

Animal industry myths about animal agriculture in a reality check

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I. Introduction

Ministries of agriculture and lobby groups, such as the Bavarian Farmers' Association, use certain narratives to justify the current form of agriculture with its animal husbandry and fish farming. They support the paradigm that animal husbandry is a necessary part of agriculture. In the following tabs, the narratives are examined in more detail and the most common myths are subjected to a reality check.

II. Animal industry myths about animal agriculture

1. Agriculture in Germany is characterized by family farms. Because of family farms, the animals are doing well.
2. Agriculture in Germany is only profitable with animal husbandry.
3. In many places in Germany, animal agriculture is the only way to produce food.
4. Animal agriculture is a crucial component of nutrient cycles.
5. Animal agriculture is sustainable.

III. Verification of the statements

1. Myth: Agriculture in Germany is characterized by family farms. Because of family farms, the animals are doing well.

In Germany, 89% of farms are individual enterprises, but only 48% of the labor force are family members ([1], p.2). It is therefore not true that German agriculture is dominated by family farms.

The use of the terms "peasant" and "family farm" and their combination is also intended to suggest the rural idyll of farms with happy animals. Bavaria has one of the highest percentages of family-run farms ([26], p.9). Nevertheless, the practices common to mass animal husbandry are also applied there. For example, 40% of cattle farms [27] and 50% of dairy farms [28] in Bavaria are tethered. In piglet farms, crate housing is still practiced for sows [27]. 91% of Bavarian laying hen places are in farms with an average of 22 thousand laying hen places ([29], p.258). For turkey fattening, beaks are regularly docked, mostly without anesthesia [27]. The common practice in the dairy industry is to artificially inseminate the cows, take away the newborn calves, slaughter the male calves or sell them abroad, take more than 20 liters of milk from the cows daily, repeat the process of impregnation, separation and killing annually, and finally slaughter the dairy cows after an average of 5 years due to decreasing milk yield.

2. Myth: Agriculture in Germany is only profitable with animal husbandry.

In fact, approximately 67% of farms keep land animals ([2], p.81). In addition, 1% of German farms run aquaculture where fish and crustaceans are bred ([3], p.9). 49% of the production value is generated with animals ([4], p.121). A change to a plant-based food system is therefore accompanied with significant changes.

On the other hand, German agriculture is heavily subsidized and cannot survive in this form without grants. The gross value added of agriculture, forestry and fishing totals 17 billion euros. The subsidies raised for this purpose comprise 7 billion euros, i.e. more than one third ([4], p.122). Slightly less than half are main farms (48%) and thus serve as the primary source of income. More than half of the approximately 244 thousand farms are part-time farms (52%), operated by the owners on a part-time basis ([2], p.91). In Germany, only about 1% of the workforce is employed in agriculture ([2], p.72). Converted, each full time worker in agriculture is subsidized with 14 thousand EUR per year.

A transformation from animal-based agriculture to a subsidy-minimized, plant-based agriculture using one-time grants therefore seems to make good economic sense and is desirable from a business perspective.

3. Myths: In many places in Germany, animal agriculture is the only way to produce food.

The statement is based on the assertion that there are many areas in Germany on which no plants edible for humans can be grown, but only feed for animals. In fact, slightly more than a quarter (28%) of the agricultural land is permanent grassland and is mainly used to grow grasses to feed dairy cows and beef cattle ([13], p.45). However, this permanent grassland is not natural native grassland (steppe, savanna) due to low rainfall or climate, but anthropogenic grassland that was formerly forest [30]. Both precipitation and nutrient content of the soils allow in principle the cultivation of plants edible for humans. Only areas that are poorly accessible to agricultural equipment are unsuitable for selective plant cultivation. In Germany, these are light pastures in the Alpine and other mountain regions. However, they account for only 0.3% of agricultural land. Only 0.8% of beef cattle and 0.1% of dairy cows are supplied with grasses via these areas [5].

Without animal agriculture, however, a large part of the agriculturally usable area is not needed anyway, so that both the very small proportion of light pasture land can remain uncultivated and the grassland - where it makes sense - can be further renaturalized (e.g. by converting it into forest, moorland). Additionally, portions of cropland used for forage can be reforested or converted to biodiverse grasslands.

The fact that humans are not dependent on animal foods was officially confirmed by the American Dietetic Association, among others, in 2016. According to this, a purely plant-based diet is suitable for all phases of the life cycle, including pregnancy, breastfeeding, infancy, childhood, adolescence, older adulthood and for athletes. Consumption of animal products, on the other hand, is a cause of certain diseases, including ischemic heart disease, type 2 diabetes, hypertension, certain cancers, and obesity [8].

