



KLIMAAKTIONSPLAN

*Im Bewusstsein der gemeinsamen
Errungenschaften und der Verantwortung
gegenüber den künftigen Generationen*



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Vision

Our vision for the food system is to supply all people living in Switzerland with healthy food meeting their demands for nutrients and well-being in a sustainable way. The latter must allow the following generations to produce enough food for them with the same intensity. It is a food system in which producers get recognition for their important work, have a fulfilling job with a good income. Consumers have access to food but also education about nutrition, the way food is produced and processed and best also about how it is handled and experienced in a cultural context.

A sustainable and healthy diet is the focus of all policy measures proposed.

These changes are part of a policy framework which supports climate friendly production practices, shifts subsidies in the direction of a plant-based diet and allows us to get away from the dependence on highly polluting methods. Its aim is to enable a sustainable food production considering the evident complexity of the issue and the relations and interactions between agriculture, the environment, society and the economy. It is essential that the issues are addressed in all the proposed fields at the same time. If we omit one of these points, or concentrate only on certain, we run the risk that it can negatively compensate all the efforts in the other fields.

A sustainable diet consists of a much larger share of plant-based products, compared to today's consumption patterns. Animal products in the diet will be reduced to one third compared to the present situation. Luxury and unhealthy food items like alcohol, sweets, chocolate, cocoa will have a much lower share in our diet and thus reduce fatalities due to illness caused by malnutrition.

Switzerland will further use grasslands for animal production. Ruminant production in Switzerland will be regulated by the amount of grassland available and fodder imports or domestic fodder production will be cut to zero. Greenhouses in Switzerland are only heated by waste energy from industrial processes or if really needed by renewable local energy.

Agricultural practice will follow guidelines for an optimized production from an environmental point of view while considering global food security and social justice and not to optimize profit rates.

The ecosystem boundaries shall be at the basis of decision-making with technical, social and economic aspects adjusted accordingly. The integration and common long-term vision of a sustainable food system must be shared by all stakeholders namely farmers, the processing industry, retailers, consumers and politicians. Future development shall be characterized by a common understanding and a common will for sustainable solutions.

Current Situation

Greenhouse Gas Inventory of Swiss Agriculture

According to the national greenhouse gas (GHG) inventory, agriculture causes approximately 15 % of all Swiss GHG emissions. In the year 2017, the agriculture sector as defined by the 2006 IPCC Guidelines for national GHG inventories encompasses an amount of 6.08 Mt CO₂ eq. (FOEN 2019). Major emission sources are methane emissions (CH₄) from enteric fermentation (3.29 Mt CO₂ eq.) and emissions of nitrous oxide (N₂O) from agricultural soils (1.58 Mt CO₂ eq.). Both these gases are also released during storage of livestock manure (0.75 and 0.41 Mt CO₂ eq. respectively). Less important are emissions of CO₂ from application of lime and urea (0.05 Mt CO₂ eq.). In addition to these sources, other emissions are related to agricultural production that are assigned to other sectors in the greenhouse gas inventory. CO₂ emissions from the combustion of fossil fuels in agricultural machinery and buildings amount to 0.63 Mt CO₂ eq. Furthermore, carbon stock changes of agricultural soils which are reported in the “Land Use, Land-Use Change and Forestry” (LULUCF) sector are also relevant. Whereas organic soils are a major source of CO₂ (0.59 Mt CO₂ eq.) it is assumed that carbon stocks in mineral soils are more or less balanced (see chapter [Negative Emissions](#)). Finally, a small amount of GHGs is also emitted during incineration of agricultural waste, from losses in agricultural biogas plants and during field composting (0.04 Mt CO₂ eq.).

Furthermore, emissions of around 0.81 Mt CO₂ eq. are incurred during the production of agricultural inputs abroad, in particular mineral fertilizers and animal feed. These emissions are not accounted for in the Swiss GHG inventory but allocated to the countries of origin in accordance with the international guidelines in climate reporting (territorial principle).

This sectoral perspective of emission inventories is limited and must be extended when assessing GHG emissions of the whole food sector in an integral way. Adopting a consumption perspective all emissions related to food processing and transport as well as emissions related to food imports and export must be considered. Under this perspective, it is apparent that more than half of all GHG emissions related to food consumption in Switzerland are originating from abroad (Bretscher et al. 2014). Nutrition turns out to be one of the most relevant consumption categories ranking third after “mobility” and “housing and energy” (Jungbluth et al. 2011; BFS 2018).

Agriculture and Food System

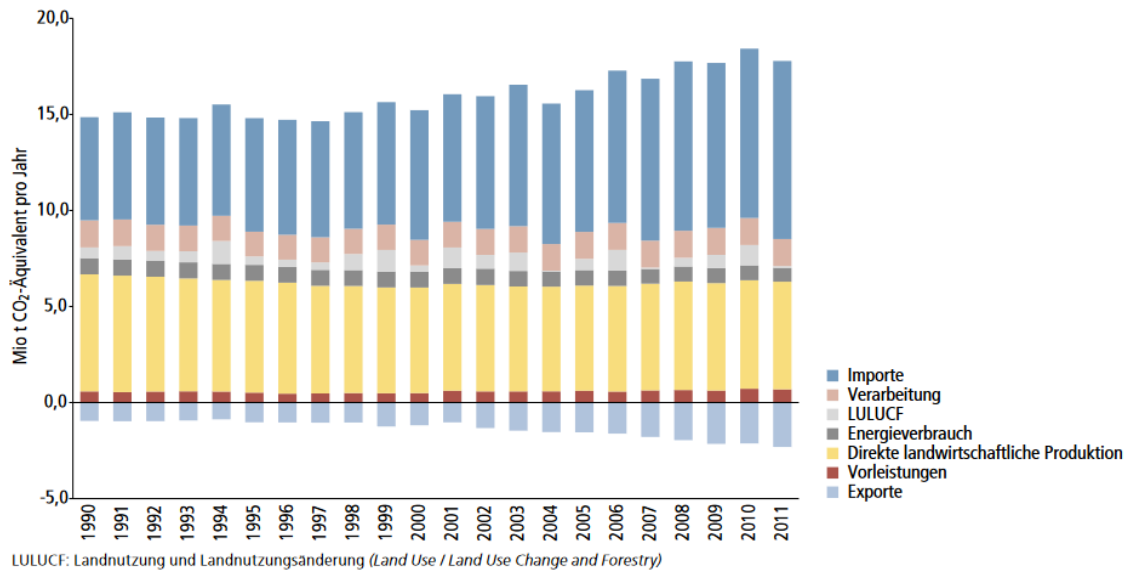


Abb. 2 | Treibhausgasemissionen der Schweizer Land- und Ernährungswirtschaft 1990–2011.

Figure 6-1 Greenhouse gas emissions of the Swiss agricultural and food industry 1990-2011

Import

According to pilot estimates by the Swiss Federal Office for Statistics, 65 % of the GHG-footprint of Switzerland is generated by imports (including Food & Non-Food). The emissions of imported food products (including non-alcoholic and alcoholic beverages and tobacco) amounts to about 12 million tons of CO₂ equivalents (FSO 2020a). In addition to production-related emissions, imported food has significantly higher emissions if transported by plane or if associated with deforestation. About 80% of deforestation it is caused by agriculture, for example to produce palm oil, meat and soy (animal feed for meat and milk production) (Kissinger, Herold, and De Sy 2012). Three products which are also of large importance in the Swiss food system.

GHG Emissions According to Different Diets

From a food system point of view, the GHG emissions coming from the diet are substantial. Especially over consumption of certain foods are increasing GHG emissions significantly. Mostly meat products, first and foremost meat from ruminants, are contributing very much to the overall GHG emissions (see Figure 6-2).

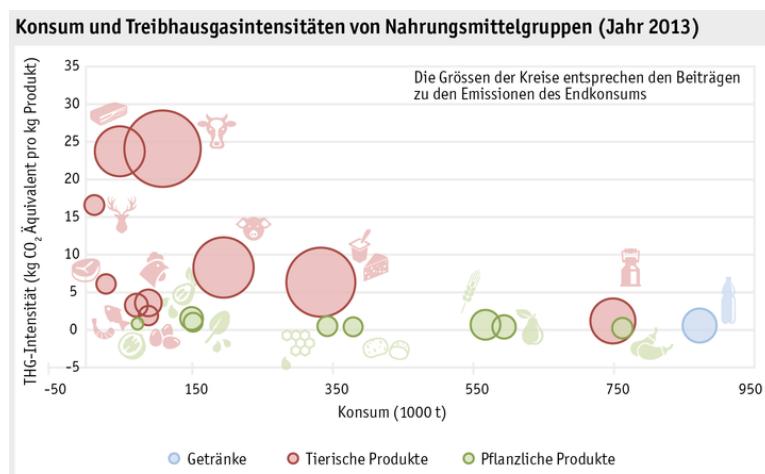


Figure 6-2 Consumption and greenhouse gas intensities of food groups

Bretscher et al. (2018) estimate that animal husbandry is responsible for approximately 85% of all agricultural greenhouse gas emissions in Switzerland, 75% alone by cattle livestock. CH₄ emissions from enteric fermentation of ruminants is by far the most important single emission source followed by emissions from feed production (mainly N₂O emissions from manure fertilizers). The outstanding relevance of livestock is also apparent when assessing the GHG footprint of food consumption in Switzerland. More than 80% of the emissions related to food consumption in Switzerland are due to the production of livestock-based food items (D. Bretscher, Lansche, and Felder 2015).

Food Waste

According to Beretta and Hellweg (2019), in Switzerland, each year about 2.8 million tonnes of avoidable food loss (food intentionally produced for human consumption which never gets consumed) is occurring across all stages of the Swiss food chain. This equals about 330 kg of avoidable food waste per person and year and about 37% of all agricultural goods produced for consumption in Switzerland (inland and abroad). The climate impact of avoidable food waste equals about 24% of the GHG emissions produced by the entire Swiss food system. Dividing the climatic impact into the main stages of the food chain, about 11% can be attributed to losses occurring at the stage of agricultural production, 30% to industrial food processing, 7% to food retailers, 12% to gastronomy and 40% to the stage of private households. The largest climate impact is caused due to losses of bread and bakery products, cheese, beef and fresh vegetables.

International Agricultural Trade

Considering not only the Swiss GHG emissions within Switzerland but also worldwide, global agricultural businesses with their headquarters in Switzerland can be crucial.

Switzerland is a hub for international commodity trade. Every year billions of tons of both agricultural and non-agricultural commodities are traded through Switzerland without ever crossing the Swiss border. Recent estimates indicate that Swiss-based companies buy and sell roughly 50% of globally traded grain, 40% of sugar, 30% of cocoa, at least 30% of coffee and at least 25% of cotton (Braunschweig, Kohli, and Lan 2019). Many of these companies have moved beyond the mere trading of agricultural commodities though and tend to exert increasing influence on many stages of the agricultural value chain nowadays. This increasingly includes, but is not limited to, direct involvement of Swiss agricultural traders in the production of agricultural commodities outside Switzerland. Mergers and acquisition have allowed few giant multinational trading companies, among which many are Swiss-based, to rapidly expand their activities and consolidate their power at the expense of farmers and agricultural workers in commodity-producing countries (Braunschweig, Kohli, and Lan 2019).

The recent surge in commodity trading has generated high tax revenues for the Swiss state. The environmental impacts of the extraction, production and transport of all commodities traded by Swiss companies, on the other hand, have been found to be 19 times larger than the ones caused by total Swiss consumption (Jungbluth and Meili 2018). (The study by Jungbluth and Meili (2018) only partly covers the emissions caused by the transport and storage processes that are associated with trade.) Similarly, the agricultural trading sector in Switzerland remains extremely opaque. The lack of transparency is the corollary of the ongoing efforts by the Swiss government to grant trading companies a very discrete and business-friendly environment. Under these lax transparency regulations, the latter have no pressure to disclose concise data on their trading activities and the potential social and environmental repercussions they entail.

The implications of Switzerland's dominant position in the global agricultural commodity market are two-fold. Firstly, Swiss trading companies' decisions about which products they buy and sell can make

a considerable contribution to the goal of cutting down emissions produced by the global agricultural sector. Secondly, and closely related to the first aspect, Swiss trading companies have both the opportunity and thus the responsibility to shape international commodity trade sustainably. Swiss companies need to acknowledge their responsibility for the negative side effects of their trading activities and try to mitigate these accordingly.

