The role of animals in sustainable land use

– Can a plant-based diet benefit both animals and land use?

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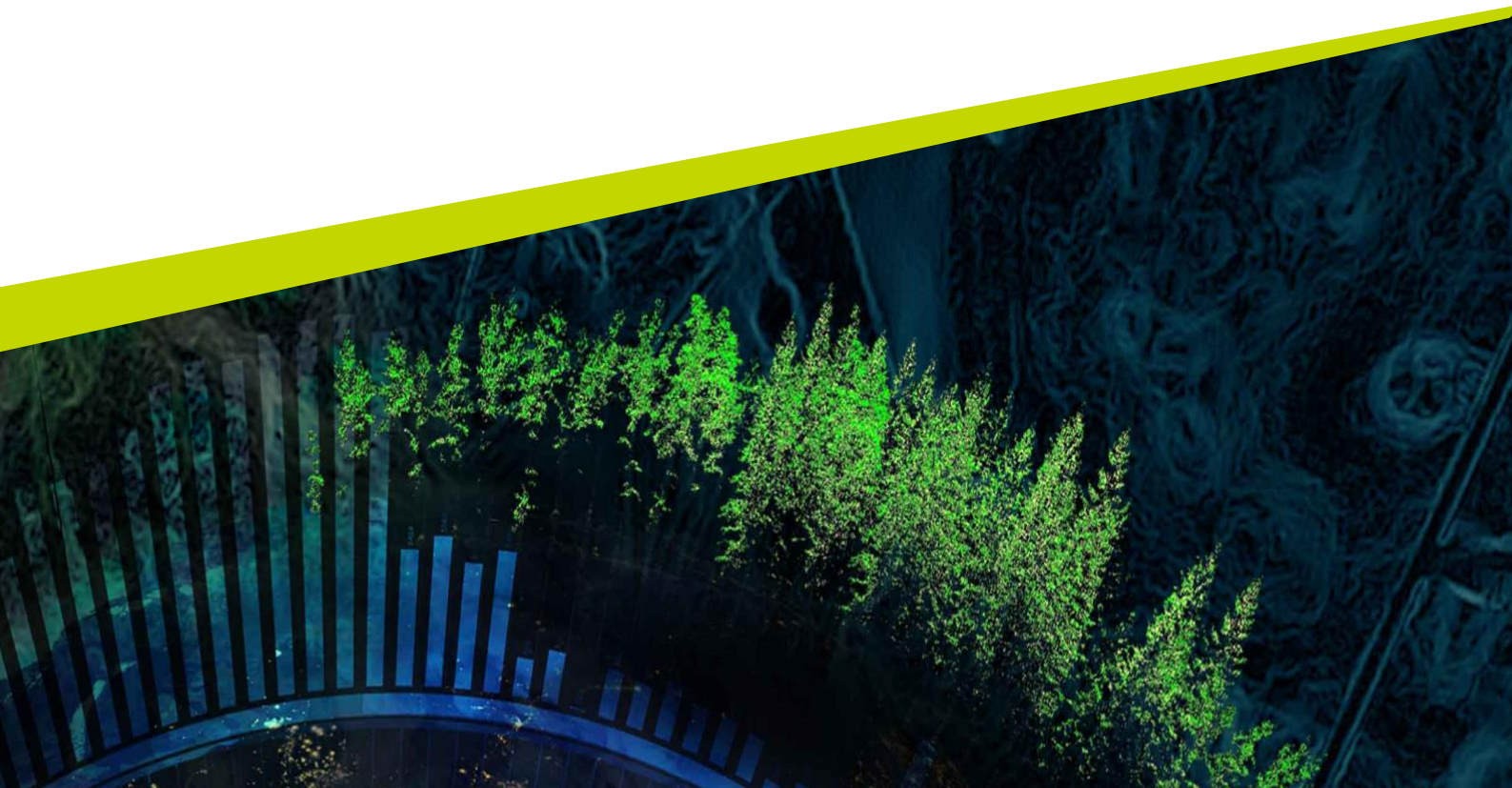

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Abstract

Introduction: Agroecology and sustainability are both concepts that aim to find solutions towards a healthy planet. This thesis is based on two pillars with a plant-based diet as the connection between them. The two pillars are 1) the missing animal perspective and 2) a more resource efficient land use. The first pillar is invisible but also actively neglected to be a part of the sustainable development, whereas land use and diet, are identified as important aspects in the discussion about and acting towards our *human* common future.

Aim: Investigate how the perspectives of animals in the agriculture are described in the context of sustainable land use if a transition to a plant-based diet would occur and how much arable land a plant-based diet demand.

Methods: This study contains two methods. The first is a qualitative method: a focus group discussion (FGD) with people having knowledge and experience of nature conservation. The second method used is a quantitative method focusing on land use and diet: calculation of land use for a plant-based diet from a weekly menu.

Results of the qualitative method: The industrial agriculture was described as disconnected from the society and unethical towards the animals. It was agreed on, with one exception, that in an ideal world meat eating is substantially reduced and animals are treated well. A scenario without eating animal derived products was described as unrealistic because we need animals for the many benefits we get from them. Another perspective that was mentioned in the FGD was trying to show how all animals want to live and that we should be conscious of how we separate animals for different purposes.

Results of the quantitative method: The amount of arable land needed for the plant-based menu is 1790 m^2 per person for a year, including food losses and waste. A few changes in the menu could reduce land use to 1230 m^2.

Discussion and conclusion: There will be excessive arable land that can be used for other purposes than for food and for a food production based on more gentle methods that also includes the cultivation of ley. It also shows that land use can be reduced with only a few changes of the raw product. However, potential solutions to a more sustainable food system can be lost depending on what perspective we have on the environment and how we value it.

Keywords: land use, fair diet, animal ethics, plant-based, vegan, agroecology, sustainability, food system, speciesism, anthropocentrism, critical animal studies

Foreword

As a child, I asked my mother if the animals we ate were afraid and saw each other when they were slaughtered. “No. They are not aware of what will happen, they feel no pain or fear. But we need to buy Swedish meat because here we know that they had good lives and were cared for”, she said. I learnt that there was no other way than to eat animals.

My experiences of studying Food Science and Nutrition at Linnaeus University (LNU) and Agroecology at the Swedish University of Agricultural Sciences (SLU) are that animals are used as resources for human needs and that is just how it should be. When I tried to problematize this at LNU, I was informed that it can’t be discussed. The program at LNU, at the time one of a few in Sweden, focused only on the raw product and further, excluding the earlier production stages.

The food industry has power and influences all of us and the environment. With power follows responsibility. But at the program at LNU, all efforts and resources needed to produce the raw product were not considered. Hence, people educated under these circumstances are not educated in the whole food chain and consequently they most probably will fail to critically consider what the costs of their decisions will be. Food will be seen as an item separated and independent from the environment. How can then the rest of the society (on all levels e.g., consumers, policy makers, companies, institutions) make responsible choices?

I started to study agroecology because I wanted to contribute to awareness and to improve the communication between the food industry and the agriculture. The conservative and static approach about the food system at LNU was in stark contrast to the curiosity and open mindedness that was pervading the agroecology program.

The idea of agroecology is an open mind to different perspectives and the importance of considering the whole food system to be able to invent more sustainable solutions. Students and teachers were engaged to find solutions for better food systems created for the people and the environment. Although the perspective that animals are important parts of the food system was persistent.

How can something be sustainable if not all perspectives are considered? The result of this will be that just the people who are interested in these areas will be the only ones who bring up this topic, but who are ready to listen and question the meat-eating culture that almost everyone is part of and have been since they were born? With this thesis I want to address that the interests of non-human animals need to be included when designing sustainable food systems for the future.

Table of contents

List of tables **10**

List of figures **11**

Abbreviations **12**

1. Introduction: challenges for sustainable food production **14**

1.1. Environmental and social impacts of the intensive agriculture 14

1.2. Background 16

1.2.1. Animals solely as resources 18

1.2.2. Sustainable land use: is there enough land to ensure sufficient food production to feed the world? 19

1.2.3. Different perspectives 20

1.2.4. The Sustainable Development Goals are anthropocentric 22

1.2.5. Land use and the impact of diets 22

1.3. Aim 26

1.4. Research questions: 26

1.5. Delimitation 26

2. Method **28**

2.1. The qualitative method 28

2.1.1. Data collection 29

2.1.2. Thematic analysis 30

2.2. The quantitative method 30

2.3. Method discussion 34

2.3.2. Focus group discussion (qualitative method) 34

2.3.3. Calculation of land use (quantitative method) 36

3. Results **39**

3.1. Results from focus group discussion 39

3.1.1. Theme 1: Industrial animal agriculture is business as usual 39

3.1.2. Theme 2: Caring about animals 41

3.1.3. Theme 3: Animals as subjects 42

3.2. Results: Land use for a plant-based menu 44

3.2.1. Land use can be reduced 45

4. Discussion **51**

4.1. Discussion of the results from the focus group discussion 51

4.1.1. Maintenance of the meat culture 51

4.1.2. Justifying eating meat 53

4.1.3. Humans decide the value of an animal 54

4.1.4. Other ways of thinking 54
4.2. Discussion of results about land use 55
4.3. A general discussion 59
4.3.1. The food system is disconnected from the society 59
4.3.2. Reconnecting society and the food system 59
4.3.3. Two perspectives: Resources versus Sentient beings 60
4.4. Conclusion 62

5. Acknowledgements 64

6. References 66

7. Appendix 72
7.1 Invitation letter 72
7.2. Themes and questions from the author during the focus group discussion 74
7.3. Nutrient content for the Initial menu 76
7.4. The Changed menu 77
The Changed menu, based on the Initial menu but with some changes. 77
Oat drink, oat yogurt and margarine are fortified 77
7.5. Land use and raw product in quantity for the Initial menu, per person and year. 78

List of tables

1.1 Northern Europe consumes more animal foods and use more land compared to Eastern Africa..... 24

2.1 The Initial menu..... 31

2.2 An example of a recipe..... 32

2.3 Soybeans in the tofu pie. Example of how the calculation was made..... 33

2.4 Food losses and waste in the food supply chain..... 34

3.1 The main themes and subthemes from the focus group discussion..... 39

3.2 An overview of land use per person and year, needed for the Initial menu and for the Changed menu..... 45

3.3 Land use for Swedish and imported raw product for different crop categories..... 47

3.4 Examples of crops in the Initial menu that can be changed and its consequences for land use..... 49

List of figures

3.1 The relation between land use for the average Swedish diet, total arable land in Sweden, land use for a Fair diet, for the Initial and for the Changed menu 50

Abbreviations

CF	Conversion factor
FAO	The Food and Agriculture Organization
FGD	Focus group discussion
LNU	Linnaeus University
SBA	The Swedish Board of Agriculture
SDGs	Sustainable Development Goals
SFA	Swedish Food Agency
SLU	Swedish University of Agricultural Sciences

1. Introduction: challenges for sustainable food production

The food system in the Western world is resource demanding and has an unsustainable impact on the environment and health (Foley *et al.,* 2011; Röös *et al.,* 2016). Healthy and nutritious food with low environmental impact for everyone is in our common interest but the many solutions on how to make it possible are not agreed on (Karlsson *et al.,* 2018). Agroecology is the holistic study of the ecology of food systems, including science, practice, and social movements. Agroecology and the UN Sustainable Development Goals try to improve the sustainability of food systems and entire societies – but only for the interests of humans. This thesis examines the roles of animals in relation to sustainable land use, based on two approaches: 1) a focus group interview to investigate how the animal perspectives are considered when discussing sustainable land use in food production; and 2) a calculation of the land requirement for supplying the Swedish population with a plant-based diet that meets the nutrient intake recommendations. Previous research has shown that a plant-based diet is the least resource-demanding diet (Godfray *et al.,* 2018; Rabès *et al.,* 2020). A plant-based diet can reduce the amount of land used for food production when it is used for human food directly and not for feed to animals (Karlsson *et al.,* 2018). A plant-based diet would also reduce the exploitation of animals.