The University of Oxford confirmed in a study that plant-based diets are both the healthiest and the most climate-friendly [7]. It is scientific consensus that the production of animal products requires many times more land compared to plant-based alternatives. A global meta-study by Oxford University proves the inefficiency: worldwide, 83% of agricultural land is used for the production of meat, aquaculture, eggs and milk, while these products provide only 18% of food calories and 37% of protein [6]. In Germany, about 60% of agricultural land is used for animal husbandry ([22], p.32), but this figure increases significantly if the land used for the production of imported feed were included.

Since the human body does not need animal products, land used for the production of animal products can thus be released. 76% of the land used for livestock can be reforested and converted into biodiverse grassland [6].

Reforestation of the released land can effectively counteract climate change and biodiversity collapse. Up to 55% of the carbon dioxide emitted globally each year by fossil fuels can be absorbed by converting livestock land to forest and biodiverse grassland [32], [33].

4. Myth: Animal agriculture is a crucial component of nutrient cycles.

The circular economy is based on the idea that the nutrients extracted by the cultivation and consumption of plants are returned to the soil. Consequently, all primary, secondary and final consumers must return their metabolic products and eventually their (residual) bodies to the soil [34].

A closed biological cycle is not present in Germany, as in virtually all modern agriculture. The nutrient cycle of an agriculture with animal husbandry is broken in several ways.

(i) According to the circular economy, nutrients have to be returned to the extracted soils via excrements, but also bodies of animals and humans. However, mainly manure and certain animal slaughter wastes are applied to the field, but hardly any animal products that are consumed and digested by humans and domestic animals (meat, milk, eggs). The excrements of humans are collected through sewage treatment plants, where important nutrients are removed from the cycle by conversion to gases or delivery to industry ([12], p.57). Due to problematic components (industrial, household, drug residues and pathogens) only a very small proportion of sewage sludge may be used in agriculture ([12], p.42). Animal products, which are not consumed by humans, but otherwise used (animal skins, blood, bones, fats) are completely withdrawn from the cycle. It is practically and ethically difficult to return the bodies of domestic animals and humans to agricultural land.

(ii) The animals are fed nutrients of foreign soils via imported plants. Germany-wide, the foreign share of feed of digestible protein is 33% ([9], p.10). A return of the nutrients does not take place, so that the countries (primarily USA, Brazil, Argentina) over this broken cycle the nutrients are taken irretrievably. On the other hand, the oversupply of nitrogen and phosphorus leads to numerous health and environmental problems. The oversupply of nitrogen [10] regularly leads to exceeding the EU limits for nitrate pollution of groundwater, which is harmful to health ([13], p.71). Nitrogen and phosphorus eventually also reach lakes and seas via rivers, where they trigger eutrophication. In addition, the biodiversity of various ecosystems is disturbed and air quality decreases due to particulate matter generated by ammonia ([13], p.105 ff).

(iii) The enormous demand for animal feed requires intensification of agriculture using artificial fertilizers and pesticides. In Germany, more than half (56%) of the nitrogen fertilizer is artificial fertilizer ([13], p.63). Sales of pesticides for agriculture in Germany in 2016 were over 32 thousand tons of active ingredient ([13], p.54). In the period 2009-2012, the limits for herbicides, fungicides and insecticides in groundwater were exceeded in about 5% of the random samples ([13], p.111).

Thus, animal husbandry is not a necessary component of a circular economy, but rather a resource-intensive factor that imbalances the material flow balance.

Without recycling human excrement and bodies, agriculture without animal use (vegan organic agriculture) does not constitute a fully closed-loop nutrient cycle either, but it can be practiced sustainably without the addition of chemical fertilizers and pesticides. Legumes can fix the most important macronutrient nitrogen in sufficient quantities via a symbiosis with nodule bacteria from the air. Through regular green manuring with legumes and the additional application of self-produced, biocycled humus and mature compost, fixed nitrogen and all other macro- and micronutrients can be supplied to the soil. The production of humus and compost can take place on the one hand via cyclic crop rotations ([14], Kp. 3.1.1.1) and on the other hand via a part of the land previously required for forage ([14], Kp. 3.6). Any nutrient deficiencies arising there can be compensated for by naturally available adjuvants (e.g. rock phosphate, potassium sulfate, magnesium sulfate) [15],[16].

5. Myth: Animal agriculture is sustainable.

Sustainability means that cycles are not disturbed and systems are not brought out of balance in the long term.

(1) Metabolism

The consumption of animal products is accompanied by considerable losses of usable biomass. On average, 90% of the energy is lost per trophic level through metabolism and respiration ([31],[17]). Due to this energy loss, considerably more resources (agricultural land, water, macro- and micronutrients) have to be expended for the consumption of animal products than for the direct consumption of plants. On the one hand, the energy is lost for human use, and on the other hand, it is released into the environment via harmful metabolic products (greenhouse gases, acidifying and eutrophying substances). The high input of resources and the high output of harmful substances disturb the biogeochemical cycles and bring the material flow balances into imbalance.

