common Agricultural Policy provided they lie in areas eligible for EU funding and the panels take up no more than 15% of the area (BMEL 2022). As a result, many solar firms are now searching for land where they can erect their panels, and a growing number are seeking shepherds to graze their parks. This is a win–win situation for all involved: the firms get land for their panels, the shepherds get fodder and income, the biodiversity increases, and the presence of grazing sheep enhances the acceptance of solar parks in the population.

It may take a few years until this can become a reality, as the firms must work through a pile of bureaucracy when applying for the permits. Will enough shepherds with experience in grazing and landscape management be left when the permissions are finally granted?

Maintaining pastoralism

The following measures could help to maintain pastoralism in Germany.

Marketing support. The government should support pastoralists to advertise their products and develop linkages with stakeholders in tourism, retail and catering and other measures that help them find markets and get better prices for their products (see, for example, Streifeneder et al 2007:23). Compared to more intensive forms of production, pastoralists receive very limited marketing support.

Adequate payment for services. Pastoralists also need adequate payments for their environmental services, not only cost reimbursement. Data from the German Alps show that financial support for extensive livestock keeping and environmental services can stop farms from being given up (StMELF 2018, Ringler 2010, Streifeneder et al. 2007).

Bureaucracy. The government urgently needs to reduce bureaucracy for mobile herders.

Regulations that give a level playing field to graziers. Certain regulations disadvantage graziers. An example is the "Notes on the intervention regulation 2018" (HzE) of the state of Mecklenburg-Western Pomerania. These specify how to carry out the ecological compensation for interventions in nature – including the construction of a photovoltaic installation. They attribute a significantly higher ecological value to extensive hay meadows that are mown than to extensive pastures. The compensation value relevant for the nature-conservation assessment is significantly higher when converting arable land into extensive hay meadows than when converting arable land into extensive pastures. This disadvantages the development of extensive pastures and the grazing of agrivoltaic systems (LSZV M-V 2019). It also neglects the fact that grazing is ecologically more valuable than mowing. To preserve extensive grazing and further biodiversity, the authorities should correct such unequal treatments in regulations.

Conclusions and recommendations

There are three types of pastoralism in Germany: transhumant shepherds, location-bound herding, and alpine herders. Over the past decades, their production systems have undergone large changes, and they continue to do so.

Few pastoralists, large contribution

Increasingly faced with obstacles to mobile herding, comparatively hard work, many working hours and bleak economic outlooks, the numbers of mobile pastoralists have been decreasing over the past decades, and they have reduced their herds and movements. Finding a successor is difficult as few young people are interested in this profession.

As a result, pastoralists in Germany are few in number. According to our estimates, they make up less than 0.1% of the German population, depending on who is included into the count and whether their families are counted as well. But there are no hard data, as German statistics do not cover "mobile herders" as a separate category.

Because of their low numbers, pastoralists' contribution to German GDP through the sale of products is very small. However, we estimate that the indirect contribution to the environment of the 1,000 largest sheep enterprises is likely to be twice or more as high as the value of their production – and much higher than the subsidies they receive from the European Union and the German government. This contribution would be even higher if the data permitted us to include the services of alpine farmers and the enterprises that keep less than 500 sheep and provide landscape management services. All in all, compared to their small numbers, Germany's pastoralists make an oversized contribution to Germany's economy and environment.

Lessons for collecting information on pastoralism

Where many countries have very few data on livestock, Germany has an almost embarrassing wealth of statistical information. However, finding data can be difficult, and the data are not necessarily categorized according to the topics of interest.

Hard data on pastoralists and their contribution are scarce for at least reasons:

- **Statistics do not cover pastoralists or mobile livestock systems.** Data on pastoralism appear in the state-level statistics of a few states at most, while Germany-wide statistics do not capture this type of livestock production at all.
- **Dispersed data.** There is a body of scientific and grey literature that focuses on (or covers) selected aspects of pastoralism. Bringing the information together and matching it with statistical data from other sources makes analysing data on pastoralism very cumbersome.
- **Lack of price tags on environmental services.** The indirect contribution of pastoralists is difficult to express in euros. For example, how much of the tourist revenue of a region is due to herders?

As a result, data collection on pastoralists is like assembling a puzzle. We had to piece together our descriptions, calculations and analyses, drawing on a large mix of sources and extrapolating statistical data. As the result, the findings highlight trends and orders of magnitude rather than reflecting precision. They nevertheless provide valuable insights on the contributions of pastoralists.

The following measures could help to improve the data situation and the visibility of their indirect contributions:

- Establish a specific body or institute to compile information and initiate research on pastoralism. Such a body could either be newly established or build on an existing institution.
- Initiate studies on different aspects of pastoralism in Germany other than the Swabian-Franconian transhumance.
- Expand the coverage of the "sheep reports" to other regions in Germany and to holdings that have fewer than 400 sheep but make their living entirely from herding. Put more emphasis on the environmental contributions of mobile shepherds.

- To measure the contributions of mobile grazing to tourism, pollination, flood protection and other outcomes, develop methodologies and collect data on the economics of environmental services:
    - Review and summarize the literature on the impact of mobile grazing on biodiversity.
    - Study and compare the water filtration capacity of land maintained by mobile livestock and land under intensive management and compare the quality and purification costs of the water produced under these management approaches.
    - Study and compare the flood damage to grazed and non-grazed dyke sections and the land they protect.

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