While benefits of a plant-based food system in terms of resource use and environmental impacts have been widely studied in previous research, there has been less attention in these studies to questions about animal ethics in relation to food production, and about avoiding exploitation of animals for the animals' own sake. It can therefore be relevant to ask if the animals' own perspectives being part of the food system are sufficiently covered in agroecology and in actions aiming towards improved sustainability?

1.1. Environmental and social impacts of the intensive agriculture

The food system accounts for up to 29% of the total global anthropogenic greenhouse gas (GHG) emissions. Meat and dairy account for approximately half of the GHG emission that comes from food production (Jan Kramer *et al.,* 1999; European Commission, 2006) and 18% of the global GHG emissions (FAO, 2006). Most of the emissions are released in the primary production, for meat the primary productions represent 90-95% of the emissions and for food in general the share is 80% (Angervall *et al.,* 2008). An important driver for GHG emissions is land use change (Hallström *et al.,* 2015). It is challenging to measure the climate impact from a foodstuff. The food chain is long and complex, and it can be difficult to get data that is reliable. Also, the type of food

system that is used and how different foods are compared; in weight, in energy or in nutrient content, will affect the numbers (ibid). Still, it is recognized that the climate impact from plants is much lower compared to meat, milk, and egg (Röös, 2014; Hallström *et al.*, 2015; Poore & Nemecek, 2018; Willett *et al.*, 2019).

In addition to climate impact, some of the major sustainability challenges of food production are listed below:

Nutrient leakage
Agriculture generates losses of nutrients that causes eutrophication, and it is worsened with the intensification of agriculture (Poore & Nemecek, 2018; Willett *et al.*, 2019). The leakage of nutrients that reaches waters can harm and disturb ecosystems. It can cause hypoxia on the bottom of the lakes and seas. If toxic algae grows it can harm the health of humans and animals (Swedish Agency for Marine and Water Management, 2019).

Biodiversity
Agriculture is a substantial cause for land conversion, with the consequences of biodiversity loss and land degradation. Ecosystems in which thousands of species are dependent on are lost. Homes for animals and humans are lost. Species die and humans and animals escape trying to survive (Foley, 2011; Benton, 2021).

Water use
Agriculture production is the major consumer of water in all countries. The agricultural products that take the biggest share of global water footprint are cereals with 27%, meat 22% and milk products 7%. Almost all water (98%) that goes to animal production is for the cultivation of feed. Bovine meat is one of the most water consuming products, hence countries with high consumption of bovine meat are taking a big share of the water. In general, developed countries use more water related to consumption of industrial products than developing countries (Mekonnen & Hoekstra, 2012). One example of how meat consumption threatens water security is the use of groundwater storages from the High Plains aquifer in the central United States for the irrigation of feed to animals. To restore these storages, it will take 500-1,300 years (Steward *et al.*, 2013). Our use of water will not only have consequences on the amount of drinking water, but it also has consequences for the global climate when the water in the overland flow is affected (Kaushal *et al.*, 2017).

Zoonoses
Zoonotic diseases are diseases between humans and animals. About 75% of the infectious diseases are zoonotic. Not only bushmeat and backyard farming are risk areas for disease spreading from wild animals but also intensive animal farming. The risk for an introduction of a pathogen in intensive farming is small but when a pathogen reaches the animals (Espinosa *et al.*, 2020), such as bird flu in Sweden, spring 2021 (SBA, 2021), the conditions will amplify the spreading. The spreading of pathogens is also a risk when wild animals reach urban areas trying to find food and homes when deforestation and climate change force them to escape, as an indirect cause of animal

agriculture. Also, the use of antibiotics in animal farming increases the risk for antimicrobial resistance (Espinosa *et al.*, 2020).

Starvation, Food waste and Obesity
The food is globally unequally distributed. The Food and Agricultural Organisation of the United Nations estimates that 690 million people are chronic undernourished, and 2 billion people suffer from moderate or severe food insecurity. 135 million suffer on a crisis-level, which means that it can affect people's access to food at a point where their lives are at risk. If current trends continue, the individuals affected will increase to 840 million people in 2030 (FAO, IFAD, UNICEF, WFP and WHO, 2020).

In contrast, about one third of all food is lost or wasted globally (FAO, 2011). In medium- and high-income countries a lot of the food that is edible is wasted because of behavioural reasons. In contrast, in low-income countries the losses are mainly because of the lack of right facilities and equipment (FAO, 2011). Until 2030 the goal 12.3 in the Sustainable Development Goals is to reduce food waste in stores and at household levels with 50% and a reduction in the whole food chain (UN, 2015b). Except for regulatory and fiscal incentives, this could be achieved by an increased societal *understanding* of the food system (Röös *et al.*, 2017).

1.2. Background

Agroecology and sustainability are both concepts that aim to find solutions towards a healthy planet. This thesis is based on two pillars with a plant-based diet connecting the two. The two pillars are: the missing animal perspective and a more resource efficient land use. The first pillar is invisible but also actively neglected as a part of the sustainable development (Svärd, 2017:10; Anthis & Paez, 2021), whereas land use and diet, more or less, are identified as important aspects in the discussion about and acting towards our *human* common future (Rockström *et al.*, 2009a).

The concept of Agroecology

Agroecology treats agriculture as an open system that needs long-term solutions
Agriculture has effects on and is affected by the environment – the biophysical environment entailing humans and animals, and companies and society, overall. Still, agriculture is often viewed as a separate system not including the rest of the society. Focus is on separate components instead of the food system as a whole and its complexity (Benton, 2021).

Agroecology is interlinked in all levels of society
The essence of agroecology is the holistic view, the system perspective and that it works through all levels of society. It is interdisciplinary and action oriented with the aim to improve sustainability. It is a practice, a movement, and a science. Agroecology involves the social, economic and ecological dimensions. All dimensions interact and are dependent on each other and need to be seen as a whole (Francis *et al.*, 2003*;* Wezel *et al.*, 2020). Consequently, it is significant to consider *how* the dimensions interlink and co-develop (Agroecology-Europe, 2021). When understanding that the

food system is both global and local, it is possible to build a true sustainable, resilient, and equitable food system (Wezel *et al.*, 2020). Wezel *et al.* (2020) identifies that most of the research in agroecology mainly focus on the field and farm level, not including the global level. For the first two levels of five in the transition pathway framework, see Gliessman (2007). They also notice that much more research needs to apply to the whole concept of agroecology, i.e., not only the ecological dimension but also the social, cultural, political, and economic parts of the planet (Wezel *et al.*, 2020).

The meaning of agroecology has developed

The word agroecology can be found in the literature from the beginning of 1900 (Wezel & Soldat, 2009; Wezel *et al.*, 2020). During the years several definitions, elements and principles have emerged to describe the concept of agroecology. It contained for a long time the *field, the farm and the agroecosystem scale* but the last 20 years also *whole food systems* have come to be part of the concept (Wezel & Soldat, 2009).

Identifying elements and principles

Wezel *et al.* (2020) have gone through the literature and followed FAO in their process to identify 10 elements during 2015 to 2019. Parallel to this he was also contributing to High Level Panel of Experts project (HLPE, 2019) which have worked out 13 principles emerging from the existing literature. The elements and principles correspond well, but they have different beneficiaries. The FAO has worked out the elements to be a support for member countries from practice to policy. The principles worked out by HLPE (2019) aims to provide a foundation to policy makers and contribute with an increased understanding how agroecology can be a way where all levels of society can work towards sustainable production and consumption of food, fibre and fuel. Some of the main agroecological approaches are: the importance of a sustainable resource use, for example less dependence on inputs; circularity; diversity; cultural and social connections; and solidarity. Co-creation of knowledge is identified as a key principle. In practice this could mean that the research needs to start with the farmer and the stakeholders formulating the questions and then working on solutions side by side with the researcher (Wezel *et al.*, 2020).

The concept of Sustainability

Sustainability is a broad and frequently used term but what does it mean?

Sustainability is usually agreed on to consist of three dimensions: environmental, social, and economic sustainability. The idea is that all of them need to be fulfilled for something to be sustainable, but what exactly are included in the three dimensions is unclear (Holden *et al.*, 2014). Are the high welfare standards in the rich world “needs” and is it sustainable to let the consequences of our living affect other parts of the world and other life than humans? What values we have will determine what we count as sustainable (Röös *et al.*, 2017) - value for itself or value as purely instrumental. We value different things hence we will protect different things. If we are aware of the values behind our opinions and actions, it is easier to understand each other. It is possible to have different values but at the same time come to the same solutions (Torpman, 2017).

In which way has agroecology influenced and shaped this study?
This study is interdisciplinary, it tries to take a system perspective and to suggest a way to cope with the unsustainable food system by suggesting a plant-based diet for a more efficient land use (Röös *et al.*, 2017). It also tries to point out that the ongoing discussion is not about whom is eaten, only about *what* is eaten. The perspectives of animals themselves are excluded (Svärd, 2017:10).