Global Food Security and Climate Change

According to the FAO (2003), food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The global food system and thereby food security is under pressure from non-climate stressors (e.g., population and income growth, demand for animal-sourced products) and from climate change. These stressors impact all aspects of food security, namely food availability, access, utilisation and stability (Mbow et al. 2019b). Climate change already affects global food security through increased temperatures, changing precipitation patterns as well as the occurrence of extreme climatic events (e.g., droughts and heat events). Food security will be increasingly affected by the projected changes in climate. Until the year 2050, a 1-29% increase in the global cereal price is expected, severely increasing the risk of hunger for low-income consumers (Mbow et al. 2019a). Agricultural production and thereby food availability will further be affected by altered distribution of pests and diseases and the negative impacts of more frequent and severe extreme climate events (Mbow et al. 2019a).

Agrofuels

Fossil fuels are infamous for their considerable contribution to global warming. This is mainly due to the emissions that are caused when extracting, transporting and consuming (=combusting) oil, natural gas and coal. In light of these negative environmental impacts of fossil fuels, as well as the oil price spikes in 2008 and 2011, agrofuels have been praised as a green, affordable alternative that help mitigate climate change. Agrofuels refer to the production of ethanol, methanol, hydrogen and diesel from vegetable biomass (but excluding biogas or energy produced e.g. with crop residues or compost on smaller scales). Over the past years, different methods of agrofuel generation have been employed: The first generation of agrofuels describes agrofuel that is generated from feedstocks. i.e. annual and perennial edible crops that are cultivated to generate diesel and ethanol. Agrofuel feedstocks encompass a variety of common crops, including maize (corn), sweet potato, sugar cane, palm oil and oil seeds. The second and third generation use lignocellulosic biomass and microalgae to produce agrofuel. The overwhelming majority of agrofuels used today is still generated from the cultivation and processing of edible crops though (Correa et al. 2017).

A strict set of import rules have prevented agrofuels to obtain a noteworthy market share in Switzerland for a long time. For example, the revised 2016 version of the Mineral Oil Tax Law Imports states that only those imported agrofuels may be exempted from the mineral oil tax that meet stringent ecological and social criteria. Imports of agrofuels have increased notably during the past decade though. This upsurge has been largely driven by legal amendments in 2014 which allow importers of fossil fuels to use agrofuels to compensate partly for emissions generated by the combustion of fossil fuels in Switzerland's domestic traffic. Current figures by the Federal Customs Administration indicate that roughly one quarter of fuels sold in Switzerland contain biocomponents. While agrofuels play an ever-more important role in Switzerland, there is extremely scarce knowledge about the specific agricultural raw commodities from which the agrofuels used in Switzerland are made, under which conditions these raw commodities are produced and which Swiss-based companies participate in the trade of agrofuels. The same is true for the production of biocomponents which are mixed with conventional fuel before being sold on Swiss markets. This blatant lack of transparency prevents a thorough assessment of Swiss-consumed agrofuels' environmental and social sustainability.

In spite of widespread initial euphoria concerning the alleged superiority of agrofuels vis-à-vis fossil fuels scholars and other experts have voiced skepticism as with regard to agrofuels' "renewability and cleanliness" for different reasons (Ji and Long 2016):

Firstly, as indicated above, the huge amounts of crops cultivated to produce agrofuel could equally be used for human consumption. The upsurge in the international demand for agrofuel production has entailed violent incidents of land grabbing in Africa, Latin America, Eastern Europe and Asia (GRAIN 2015), squeezed the area that contributes to human food supply and obviously entailed an increase in prices for different food crops, including oilseeds (Correa et al. 2017; Rosegrant et al. 2008; Ji and Long 2016). Ultimately, agrofuels thus have strong potential to deplete the income of millions of households due to land grabbing and destroy large areas of tropical forests, pastures and meadows. Secondly, depending on the circumstances such as climate, soil fertility and the type of agrofuel feedstock cultivated, the amount non-renewable energy that is needed in the agrofuel production and transport process surpasses the quantity of energy agrofuel provides (Ji and Long 2016). Thirdly, the widely spread first generation agrofuels need large quantities of pesticides and fertilizers which all pose an immediate threat to vertebrates populations, species richness and biodiversity as a whole (Correa et al. 2017; Sreevani 2019). This threat is exacerbated by the fact that many agrofuel feedstock plantations are monoculture plantations. Fourthly, agrofuel feedstocks require huge amounts of water (FAO 2008; Jewitt and Kunz 2011; Ji and Long 2016). Finally, there is evidence that the increased competition between agrofuels and fossil fuels decreases the prices for the latter (=positive rebound effect) (Allaire and Brown 2015; Ji and Long 2016). Low fossil fuel prices, however, spur economic activity which in turn increases pollution levels.

The detrimental environmental and social consequences of agrofuel production sketched above threaten to be amplified by the plans to use agrofuels in aviation. Aviation is responsible for roughly 2% of the planet's annual CO₂ emissions. This figure is likely to increase in the future as experts anticipate annual passenger figures to soar until 2050 (Terrenoire et al. 2019). The excessive operation of airplanes thus represents a major obstacle to climate change mitigation. Comparable to the situation in the automobile sector, agrofuels have been identified as a viable alternative for conventional fossil fuels in terms of their environmental sustainability (Hari, Yaakob, and Binitha 2015). Many governments around the world share this positive view and provide considerable financial means to research and testing programs that shall help agrofuels achieve aviation market maturity (Cremonez et al. 2015; O'Connell, Kousoulidou, and Lonza 2019). The Swiss government has equally embraced sustainably produced agrofuels in aviation as a potential element of a coherent climate change mitigation strategy. At the same time, it has not outlined the extent to which it will actively promote agrofuels in the aviation sector in the future. Any decision in this regard will arguably depend on the content of Switzerland's revised CO₂ Act (UVEK 2019). In the meantime, the managers of Zurich-international airport have celebrated the first airplane ever having been filled up with a blend of conventional fuel and agrofuel in Zurich in January this year (Zürich 2020). This clearly indicates that the operation of airplanes on agrofuels starts becoming reality in Switzerland.

The proponents of agrofuels in the aviation industry tend to ignore or talk down the detrimental environmental and social consequences the conversion to agrofuels in the aviation sector would entail in the countries of production. The aviation industry would require incredible amounts of agrofuels every day to refuel only a small proportion of the thousands airplanes which are used for transport of goods and people nowadays. Large-scale production of agrofuels that satisfy this huge demand would accelerate deforestation, biodiversity loss, water depletion and pollution and land grabbing, and undermine food security in producing countries (Hari, Yaakob, and Binitha 2015). Along these lines, a significant and permanent reduction in the number of flight movements is the only viable way to ensure that the aviation industry attains the Paris Agreement's objectives. (For more information on aviation, see chapter [Mobility](#).)

Overall, the production of agrofuels undermines global food security and accelerates deforestation and biodiversity loss only to fill tanks. We acknowledge though that microalgae-based agrofuels seem to be superior to traditional agrofuels. The former seems to require less direct and indirect land use

change, works well on non-arable land and without pesticides, does not compete with the cultivation of food crops and saves water (Correa et al. 2017; 2019; Klinthong et al. 2015; Voloshin et al. 2016). Some contributions, on the other hand, highlight prevalent weaknesses in the current microalgae ag-rofuels production process including the large quantity of energy required (Dasan et al. 2019).

Speculation with Agricultural Commodities and Food

The global food market has seen major price swings in agricultural commodity prices over the past two decades, with food prices hitting a high point in 2008 and 2011, respectively. These price spikes have pushed millions of people in Sub-Saharan Africa and the Middle East below the poverty threshold and incited food riots in poverty-stricken regions (Cochrane, Adams, and Kunhibava 2015). Both the price swings on the global agricultural commodity market and the food price spikes have coincided with a doubling of financial flows into the food commodity markets between 2006 and 2011. A considerable share of these new financial inflows can be attributed to speculators who bet on price developments in the global food market to benefit from the volatility in food prices. It is the co-occurrence of these developments that nurtures concerns among experts and students with regard to the distortive impact of unregulated speculation on food commodity prices.

In the beginning, contracts on future deliveries of agricultural products at a spot price that is fixed before the actual crop is harvested have proven to be an effective tool for farmers to hedge against adverse future price changes. Things have considerably changed though with the massive deregulation of commodity trading in the 2000s, first and foremost in the US. Under these relaxed rules new speculators with very distinct economic interests have rapidly increased their level of activity on the future markets in the field of agricultural commodities. Banks, hedge funds and pensions have no interest in actually possessing the agricultural crops but merely hope that food prices will increase or decrease in the time between they draw a future contract and the expiry of that contract.

Different empirical studies indicate that food speculation can dramatically amplify the detrimental effects of factors such as weather extremes or surging world market prices for fossil fuels that often precede food price spikes (Lagi et al. 2011; 2015; Herman, Kelly, and Nash 2011; Tadesse et al. 2013; UNCTAD 2009). In a nutshell, due to investors' activity, the pronounced volatility in agricultural commodity prices does not mirror demand and supply, but speculators' expectations about how the price will develop. The resulting jumps in food prices are a major concern for producers and consumers who need stable food prices to plan ahead. Moreover, speculators' attempts to fill their own coffers, result in artificial price spikes that breed poverty and malnutrition in many developing countries where millions of people spend the lion's share of their income on food.

Swiss Agricultural Policies

Three different aspects of Swiss agricultural policies and laws were detected to have a direct impact on the CO₂ emissions produced in Swiss agriculture.

First of all, the Direct Payments (Table **Fehler! Verweisquelle konnte nicht gefunden werden.**) regulated within the Agriculture Act are a big part of Swiss farmers' income and therefore have a huge impact on the way agricultural goods are being produced. Within this legislation frameworks for agricultural production, standards that have to be met to get financial basic support are defined (Proof of Ecological Performance – ÖLN/PER). Furthermore, payments are possible if other, higher standards are met. However, the ecological requirements (ÖLN/PER) the farmers have to fulfill to receive these payments are in most cases based on self-declaration of data that are difficult to quantify. Monitoring and enforcement of the proof of ecological performance is thus difficult and offers many loopholes. In

addition, those requirements are mostly not higher than what the legal basis is demanding anyhow. Some of the requirements do not even meet the existing environmental law. Key Elements of the Proof of Ecological Performance are a balanced fertilizer regime (Suisse-Bilanz) and a minimal ecological compensation area of 7%. (FOAG 2018)

Table 6-1 Payment framework for direct payments in agricultural policy 18-21 (Schweizerische Eidgenossenschaft 2016)

(in Mio. CHF, mit Rundungsdifferenzen)	B 2016	2018	2019	2020	2021	Total
Versorgungssicherheitsbeiträge	1095,0	1055,7	1055,7	1055,7	1055,7	4222,8
Kulturlandschaftsbeiträge	505,0	530,0	530,0	530,0	530,0	2120,0
Biodiversitätsbeiträge	400,0	400,0	400,0	400,0	400,0	1600,0
Landschaftsqualitätsbeiträge	130,0	150,0	150,0	150,0	150,0	600,0
Produktionssystembeiträge	455,0	467,0	472,0	477,0	480,0	1896,0
Ressourceneffizienzbeiträge	45,0	72,0	77,0	82,0	87,0	318,0
Übergangsbeiträge	179,0	78,1	59,3	49,3	41,3	228,0
Total	2809,0	2752,8	2744,0	2744,0	2744,0	10 985

A third of all the direct payments paid in Switzerland indirectly supports costly, not necessarily sustainable farming practices that would otherwise be too expensive. For instance, livestock husbandry, currently causing the major part of GHG emissions, is heavily subsidized within the Direct Payments. Contributions for the assurance of food supply (Versorgungssicherheitsbeiträge/ Contributions à la sécurité de l’approvisionnement/ Contributi per la sicurezza dell’approvvigionamento) ask for a minimal number of livestock grazing on permanent grasslands. Various subsidies, originally thought to promote animal welfare and sustainable livestock husbandry, are coupled to livestock numbers and thus indirectly lead to higher population numbers and a consolidation of an unsustainable extent of livestock. In article 12, the Agriculture Act also states support of sales promotion measures (2) of Swiss farming products. Even though the amount of money spent on sales promotion for livestock products (12 Mio CHF for ProViande in 2018) is very little compared to the amounts spent within the Direct Payments (approx. CHF 3 bn / year) the advertisement can have a big impact on the public perception of meat & dairy products (Schweizerische Eidgenossenschaft 2020b).