(1.1) Resource input

(1.1.1) Land

One unit of protein from beef production requires 48 times more land than an equivalent unit of protein from pea production. For pork, the ratio is 3:1, for poultry 2:1, for cheese 12:1, for eggs 1.7:1, for fish (farmed) 1:1, and for crustaceans (farmed) 0.6:1. Cow's milk requires more than 13 times as much land as soy milk [6]. This enormously high land use for animal products is manifested in Germany, among other things, by the fact that about 60% of the agricultural land is used for animal feed ([22], p.32) and yet an additional third of the total protein yield must be imported from overseas for animal feed.

(1.1.2) Water

The production of one protein unit of beef requires 6 times more water than the production of an equivalent protein unit from legumes. For pork and lamb, the ratio is 3:1. Chicken protein requires 79% more water than the production of equivalent protein from legumes, protein from eggs uses 53% more water, and protein from milk uses 63% more water ([18], p. 409).

(1.1.3) Chemical fertilizers

To achieve the high feed yields, chemical fertilizers are applied on a large scale in addition to manure and slaughterhouse waste. In Germany, more than half (56%) of the main fertilizer nitrogen comes from chemical fertilizer ([13], p.63), which is produced by the particularly energy-intensive Haber-Bosch process.

(1.2.) Emissions

The high material input in animal agriculture results in increased emissions of metabolic products such as methane, carbon dioxide, nitrous oxide, ammonia, nitrates, nitrogen oxides and phosphates.

(1.2.1) Greenhouse gases

Animal agriculture is a major contributor to climate change, especially due to the high greenhouse gas potentials of methane and nitrous oxide, the clearing of forests, and the opportunity costs of unused carbon sinks. Depending on the calculation method, the share is 18% ([20], p.271), 28% ([37], [11], p.44) and 51% ([21], p.11). A direct comparison of greenhouse gas emissions from fossil fuels [33] and greenhouse gas emissions and carbon opportunity costs [32] from livestock farming illustrates the climate impact of agriculture with livestock.

The production of one unit of protein from beef emits 125 times more greenhouse gas equivalents than the production of an equivalent unit from peas. For pork, the ratio is 19:1; for poultry 14:1; for cheese 28:1; for eggs 11:1; for fish (farmed) 15:1; and for crustaceans (farmed) 45:1. Three times more GHG equivalents are produced for cow's milk than for soy milk [6].

(1.2.2) Acidifying gases

Animal agriculture produces high gas emissions of ammonia and nitrogen oxides. By eventually raining off, they enter all ecosystems, causing them to acidify. The acid stress leads to a reduction in plant vitality via an unbalanced supply of nutrients and results in lower plant resistance to drought and frost. In addition, species composition changes. Production of a unit of protein from beef emits 42 times more acidifying gases than production of an equivalent unit from pea. For pork, the ratio is 23:1, for poultry 16:1, for cheese 20:1, for eggs 13:1, for fish (farmed) 8:1, and for crustaceans (farmed) 24:1. Cow's milk produces 8 times more acidifying gases than soy milk [19]. Ammonia is also a gaseous precursor from which harmful secondary particulate matter is formed ([13], p.107).

(1.2.3) Eutrophying substances

The input of liquid manure and the use of chemical fertilizers result in an oversupply of bound nitrogen and phosphorus in the soil, which cause eutrophication of water bodies, rivers and finally marine areas (North Sea). In large parts of Germany, the inputs permanently exceed the pollution limits ([13], p.76). Eutrophication favors nutrient-loving plants, displaces nutrient-sensitive plants and thus leads to a loss of biodiversity among plants, insects and animals. In lakes and oceans, entire ecosystems are collapsing. The production of one unit of protein from beef causes 44 times higher loads of eutrophic substances than the production of an equivalent unit from peas. For pork the ratio is 14:1, for poultry meat 8:1, for cheese 13:1, for eggs 6:1, for fish (farmed) 30:1 and for crustaceans (farmed) 45:1. Cow's milk results in 10 times more eutrophic substances released to surface water than soy milk [19].

(2) Use of herbicides, fungicides and insecticides.

The high demand for feed for livestock requires intensification of agriculture using herbicides, fungicides and insecticides. In Germany, such agents with more than 32 thousand tons of active ingredient ([13], p.54) were sold in 2016. On the one hand, herbicides, fungicides and insecticides are harmful to human health via water and food intake. On the other hand, they significantly damage insect populations. At representative sites in Germany, an average decline in insect biomass of 76% has been measured over 27 years [23]. The decline in insects in turn has an impact on plants and animals. For example, about 80% of wild plants depend on insects for pollination [35], while 60% of birds depend on insects as a food source [36].