1.2.1. Animals solely as resources

Old norm using animals for our purposes
For almost 10 000 years humans have eaten and domesticated animals (Jensen, 2012). Humans benefit from animals in several ways that humans value and is the normative approach: they are used for food, for clothes, for science as bodies to experiment on, for biodiversity, for pleasure, for sport activities, as pets and so on (Svärd, 2017).

Legally counted as property and turned into raw material
From a legal perspective, animals in the agriculture are someone's property. Every year the food industry takes the life of at least 100 millions of land-living animals in Sweden (SBA). Globally, the number of land-living animals slaughtered every year are at least 70 billion (FAO). Birds as hens and chickens, and fish and shellfish are not counted as individuals but in weight. The numbers of fish individuals that die in the fish industry are estimated to 1-3 trillion every year (Brooke, 2010).

As affordable as possible with little room for natural behaviour
Animals in the agriculture are reared so they in the most effective and affordable way produce what humans want to eat, i.e., flesh, milk and eggs (Jensen, 2012). Despite this intensive breeding of the animals, the needs of the animals have not changed. This is general for all domesticated animals. As an example: when a sow (of the same breed used in animal production,) is let out in the nature, she will walk several kilometres to find a place to give birth for her piglets. Similar is what the white leghorn hen does in her search for a hidden place to lay her eggs. This natural behaviour is not possible in the intensive agricultural systems (Jensen, 2012).

The questioning of the objectification of animals increased parallel to the industrialization
Parallel to the development of the industrialized agriculture, the interest of the human-animal relationship has increased significantly, both in the academic and in the public (Lund, 2002b; Svärd, 2015). There has been a gain in awareness that many animals are sentient and how they are treated by humans. The book 'Animal Machines' (Harrison, 1964), documented the new intensive agricultural systems when they first came, e.g., with battery cages for hens and individual veal crates. 'Animal machines' came to be a "wake up call" (Torpman & Röcklinsberg, 2021:2) and the start of a debate in the general society (Karen, 2013). This urged the British government to start an investigation of the welfare of animals in the intensive agricultural systems and led to the 'Brambell report' and the 'five freedoms' (Brambell, 1965) and has been a base for today's EU-legislation (Torpman & Röcklinsberg, 2021). The raise in this development came with the moral philosophy

that contributed with reflections about our relation to animals and our exploitation of them asking ethical questions which also came to influence other disciplines (Svärd, 2015). A discipline important to mention is Critical Animal Studies (CAS). It is an interdisciplinary research field that not only sees the ethical perspective but critically examines how the society is built on the use of animals in several ways. On the course page at Lund University, it is explained:

> ...one key aspect of CAS is a holistic understanding of the commonality of oppressions, such that speciesism, sexism, racism, ableism, statism, classism, militarism and other hierarchical ideologies and institutions are viewed as a part of a larger interlocking global system of domination. Critical Animal Studies also actively seeks to link theory to practice, analysis to politics and the academy to the community (Communication and Media, 2021).

Even if there is relatively big academic activity about animal rights, animal ethics and animal welfare, there has been little interest in the politics, that is the realm where decisions are made and implemented (Wissenburg, 2014; Svärd, 2015). One example is the anthropocentric perspective and its exclusion of nonhuman animals in the Sustainable Development Goals (Torpman & Röcklinsberg, 2021), goals that will have definitive impact for all life on Earth.

1.2.2. Sustainable land use: is there enough land to ensure sufficient food production to feed the world?

77% of agricultural lands is used for grazing and feed production

Agricultural land is divided in arable land (also called cropland which is land used for crops) and pastureland (pastures and other grasslands not used for temporary crops) (FAO, 2021). Agriculture covers approximately 38% of Earth´s terrestrial surface. Of the total agricultural land, 77% is used for livestock (meat and dairy) via grazing and feed production, and the rest 23% is used for crops for humans (Poore & Nemecek, 2018).

Limited amount of agricultural land and it is unequally divided

Arable land per capita globally is unequally divided – rich countries take advantage of three times more land per capita than developing countries (Alexandratos & Bruinsma, 2012:108). The share of global cropland per capita is decreasing. Projections by Alexandratos and Bruinsma (2012:108) show that the share of global cropland 1961 that was 4500 m^2 (0.45 ha) will decrease to 2100 m^2 per person and year in 2016. A diet inside the planetary boundaries is 2100 m^2 per person and year. It is the total amount of arable land that is *accepted* to increase inside the planetary boundaries, from 12% to 15% (Rockström *et al.*, 2009b), divided with the projected global population of 9.5 billions year 2050 (Röös *et al.*, 2016).

Plant-based foods are resource efficient

Of the total global calorie- and global protein supply, 18% and 37% respectively come from animal derived food. These are low numbers when considering that as much as 77% of the agricultural land is used to produce feed for the animal-based food production (Roser, 2013; Poore & Nemecek, 2018).

1.2.3. Different perspectives

Human centred view where all other beings are of instrumental value
Animals are an important compound for the synergy with plant production, for ecosystem services, job opportunities and as food (Lund, 2002b; Gliessman & Engles, 2015). One of the principles in agroecology is to ensure animal health, which is important for the system to be resource efficient (Wezel *et al.*, 2020). A healthy animal will be resource efficient, an unhealthy will not:

> ...today it is the lack of expected production that is regarded as an indicator of possible poor welfare – not poor welfare in itself (Algers, 2011:1).

Anthropocentrism
In anthropocentrism humans are in the centre and animals are objects with instrumental value, meaning they exist to be achieved for the benefit of humans:

> …it is about an ideology that privileges any and all humans above the rest of nature (Kopnina *et al.*, 2018:118).

> ...is not an innate disposition but a historical outcome of a distorted humanism in which human freedom is founded upon the unfreedom of human and animal others (Weitzenfeld & Joy, 2014:3).

This way of seeing the world is ubiquitous, at least in the Western world, but it is not much questioned. It is pervading institutions and the public and our politics, for example the Sustainable Development Goals (SDGs). Torpman and Röcklinsberg (2021) express it:

> …the anthropocentric perspective appears to be structural in the sense that it comes embedded in people´s general worldviews. Nevertheless, the anthropocentric perspective on the SDGs can be based on some more or less implicit assumptions, that are widespread among politicians as well as the public and the research community (Torpman & Röcklinsberg, 2021:2).

Beings with own interests and beings with instrumental value
In the environmental ethics, which animal ethics is part of, the question about moral status is of high relevance to understand what values lie behind our opinions, decisions and thus our actions. Who, and on what grounds, should we include in our ethical consideration? Animals, plants or perhaps even ecosystems (Anthis & Paez, 2021)?

Expanding the moral circle to be conscious of what we value and why
Who belongs to our moral circle can be visualized by circles that are expanding with the smallest in the middle followed with wider circles (Lund, 2002a:36). Expanding the moral circle can serve as a way to address blind spots in our moral thinking (Williams, 2015). Egocentrism is the narrowest in which the interests of one human individual is the only interests that needs to be taken into consideration. Ratiocentrism includes only the ones that are rational which means that babies or mentally disabled humans will not be included, but some other animals will. In anthropocentrism

humans are the only ones with own interests and everything outside this circle is of instrumental value for humans.

If the circle widens one step, also all *sentient* beings will be included in our moral concern, this is called sentientism (or psychocentrism). Humans as *moral agents* with the ability to understand the consequences of our actions consequently have the responsibility to protect all sentient beings. Animals are not moral agents because they do not understand the *human made* ethics and cannot bear a responsibility like that. Expanding the circle to include all life, both plants and animals, is called biocentrism and even wider, ecocentrism, where the holistic view is of higher value than one individual, such as ecosystems or a specie (Lund, 2002b; Torpman, 2017:62-70).

Societal systems of oppression

It is not enough to only talk about ethics and what is morally right or not. This is because it is a structural system. To challenge it, it needs to be examined critically:

> Human history is riddled with atrocities committed against contemporary members of our own species, and if species-based discrimination is wrong, then history is also riddled with serious harms committed against nonhuman animals. (Anthis & Paez, 2021:2)

Speciesism is a structural system of oppression and shares the same belief system as all oppression systems do. Joy (2019) has named these systems powerarchies and describes it as follows:

> All "powerarchies" (patriarchy, classism, racism, an abusive relationship or work culture, etc.) share the same basic structure and, more importantly, reflect the same mentality: the belief in a hierarchy of moral worth, that some individuals or groups are more worthy of moral consideration, or being treated with respect, than others. The primary difference among powerarchies is *who* is oppressing *whom*; the nature and psychology of the oppression is the same. (Joy, 2019)

Speciesism is the ideology where the membership of the specie is what decides if a being should be treated with respect or not, with other words, speciesism is like to racism and sexism but instead of discrimination of human differences this term is about the human structural discrimination and moral prejudice of animals. Peter Singer developed the concept of speciesism in his book Animal Liberation (Singer & Petersson, 1999).

Carnism, coined by Joy (2005), is a subsystem to speciesism and is about the meat-eating culture:

> The most grand and omnipresent occurrence of speciesism are ironically the most banal: the exploitation, objectification and consumption of animals as food. (Weitzenfeld & Joy, 2014:20)

Carnism is an ideology that is built on myths but presented as facts: Eating meat is normal (everybody does it), natural (humans evolved by eating animals), necessary (as a food: the animal protein, and as a necessary part in the whole food system) and nice (Piazza *et al.*, 2015). This system is invisible because of the dominant meat norm: everybody eats meat so there is no problem with it (Joy, 2005).

As with all oppressive systems, it is first by making it visible, such as giving the structure a name, that it can be challenged. If carnism is not made visible for the society it remains as the normal neutral behaviour and only veganism, the counter system of carnism, is seen as a belief system, a choice, when in fact eating animals is not necessary for most of us, and thus a choice. A choice that is not realized but taken as a given (Joy, 2005; Godfray *et al.*, 2018).

Another aspect of carnism is how the industry is detached and hidden from the rest of society – people do not need to think about it. The industry instead sells the idea of the "happy-to-be-eaten meat" (Weitzenfeld & Joy, 2014:22). The animals that are used as foods are not referred to as individuals, they are instead grouped – all of them are the same. One individual pig is the same as all other pigs. The use of words is of importance for keeping a distance and reduces the living animal to a meat, such as using words like beef, pork, seafood and livestock (Joy, 2005).

1.2.4. The Sustainable Development Goals are anthropocentric

The anthropocentric world view is clearly exemplified through the SDGs that are designed to meet the needs for humans. In the article "Reinterpreting the SDGs: Taking Animals into Direct Consideration" (Torpman & Röcklinsberg, 2021) they argue why animals should be included in the SDGs (United Nations Agenda 2030) for their own value (direct) and not as instrumental value (indirect). Animals are not even considered indirect in the SDGs (Keeling *et al.*, 2019).