Lastly, Swiss farmers profit from a reduced value-added tax for pesticides, fertilizers, animal feed and fossil fuels. These indirect subsidies lead to an economically and environmentally unsustainable use of the discounted products.

Situation of Farmer and Food Production

Climate protection in agriculture is challenging and complex. Many other aspects such as food security, land use and other aspects of sustainability as well as other actors in the food system and their dependencies must be taken into account. Achieving a sustainable food system that can cope with the climate crisis, the increasing demand for food and the shortage of fresh water is a major challenge. In order to meet this challenge, additional sectors and the population must cooperate.

To achieve the needed transition and reorientation, a lot is expected from the farmers in particular, who make up the agricultural sector. The farming profession is already a demanding profession and

many standards and expectations must be met in Switzerland. The subsidies and the orientation of agriculture is already a discussed topic.

For these reasons it is important to have a look at the situation of farmers and the food system in Switzerland. Here, we will try to give a brief overview, which of course does not deal with the subject in an exhaustive manner.

Work in agriculture is demanding. In Switzerland, a farmer works an average of 60 working hours per week (BfS 2016) and seasonal harvest workers sometimes even more. Working in nature is also physically demanding and requires passion and commitment. It often means taking over a farm and a lot of responsibility and in most cases, it means a long term and far reaching decision on how to live.

Despite subsidies, farmers' economic scope is becoming increasingly limited. For many farmers and their families, it is difficult to earn sufficient income from agricultural products, or even to cover their costs at all. The number of farms has halved since 1990 and continues to decrease steadily while the average size of farms is increasing (BfS 2020). Dairy farming, which in Switzerland has long been a secure route to stable income, also through political support, can increasingly only be economically viable for large farms.

Agricultural production is at the beginning of a long value chain in which all the subsequent players must earn the greatest possible profits and put pressure on prices. At the end of this chain, there is often not much left for farmers to gain.

One criticism is that subsidies to agriculture ultimately do not help the farmers in the first place, but rather the purchasers, who can buy at lower prices. Especially monopoly customers, such as Migros, Coop or Red Bull (for sugar), can allow themselves to reduce prices extremely. But also, the sellers of machines, fertilizer, animal feed and other inputs can often profit from the subsidies.

Many farmers complain that it is no longer really possible to earn money with food production. In order to find new solutions which are financially viable, those in which the production of food is no longer the main focus often need to be chosen such as gastronomy, energy production, class tours etc. Even when new profitable techniques or methods come onto the market, the farmers are usually not the ones who benefit from the business. Nevertheless, they are often the ones who have to take responsibility for the environmental damage caused and for the practices.

For it is not only the subsidies that are politically charged, there seems to be a lot going on in Swiss agriculture in general, and there are various initiatives with different backgrounds and interests. A great deal of research has also been conducted, established and debated in Swiss agriculture on sustainability.

This high level of activity and the many changes in agriculture are also related to the profound structural changes that have taken place in global agriculture in the last decades. Due to the industrial and green revolutions, agricultural productivity exploded within a few decades. Farms could suddenly feed many more people with less labor and farm much larger areas of land. In addition, farms were increasingly managed towards a gradually profit-oriented and growth-oriented manner. Food prices of many small farms were displaced by larger and financially more efficient ones. This restructuring has an on-going impact on agriculture around the world which was and still is traditionally very small scaled in big parts of the world. It has not reached the same extent in every region and in different countries it changed agriculture in a different way or only some aspects were adopted while others were not. In many countries, this has already taken on a much more extreme dimension than in Switzerland, where it is due to geographical, political and cultural conditions.

Although restructuring brings an increase in productivity, in many cases it also requires a lot of seasonal work such as harvesting legumes. In Switzerland this work is carried out by migrant seasonal workers. In order to pay Swiss people appropriately for their hard and arduous work, there seems to be a lack of money in agriculture. The workload is therefore generally concentrated on just a few people who work much. The number of full-time employees has been cut in half since 1990 (BfS 2020).

Agriculture and Food System

The migrant workers are often invisible and are not part of our image of agriculture. In fact, they are an evident part of Swiss agriculture, as well as of the European one.

Policy Measures Concerning the International Impact

The volume of internationally traded processed and unprocessed agricultural products has skyrocketed over the past years, from 443.2 billion USD in 2000 to 1310.8 billion USD in 2016, and is expected to continue doing so in the future (Tuninetti, Ridolfi, and Laio 2020; Balogh and Jambor 2020). Switzerland is no exception to this trend and its import and export figures of agricultural products hit a new high point in 2018 (Eidgenössische Zollverwaltung 2020). While it strictly protects its domestic markets from the entrance of some agricultural products, the country strongly relies on agricultural imports, including soybeans, palm oil and animal feedstuff (Rossi 2019). Recent developments suggest that Switzerland will not reduce its activities in international agricultural trade any time soon. On the contrary, the conclusion of the trade deal with first Indonesia and then the MERCOSUR states in summer 2019 indicates that the Swiss government is willing to sacrifice environmental interest for economic prospects.

Policy 6.1: Free Trade Agreements

Roughly two-thirds of the CO₂ emissions that result from today's consumption in Switzerland are produced outside of the country (FSO 2020a). Under the principle of territoriality, however, Switzerland and other industrial nations have assumed very little responsibility for the emissions it produces abroad in the past. In order to obtain an accurate picture of Switzerland's carbon footprint and initiate mitigating measures it is time to acknowledge the detrimental environmental consequences of Swiss consumption, irrespective of where exactly they are produced. This also implies that Switzerland must necessarily be held accountable for any negative side effects its consumption patterns entail in the realm of human rights and labor standards abroad.

The Swiss government must revise both planned and existing trade agreements that cover agricultural products so that they adhere to strict and enforceable environmental and social standards. New trade agreements for agricultural products should be reduced to a minimum and may only be concluded if they contain an environmental and human rights compatibility statement. Any such compatibility statement must necessarily include the following provisions:

- The trade agreement merely allows for the import of crops that are cultivated on already existing cropland.
- Trade agreements are only possible if the production of the goods in the other country fulfills location-appropriate ecological standards and if the relevant government takes serious action to achieve and support a sustainable food production.
- The Swiss government must commit itself to provide financial support to agricultural extension programs in order to boost local knowledge on how to grow the traded crops in a sustainable and climate-friendly manner.
- Trade agreements must contain provisions on how to mitigate the socio-economic and human rights implications of the agreement.

For trade agreements that have already been implemented such statements must be added where necessary. These compatibility statements must be complemented by an environmental and human rights impact analysis that helps assessing whether the products covered by the respective free trade agreement comply with strict environmental and human rights standards. In addition, new and already existing trade agreements to which Switzerland is a signatory party must encompass concrete

provisions on how the exporting country continuously and efficiently monitors the production process' compliance with these standards.

Based on the overarching goal to render Swiss consumption environmentally and socially sustainable, Switzerland must ban all import products that fail to meet these standards. The Swiss government must equally assure that Switzerland has the right to terminate trade agreements should other signatory parties to a trade agreement be convicted of fooling their trade partners regarding the environmental and social impact of the traded products. This ensures that Switzerland neither fosters the production of environmentally harmful products nor neglects human rights and labor standards abroad.

At the same time, it is crucial to acknowledge that a shift in Swiss diets towards dramatically reduced animal product consumption is key to mitigate the negative side effects associated with agricultural trade (Eggenberger, Jungbluth, and Keller 2016; Balogh and Jambor 2020; Jungbluth, Itten, and Schori 2012). The [Policy Measures Concerning Swiss Food Consumption](#) below fleshes out several measures that shall help achieve this: The Swiss government must encourage different Federal Offices (e.g. BLW, BAG, BLV and BAFU) to map out a cross-sectoral nutrition strategy plan that promotes a healthy and climate-friendly diet in Switzerland; Renders the production of plant products financially attractive and ensures that producers have access to technical support where necessary; Raises the Swiss population's awareness of alternative diets; Stops subsidizing animal sourced food publicity and continuously increases taxes on animal sourced food. To multiply the impact of these policy measures, Switzerland should nevertheless promote to limit export of agricultural products, first and foremost meat and dairy products, in international negotiation. If traded meat volumes remain high and Swiss consumers resist to change their diets, the Swiss government must consider the outright ban of meat imports.

The advanced trade liberalization also forces Swiss policy makers to take continuous care of the Swiss agricultural sector. It is mainly the giant industrial agri-businesses that benefit from eroding barriers in agricultural trade. The growing dominance of these large industrial players poses a severe threat to local producers who are unable to compete with the masses of cheap imported agricultural products under an increasingly liberal trade regime. It follows that there is a strong need to ensure that all trade agreements signed do not undermine the survival of the Swiss agricultural sector that adheres to comparatively high environmental standards. Accordingly, no trade agreements may grant agricultural products access into the Swiss market whose production and transportation emits large quantities of carbon dioxide and methane, pollutes and depletes water resources or soil in the country of production and clears primary forests. Crucially, Switzerland must maintain the right to prevent environmentally harmful agricultural products from entering the country. Along these lines, the Swiss government may not join trade agreements that allocate legal arbitration power to non-transparent arbitral tribunals. Rather, the process of drafting, implementing and monitoring of those new free trade agreements deemed necessary must include Swiss politicians, civic community representatives and scientists and their counterparts in the respective countries.

Two final issues related with the endeavors to curb agricultural trade liberalization deserve attention as well. Firstly, we acknowledge the potential of agricultural free trade agreements to address imbalances of global food supplies by transferring foods from surplus regions to regions that grapple with diminishing yields due to climate change driven weather extremes (H. Huang, von Lampe, and Tongeren 2011; Ludi et al. 2007). If Switzerland can contribute to a steady supply of food products to poverty-stricken regions that are hit by the repercussions of climate change via free trade agreements, the Swiss government should engage in such "supportive free trade agreements". Those agreements must nevertheless adhere to the general guideline of mitigating CO2 emissions and producing sustainably within Switzerland.

Secondly, we recognize the risk that discrimination of certain products based on environmental concerns might be in tension with WTO rules to which Switzerland is a signatory party. Legal experts stipulate that existing multilateral trade rules do not preclude the preferential treatment of sustainable products vis-à-vis their respective conventional counterparts at the border per se (Buergi Bonanomi 2016; Häberli 2018). Yet, arbitration in previous years and legal experts' interpretation of the WTO

rules indicate that the WTO is probably willing to accept state-induced Sustainability Ordinances that concern agricultural imports only if they do not distort full-fledged free trade (Buergi Bonanomi 2016). It is, however, essential that the WTO at least commits to the goals of the Paris Agreement and undertakes serious endeavors to mitigate trade's carbon footprint accordingly. Modifications of the multi-lateral trading rules are always possible, and Switzerland should lobby at the international stage for the acceptance of trade barriers that demonstrably discriminate against products with high carbon footprint only. These lobbying attempts will only succeed though if the Swiss government grants radical preferential treatment to domestic environmentally and socially sustainably produced agricultural products, too.

For this topic, see [Policy 10.3](#) of the [International Collaboration and Climate Finance](#) chapter.

Policy 6.2: Ban for Growing, Using and Trading Agrofuels by 2023.

Background information for this policy can be found in the section about [Agrofuels](#).

It is important to state that agrofuels are not a panacea to the global climate crisis and risk diverting attention from the ultimate need to leave oil in the soil. Therefore, the Swiss government must thus ban the production, usage and speculation of agrofuels altogether from 2023 onwards. This ban must necessarily apply to both the automobile and the aviation sector. However, based on the ample evidence gathered on the microalgae system's potential to become a truly sustainable alternative to fossil fuels they should be explicitly exempted from the ban for the time being. This exemption must be both continually reviewed and immediately revoked if more evidence about the negative environmental side effects of microalgae agrofuel production appears. Until the ban enters into force, tight transparency rules must be enforced to make traders and retailers of agrofuels disclose full information on the origin, composition and production processes of agrofuels that are currently used in Switzerland. This will foster a better understanding of the features of agrofuels used in Switzerland and help draft the envisaged ban of agrofuels.