Overall, the use of artificial fertilizers and herbicides, fungicides and insecticides, the loss of insects, the high demand for land and thus the displacement of plants and wildlife, and the high emissions of acidifying and eutrophying substances are reasons for the loss of biodiversity leading to a decline in plant diversity and animal populations [25] and the observable sixth mass extinction of species. The extinction rate is 117 times higher than would be expected without human impact [24]. Most endangered species are native to South America, Asia, and Oceania, but livestock production in Germany also bears a causal share of responsibility for the extinction events there due to high feed imports and the associated clearing of rainforests.

(3) Use of antibiotics

Animal husbandry requires a high use of antibiotics. They are used to a small extent against individual animal diseases, but for the most part prophylactically and to accelerate the growth of the animals and thus their readiness for slaughter. In 2019, 670 tons of antibiotics were used in veterinary medicine in Germany, including 131 tons of reserve antibiotics classified by the WHO as “Highest Priority Critically Important Antimicrobials for Human Medicine” [40]. By comparison, 666 tons of antibiotics were consumed in human medicine in Germany in 2016 ([41], p.6).

Antibiotic use, especially in animal agriculture, leads to dangerous antibiotic resistance, which impairs the effective treatment of infectious diseases in humans and animals. In Germany, about 6000 people die each year from multiresistant germs. The WHO classifies antibiotic resistance as one of the greatest threats to global health, food security and development [42].

(4) Cause and driver of zoonoses and pandemics

Animal agriculture, with its high density of animals and high land requirements, is one of the main causes of animal-to-human transmissible diseases (zoonoses) and eventually pandemics. The high stocking densities promote the emergence of pathogens within animals and the likelihood of spillover to humans. The enormous amount of land required by animal agriculture for feed and grazing displaces wild animals from their habitats and brings them into contact with domesticated animals and humans ([38], p.15-19). More than 70% of all new diseases occurring in humans are zoonotic diseases ([39], p.5). Almost 100% of pandemics are caused by zoonoses ([39], p.8).

The World Biodiversity Council IPBES has therefore identified, among other things, meat consumption and animal husbandry as pandemic high-risk activities and proposes appropriate taxes and levies. In addition, the Council calls for the economic costs of pandemics to be priced into consumption and production and for funds to be allocated for transformation processes in government budgets ([39], p.8).

IV. Conclusion

The consumption of animal products is not necessary for humans. In Germany, there are hardly any areas that would not be suitable for the cultivation of crops. In addition, the few alpine pastures are not necessary for food production if enormous areas are freed up by the elimination of animal husbandry. Animal agriculture is not a necessary component of a nutrient cycle. It is not sustainable because it requires enormous resource inputs while imbalancing various material cycles and ecosystems through the emission of metabolic products. The negative effects include (i) unused carbon sinks due to land consumption, (ii) high consumption of fresh water, (iii) high use of energy-intensive chemical fertilizers, (iv) nitrate contamination of groundwater, (v) high emissions of greenhouse gases, (vi) acidification of ecosystems, (vii) increase in particulate matter, (viii) eutrophication of water bodies, and (ix) use of pesticides. Animal agriculture disrupts a wide variety of biogeochemical cycles, sometimes irreversibly, and thus contributes significantly to global warming and the collapse of biodiversity on land and in water.

Due to the high farming densities and land consumption, animal agriculture is a major cause of zoonoses and pandemics. Furthermore, it requires a high use of antibiotics and thus promotes antibiotic resistance. Animal agriculture thus represents one of the greatest threats to global health.

Economically, agriculture plays only a minor role in Germany. Only about 1% of the workforce is employed in agriculture. Two thirds of the farms are part-time farms. Agriculture is only viable through subsidies. It plays an important role for the security of supply, but in its current form it causes enormous damage to the environment and to the health of humans and animals.

V. Solutions

A change from outdated, outmoded traditions and a shift to a purely plant-based agriculture is a logical consequence from an economic and ecological point of view, and only in this way can we be justified to future generations. This change can lead to new and self-sustaining employment in addition to the imperative reduction of environmental pollution and the prevention of health hazards. The framework conditions for this change must be demanded by the stakeholders from the politicians. Politicians must create incentives for this change, in particular by shifting subsidies. Lobbying associations and politicians must also educate consumers about the necessity of switching and highlight the advantages.

Change is already possible for farmers. Some [pioneer farms](#) have already successfully completed the transition to a bio-cyclical vegan agriculture. In addition, there is a [certification body](#) and more and more consulting services for transformations. Although the Federal Environment Agency still describes vegan organic agriculture as a niche, it has recognized its advantages and acknowledges its high sustainability and great potential ([\[43\]](#), p.36-39).

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