1.2.5. Land use and the impact of diets

The average diet in Sweden

The average diet in Sweden, based on the latest food consumption survey, Riksmaten 2010 (Amcoff, 2012), demand 3400 m^2 agricultural land (arable land and pastureland) per person and year (Röös *et al.*, 2015) and can be compared to a fair diet of 2100 m^2 (Röös *et al.*, 2016). That means that the Swedish peoples' diet demands agricultural land from people in other countries. At the same time the share of global arable land per capita is decreasing (Alexandratos and Bruinsma (2012:108).

The food consumption in Sweden - the latest food survey Riksmaten 2010

The share of different food categories consumed in Sweden are presented in Riksmaten 2010(Amcoff, 2012). The amounts are presented in gram per person and day, described in table 146 with an energy intake of 10 MJ (2388 kcal): 280 g of vegetables, roots and tubers, 270 g of fruit and berries, 250 g of cereals including legumes, 340 g of dairy, 135 g of meat including 58 g of fish, and 19 g of egg; 370 g is other types of food including ice cream, alcohol, pizza, candy and other sweets. About one third (34%) of the energy intake is coming from vegetables, roots and tubers, fruits and berries, and cereals. One third (32 %) comes from animal derived products and other food is about 28% of the energy intake.

Land use is reduced when 50% of meat consumption is replaced with legumes
In Sweden, 2.2% of arable land is used for legumes and the majority part of it is used for feed (SBA, 2018). According to Riksmaten 2010 (Amcoff, 2012), the Swedish diet in 2010 contained about 12 g of cooked legumes per person and day. A scenario designed by Röös *et al.* (2020) where 50% of the meat consumption is replaced with 55 g (20 g dry weight) of Swedish produced legumes has shown that it is possible to meet an increasing demand in legumes. It would increase the use of arable land for cultivation of legumes to 3.2%. In the scenario more land will be available for food production as a consequence of the decreased need for feed (Röös *et al.*, 2020).

If the whole population in Sweden adapted a plant-based diet, how much land is needed and what is known today?
There are different studies comparing different things, but plant-based food demands less land than animal-based food, according to several studies (Aleksandrowicz *et al.*, 2016; Chai *et al.*, 2019; Rabès *et al.*, 2020), at the same time as there are studies that claim that a diet with a small amount of animal protein is more land sparing (Kernebeek *et al.*, 2016).

What kind of underlying diet data and other data, as well as method to calculate the land use (e.g., region specific or global) and in which way food losses and waste along the food chain are included in the results or not, will be of great importance for the results. Here are some examples of studies that illustrate the differences: 1 gram of protein from beef that is consumed takes 42 times more land compared with staple plant foods (Cleveland & Gee, 2017), 1 kg of beef demands as much as 163 times more land than rice or potatoes (Scarborough *et al.*, 2014); depending on which animal the diet contains it requires 6-17 more land than soy beans (Reynolds *et al.*, 2014); FCR (feed input per unit of fresh product) is used to communicate how effective an animal is in converting feed to protein and differs much depending on what aspects are included, such as which type of animal it is and in which circumstances (Wilkinson, 2011; Mottet *et al.*, 2017). When numbers for land use are showed for a complete diet, it also differs between different studies which the following text will highlight.

Land use for different diets globally – rich regions claim a bigger share
There are studies that have calculated the demand for land for food production. Kastner *et al.* (2012) have calculated (data from FAO and Kastners own calculations) land requirement for different foods and energy intake for an average diet – per person and total for the whole world and regions, Table 1.1. As an example: Northern Europe consumes more animal foods and use more land compared to Eastern Africa. Kastner *et al.* (2012) also show that luxury food, i.e., food that is not necessary physiologically, is consumed in greater amount in the rich regions compared to less rich regions. On a global level it could be said that rich countries take resources from less rich countries.

Table 1.1. *Total intake of calories, land use and intake of luxury food, shown for the global average and two contrasting regions (North Europe and East Africa). These regions were chosen in this thesis just as an example to show the difference between rich and developing countries, but other regions could have been used for the same purpose. Based on Kastner et al. (2012).*

[1]Northern Europe: Åland Islands, Channel Islands, Denmark, Faeroe Islands, Finland, Guernsey, Iceland, Ireland, Isle of Man, Jersey, Norway, Sark,

Year 2007	Total Kcal/cap/day	Of which is from animal sources:	Land use m^2/Cap/yr.	Of which is from animal sources (m^2/cap/yr.)	Stimulants/Alcoholic beverages/sugar and sugar crops[3, 4] m^2/cap/yr. % of total land use/cap/yr.		
					Alc. beverages	Sugar	Sugar crops
World	2780	481 (17%)	1 732	668 (39%)	**World, year**		
					33	24	42
					0.19%	0.14%	0.24%
N. Europe[1]	3362	1057 (31%)	2 127	1 232 (58%)	**N. Europe, year**		
					146	56	35
					6.9%	0.26 %	0.16%
E. Africa[2]	2036	145 (7%)	1 774	332 (19%)	**E. Africa, year**		
					11	8	22
					0.6%	0.045%	0.124%

Svalbard and Jan Mayen Islands, Sweden, United Kingdom of Great Britain and Northern Ireland
[2]Burundi, Cosmoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mayotte, Mozambique, Réunion, Rwanda, Seychelles, Somalia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
[3]Coffee, tea, cocoa beans, [4]Sugar cane, sugar beet, sugar, sweeteners

Animals eat rest products and make use of land not suitable for cultivation of food

Kernebeek *et al.* (2016) conclude that a plant-based diet is always more land demanding than a diet that includes animal protein in small amounts; 12% of animal protein in the diet is the optimal amount. The reason that a small amount of animal protein is better than a total plant-based diet, according to Kernebeek *et al.* (2016), is that animals can eat rest products produced by humans instead of let it go to waste, and their ability to make use of land (grazing and in that way produce animal proteins for humans) not suitable for cultivation of food for humans. Kernebeek *et al.* (2016) also mention that there are other studies (Meier & Christen, 2013; Hallström *et al.*, 2015) which means that plant-based diets need the least amount of land (second best is lacto-ovo-vegetarian diets) and explain that the reason for this contradiction is that the mentioned studies have not included the aspects of rest products and land not suitable for cultivation.

Chai *et al.* (2019) concluded that a plant-based diet is the least land demanding diet compared to omnivorous and lacto-ovo-vegetarian diets. The result also says that it is possible with a diet containing a small amount of animal derived foods reaching the same environmental impact as a plant-based diet. Chai *et al.* (2019) also notes that depending on what food items a plant-based diet contains the environmental impact can be similar to a diet with locally produced animal products.

Three scenarios with animal derived food gave idea to plant-based scenario

Röös *et al.* (2016) examined different diets and their impacts on the agriculture. All diets in the study by Röös *et al.* (2016) contain animal derived food, although in relatively low quantities, 11-21 kg of bone-free meat per capita and year. In comparison, according to the latest food intake survey from 2010 (Amcoff, 2012), used in Röös *et al.* (2016) about 50 kg bone-free meat was consumed.

Röös *et al.* (2016) created a model to calculate three different scenarios, built on following four principles: 1) Arable land will mainly be used for human food; 2) Animals will eat rest products not

wanted or suitable for humans; 3) Biodiversity conservation: semi-natural grassland will be grazed and 4) Fair diet: the diet must reach the nutritional recommendation and use not more land than what is available globally for each person and year (2100 m^2).

In this thesis the diet is completely plant-based and only the aspect of a fair diet is considered, i.e., how much arable is needed for a plant-based diet with fulfilled nutritional recommendations?

Further, Röös *et al.* (2016) use the concept ”Planetary boundaries” (Rockström *et al.*, 2009a) considering the environmental sustainability and claim that despite the reduced consumption of animal derived food, the diets used more resources than what were available. Even in the least resource demanding scenario, the environmental sustainability limits are exceeded in terms of climate, nitrogen and phosphorus. It is discussed that ethical aspects and different perspectives, such as animal welfare, could be important to include in the discussion about sustainable diets (Röös *et al.*, 2016).

Not realistic that people will change how they eat?
In a later publication (Karlsson *et al.*, 2018) built on previously named study (Röös *et al.*, 2016) researchers and NGO’s worked together to create a future food vison. In this vision animals were included, but the amount of animal food products in the diet was heavily reduced compared to the amounts today. They suggest that a complete plant-based diet could be one way to cope with the climate impact, as a plant-based diet has the lowest climate impact (Hallström *et al.*, 2015). This was discussed with the NGO’s but not accepted. They wanted to have grazing animals on the natural pastures and crop rotations with ley and this would be used as resource efficient as possible because the grazing animals would also be eaten. Furthermore, it was not accepted due to the agroecological approach to respect different traditions and cultures and values; the participants agreed on that the future food vision would contain foods that is eaten in the region at the time (Karlsson *et al.*, 2018).

Grazing causes biodiversity
Grazing animals graze and walk on the lands and by doing so they contribute to biodiversity conservation and to the aesthetic open landscape that is valuable for many humans (Lund & Olsson, 2006). Yet, one often used argument against a plant-based diet is that a diet containing of meat and dairy is necessary for the biodiversity conservation (Rook *et al.*, 2004; Jerrentrup *et al*., 2014, see Röös *et al.* (2016); Röös & Torpman, 2021).

Alternative methods to grazing can be used to sustain the biodiversity
Meadows and pastureland are of big value for the biodiversity since they provide a unique environment for many species. Grazing animals are important for the biodiversity on these lands. It is a challenge, both practical and economic, to bring the animals to the pastures. Also, the number of animals available are decreasing. However, it is possible to work with alternative methods with satisfying results, but the methods need to be developed further (Carlsson *et al.*, 2014). Carlsson *et al.* (2014) have gathered and examined the knowledge for alternative methods, e.g., different types of machines that can be used for meadows and pastureland and different possibilities to use the harvested material as a resource, such as for energy as biogas.

In Sweden 75% of the arable land is used to grow feed for animals
The major part of the arable land in Sweden, 75%, is used to produce feed to animals (Röös *et al.*, 2016) which later end up on our plates. This is an energy demanding way to produce food but also an ethical issue. Instead of using the land to feed animals and at the same time loose huge amount of energy and nutrients, the land could be used to grow food for humans (Röös *et al.*, 2016:11-12; Broom, 2019).