Policy 6.3: International agricultural corporations in Switzerland

Switzerland is home to many international agricultural corporations (headquarters or branch offices in Switzerland) that provide inputs for agricultural production or produce and process agricultural output themselves mainly outside of Switzerland. These Swiss-based players must change fundamentally to render global agricultural production more sustainable. To this end, the Swiss government must democratically establish enforceable and binding frameworks and rules on climate mitigation by the end of 2021 for these companies. Based on these binding frameworks, each corporation must democratically elaborate plans to outline how it intends to cut down its emissions. These plans must necessarily encompass the following aspects:

- A calculation of the amount of GHG that the respective corporation and its subsidiaries currently emit, as well as other environmental impacts e.g. on biodiversity.
- Detailed and consecutive GHG reduction plans of the corporation and its subsidiaries that can be assessed quantitatively and align with the ambition of the Paris Agreement to limit the increase of global warming to below 1.5 °C.
- The corporation and its subsidiaries must fully and transparently cooperate with the state to evaluate their compliance with both their reduction targets and human rights on a rolling basis. If they fail to follow the rules given by the government, there must be effective sanctions.

All corporations and its subsidiaries must necessarily commit themselves to only use already cultivated agricultural land for production on which no one has any claims and to exclude all products from their activities that were grown on land that was cleared to expand agricultural production.

The corporations should elaborate their plans on how to ensure their environmental and social sustainability democratically. This implies that both people who are employed at the corporations and actors that are affected by the corporations' activities participate equally in the drafting process of the respective corporation's climate strategy and have no lesser rights than the company shareholders or management. It is the state that controls this process. This inclusive drafting process ensures that the corporations, as well as the affected people and employees, remain in the driving seat. While the transition towards more sustainable and labor-friendly agricultural production will involve considerable costs in many cases, the corporations are demanded to exploit their huge financial clout in order to implement their sustainability plans.

Should the corporations fail to present their mitigation strategies by the end of 2021 or act against the targets defined by the state in the future, the Swiss government must elaborate sanctions that target the non-compliers.

Policy 6.4: International Trade with Food in Switzerland

Background information for this policy can be found in the section about the [International Agricultural Trade](#).

The trade with agricultural products in Switzerland must adhere to strict environmental standards which align with the ambitions of the Paris Agreement. Swiss trading companies must legally commit to only buy and sell agricultural products whose production and distribution inflicts minimal possible damage upon the environment. To this end, agricultural products must be classified according to their environmental and social impacts. This classification should then be promoted by the Swiss government to create a level playing field in international trading relationships. Again, trading agricultural products that were grown in previous forest areas, meadows and pastures shall be strictly prohibited. Additionally, trade must also guarantee living wages/prices and decent work conditions in the food systems of the exporting countries. Merely relying on Corporate Social Responsibility like the Swiss government mostly does in the realm of agricultural commodity trading these days will not do the job. Rather, the Swiss government must start regulating agricultural commodity traders and ensure that each trading company provides precise and coherent information about both the quantities of agricultural commodities it trades and where and under what labor conditions these commodities are produced on a regular basis. This high degree of transparency has ample positive effects. Firstly, it is key to address the numerous human rights violations and incidents of forced and child labor reported in countries that cultivate and harvest agricultural commodities for export in a targeted manner (Braunschweig, Kohli, and Lan 2019). Secondly, high transparency will help counteract rampant corruption and tax evasion along global agricultural value chains and thereby help exporting countries build up the necessary financial clout to enforce and monitor the compliance with human rights in their agricultural sector and even more generally. Ultimately, state-decreed compliance of agricultural traders with strict transparency rules will increase the leverage of small-scale farmers and agricultural workers in exporting countries over the powerful agricultural trading companies. If Swiss-based agricultural traders should then stand convicted of violating the compulsory human rights and environmental standards abroad the victims of this misconduct must be granted the possibility to sue them in Swiss courts. This will help restore the balance of power along agricultural global value chains.

Those products which are not classified as environmentally and socially sustainable by 2025 must be blacklisted and may no longer be traded by Swiss-based companies from then onwards. Irrespective

of this measure, the Swiss government must ensure that all Swiss-based agricultural traders respect, adhere to and help strengthen human rights everywhere.

Policy 6.5: Ban for Speculation with Agricultural Commodities and Food

Background information for this policy can be found above in the section about the [Speculation with Agricultural Commodities and Food](#).

To strengthen global food security, it is crucial that agricultural commodity prices are both stable and determined by actual global supply of and demand for food crops. Speculators in the food market that prefer food prices to jump continuously in order to financially exploit these variations are an obstacle to this goal. Along these lines, speculative trading in foodstuff must adhere to different rules and principles than speculation in other commodities. By the end of 2021 the Swiss government must ban all institutional investors and investment funds from the agricultural commodity market. Banks, pension funds and hedge funds may no longer retail financial products based on food commodities accordingly. A major exemption from these stricter regulations concerns the use of future contracts to do price hedging: Food producers, traders and on-traditional speculators in the agricultural commodity market may still use these contracts to hedge against plummeting food prices. However, to close potential loopholes in the food speculation regulations, the government should implement strict limits on the amount of food commodities an individual trader can buy and sell.

Policy Measures Concerning Swiss Food Consumption

Policy 6.6: Cross-Sectoral Nutrition Strategy

Description

The federal departments BAG, BLW, BLV and BAFU should work on a cross-sectoral plan. This national nutrition strategy should guarantee both a healthy and an environmental- and climate friendly diet. This strategy needs to be elaborated together with people working in these sectors (agriculture, processing, sales, gastronomy). Their participation is guaranteed in the strategy.

Background

As Swiss consumers we eat three times more meat than it is recommended by the “Federal Food Safety and Veterinary Office” (FSVO 2017). This overconsumption affects our well-being in two ways: it is unhealthy, and we produce greenhouse gases that could be easily reduced (Daniel Bretscher et al. 2018). In the meantime, one third of globally produced food for humans is lost or wasted (Schanes, Dobernick, and Gözet 2018). This estimated 1.3 billion of food wasted per year could feed the people that are still suffering from hunger today (Priefer, Jörissen, and Braeutigam 2016). According to Müller et al. (2017), the reduction of food waste in combination with less meat and animal sourced products consumption would allow an agricultural model without any need to increase productivity while still guaranteeing food security.

From a food-system perspective, a shift in our diet is crucial (see [Current Situation](#)). As consumers, our food habits and culture or even individual decisions can directly trigger the supply of climate-friendly products. The condition for consumers to choose a climate friendly and healthy diet should be improved with our policies, so that our society backs up and supports a climate friendly way of food production and a sustainable and healthy food culture.

Especially wealthy consumers, that have a connection or knowledge about the production of their food can bear a great responsibility for the direct and indirect emission of their food.

Today, agricultural policy supports the production of meat, while other federal departments promote the reduction of meat consumption (FSVO 2017). It is not the only contradiction these two departments produce that slows down all efforts to achieve a sustainable nutrition in Switzerland or makes them less effective.

To solve this contradiction researchers, suggest cross-sectoral political actions, which consider the different players (Stolze 2019).

In concrete we would suggest that BAG, BLW, BLV and BAFU should work on a cross-sectoral plan. This national nutrition strategy should guarantee both a healthy and an environmental- and climate friendly diet. As for many issues in today’s food system, solutions like reducing the meat and milk consumption are working for both, the environmental and the health aspect need to be elaborated together with the auteurs active in agriculture and be included in the future plans for Swiss agriculture.

Financing, Implementation & Impact

The aim of this policy is to use the resources that are already used today in a more coherent and efficient way. Additionally, the amount of CHF 40 million that is spent to publicly finance sales promotion of meat and dairy products can be used to improve the elaboration and improvement process of the strategy. We can profit massively from the resources we already spend on these departments, if they focus on working together for a sustainable future nutrition- health- and agriculture-strategy or at least avoid breaking each other out. New decrees regulations and laws need to be in line with the strategy. Concerning the working strategy, it is evident that the people working in these sectors (agriculture, proceeding, sales, gastronomy) contribute to the elaboration and their participation is guaranteed in the strategy.

A central point therefore can be the support and development of alternative food products, but also income possibilities and models concerning businesses and actors. Therefore, the cultivation, proceeding, product development and connection between the different players within the food chain could be massively supported by educational programs, courses and training platforms for connection between the actors and specific efficient support as we suggested in Policies 6.8, 6.9 and 6.17.

A further supporting tool could be an annual published update magazine which is provided to all people working in the processing, distributing, delivery or selling industry and contains news and aspects about the current climate crisis and a sustainable food system as well as the latest common projects, progresses and new possibilities. This example - or further information tools - should not only be focused on greenwashing existing practices or glorifying tiny changes, but be delicately focused on achieving a net zero emission food system at the needed scale.

The nutrition strategy should be compatible with our needed emissions reduction path and needs to be controlled with accurate estimations. The work of the departments should enable Switzerland to adapt its nutrition to a sustainable, zero emission for both food produced in Switzerland and imported.

Policies in the following chapter can partly be suggested examples for measures of such a plan including a national food waste reduction plan in Policies [6.13](#), [6.14](#), [6.15](#) and [6.16](#). Even if ours would need to be improved and the list is far from complete.

Policy 6.7: Awareness Rising and Sustainable Diet in Public Canteens

Description

Each day one million people are eating outside: takeaway, in restaurants or in public canteens (BLV, 2016). Especially public canteens have a great potential to reduce the ecological footprints of their meals.

They can not only convey information about the environmental impact of food, but also show various delicious sustainable menus and offer them at a good price.

People get in touch with those menus, they may get used to them, start being interested in a sustainable diet or start seeing and knowing the different alternatives for animal sourced food (ASF) and the various possibilities for a sustainable and healthy diet.

Vegan and vegetarian sustainable and healthy menus should no longer be just chic or a luxury product they should become the everyday meal in people's lives.

Therefore, all public canteens (such as universities, hospitals etc.) should have:

- 60% of their meal vegetarian or vegan by 2025;
- 100% vegan and vegetarian meals by 2030;
- Furthermore, the food must be as seasonal and local as possible.

Possibilities for a direct supply of food from local farmers or local food waste should be preferred. To organize this supply in an intelligent way and to get the connection with local food producers the canteen manager and worker should be supported by the work of the federal departments for example with platforms for connection and organization but also with help for their specific issues.

As described in [policy 6.8](#), obligatory training for professional chefs and canteen workers on sustainable diet and how to work and prepare these foods will be organized.

Furthermore, materials for information about the food, its production, the environmental impact and needed contexts should be prepared and free to use for the canteens. The canteens are free to creatively create their pathway to sustainable diets by 2030 and the target for 2025. They can have different priorities and are free to use the prepared info material or to convey information about the meals in their own way.

Finally, we propose this measure to be also implemented in the compulsory military service in Switzerland. The time of military service can represent a shaping period in the lifetime of young people in Switzerland. Rising awareness of environmental issues related to food might have a long-term impact on the Swiss society.

Financing

The canteens do not need to have higher costs. Money will just be spent on other food. For the transition the national strategy should provide the needed expertise. Education courses and information materials can be organized nationally so that the budget can stay very small.

Social Compatibility

It is socially compatible as no prices will increase. Especially, large quantities food with none to very little animal sourced food can be prepared with the same amount or even less money. In combination with further measures, it can contribute to a cultural change towards new eating habits.

Impact

The measurement should reduce the carbon footprint through sustainable diets in canteens. Based on interventions in 6 canteens in Zurich CO₂ emissions could be reduced by up to 42% and on average, by 18% given the right coaching on food and their impacts (Ellens et al. 2018). With our measures that go further than the interventions in the study, even more reduction can be expected.

Also, awareness should be raised with the aim to change long term behavior of participants to increased satisfaction and demand for sustainable food.

Policy 6.8: Training Courses for Professional Chiefs

Description

Training courses lasting several days should be mandatory for all Professional chiefs and gastronomy-managers.

The content of these courses is intended to provide an understanding of the current crisis, the consequences and impact on agriculture and the food system, the challenge of a sustainable and productive food system as well as various approaches to solve the problem.

It should then focus on sustainable nutrition and mainly serve as a practical skills training in composing and preparing a sustainable menu as well as organizing access and connections to suppliers for sustainable food.

These courses (as well as aspects in [Policy 6.6](#) or [6.9](#)) should also serve as a platform to connect with people working or studying in other sectors of the food system.

Financing

As spending on this Policy will not be much, compared with the government's budget, we have not proposed a specific financing for these courses. There are several possibilities: For instance, it could be financed with a levy or tax on profits for major distributors and other actors in the food sector that made the most profits in recent years (and therefore profited the most from the unsustainable way food was produced and consumed and did not have to pay all the externalized costs - see Policy pricing). Otherwise, it could be financed with revenues from policies [6.11](#) and [6.12](#) or co-financed with the department's available budget for nutrition or already existing education projects in the sector, for example by integrating the project into existing Universities, colleges or other educational programs.

Impact

The concrete Impact of such a measure is hard to quantify. Its aim is to create the necessary foundations and connection of people in the food sector to help create the possibilities for the necessary changes. It should educate people and enable them to work actively on solutions. In this sense it should also serve to make the other proposed measures realizable and to improve and guarantee their impact.

Policy 6.9: Support Sustainable Alternatives in Processing Sector and Retailer

Description

Cheaper and healthier alternatives to animal sourced food (ASF) should be available on the market. On the political level, not only research on processing of leguminous and other sustainable protein production should be fostered, but also the processing sector and the retailers, should be included.

Especially in the processing industry we have many businesses that have been depending on the processing of milk or meat like dairies, cheese dairies or butchers. For them the needed shift in the diet should not conclude in their ruin. Instead they should be supported in proceeding with more and more other foods with similar or different techniques and adapt the development of their products to sustainable food.

A processing culture that evolved by processing milk and meat can use its knowledge and capital also for the processing of other food. Especially those of alternative milk products or fat and protein rich foods. The production of yoghurt for example can, with a very similar procedure also be produced out of Swiss soy instead of Swiss milk.

In general, processes such as enrichment through bacterial processes can also be applied to various other foods and products, especially since we have much more knowledge and possibilities about microbiological and other enrichment processes today than when they were first developed. In order to fully exploit this potential, cooperation with universities and research in the field of nutritional sciences should take place there and be promoted.

Other qualities of the milk and meat processing industry, such as the good location and infrastructure access to the farmers, can also be used to process other fresh food or to find new products and opportunities to directly sell their products to consumers together with the farmers.

Retailers

An independent political consulting institution for retailers should provide comprehensive information about climate friendly alternatives and inform grocers about the environmental impact of food. The aim of this consulting institution is to encourage grocers to change the food assortment towards a more sustainable diet. It is crucial that also retailers assume their responsibility against climate change. With this measure the state could be an assistance to promote corporate responsibility of grocers and consumers against climate change.

An example of a marketing idea could be that only sustainable products give points on customer cards and at the end of the year the customers can see how much GHG they saved compared to an average consumer.

Policy 6.10: No Subsidies for Animal Sourced Food Publicity

Description

Swiss government supports sale promotion for ASF with around CHF 40 mio (FOAG 2019). This public financing of sales promotion needs to stop immediately and is easy to stop. Instead, this budget should be invested in the elaboration and improvement process of the national nutrition strategy ([Policy 6.6](#)). These publicities about meat and dairy products shape consumer's perception, in a wrong way as we consume three times as much meat as is recommended and ASF products have a big responsibility on the climate crisis we are in. These spending increase the ASF consumption and work against brought efforts to achieve the opposite.

The “Milk Day” in public schools should be replaced by a day about sustainable diet, especially substitutes for milk products and how they are produced.

Policy 6.11: Food Labelling and Pricing with Climate Impact Assessment

Description

Food prices were assessed to be a major driver for consumer's buying decision in Switzerland (Stolz et al. 2017). These prices however mostly only include the direct costs of production but do not account for the impacts on quantity and quality of natural capital (see [Policy 1.2](#) in the [Cross Sectoral](#) chapter).

For the implementation of an effective and socially compatible labelling and pricing for food products there is a need for accurate and transparent assessment of the climate impact on food and mechanisms ensuring the ability for lower income households to afford a diverse and high-quality diet.

Regarding the assessment of climate impacts of food products there has already been a lot of research being done and there are extensive databases on the environmental impacts of several food products and categories (Poore and Nemecek 2018). Such a labelling should in a first step be implemented for all food products and could further serve as a basis for a pricing policy.

Financing

Tax revenues can be earmarked for developing clean technologies. They could also be earmarked to compensate for incurred damages from climate change, or they could just be fused with the general tax revenue of the government. One approach would also be to use them in so-called “refunded emission payments”. In those, only a small part of the tax revenue would be used for administration of the instrument, while the largest part for it would be redistributed to the payers, depending on their relative emission performance: Those that are better than the average get money back, those that are worse pay. Such a scheme has slightly lower emission reduction incentives (as part of the money flows back), but it can be more acceptable among the targeted industries or consumers.

Impact

A pricing of food products according to their actual environmental impact would influence the buying decisions of consumers, with resource-intensive and environmentally harmful products being less demanded and likely less wasted once bought.

Pricing policies (True Cost Accounting) can be crucial for the transition towards sustainable food systems. The leading audit and advisory firm KPMG estimated the environmental costs of food production to reach 200 bn USD in 2012, making the food industry the most environmentally detrimental industry. In comparison, the global oil and gas industry was accountable for 150 billion USD of environmental costs according to the consultancy (Averchenkova et al. 2012). In 2014, the FAO estimated that environmental and social costs of global food waste – which amounts to roughly one third of global food production – cost society at least 700 and 900 billion USD, respectively (Scialabba et al. 2014). Although the calculation of these numbers show an increasing interest in the consideration of the food system as an entity, most existing numbers address only selected food system externalities. True Cost Accounting aims to include all these externalities and is promoted as a key methodology to inform the development of sustainable food system policies (Aspenson 2020). True Cost Accounting can be utilized to include considerations of other important externalities into food and agriculture policies. Only a holistic consideration of the food system and its impacts will lead to a truly sustainable food system.

Social Compatibility

There is a need for mechanisms ensuring the ability for lower income households to afford a diverse and high-quality diet which is discussed in the cross-sectoral chapter on GHG pricing.

Questions and Uncertainties

Are discussed in detail in the policy 2 on GHG pricing in the cross sectorial chapter.

Policy 6.12: Taxes on Animal Sourced Food

Description

We suggest higher tax rates on ASF to reflect the true cost on the environment and on the society. As a first step for a tax system towards a sustainable diet we suggest a small change in the national tax system. ASF should be excluded from the reduced value-added tax (VAT). In Switzerland all food items are taxed at a reduced rate of 2.5%. The normal VAT rate for most other products is 7.7% (Die Schweizer Behörden online 2020). ASF should not be included in this reduced VAT, as their production causes environmental pollution, which triggers climate change (Bundesamt für Umwelt (BAFU / FOEN) 2019). Therefore, we suggest that products containing ASF are included in the normal VAT rate. All products containing more than 5% ASF should be taxed with a VAT rate of 7.7% irrespectively if they are produced in Switzerland or imported.

This first step is rather easy to implement and the administrative costs are low, as there exists already different VAT rates (Schweizerische Eidgenossenschaft 2004). The change should enter into force by the 1st 2022. The legal basis can be found in Art. 130 of the federal constitution, whereas the federation can change value added tax rates from a reduced to a normal tax rate on any objects.

With this political measure we want to achieve two effects: On one side, a higher governmental revenue through the increased tax rate. On the other hand, should the slightly higher prices for ASF products show the consumers that these products have higher environmental costs than other food items. The policy should be a first step towards a sustainable diet:

- The price increase of 5.2% for ASF is not enough to change the consumers purchase behavior. Therefore, we suggest a dynamic tax rate approach: The tax will be higher each year if a specific GHG aim is not reached.
- For the future we suggest taxing food concerning its average emission, which would be more accurate, but also would mean an additional administrative effort. A feasibility analysis on specific GHG emission tax for different food categories should be conducted until January, the 1st 2023.
- Another approach or a complementary measure would be to introduce certificates on meat. The federation auctioned off a few certificates, which empower to slaughter animals or import meat. This would allow direct control of the availability and therefore the consumption of meat can be easily reduced. The number of certificates available needs to be strictly linked to the emission goal of net zero by 2030.

Financing

This measure will generate money that can be used for implementing other measures.

Impact

Broeks et al. (2020) were the first to create a model study including and monetizing social costs and benefits of a 15% or 30% meat tax or a 10% fruit and vegetables subsidy in the Netherlands. The outcome shows that all three interventions could lead to a net benefit to society over a 30-year time frame.

To our knowledge no country has yet implemented taxes on ASF. Neither did anyone research about the impact of such a tax in the Swiss context. Therefore, we cannot say if a higher VAT rate of 7.7% would trigger the consumers to buy less ASF or if we can reduce GHG emissions at all with this policy. However, it is very clear that the meat consumption must be reduced as emissions from animal husbandry must be reduced.

An interesting side effect is that the overconsumption of meat is shown to be the cause of several illnesses (Richi et al. 2015). If we can reduce this overconsumption, we can also reduce health costs.

Social Compatibility

Farmers: Animals, especially cows are part of the cultural heritage of Switzerland. They are the pride of most farmers. Tax revenue shall be used to financially support farmers wishing for a transition from ASF to more sustainable crops using the current administration for agricultural subsidies.

As the sales of ASF might decrease, farmers and retailers will have less revenue. Mechanisms which are described in the other policies should help farmers and retailers to get other income sources.

Retailers: Retailing is dominated by Coop, Migros and Fenaco. We cannot imagine that these three companies would be hardly affected by our policy, as these retailers sell a lot of other products, where

they can get revenue from. However, retailers, which only depend on selling ASF, will be affected. For them a supported reorganization is needed.

Consumers: Swiss people spend on average around 6% of their monthly budget on food (FSO 2017a). A tax of this kind will of course bring a strong financial pressure not to buy meat. However, we believe this is acceptable since meat is not the only type of food available. In fact, it will probably be cheaper to cook with less meat and should not be a problem if consumers are educated on how to cook with alternatives.

Authors of studies modeling such taxes affirm that the use of tax revenues is critical for acceptability considering its economic effects (Caillavet, Fadhuile, and Nichele 2019) hence the revenue shall be directed to satisfy as many stakeholders as possible.

Food Waste

Food waste indicates a substantial inefficiency in our food system, from an ecological, ethical as well as an economic perspective. Ecologically, food waste stands for a waste of those natural resources which build the foundation of our food system. Reducing food waste thereby means avoiding the waste and depletion of soil and water resources, the waste of energy as well as agricultural inputs including pesticides and fertilizers. For Switzerland, zero food waste would indicate avoidance of 24% of the total GHG emissions from the entire food system (C. Beretta & S. Hellweg, 2019). From an economical point of view, only considering avoidable food waste in households, the costs of food waste in Switzerland amount to about CHF 600 per person per year, summing up to the potential of saving CHF 5 bn per year. Finally, considering the millions of people facing hunger worldwide, reducing food waste represents an ethical necessity.

However, as previously introduced, food waste is a complex problem concerning all stages of the food chain, including producers, distributors and consumers. Accordingly, to reduce food waste, a coherent framework with measures concerning all stages of the food chain is needed. Thereby, these measures primarily should seek to prevent food waste by limiting the generation of surplus food at each stage of the food supply chain (i.e. production, processing, distribution and consumption), and secondly, where food waste still arises, they should secure the most efficient use of the surplus food.

Policy 6.13: Educate and Raise Awareness on Food Waste

Households are responsible for about one third of the total food waste in Switzerland (in terms of fresh matter). The extent of food waste heavily depends upon the societal value we give food. Food waste at the household level might be driven by a devaluation of food, meaning that we no longer value food as something essential for life, a lack of knowledge of how food is produced (e.g., resources and energy used, farmer's commitment) as well as a loss of food cultures in the course of globalization. These things lead to a loss of social and emotional linkages to food.

We consider a lack of knowledge and awareness to be a major driver for this development and thus consider the targeting of food related topics in education as one of the most important measures to combat food waste. The production of food, its impacts on the environment as well as the meaning of seasonality and locality needs to be part of the educational schedule in the Swiss education system at all levels. We thereby consider practical experience in the form of field work on farms, excursions to farmers or any stakeholder in the food chain. Foremost there should also be practical skills training in conserving and storing food, in assessing what is still edible and what is not as well as healthy, sustainable and waste-free cooking classes.