1.3. Aim

The aim of this study is to investigate how the perspective of animals in the agriculture is described in the context of sustainable land use if a transition to a plant-based diet would occur and to investigate how much arable land that is required for a plant-based diet.

1.4. Research questions:

1. How is the animal perspective described in discussions about sustainable land use?

2. How much land is required for a completely plant-based diet for the Swedish population, fulfilling the nutritional recommendations?

1.5. Delimitation

GHGs
The menu is only calculated for land use. However, regarding GHG emissions it is known that a plant-based diet in general has lower GHG emissions than a diet containing foods derived from animals (Aleksandrowicz *et al.*, 2016; Chai *et al.*, 2019; Rabès *et al.*, 2020).

Fertilizer use
In the scenarios designed by Röös *et al.* (2016) the environmental sustainability limits are exceeded in terms of nitrogen and phosphorus. This has not been studied in this thesis.

Land use for fodder to grazing animals
If grazing animals are going to graze natural pastures, they will need fodder during the winter (Röös *et al.*, 2016). No calculation of land use for fodder was made.

Land use for ley in crop rotation is not included in the scenario
As ley in crop rotation is not included in the scenario there are some challenges. The most central advantages with ley are that ley can hinder eutrophication and contribute to the soil structure and

hinder soil erosion because of the large biomass and roots that will be in the soil all year around. It can also contribute with increased soil carbon storage. If there are legumes in the ley such as clover, it also contributes with biological nitrogen fixation (Carlsson *et al.*, 2014). However, there will be a discussion about the possibilities to cultivate ley in relation to the results about land use.

Work opportunities
What will happen to those who no longer can make a living out of the animal agriculture is not studied in this thesis.

Willingness to eat plant-based food/to stop eat animal-based food
No analysis about the probability that people chose to eat plant-based is made, i.e., about how likely a plant-based scenario is in Sweden today, considering current laws and norms.

2. Method

This study contains two methods. The first is a qualitative method: a focus group discussion that aims to study how the animal perspectives are described by people with knowledge and experience of nature conservation when discussing sustainable land use in a plant-based scenario. The second method is quantitative and focuses on land use and diet: calculation of land use for a plant-based diet from a weekly menu designed by the Swedish Food Agency. The qualitative method will be described first.

2.1. The qualitative method

The qualitative part of this study used a focus group discussion to collect information about how the animal perspective is described by people working with nature conservation or similar, when they discuss sustainable land use in a plant-based scenario.

About focus group and its leader in general
A focus group can be used to form an idea of what is being discussed about a particular issue in a society or, as in this study, a particular occupational group. The focus group consists of people who are interested in and/or have knowledge of a subject but who otherwise do not need to have any common points of contact (von Essen, 2021a).

The focus group leader, the author of this thesis in this case, initiates the discussion by giving the group a subject for the participants to discuss. During the discussion the focus group leader will take part as little as possible to let the group discuss freely. The focus group leader will only interact when it is needed to initiate additional themes, when something in the discussion needs to be clarified or when the discussion loses its focus and needs some guidance back to the subject. Also, the focus group leader needs to ensure that all of the participants get the same amount of time to speak (Wibeck, 2010b:11-12). Wibeck (2010b) recommends four to six participants but there are other recommendations as many as sixteen (Wesslen, 1996). In a focus group the participants give their point of view and in that way it can generate additional ideas that could be unexpected for the researcher (Wibeck, 2010b:50-51).

Recruitment of the participants for the focus group discussion
For the focus group discussion, participants working with nature conservation or similar subjects were chosen for their expected experience in nature conservation and land use, and knowledge about some of the different perspectives in this area. For example, in the meetings with landowners

and farmers, nature conservationists get an opportunity to understand their perspectives. Thus, they were expected to have a system perspective and local knowledge and an ability to identify and understand related challenges and potential solutions.

The participants were contacted via email (Appendix 7.1) that was sent to: 1) all 21 County Administrative Board in Sweden; 2) persons identified through a search for "naturvårdare" (nature conservationists) on Google; 3) the Swedish Environmental Protection Agency; 4) the Swedish Board of Agriculture and 5) Fifteen municipalities with even geographical spreading. It resulted in six positive answers and five of them participated in the focus group meeting. Below follows a short presentation of the participants.

Presentation of the participants
There will be no specification of where they work nor their names because of protection of their identities. Four of them worked at the time as nature conservationists and one with administrative tasks related to nature conservation. Two of them worked mostly with endangered species mainly dependent of agricultural landscapes, often a grazing landscape and one of them also worked with the restoration of pastures. Two of them worked as managers mainly for pastures and mowing fields, both with reserves. One of them also worked with pastures in the city. One of them was an agronomist and worked with administrative tasks and control of area for the agriculture subsidies.

2.1.1. Data collection

Why was focus group chosen in this study?
By gathering a group of people asking them to talk about a topic makes it possible to mirror a broader and more general view compared to individual interviews that instead will be about the opinions of individuals.

Implementation - the focus group discussion
The discussion was held online via the meeting program Zoom and the author of this thesis was focus group leader. The topic, the same that were described in the invitation letter, see Appendix 7.1, was presented digitally, both verbally and written to the group of five participants. If the discussion lost its focus, a supplementary question was asked and when the discussion was satisfied a new theme was presented. All themes and questions asked by the author are presented in Appendix 7.2. The meeting lasted 1 hour and 45 minutes. An assistant was available during the discussion in case of e.g., technical issues.

Transcription
Both audio and video were recorded by the program Zoom and an additional audio recording was made. Both recordings were used during the transcription and transcribed word by word (called verbatim). The transcript was checked several times to the recordings, both audio and video.

2.1.2. Thematic analysis

Analysis of the focus group discussion was made by thematic analysis according to Braun and Clarke (2006). It was used to categorize and sort material in a way to find patterns. The analysis was done by the following six steps:

Step 1. Familiarizing with the data
The video recording was helpful to ensure that nothing was left and to understand their argumentations better. Reading of the transcript was done to stay as objective as possible and only focus on the actual words.

Step 2. Generating initial codes
In this phase the transcript was checked for codes. The whole transcript was systematically elaborated several times. The coding was made manually, first in a document with three columns where the whole transcript was put in the left column. In the middle column the transcript was written with less words to easier see the content. In the right column the essence of the content was written, the codes, in one or a few words or in a short sentence.

Step 3. Searching for themes
In the subsequent step the different codes were written on different papers and served as a mind map to start figuring out the different relations and levels of the themes.

Step 4. Reviewing themes
In this step several potential themes were identified. This step was a way to organize and come forward in the process to see how codes and themes, respectively, related to each other. Many of the themes that was gathered was sub themes to a few main themes. In this stage it was useful to repeatedly go through the recording to enable a review of the codes.

Step 5. Defining and naming themes
When the final themes were identified they were defined and given names that captured the content.

Step 6. Producing the report
The opinions and citations from the discussion were organized into the different themes.

2.2. The quantitative method

The quantitative method estimated the amount of arable land needed for a plant-based menu, which is named the Initial menu, for the entire population in Sweden for a year. The Initial menu was compared to what will be named as the Changed menu. No considerations have been taken regarding the geographical resolution such as different soils and climate conditions. All data on crop yield levels are derived from national and international statistics and based on conventional farming. Statistics based on conventional farming was chosen because it was difficult to find

statistics for organically grown food at the time, especially in Sweden. Also, no animals are used for food in the scenario and therefore no manure that can be used to grow crops.

The starting point was a weekly plant-based menu, Table 2.1, from the Swedish Food Agency (SFA) fulfilling the nutritional recommendations. The Initial menu is based on a food survey for students in 2014.

Table 2.1. *Initial menu for one week.*

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
BREAKFAST	Porridge oat with oat drink and apple puree 1 soft rye bread 1 soft white bread Margarine, bean paste paprika Juice 1 dl	Oat-based yoghurt with cereals and dried fruit 1 soft rye bread 2 crisp breads Margarine, hummus Juice 1 dl	Oat drink with cereals and dried fruit 2 crisp breads 1 soft rye bread margarine soya cheese Juice 1 dl	Oat drink with cereals and dried fruit 2 crisp breads 1 soft rye bread margarine avocado, sprouts Juice 1 dl	Molino porridge with oat drink and apple puree 1 soft rye whole grain bread 1 soft white bread margarine hummus paprika, Juice 1 dl	Oat drink with cereals and dried fruit 2 crisp breads 1 soft rye bread margarin nut and almond butter sprouts Juice 1 dl	Semolina porridge with oat drink and apple puree 1 soft rye bread 1 soft white bread Margarine, hummus paprika Juice 1 dl
	Banana Tea with oat drink	Apple Tea with oat drink	Clementine Tea with oat drink	Banana Tea with oat drink	Apple Tea with oat drink	Pear Tea with oat drink	2 Crusts with margarine Tea
LUNCH	Fried chickpea steaks with broccoli and tomato sauce with boiled bulgur Salad: different kinds of lettuce, carrot with vinaigrette sauce Honeydew melon 50 g	Cooked pasta with tomato sauce and soy-based cheese Salad: different kinds of salad cucumber, pepper and olives with olive oil Pineapple 50 g	Boiled soy sausage with boiled potatoes and spinach stew Salad: different kinds of lettuce, cucumber, tomato, carrot and cooked chickpeas and olive oil Apple 1	Falafel with salad of cucumber, tomato, carrot, corn, avocado and tofutti and olive oil 1 pita bread Orange ½	Carrot steaks with tomato sauce and mashed potatoes Salad: cucumber, tomato, lettuce, olives, corn, cabbage and vinaigrette Honeydew melon 50 g Walnuts	Potato buns with mushroom sauce and spinach Salad: cabbage, green beans, olive and flaxseed oil, cashews, mango 50 g	Warm quinoa salad with tofu, lettuce, cashews, alfalfa sprouts and olive oil Orange 1
	1 rye bread margarine tomato Tea with oat drink	2 Sandwich wafers margarine Tea with oat drink	2 Sandwich wafers margarine, tomato Tea with oat drink	2 Sandwich wafers whole grain, margarine tomato Tea with oat drink	1 rye bread margarine tartex Tea with oat drink	Dark Chocolate, dried fruit, banana chips, Pistachios	1 cinnamon bun Tea with oat drink
DINNER	Tofu pai Salad: different kinds of lettuce, white beans, tomato and avocado Dressing: Olive oil and lemon juice	Lentil soup 2 ryebread whole grain margarin, hummus cheese made of soy Salad: 100 g mixed salad Banana	Pizza Salad: cabbage, ruccola and cucumber Dressing: Flaxseed oil and lemon juice Pear	Aubergine with soy mince sauce and boiled millet Salad: ruccola, corn, alfalfa sprouts, tomato and avocado grapes	Mushroom stew with coconut milk brown rice Salad: fermented mixed vegetables, marinated chickpeas Dessert: pannacotta with raspberries Drink: 3.5% beer 3.3. dl	Veg burger with bread, tomato, lettuce Tofutti Salad: lettuce, sprouts, beans, cucumber and olive oil Drink: 1.5 dl white wine 12%, pear	Bean stew cooked whole grain pasta with soy cheese Salad: carrot, orange, lettuce different varieties and olive oil Dessert: Apple pie with ice cream (oat)
	Whole grain unsweetened crusts blackberry jam Oat drink 1.5 dl	Semolina pudding with juice sauce	1 soft graham bread hummus margarine Oat drink 1.5 dl	Rice frutti (whole grain millet with oat drink and oat fat 13%) Strawberry jam	Nuts and seeds 40 g (walnuts, pumpkin seeds, squash seeds, sunflower seeds)	1 Crust whole grains with blackberry jam Tea with oat drink	1 Sandwich wafer whole grain margarine and hummus, oat drink 1.5 dl

First there is a brief overview of the different steps that were implemented to calculate land use, followed by a more detailed description.