A further possibility to increase the experienced value of food for consumers, is to increase their contact with producers. This should lead to less food waste and possibilities for direct selling from farms but also from the processing sector as they are already increasing today and should be supported

further as described in [Policy 6.9](#), [6.20](#) and [6.21](#). One possibility to concretely reduce food waste with that is to sell and buy non-tradable food in farm shops.

Policy 6.14: New Labeling for Expiration

Dates

Largest environmental impact of food waste can be attributed to the last stages of the food chain due to the resources needed for transporting, processing and storing of the respective goods (Beretta and Hellweg 2019). Food waste at the respective stages (especially at the retail, catering and household stage) might be considerably supported by misinterpretations and confusion on the food labelling concepts 'sell until', 'best before date' and 'expiration'. Expiration dates are of great importance regarding food safety and human health as they indicate the potential of contamination by microorganisms producing harmful toxins. However, these are only mandatory for products which need continuous cooling throughout the food chain and that can represent a health risk even if their smell and taste are normal. The 'best before date' indicates the date until a specific food product maintains 'original' quality regarding for example smell, consistency or color. This however does not mean that the respective product cannot be consumed thereafter and should not be interpreted as an expiration date. Finally, some products are currently still labelled with a 'sell until' label which does not indicate any quality or health aspect at all (FSVO 2014). To avoid misinterpretations with expiration dates, the food labels 'sell until' and 'best before' need to be communicated clearer to the consumer or even better be omitted completely.

Policy 6.15: Adjust Industry Norms

From the total Swiss agricultural food production for human consumption about 225'000 tons of fresh matter is not used as food and ends up as food waste. From these 225'000 tons about 90% is considered potentially avoidable. Main sources for food waste at this production stage are the failure to comply with industry norms and unsuitable storage (Baier et al. 2017). Assuming an average price of CHF 3 per kg of fresh matter, this corresponds to a value of CHF 600 mio per year.

A reduction of food waste from the agricultural production can be achieved by adjusting the industry norms so that less of the products are rejected due to size, form, color or other appearance quality standards not influencing food quality. There are several ways how an adjustment of industry norms could be carried out. One way would be to carry out a mandatory consumer survey to set norms adjusted to consumer's needs. Another possibility would be to omit industry norms completely so that food processing companies must accept all products from a specific farmer. It then is in the competence of the companies to decide on which agricultural resources they can use for further processing and which not. This would additionally increase product innovation to enable the use of the entire quality spectrum of the products delivered by the farmers. In any case, fair sectoral agreements between farmers, industry and retailers are needed.

Policy 6.16: Promotion of initiatives for food waste reduction

If food waste cannot be prevented by the depicted measures, still the most efficient use of the respective goods should be enabled. In several cities of Switzerland there is an increase in communities which try to establish concepts to ensure this. These 'food sharing' communities, for instance, make

overproduced food or leftovers freely available in public fridges. However, considering the total mass of food waste across all stages of the food chain, these initiatives reduce food waste only to a very limited extent. Thus, the promotion and up-scaling of such activities at all stages of the food chain have a large potential to decrease food waste in Switzerland. Governmental actions in this context could include the adjustment of law and regulations to enable such activities on a legal basis, the creation of a fund specifically supporting start-ups which develop concepts and technologies to use food resources which were discarded at the industry, retail or gastronomy stages, the provision of consulting for such start-ups, the promotion of food sharing activities at the community level or the provision of energy-efficient infrastructure for such.

Policy Measures Concerning Domestic Agricultural Production

Policy 6.17: Updating the Vocational Education for Farmers

Description

Aspiring farmers should be prepared for the challenges they face concerning food production in the 21st century and the current climate crisis, and be equipped with the necessary skills. Therefore, today's vocational education for farmers needs to be updated.

The education should contain an understanding of the climate crisis, its consequences and impacts on agriculture and the challenge of a sustainable and productive food system. Only methods and techniques that are sustainable and compatible with the following measures of the chapter should be learned. Accordingly, livestock farming should be less centrally located, and more focus should be placed on resource-conserving and productive food cultivation. Agro-ecological methods should be introduced and learnt, as well as skills in understanding the local impacts of the climate crisis and adaptation possibilities.

Within their education the future farmers should also have the possibility to get in touch with other people working in the food sector as well as students in the field. (See Policies [6.6](#), [6.8](#) and [6.9](#)..) Project-weeks as well as theoretical and practical excursions to learn about aspects of the climate crisis and sustainable solutions together with others should be integral parts of vocational education. Education should also be made more attractive and accessible for more people.

Financing

This policy does not require additional funding as the vocational education for farmers could be financed in the same way it is financed today.

Impact

The impact of this measure is hard to quantify. Its aim is to create the necessary foundations in the food sector to help create the possibilities for the necessary changes. It should educate people and enable them to work actively on solutions. In this sense it should also serve to make the other proposed measures realizable and to improve and guarantee their impact.

Policy 6.18: Improving Farmers Rights and Working Conditions

To achieve the needed transition and reorientation in the agricultural sector, a lot is expected from the farmers. (See [Current Situation](#).)

To make this possible, it is important that farmers can inform themselves, get involved and have an amount of operational scope in their work. This requires sufficient time and good working conditions, which should be ensured with the following three measures:

1. A core part of a strategy to render Switzerland's agricultural sector socially and environmentally more sustainable must protect the peasant land law (Bäuerliches Bodenrecht/ droit foncier rural/ diritto fondiario rurale). This law prevents the fragmentation of agricultural land, hedges against massive land price increases by prohibiting speculation on agricultural land and regulates the transfer of agricultural land. A relaxation of it could open the doors for climate-damaging, profit driven large-scale agriculture. Small-scaled agricultural production must remain possible in Switzerland as it is also the chance for many people to engage in this sector and not to further lower the number of people working in this sector. It should also protect the people's right to define their agricultural and food policy and to prioritize local agricultural production in order to feed the people as well as to give access of peasants and landless people to land, water, seeds, and capital which are core principles of food sovereignty.
2. A farm provides a family with work, livelihood, housing and free time and is therefore the central element in the life of a farming family. Therefore, there is often a strong interdependence between business and private life. Marriage and divorce are closely linked to material claims and business obligations. Today, wives of farmers have no guaranteed right to have the work done on the farm credited for payments and pensions and in the event of divorce they are much more likely to waive claims or compensation. To reduce legal dependency on other people, this must be corrected, and insurance and compensation must be guaranteed for both married partners in future. In addition, further projects are to be intensified and promoted to make the sector more attractive and accessible for women, not only as wives.
3. To create a decent working environment for agricultural workers (also migrant workers), jobs in agriculture must be amenable to the Swiss labor law. This includes the conclusion of a collective bargaining agreement that defines maximum weekly working hours for agricultural workers and regulates their salary, accommodation and residence status. The government must establish legal contact points for both domestic and foreign agricultural workers and start proactively informing seasonal workers about their rights as well as monitoring the working conditions of Swiss farms on a regular basis. Since the income for many is already scarce in agriculture and many farms are heavily indebted, it is crucial that this must be accompanied by projects for more subsidized auxiliary workers ([Policy 6.19](#)) and good income opportunities to produce food. ([Policy 6.9](#) and [6.28](#))

Policy 6.19: More People Working in Agriculture

What is also needed to achieve the necessary transition and reorientation in the agricultural sector as described in the current status, is enough committed people working in agriculture. The sometimes-

hard work and the many weekly working hours will be spread over more people as well as being accessible to more people. More people being engaged in the production of food could also have an impact on consumption patterns in society.

To this end, not only vocational education for farmers should be made accessible to more people but also the following three points should be implemented.

1. Swiss agricultural policy must facilitate the access to agricultural land for young educated farmers, who are often struggling to find that nowadays.
2. The opportunity to cultivate agricultural land in Switzerland should not be reserved foremost for members of peasant families. Rather, lateral entrants with agricultural education from non-peasant families must be granted simplified legal access to farmland state support.
3. Possibly created green job programs as well as other projects to support and pay auxiliary workers should be used to help and work on farms or other food-producing facilities. Existing projects like ZIVI/CIVI therefore could be extended and not only include male persons.

Overview on Livestock Production in Switzerland

The extent of livestock husbandry can be understood to be mainly determined by two constraints: (A) Sufficient provision of nutrients for a healthy and balanced diet of a population and (B) Environmental impacts that must not surpass environmental limits of local and global ecosystems. Land use suitability (e.g. for cropland, grassland, forestland) can be seen as an additional framework condition. Three quarters of the agricultural land in Switzerland is grassland that cannot or should not be ploughed. Production of food on this grassland is only possible with ruminants. However, alternative uses of grass (e.g. for fiber, insulation, energy production) and grasslands (e.g. reforestation, promotion of biodiversity) should be considered as well.

For many industrialized countries including Switzerland consumption of animal-based food, particularly meat is above the recommendations of public health institutions (FSVO 2017). At the same time, overly large livestock populations lead to negative impacts beyond the environmental limits, particularly in respect to global climate change (Searchinger et al. 2019; Springmann et al. 2018; Willett et al. 2019). Buckwell and Nadeu (2018) conclude that in order to reach the 2050 climate goals (reduction of GHG-emissions by 80%) the EU28 must reduce its direct livestock emissions by 74%. This can hardly be realized by technical measures (see [policy 6.33](#)). In view of that, numerous studies conclude that a significant shift towards a more plant-based diet together with a respective reduction of livestock populations is an important - if not indispensable - step in order to reach necessary GHG emissions reduction goals (Bajzelj et al. 2014; Bryngelsson et al. 2016; Hedenus, Wirsenius, and Johansson 2014; Happer and Wellesley 2019).

Further industrial meat production creates an ideal environment for the spread, development and increased virulence of viruses.

Livestock usually converts only a small part of the nutrients and energy in the feed to human edible food (Shepon et al. 2016; McDonald et al. 2011). As far as possible, use of animal feed should thus be limited to feedstuff not edible for humans (M. Meier, Moakes, and Spörr 2018; Mottet et al. 2017; Schader et al. 2015). This namely includes grass grown on permanent [natural] grassland (i.e. land not suitable for crop production) and by-products from the food industry that cannot be transformed to human edible food. These animal feeds should be used efficiently, getting the right nutrient to the right animal at the right time (Andeweg and Reisinger 2015).

Framework for Future Livestock Production in Switzerland

As an overarching goal for agricultural production in Switzerland, it is necessary to determine the extent of livestock populations that combine sustainable production and healthy diet. Several studies

have been conducted in this direction (H. Kim et al. 2019; Stolze 2019; Zimmermann, Nemecek, and Waldvogel 2017). As a point of reference, we suggest here a diet and agricultural production according to the LMP/Kal scenario in Zimmermann et al. (2017) (Table 6-2). This would lead to a reduction of total GHG emission from food consumption in Switzerland by 56%. The reduction potential might even be higher if food waste were reduced as far as possible (see also chapter on food waste). GHG emissions from agricultural production within Switzerland decrease to a lesser degree. Based on the model of the Swiss national GHG inventory, Bretscher et al. (2018) calculated a respective reduction potential of approximately 30%.

Under the LMP/Kal scenario in Zimmermann et al. (2017) the total number of livestock units falls by 44%. Particularly meat production from cattle, swine and poultry is reduced. Production and consumption of milk and eggs is maintained or even increased in order to guarantee sufficient provision of animal proteins and micronutrients. This scenario is in accordance with other studies such as e.g. Buckwell and Nadeu (2018) who state that: *“a conservative estimate is that about half of the current ruminant livestock in the EU could be justified in their role of making use of the available permanent pastures, including rough grazing”*. Considering ecosystem boundaries, Meier and Moakes (2018) propose a similar reduction of the cattle population in Switzerland as Zimmermann et al. (2017) (-37%, feed no food scenario). The population of swine would fall by 59% and the population of poultry by 88%.

Table 6-2 Livestock populations according to the reference and LMP/Kal scenario of Zimmermann et al. (2017).

Livestock Units	Reference	LMP/Kal	% Difference
Dairy Cattle	563'373	427'129	-24%
Breeding Cattle	179'274	98'323	-45%
Fattening Calves	8'471	1'239	-85%
Fattening Cattle	48'155	13'184	-73%
Suckler Cows	94'310	9'746	-90%
Suckler Calves and Cattle	23'052	4'053	-82%
Total Cattle	916'635	553'674	-40%
Swine	183'492	41'603	-77%
Poultry	60'055	48'002	-20%
Sheep	39'545	12'584	-68%
Goats	10'819	24'360	125%
Horses	44'805	19'475	-57%
Total	1'255'351	699'698	-44%

Feed rations of the individual livestock categories changes considerably under a scenario for a sustainable and healthy diet such as LMP/Kal. Ruminants are mainly fed based on roughage from permanent grassland and leys in arable crop rotations. Since the total agricultural area is maintained constant, permanent grassland can be used more extensively while still producing sufficient feedstuff. The amount of silage maize that is currently mainly used in cattle husbandry is reduced massively (-90% of the respective cropping area). Furthermore, the results from Zimmermann et al. (2017) suggest that feed imports could be reduced almost to zero due to the much-reduced demand for feed concentrates. Additionally, in Switzerland more cropland will become available for crop production directly for human consumption (e.g. grains, vegetables, root crops, oilseeds).

The degree of food sovereignty in Switzerland would increase considerably with the shift to a more healthy and sustainable diet. Zimmermann et al. (2017) estimate that both gross- and net- (subtracting production based on imported feed) self-sufficiency in terms of food calories could augment to over 80% compared to <60% respectively 50% today.

Consequences for Food System Policies

Based on the study of Zimmermann et al. (2017) we suggest limiting livestock populations in Switzerland to the numbers of the LMP/Kal scenario as provided in Table 1. The number of livestock units should be fixed for ruminants (cattle, sheep, goats) and monogastric animals (swine, poultry) with some flexibility within these groups. Animal feed should be restricted as far as possible to feedstuff not edible for humans and stocking densities should be adapted to local feed availability. To achieve this, we suggest the following policy measures:

Policy 6.20: Import of Animal Products and Productivity

To ensure that the following measures concerning livestock production in Switzerland lead to a reduction of GHG emissions in total and are not compensated by more emissions, land use and bad agricultural practices in other countries through more imports, it is essential to have a productive domestic agriculture sector. The Swiss population needs to be supplied to the highest possible degree from domestically produced food. The degree of self-sufficiency should at least stay the same if not increase with all the suggested policies. This should be a key target in any agriculture politics and has a further advantage of leading to less transport emissions. We want to ensure this through the “feed no food” principle, which allows more calories and nutrition being produced per hectare and with further support of different practices and alternatives described in [policy 6.9](#), [6.26](#) and [6.27](#).

To reach that target, implementing the following two import regulations are important:

- Import of animal sourced food products is only allowed when it is produced under the same framework conditions as in Switzerland (“feed no food” principle and observance of maximum local stocking densities). The concepts of the “feed no food” principle and the maximum stocking densities should be promoted by Switzerland on an international level. It will be consistently represented in trade relations and international cooperation and research projects. The development of respective international trade regulations should be pursued (see [policy 6.1](#)).
- Furthermore, the following policies, foremost the once to reduce the proportion of animal sourced food production, need to come together with a shift in diets in Switzerland and should not lead to more ASF being imported (even if it is produced under the same sustainability framework as in Switzerland, it will increase the demand for meat and lead others to the consumption of more harmful produced ASF or take away the land and possibility for others to eat ASF). The above policies concerning Swiss food consumption should help to make that shift possible. But to guarantee it, there is the need for a cap for imported ASF at the level it is today, decreasing until 2030 to a maximum of 10% of the amount of what is produced in Switzerland.

It can be a support for achieving both measures, to adapt a border tax adjustment in the direction of action of [policy 6.11](#) and [6.12](#).

These two measures and the aspect of a productive agriculture allow the change in Swiss agriculture to have a real impact on the fight against climate crisis. By changing both, the way we produce food, and the way and amount we consume, we will enable both parts to have great impacts and to be an evident part towards a sustainable food system having a global relevance: First as a good example to show that it is possible and second to already bring up solutions for the global food system that can be used further or adapted by others.

Policy 6.21: No Subsidies for Feed Production on Arable Land

All subsidies or any other support for feed production on arable land except for leys in arable crop rotations should be reduced continuously and stopped by 2030. Arable lands could be defined as the crop rotation areas as designated in ARE (2006). Alternatively, the elaboration of a respective policy system could consider the area- and food-competition as proposed by Zumwald et al. (2019). The subsidies should instead be shifted towards sustainable practices and techniques as suggested in the policies [6.27](#) and [6.28](#): Alternative proteins/incomes.

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.22: No Imports of Animal Feedstuff

An increasing tax on imported feedstuff should lead to its reduction to zero by 2030, year where it should be banned. Incomes generated by the taxes should be used to create other income possibilities for farmers ([Policy 6.28](#)).

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.23: Limit Stocking Densities for Ruminants

The stocking densities for ruminants on permanent grassland should be limited to one livestock unit per hectare on average. The maximum stocking density may be adjusted regionally to take into account the differences in local production potentials.

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.24: Limit Populations of Non-Ruminant Animals

The populations of non-ruminant animals should also be limited to values provided in Table 6-2 or to numbers that can be supported with feedstuff from by-products of the regional food industry that are not edible by humans, if this is lower.

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.25: Consider Maximum Stocking Densities for New Projects

For the approval of new construction or renovation of old infrastructure (e.g. stables) and for the guarantee of credits or any other long-term support investments the regional maximum stocking densities need to be considered.

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.26: Promote Research and Development

In order to optimize grassland-based animal production and convert food industry by-products to animal feed, research and development should be promoted - for instance in precision feeding as proposed by Andeweg and Reisinger (2015).

Further GHG reduction potentials may be achieved with technical measures. This includes in particular an increased longevity for cattle animals (Grandl et al. 2018, Meier et al. 2017), nitrogen optimized feeding strategies (Bracher et al. 2011, Kupper et al. 2018), and low emission stable- and manure management systems (see policy 6.33.) (Daniel Bretscher et al. 2018). So far, there is no scientific consensus whether pasture or stall-feeding systems are more beneficial in terms of GHG-emissions (Zollitsch, Hörtenhuber, and Lindenthal 2010; Zumwald et al. 2019). For animal-welfare reasons we suggest letting animals graze if possible. In general, it is expected that the technical measures for the reduction of GHG emissions in practice are of limited potential and difficult to implement. Nonetheless, they should be promoted as far as possible. This could include e.g. bans for unsustainable practices, regulations and/or capacity building programs. Financial incentives should be used with reluctance and only granted to cover additional costs as they shall not reinforce structures of livestock activities beyond the ecological system boundaries.

Policy 6.27: Promote Alternatives to Animal Proteins

Alternatives to animal proteins i.e. plant-based protein sources like leguminous crops should be specifically promoted and supported as well as the research on breeding and cultivation of those alternatives in appropriate scale in Switzerland.

The impact and further details can be found in the overview and framework for future livestock production in Switzerland. Important questions such as financing or social or cultural compatibility are answered by the accompanying measures, both previous and following.

Policy 6.28: Promote Alternative Income Possibilities

Farmers depending on livestock production today should be supported by promoting alternative income possibilities as support for transition to crop productions, additional energy production or concerning [policy 6.9](#) possibilities for direct selling of their products in the farm or in association with the processing sector. Accordingly, framework conditions need to be designed in a way that allows for alternative economic activities. Difficulties and challenges in arable crop production such as seasonally uneven distribution of workload and income and risks for crop failure due to extreme events must be addressed in order to strengthen the attractiveness and feasibility of this activity.

Minimize GHG intensive practices

Nitrous oxide (N₂O) emissions from agricultural soils are the second largest GHG emission source in the agricultural sector (1.58 Mt CO₂ eq.; see Current Situation). They are mostly a result of nitrogen transformation processes in animal manure and agricultural soils. The production and use of nitrogen containing fertilizers (mineral fertilizer and animal manure) are the cause of most N₂O emissions. Among the additional nitrogen sources are decaying crop residues, nitrogen mineralization in soils and inputs from atmospheric deposition of nitrogen species leading to N₂O emissions. Particularly high nitrogen supplies beyond requirements of crops lead to hot spots of N₂O emissions.

However, any overabundance of nitrogen, also when coming from high additions of compost, will lead to N₂O emissions. In addition to on-farm greenhouse gas emissions from fertilizers, emissions of around 0.81 Mt CO₂ eq. are incurred during the production of agricultural inputs abroad, mineral fertilizers and animal feed. The use of organic soils for arable farming or grazing is another major source of GHG emissions (mainly CO₂) in Swiss agriculture. Additionally, CO₂ emissions from the combustion of fossil fuels in agricultural machinery and buildings amount to 0.63 Mt CO₂ eq. and therefore contribute 10% of the GHG emissions from agricultural production in Switzerland. To reduce all these emissions from agricultural production, several measures are proposed below.

Policy 6.29: Promote Low-Input Agriculture

Description

For the Swiss agricultural production system and for the Swiss farmers, to sustain the shift towards a less input-intensive production system the production portfolio must be adapted in a way that allows sustainable low-input agriculture. To this end and in accordance with article 104 of the Swiss constitution, the use of cultures and varieties as well as animal species and breeds that are adapted to climatic, soil and topographical conditions should be supported. Accordingly, the need for external inputs should be lower, as less fertilizers and agrochemicals are necessary in order to maintain agricultural production against fundamental ecological constraints. This policy suggests production system contributions within the direct payment framework for previously specified low-input agricultural practices incorporating agroecological principles and lowering the GHG emissions in comparison to currently established systems.

Financing

The described direct policy could be financed by the redistribution of the direct payment budget, reducing the payments for animal husbandry and redirecting these payments towards locally adapted low-input agricultural practices.

Impact

This policy is mainly necessary to sustain the policies aiming at reducing GHG emitting inputs in the agricultural system. The direct emission reduction effect is hard to calculate.

Social Compatibility

Due to its character as a supporting measure for the policies mentioned below, this measure should increase the acceptance of the policies aiming at reducing harmful inputs in agricultural systems.

Policy 6.30: Tax on Nitrogen Inputs that Exceed Plant Demand & Cap for Synthetic Fertilizer Application (SFA)

Description

An overabundance of freely available nitrogen in the soil can lead to high N₂O emissions. The temporal and spatial nitrogen supply should match the plant's demand as close as possible. In Switzerland Bosshard et al. (2012) report that there is a substantial potential for improving nitrogen use efficiency in Switzerland. Since amounts of nitrogen emissions not only depend on the source but mainly on the amount of nitrogen applied (Necpalova et al. 2018), nitrogen addition should be monitored very closely and inputs that are beyond the plant supply should be taxed. For this, a user-friendly tool should be made available to farmers that accounts for e.g. the nutrient demand of plants, the availability of nitrogen in the soil, the type of fertilizer used and the application technique. As a complementary measure an incentive tax on synthetic fertilizers can be raised. The revenues of this incentive tax can then be redistributed to the farmers directly or via investments in research and development of more efficient nutrient managing techniques.

To complement the tax-based measures aiming at a reduction of N₂O emissions a stronger incentive for farmers to use their crop rotation and organic fertilizers as nutrient sources can be applied. To this end we suggest a cap for synthetic fertilizer application (SFA) based on local conditions as part of a compulsory fertilization balance for all farmers. This cap will be lowered in a stepwise manner guaranteeing both the aimed reduction and the possibility for farmers to adapt to the new situation. This policy is independent of the direct payment regulation and can also be applied if incentives based on taxes do not lead to any change in the N₂O emissions.

Impact

An increase in nitrogen use efficiency of manure management could lead to a reduction of 0.261 Mt CO₂ eq. per year (Daniel Bretscher et al. 2018). Therefore, an improvement of mineral fertilizer management could result in 16.5% lower soil N₂O emissions. The complete waiving of the use of synthetic fertilizers could reduce the emission of GHGs directly emitted by soils by 15%. Additionally, a substantial part of the 0.81 Mt CO₂ eq emitted by the production of agricultural inputs abroad could be reduced by the renunciation of synthetic fertilizer. Accounting half of the emissions from the production

of agricultural inputs abroad to synthetic fertilizer, a waiving of mineral fertilizers would lead to a reduction of GHG emissions from agriculture by approximately 0.64 MT CO₂ eq per year. This accounts for a reduction of 10% of the agricultural GHG emissions. Since policies are aiming at the reduction and not at the complete renunciation of organic fertilizers the suggested policies would result in GHG emission reduction in accordance with the proportion of mineral fertilizer reduced.