1. Initial menu from SFA given in meals (Table 2.1).
2. Amount of raw product needed for the Initial menu.
3. Amount of land needed to produce the raw product using statistics from the Swedish Board of Agriculture and FAOSTAT (FAO (2020b) for imported produce between the years 2008 and 2017.
4. Amount of food losses and food waste for the Initial menu. This was added to step 3 and the result is the total amount of land needed for the Initial menu.

Here follows a more detailed description of the method:

1) Initial Menu

From the Swedish Food Agency a plant-based initial menu (Table 2.1) for one week was received in 2015 and is based on a food survey for students made in Sweden 2014. The oat drink, oat yoghurt and margarine are fortified e.g., with B12 and vitamin D, see Appendix 7.4. The Swedish Food Agency have calculated the Initial menu regarding the nutritional content to ensure the nutritional needs are covered. The Initial menu was given in meals. It has an energy content of 9.42 MJ (2250 kcal) per person and day. The nutrient content is showed in Appendix 7.3.

2) Converting the Initial menu to raw product

To be able to calculate the amount of raw product for each of the meals a recipe was needed. Thirty of the recipes were received by SFA (an example of a recipe is shown in Table 2.2), thus not covering all of them. For the meals without a recipe the content was estimated based on recipes that were found at websites such as Ica.se and Vegomagasinet.se. Some of the ingredients is a mix, for example oat drink that contains both oat and rape seed oil. In these cases, producers were contacted. Many informative answers were received but also answers telling it was confidential information and sometimes no answers at all. In those cases, the ingredient list and macro nutrient content on websites and packages were used to calculate the amount of the different food items.

Table 2.2. *The recipe for tofu pie*[1].

INGREDIENTS	AMOUNT	WEIGHT (g)
Tofu (made of soybeans)	500 g	500
Broccoli (frozen)	400 g	400
Soy cream	250 g	250
Wheat flour	4 dl	240
Onion, red	2	190
Rapeseed oil	125 g	125
Soy drink	125 g	125
Tomatoes	1	80
Olives, green with red pepper, drained	1 dl	45
Sundried tomatoes in oil, drained	25	25
Garlic	2 gloves	6
Basil, fresh	0.25 dl	1.25
Salt with iodine	1 g	1

[1]Example: The whole tofu pie weigh 1988 g. One portion is 300 g. The amount of tofu needed for the pie is 500 g. Tofu contains of soybeans and water. About 250 g of soybeans is needed for 500 g of tofu (Yi-Pin, 2016).

3) The statistics for yield per square meter

It was decided to use Swedish produce for all crops that have yield data reported in the Swedish national statistics. The statistics for yield per hectare for crops produced in Sweden were taken from the Swedish Board of Agriculture between the years 2008 and 2017. Data for imported produce were collected from the FAOSTAT (FAO, 2020b) where "world" and "yield" were chosen for the same period. In some cases, there were no information about some of the years for the Swedish statistics, yet data was always between 2008 and 2017. It was decided to have the same years for Swedish and imported produce instead of having the latest published years.

The following two examples show how the calculation was done: For soybeans the average yield according to FAOSTAT (FAO 2020b) was 0.254 kg/m^2 (2540 kg/ha) for the chosen period. The recipe for the pie (Table 2.2), is for more than one person, thus the amount for one person was calculated based on information from the SFA. The Initial menu is for one week. To know how much raw product is needed for one year it was multiplied with 52 (weeks), and food losses and waste were accounted for (Table 2.3) and is further explained in the next paragraph and Table 2.4. Another example: the tofu pie recipe contains 125 g rapeseed oil (Table 2.2). Three times more rapeseed are needed for one unit of oil according to information from a Swedish rapeseed oil producer, thus 375 g of rapeseed is needed (losses and waste not accounted for).

Table 2.3*. Raw product to land use. Example of how the calculation was made from amount of soybeans in the recipe for tofu pie, for one person one time every week, to land use for a year.*

Raw product: Soybeans Average yield: 0.254 kg/m^2	Per person
Amount (g) soybeans for one portion of pie	37.7 g
One year (1 portion/week) 52 weeks	1.96 kg
Need to be produced - food losses and waste included	2.20 kg
Land use **including** food losses and food waste	8.6 m^2
Land use **without** food losses and waste	7.7 m^2

4) Food losses and food waste

Much food is lost along the food chain. There are losses during the agricultural production; postharvest, handling and storage; processing and packaging; distribution to supermarkets and finally at the consumer (FAO, 2011). Consequently, more food needs to be produced than what is eaten. To calculate this, Annex 4 in the report from FAO on global food losses and food waste (FAO, 2011) was used (Table 2.4). The first step[1] of the agricultural production, that is "losses due to mechanical damage and/or spillage during harvest operation (e.g., threshing or fruit picking), crops sorted out post-harvest, etc." (FAO, 2011:2) is already accounted for in the crop yields statistics (Ländell, 2021) and therefore it was not calculated for in this thesis.

Table 2.4. *Food losses and waste in the food supply chain, based on (FAO, 2011).*

	Agricultural production[1]	Postharvest handling and storage	Processing and packaging	Distribution: Supermarket	Consumption
Cereals	2%	4%	0.5%	2%	25%
Roots and tubers	20%	9%	15%	7%	17%
Oilseeds and pulses	10%	1%	5%	1%	4%
Fruits and vegetables	20%	5%	2%	10%	19%

The initial menu was partly updated with some changes

The changes were: 1) rice was changed to oat; 2) millet was changed to a mix of rye, barley, and oat with equal amounts; 3) chickpeas was changed to beans; 4) half of the olive oil was changed to rape seed oil; 5) semolina porridge was partly changed to whole wheat porridge; 6) grapes was changed to apples. For these changes (1-6) land use was calculated and compared to the Initial menu. There were also some additional changes discussed but land use was not calculated for those. The reasons for including a changed menu are described below (Section 2.3.3).

2.3. Method discussion

2.3.2. Focus group discussion (qualitative method)

The group constellation

The recruited group consisted of four women and one man. Four of them were meat eaters and one of them was vegan and they were from both the northern- and southern parts of Sweden. Being meat-eater or vegan was not regarded before the meeting and it was first in the end of the meeting the vegan participant labelled themself as vegan, still, the different nature of the perspectives was highlighted during the conversation and expressed by the participants as something positive. These two opposites were probably positive for the dynamic and the generation of additional reflections by the participants although as the meat eating norm is the dominant norm it is an imbalance even with the equal amount (Weitzenfeld & Joy, 2014).

The participants were aware of the geographical differences and discussed it. Overall, it was not possible to say how the participants experienced it and how they would have expressed themselves in a different group composition. The nature of the subject can be sensitive and awkward for people

who are used to eating meat and using animals in other ways. It can sometimes be difficult to know if a question exceeds a limit for someone when different ways to see the world collides.

Transferability

To what extent the results from qualitative research can be applied outside the focus group discussion is called transferability (Bryman, 2008:34). The intention was to also have at least two individual interviews after the focus group discussion, but unfortunately there was no interest. This could have been a way to enrich and strengthen the interview material (von Essen, 2021b).

Ethical considerations

As a researcher it is crucial to ensure that the participants know everything about the research that is necessary for them to not be harmed in any way. Information about the participants must be treated confidential, for example it must be impossible to identify the individuals for persons from outside the research team. It is a central principle to respect the integrity of the participants and ensure that they will not feel uncomfortable during the research or after and this is important to communicate.

The ethical rules dictate that you inform the respondents: In the invitation letter and in the beginning of the focus group discussion the participants were informed about the purpose of the study (Information), that the interview was voluntary and could be cancelled at any time (Voluntary), the material being confidential (Confidentiality) and how the interview material was intended to be used (Utilization). They could end their participation whenever they wanted to without any explanation (Patel & Davidson, 2003:60-61) and they were asked if they agreed to be video recorded (Consent). They were informed that the recorded material would be deleted as soon the thesis was finished and that no one else would have access to it. They were informed that the thesis would be sent to them before it is published so they could see if there was something they wanted to change. No request for change was received after sending the thesis to the participants. They were also informed that they will be anonymous in the final version of the thesis (Patel & Davidson, 2003:105). However, a problem that comes with focus groups is that it is impossible to control if the participants share information from the discussion to external people.

Limitations

The researcher is involved in the research and can never be just an observer. This is a limitation because no matter how transparent the research is, there are things that cannot be controlled, for instance how the group leader may affect the participants. However, they discussed easily with each other and seemed to be unaffected. Possibly, the distance by having the meeting online made it easier for the participants to focus on each other. They were informed that my role was to listen to them and their discussions and to interact as little as possible.

During a focus group it is important that the participants feel relaxed and comfortable with the situation to be able to have a good discussion, otherwise people can be inhibited and not contribute as if they were comfortable, and this could perhaps be easier to achieve when meeting in person. To meet people via the computer screen for the first time reduces the amount of communication compared with a meeting in real life. But meeting in real life also comes with some challenges, for

example the place for the meeting and the possibility for the participants to interact with each other independent of where they sit. When people sit in front of each other they interact more compared to if they sit next to each other (Wibeck, 2010a). In Zoom all the participants were in front of the screen the whole time.