Financing

The costs of this measure will be covered by the farmers themselves. However, better education on climate-friendly agricultural practices, particularly higher nitrogen use efficiency and an increased use of nitrogen fixing crops, and the general reduction of nitrogen inefficient livestock husbandry will lead to a higher nutrient use efficiency. Therefore, overall production of food calories and -proteins will not decline and no additional costs should arise.

Social Compatibility

Enhancing nutrient (mainly nitrogen) use efficiency should not lead to lower yields and therefore a reduction in fertilizer use should not come at a cost or might even be financially beneficial for farmers. Studies have shown that intensive crop management does not necessarily increase GHG emissions per unit of crop production (Snyder et al. 2009).

A complete renunciation from synthetic fertilizers will possibly lead to lower outputs (Necpalova et al. 2018). To maintain our current production level of energies, proteins and nutrients a simultaneous withdrawal from the production of animal feed on agricultural areas is necessary. However, the initial increase of production costs might cause temporary problems with a lack of income for the farmers. This should be overcome by a fairer pricing system accounting for more sustainable production systems. Further thorough consulting and a step by step implementation are necessary accompanying measures to guarantee a smooth transition.

Policy 6.31: Rewetting of Organic Soils

The use of organic soils for arable farming or grazing is another major source of GHG emissions. These soils are formed by the anaerobic, incomplete decomposition of plant matter in water-saturated soil in peatlands (fens or bogs). Typically, farming requires the drainage of these soils. Upon drainage however, the peat becomes exposed to oxygen and a high amount of carbon which has accumulated over thousands of years is released to the atmosphere in the form of CO₂. Despite their long history of drainage, large amounts of carbon are still stored in organic soils. These stocks (equivalent to about two years of total Swiss GHG emissions) should be preserved by rewetting, thereby reducing GHG emissions. Over longer time scales rewetting can also, under favorable conditions, renew the C-sink function of these soils.

Financing

Currently farmers receive direct payments for very general services (e.g. Versorgungssicherheitsbeiträge/ Contributions à la sécurité de l'approvisionnement/ Contributi per la sicurezza dell'approvvigionamento). Part of these subsidies are also invested in the cultivation of organic soils. Furthermore, the government invests large amounts of money in the renewal and maintenance of drainage systems (about CHF 1000 per hectare) and will have to invest 1.7 billion in the next 10-15 years (SRF 2017). These funds should be used for rewetting and renaturation projects. The costs to rewet these soils are very high on a per area basis and are additionally associated with a decrease in agricultural production. Additional funds should therefore be used to incentivize alternative income sources for affected farmers. CO₂ certificates are another option. A program that is already running for raised bogs is *max.moor*. Current prices are too low and would need to be roughly doubled (Ferré et al. 2019).

Impact

The mitigation potential of organic soils under agricultural use (intact or degraded peaty soils) is large, as they emit about 0.6 Mio. t CO₂-eq. per year (about 10% of the agricultural emissions, see “Current situation”).

Social Compatibility

Rewetted organic soils could be used for paludicultures (wetland plants). Examples are *Phragmites australis* (for paper and pulp production or as fuel), *Typha* sp. (cattail, as insulation or construction material or as fuel), *Sphagnum* sp. (alternative for peat in horticulture), *Alnus glutinosa* (as construction or furniture wood, fuel). Experiments with rice have been performed in the Seeland and have shown that rice would offer an economically as well as ecologically (especially for biodiversity) very interesting option (SRF 2019b; 2019a). Whether significant amounts of methane are emitted has yet to be assessed.

Organic soils are very important for vegetable farming. An alternative might be to farm vegetables on *Hors-Sol* in vertical farms.

Policy 6.32: Apply Standard Mineral Oil Tax to Agriculture

Description

CO₂ emissions from the combustion of fossil fuels in agricultural machinery and buildings amount to 0.63 Mt CO₂ eq. and therefore contribute 10% of the GHG emissions from agricultural production in Switzerland. To increase the efficiency of the use of agricultural machinery standard mineral oil tax should be applied for agricultural production. With this measure, additional policies aiming at an establishment of Truth of Costs and changes in the mobility sector can automatically be applied to mobility in the agricultural sector as well.

Financing

The costs of this measure will be covered by the farmers themselves. However, a redistribution of subsidies can support the shift towards emission-free energy alternatives here as well. Furthermore, the improved use of fossil fuels and heavy machinery in many cases lowers or even neutralizes the economic impact of this measure for farmers.

Impact

The improved use of fossil fuels and heavy machinery in agriculture is estimated to reduce the amount of CO₂ eq. of the combustion of fossil fuels in agriculture by 1/3.

Policy 6.33: Promotion of Individual Technical Mitigation Measures

Overview

Many organizations and institutions already elaborated compilations of technical measures to reduce GHG emissions. Instead of discussing the individual measures here again, we rather focus on this contribution on the general aspects and findings.

The highly complex biochemical emission processes with a great number of different microorganisms involve generally difficult technical reduction potentials on agricultural farms. Additionally, the great number of individual emission sources are often interconnected among each other's exacerbating effective mitigation measures. Numerous negative side effects, trade-offs with other pollutants and/or animal welfare as well as high implementation costs are additional challenges of technical reduction measures. After decades of intensive research on agricultural GHG emissions no technical solution or set of reduction measures with a potential that would be sufficient to meet the necessary reduction for the 2 °C target (even less so for the 1.5 °C target) is in sight (Bajzelj et al. 2014; Bryngelsson et al. 2016; Garnett 2011; Hedenus, Wirsenius, and Johansson 2014). This is particularly true for the most important emission sources: methane emissions from enteric fermentation and nitrous oxide emissions from soils.

Supposedly effective reduction measures based on chemical enzyme blockers such as nitrification inhibitors (3,4-Dimethylpyrazolophosphat (DMPP), Dicyandiamid (DCD), Nitrapyrin, Etridiazol) or methane inhibitors for enteric fermentation (3-nitrooxypropanol (3NOP)) run the risk of yet unknown negative side effects and should be dealt with restraint under strict observance of the Precautionary Principle (UNESCO 2020). Furthermore, consumers can be very sensitive to chemical substances used in agriculture. Bad experiences with nitrification inhibitors in New Zealand advice to pursue these seemingly promising mitigation measures with caution.

Major potentials might be situated in the field of soil carbon sequestration. In particular, soil application of biochar or deep ploughing of arable land may lead to the build-up of higher stocks of soil organic carbon. However, several drawbacks such as large uncertainties, reversibility and saturation effects should be clarified.

One way forward might be a target-oriented program that promotes the simultaneous implementation of many technical measures. Examples are a system of maximum allowable nitrogen surpluses or a points-based system that prescribes a minimal score for different farm types. Such arrangements allow flexibility for individual farms to exploit site-specific potentials. The effect of the latter, however, remains limited if the major emission sources from enteric fermentation and manure management are not addressed.

In conclusion, technical measures on the production side are characterized by low reduction potentials and/or by trade-offs with other environmental impacts, as well as by technical problems with implementation and/or prohibitive costs. First experiences with pilot projects in Switzerland and abroad confirm this finding. Given this, a mitigation strategy based solely on technical, production-side measures does not seem a viable way to reach the goals of the Paris Agreement (1.5 °C or 2 °C target). This finding is also supported by the fact that agricultural GHG emissions in OECD(Organisation for Economic Co-operation and Development) -countries did hardly decline in the past decade, despite significant investments in research and development (OECD 2013). Furthermore, the lacking progress in reducing the ammonia- and nitrogen surplus problem should make us cautious regarding promised technical potentials. Accordingly, false trust in technical solutions should under no circumstances delay urgent action that address agricultural structures through a change in human diet and reduced food waste.

Policies

All policies, namely financial incentives, should be designed in a way that they do not consolidate agricultural structures and production processes that cause negative environmental and social impacts. Any lock-in situation due to high investments that exacerbate further mitigation action must be avoided. Technical mitigation measures should also not hamper locally adapted production and should be designed in a way that does not contradict the fundamental properties of a climate friendly production system (Figure 6-3). A thorough analysis of all technical policy measures in this respect is essential.

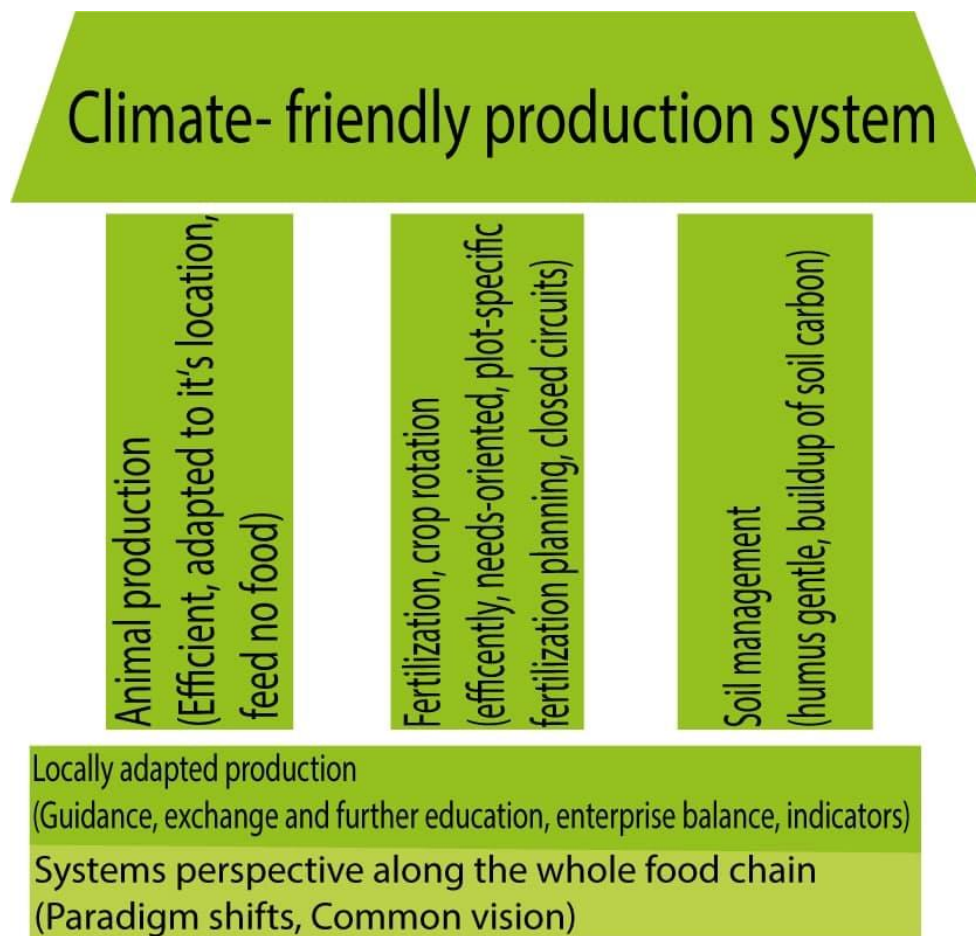


Figure 6-3 Climate-Friendly Production System (original graphic in German: (D. Bretscher and Felder 2019))

Economic Incentives that Allow the Implementation of Technical Measures

Ideally the producer price for the farmers should be high enough in order to allow the implementation of technical measures and produce accordingly to the best available and sustainable management practices. Internalizing all environmental and social costs can therefore be a prerequisite to this policy. The income of the farmers should allow them to dedicate sufficient time in the observation, analysis and optimization of their production system (soils, plants, animals, infrastructure). Likewise, farmers should be able to participate in capacity building programs and benefit from consultation services. As a last option individual technical measure can directly be subsidized.

Research and Development

Research and development of promising mitigation measures such as feed additives to reduce methane emissions from enteric fermentation or measures to promote soil organic carbon sequestration should be promoted by dedication of sufficient financial resources. Applied research and investigation of implementation mechanisms on the farms should be strengthened. Among this, research studies that analyze the sociocultural background of the farmers and how their engagement can be raised.

Overarching Programs and Access to Information

Overarching programs such as low emission breeding programs for livestock or geographical information systems to promote locally adapted agriculture should be financed and supported. Farmers should have free access to any other kind of information (scientific results, meteorological data, soil information etc.) that contributes to an optimized management.