The participants might come across each other in their work. They can feel inhibited to share their personal opinions if they do not fully trust that all of them will keep the information in the group, however this is not possible to control.

The plan to have a short individual meeting with all the participants separately from the other in the focus group to inform about the meeting program (Zoom), was not possible to manage. Instead, it took about 20 minutes in the beginning of the focus group meeting to learn about the program. This time was not wasted, they all participated and helped each other to understand Zoom. The interaction probably contributed to a more relaxed and comfortable feeling for the participants, as a "warm up" before the discussion.

A phone call occurred during the discussion, and it was some problem with the internet connection for some of the participants but except from that the meeting ended up very well.

All citations are translated from Swedish to English by the researcher, thus there can be misinterpretations.

2.3.3. Calculation of land use (quantitative method)

Swedish vs. Imported

As long there was statistics to find for Swedish raw product, it was chosen. This can be a contradiction to what is most resource efficient. For instance, tomatoes grown in green houses in Sweden need energy for heat and light in comparison to a country where the sun serves as the energy source, but the use of pesticides in Sweden might be less. On the other hand, tomatoes growing on free land in Spain can have a high-water demand (Karlsson Potter *et al.*, 2020; WWF, 2020b). Fossil fuels from transportation can be reduced, how much depends on the choice of transportation.

Nevertheless, a reason for this choice is that one of the Swedish Food Strategy overall goals is to increase the Swedish food production (Government Offices of Sweden, 2017). With an increased domestic food production, a higher level of self-sufficiency can be reached with an increased resilience, in case of disturbances such as conflicts and natural disasters.

One of the missions that the Swedish Food Agency has is to increase the knowledge and awareness in the society about how the food is produced to enable sustainable food choices. According to agroecology, reconnecting the people to the food system is one of several important aspects that defines sustainable food systems (Gliessman & Engels, 2015:16-17). It will enable an engagement

and an opportunity to be part of and have a say how and what food that is produced, how it is exchanged and distributed.

Statistics based on conventional farming
Statistics based on conventional farming was chosen because it was difficult to find statistics for organically grown food at the time, especially in Sweden. Also, no animals are used for food in the scenario and therefore no manure that can be used to grow crops.

The menu can be improved
The menu was given from the Swedish Food Agency 2015 based on a survey from 2014. Since the menu is based on 2014 also some changes of the menu were discussed to better mirror the goals in the food strategy where SFA have the mission, among other things:

> ...to contribute to a competitive and sustainable food chain and that consumers have a high level of trust for the food and to be able to make conscious and sustainable choices. (The Swedish Government, 2019:1) Translated from Swedish by the author.

It was discussed with SFA of how the menu could be changed to be less dependent on imported produce and to be healthier. Based on the changes decided in the discussion, SFA created meals fulfilling the nutritional recommendations. Because of the additional workload for SFA the Initial menu was not entirely changed. The changes that were discussed with SFA are listed below with some additional changes not mentioned in the Changed menu (Appendix 7.4):

1) Rice was changed to oat.
2) Millet was changed to a mix of rye, barley and oat.
3) Falafel made on chickpeas was replaced with other food. For example, some varieties of hummus were added based on green peas, red beets and white beans.
4) Half of the olive oil was changed to rape seed oil.
5) Some of the semolina porridge was changed to whole wheat porridge.
6) Grapes and raisins were changed to apples and dried apples.
7) Luxury food: Sugar could be exchanged to fruit or other food
8) Instead of 700 g (one glass per day) of orange and pineapple juice respectively, juice was reduced and instead more fruits and berries were added.
9) Avocado was exchanged to other foods.
10) Coffee was added and replaced half of the tea.
11) Soy drink and soy cream were changed to oat drink and oat cream.
12) Palm oil was changed to rape seed oil.
13) Additional pumpkin seeds, sunflower seeds and hazel nuts were added.
14) The soy burger was changed to burger with black beans and the sausage made of soy was changed to lasagne with lentils.
15) Wheat pasta was changed to bean pasta.
16) Breakfast cereals and oat drink were replaced by a smoothie based on oat and berries.
17) A porridge of millet and cream. Millet was changed to buck wheat.

Unfortunately, it was not possible to calculate land use for the Changed menu in the same way that was done with the Initial menu, (i.e., from recipe to produce to land use), because of the additional workload, hence the main results of land use are based on the Initial menu. However, to get an idea of what impact the Changed menu had on land use, land use was calculated for the first six changes (1-6) listed above. Land use for the two menus is presented and compared in the Results (section 3.2.) and in the Discussion (section 4.2.). Changes 7-10 are discussed but there were no calculations of land use.

Calculate land use from recipes was time demanding

To calculate land use starting from a ready-to-eat menu and from there go backwards to estimate the amount of raw product was time demanding and based on estimates that may have caused bias. Yet, it can be beneficial for the understanding to show an actual weekly menu instead of presenting it in kg per product.

3. Results

First the results from the qualitative part (focus group) are presented followed by the results for the quantitative part (menu converted to land use).

3.1. Results from focus group discussion

The results from the focus group discussion ended up in three main themes and six subthemes (Table 3.1). The main themes are 1) Industrial animal agriculture is business as usual; 2) Caring about animals, and 3) Animals as subjects.

Table 3.1. *The main themes and the subthemes show the results from the focus group discussion.*

Main themes	**1) Industrial animal agriculture is business as usual**	**2) Caring about animals**	**3) Animals as subjects**
Sub themes	Effective animal production	How an animal is well cared for	Living side by side without seeing animals as objects
	Necessary to sustain established values	You can eat them because they have agreed to it	Animals have feelings and social needs

3.1.1. Theme 1: Industrial animal agriculture is business as usual

This theme describes how the participants express dislike against the industrial animal agriculture. How it is unsustainable because of prioritizing money before the welfare of animals and how the farmers have not much choice than to be as effective as possible. How the society has no insight in the systems and a consequence is that the sentient beings are reduced to the "meat on the plate" (Participant 5). The participants also described how it was to grow up in a meat-eating culture. There was an idea of how the animals have lived their lives and that we do not think more about it.

> We could not even imagine a house full of dogs on the same area as thousands of pigs but it is because they are in a building somewhere that nobody sees and then it is easier to distance yourself from that picture I think... But it is not often today that the neighbour has 20 ewes ... the norm is this big and then it is easier to see them as objects, that they are not even animals but the meat on the plate. (P5)

Sub theme 1. Effective animal production

The participants described the current industrial agriculture as centralized and unsustainable and how the society lost its connection to food production. They describe how animals are reared to produce as much as possible to be as affordable as possible and farmers are pressed to cut their costs to be able to survive at the market:

> And my whole education was about how you maximize profit from the animals in the agriculture. It was how you feed them as fast as possible and how you breed them to give birth to as many babies as possible. And all encourage that, you were not supposed to call yourself a farmer anymore, you were supposed to say you were a business owner. And you were encouraged to be bigger and bigger. (P5)

Current food system was described by the participants as unethical towards the animals:

> And those extremely large agriculture, no matter what kind of animals feels a little bit...unethical. (P3)

P3 questioned the use of high producing breeds that are used in current food systems and described how the animals could feel better:

> Do we really need them to be so high producing, every milk cow gives enormous litres of milk? They would maybe feel better if they were on lean lands and milked a little less. (P3)

P1 described that as a consumer you need to make a choice between meat that is said to be "climate smart" but comes from animals that lived lives with poor welfare and meat that is less "climate smart" but comes from animals with better welfare:

> I know that chickens are climate smart, but I do not think there are so many chickens that are able to live very well so that is why my opinion is...that I do prefer the grazing animal. (P1)

They described the food system as disconnected (P1, P5) and hidden from the rest of the society, both physically and emotionally. How it operates in huge facilities where the animals are maximally utilized (P5) when time and money are valued the most (P4).

The participants talked about how upbringing and culture have shaped our approach towards the animals and how we create an idea of how the animals in the agriculture have lived their lives and how we stick to that idea to be able to continue (to eat them) as usual:

> They (the animals) are almost seen as soulless, they are not seen as someone who has lived, they are simply reduced to the meat on the plate. (P5)

Sub theme 2. Necessary to sustain established values

The theme illustrates that it was difficult for most of the participants to picture a scenario where no animals were eaten. That animals can only exist if they benefit humans.

The participants described that the animals in the agriculture contribute with several values and these would be lost if the animals disappeared. P1 and P2 said that they believe it is possible to have a crop production without the natural pastures but that was not something they wanted:

> We want to have grazing animals and animal farmers can not disappear. (P2)

It was also described how animals in the agriculture can exist only if they benefit humans. If humans do not eat them, both the attractive landscape and the animals will disappear:

> They would not have the right to live if we did not have use of them. This is not what I think but that's how it is. (P2)

Another participant described it as "to not have animals at all, I see as no end in itself, I think" (P4).

One participant said that the attractive landscape, as a result from the grazing animals, is an important income from tourist activity, thus it is not possible with a plant-based scenario (P3). If the scenario will become reality the pastures will be overgrown because it would only be a social activity to take care of these lands:

> Even if there was a political will to pay people to take care of the land it would not be much more than a social activity. (P2)

3.1.2. Theme 2: Caring about animals

The theme is about how the participants described the world they want to have. In this world the animals are not solely raw materials that need to be used as resource efficiently as possible, it is also important to ensure they have good lives. Humans make sure they are treated well and are happy and in exchange the animals give their lives to us.

Sub theme 1: How an animal is well cared for

The participants described a world where the animals are eaten but treated well during their life. Several of the participants talked about their *dream world* and one of them reflected over they own approach:

> Yes, but I guess I have little bit of a romantic approach of agriculture after all, I suspect. I live in a village with two farmers which do not have a lot of animals and they know their animals and I go to the farmers shop and buy my fine natural pasture meat there and of course I dream about it could be like this everywhere. (P3)

Four of the participants described that when using animals as food the whole animal should be used. They also advocated eating less meat and when eating meat, it should be something exclusive and expensive.

They talk about how the milk cows probably will feel better and thrive if they milk less and stay at less nutrient rich soils. It was expressed like "a meat that is well cared for" (P3) and:

> We could eat more expensive, a little more exclusive meat that had walked on shore meadows, natural pastures or something. (P1)

Sub theme 2: You can eat them because they have agreed to it

It was described how the perception that farm animals were both friends and later food, was no subject of discussion on the farm where P2 grown up:

> You were like friends with them. But there was no talk about that they were not going to be eaten. (P2)

One of the participants, P1, described the view of the relation between humans and animals as an agreement. Humans look after them and care for them and for that they give us their life so we can eat them:

> But I probably do not see them as objects, but I probably see them as, it is some kind of agreement that we have, that we try to do as good as we can in every way towards the animals but...then we eat them. (P1)

The participants also talked about other alternatives, e.g., the possibility to have the animals as employed and let the society pay for the ecosystem services. They said nothing about what would happen to the animals in a later stage.

Four of the participants described themselves as mostly eating vegetarian food and eating meat mostly from natural pastures. One participant reflected over the free choice and how it can restrict the ability to change norms:

> Today we have the freedom of choice, but I mean that a social movement is needed where the norm is to eat plant-based but you can eat meat if it's fine. (P4)

3.1.3. Theme 3: Animals as subjects

In this theme the participants described how they struggled trying to imagine a plant-based scenario where animals are not eaten. It is not realistic to stop eating meat but if it happened it would come with a lot of problems which will be hard to solve. They asked themselves questions about how to handle animals when they become too many and how to protect us from them. They described how they ended up asking themselves if it is even possible to not see animals as objects.

A different view was described as a possible approach to the plant-based scenario. In this view we were asked to expand our moral circle of compassion to also include animals (P5). P1 said that we live in a system in where we do as best as we can.

Sub theme 1: Living side by side with animals without seeing them as objects

The participants described, if being in a plant-based scenario, how it could be avoided that the number of animals will increase and how it could be possible to prevent them to be in places where they are not wanted. It was described as something difficult to control.

They described that if we do not see animals as objects, it would be difficult to protect ourselves, our crops and roads from the animals. One of the challenges raised was how we could handle "parasites on our bodies" (P1)?

P1 described how these issues are challenging and that these were often discussed with the family where the children used to ask why we need to eat animals instead of letting them be old: "It's not easy, should we give them birth control pills" (P1)? This solution, to give them birth control pills, was described to be even more unethical and objectifying than killing and eating the animals (P4).

One of the participants described how the society favours humans and that something else would be difficult:

> Is it even possible with a plant-based scenario if we stopped seeing animals as objects? ...We agree on that the culture is for the benefit of humans today and that is not the society that I think, always is correct, but now it is what it is and it is difficult to find something else. And that is why the animals become objects. But it would have been exciting to explore where they are not. (P4)

The participant, P4, reflected over why they said animals were not objects but at the same time described the relationship they called the agreement (described in sub theme 2 by one of the participants). P4 was describing the agreement but instead of an example between an animal to be used for food and a human, the example was between two humans:

> Production of human meat as a meat-based diet, I have a little trouble to see but I can say I think if you look at the alternative what we could do if they were not objects then the world would look very, very different. It is a huge transition that would be needed. We would need to release everything and then live and let die, as I interpret it. How would we do with the animals, do you suggest if they were...then everything needs to be released. (P4)

Sub theme 2: Animals have feelings and social needs

In this theme the animals were described as individuals with feelings and social needs, just as humans have feelings and social needs. It was described by one of the participants that it was positive for the discussion that this perspective raised by P5, also was discussed:

> It is very good that you (P5) are here. How would this discussion be otherwise? (P3)

Another way of seeing the plant-based scenario where the animals were exclusively grazing animals and not food, was raised:

> They could graze their whole lives and die of age. We do not need to kill and eat them to sustain the valuable lands. (P5)

Participant P5 described how the animals in the agriculture are sentient beings just as our pets and described that it is possible to widening our ethical thinking towards the animals:

> One is not aware about what priorities that occur in one's own ethical thinking, so one is not aware of that others also have feelings and feel pain and love. (P5)

They described how they do their best in the existing system and where some, possible even humans, are more objects than others:

> It is difficult. We are inside a system. Where I feel that I can only do as good as possible. Some are more objects than others, that is how it is. My dog is also an object. I decide when it will die and not die. I take it to the limit now, I will say like this that what we think about humans in other countries it is not objects we think about, but we actually decide through our politics if they will live or die. So this, it is deep inside us, this. (P1)

Summary

The results show that industrial agriculture is viewed as disconnected from the society and that it is unethical towards the animals. An ideal world is described in which meat eating is substantially reduced and where the animals are treated well. The animals should be chosen so they can thrive in the place where they will stay. A scenario without eating animal products is described as unrealistic because of the problems that will follow and all that will be lost. Another perspective is trying to show how all animals want to live and that we should be conscious in how we separate animals for different purposes as we do with the animals we have as pets and the animals we raise for food.

3.2. Results: Land use for a plant-based menu

The amount of arable land needed for the Initial menu is 1790 m^2 per person for a year, including losses and waste (1.79 million ha for 10 million people). The raw product grown in Sweden requires 993 m^2 and 796 m^2 per person for the imported raw product (Table 3.2). The amount of arable land in Sweden 2020 was 2 549 500 ha (SBA, 2020) which gives opportunities for an increased food production.

The crop categories and the demand of land in square meters per person is presented in Table 3.3. For supplementary data, see Appendix 7.5.

It was shown that some changes of the raw product in the initial menu could reduce land use with 31% to 1230 m^2. This is described in the next Section (3.2.1.).

Table 3.2. *An overview of land use per person and year, needed for the Initial menu and for the Changed menu. Land use for the two menus is also shown as percent of total arable land in Sweden. Total arable land in Sweden is presented in hectares. 1 ha is equal to 10,000 m^2*

Land use for the Initial menu and for the Changed menu	Area m^2	Proportion of total land use %	Proportion of total arable land in Sweden which is 2 549 500 ha %
		INCLUDING FOOD LOSSES AND WASTE	
Initial menu, total land use	**1790**		70
Swedish raw product	993	56	39
Imported raw product	796	44	31
Land use for food losses and waste	442	25	17
Changed menu, total land use	**1230**		48
Swedish raw product	674	55	27
Imported raw product	555	45	22
Land use for food losses and waste	306	25	12
		WITHOUT FOOD LOSSES AND WASTE	
Initial menu, total	**1350**		53
Swedish raw product	699		27
Imported raw product	652		26
Changed menu, total	**922**		36
Swedish raw product	506		20
Imported raw product	416		16

3.2.1. Land use can be reduced

Land use can be reduced significantly if a reduction of food losses and waste could be reduced. It was estimated that 25%, (Table 3.1) of land used for the menu is for food that will never be eaten. This is discussed in chapter 4.

Land use can be reduced further with some modifications of the menu. Imported raw product can be changed to Swedish raw product and land demanding raw product could be changed to less land demanding raw product. Land use per crop category for the Initial and Changed menus, for Swedish and imported, are presented in Table 3.3.

The menu also contains luxury foods like sugar (from sugar beets) for desserts and main meals which could be changed to more nutrient rich foods. It contains tropical fruits (juice and fruit for direct consumption) and avocado, which could be changed to fruits and berries grown in Sweden and other less land demanding produce.

All numbers for land use include food losses and waste. For some of the products (oil, semolina, sugar, juice) the conversion factor (CF) is mentioned, i.e., how much raw product is needed to get a certain amount of product.

Changing imported raw product to Swedish raw product (changes 1-4)
The menu consists of many foods that possibly could be changed to Swedish produced food. To get an idea of the effects on land use, four changes were done: 1) rice was changed to oat; 2) millet was changed to a mix of rye, barley, and oat with equal amounts; 3) chickpeas was changed to beans, and 4) half of the olive oil was changed to rapeseed oil.

The results of changes 1-4 are shown in Table 3.4. Total land use was reduced from 1790 m^2 to 1640 m^2. Land use for imported raw product decreased from 789 m^2 to 544 m^2. Land use in Sweden increased from 993 m^2 to 1096 m^2.

The four changes are described more in detail below:

1) All rice (12.8 m^2) could be changed with oat (13.9 m^2). Land use would increase with 1.15 m^2 since rice has a higher yield (0.448 kg/m^2) than oat (0.411 kg/m^2).

2) All millet (87.5 m^2) could be changed with a mix of rye, barley, and oat with equal amounts (15.7 m^2). This change could save 71.8 m^2.

3) All chickpeas (92.9 m^2) could be changed with beans. With a yield of 0.15 kg/m^2 (yield can vary depending on what kind of beans that is used) the amount of chickpeas changed to the same amount of beans could decrease land use to 57.4 m^2. This could save 35.5 m^2.

4) Half of the olive oil (48.2 m^2) could be changed to rapeseed oil (12.6 m^2) with maintained nutrition (if all olive oil was to be replaced by rape seed oil, it might be necessary to supplement with other fat sources to obtain optimal fatty acid composition of the diet). This could save 35.6 m^2. Olive oil and rapeseed oil also have different CF:s: for 1 part of olive oil 6 times more olives are needed. For 1 part of rapeseed oil 3 times more rapeseed are needed.

Table 3.3 *Land use (m^2) for Swedish and imported raw product for different crop categories in the Initial menu and in the Changed menu, per person and year. The numbers include food losses and waste. The proportion between Swedish and imported produce are presented in percent (%) for both menus.*

	Initial menu		**Changed menu**	
Crop categories	**Per person m^2**	**Proportion of land use for Swedish and imported raw product, %**	**Per person m^2**	**Proportion of land use for Swedish and imported raw product, %**
CEREALS			Cereals - rice replaced with oat; millet with rye, oat and wheat; semolina replaced with whole wheat	
Swedish	424	74	305	87
Imported	147	26	46	13
PULSES			Pulses - chickpeas replaced with beans	
Swedish	35	18	93	60
Imported	161	82	69	40
FRUIT			Fruit - grapes (berries) replaced with apples	
Swedish	45	24	65	31
Imported	142	76	142	69
BERRIES			Berries – grapes (berries) replaced with apples	
Swedish	8.3 +292[1]	99.9	8.3	97
Imported	0.27	0.09	0.27	3
OILSEEDS[2]			Oilseeds[2] - olive oil replaced with rapeseed oil	
Swedish	118	45	131	58
Imported	142	55	94	42
ROOTS AND TUBERS			NC[3]	
Swedish	20	100		
SUGAR BEETS			NC	
Swedish	7.5	100		
VEGETABLES			NC	
Swedish	44	66		
Imported	23	34		
NUTS			NC	
Imported	118	100		
TEA			NC	
Imported	14	100		
CACAO			NC	
Imported	48	100		
	Initial menu		**Changed menu**	
Total Swedish	993	56	674	55
Total Imported	796	44	555	45
Total	1790 m^2		1230 m^2	

[1]Grapes. [2]Oilseeds: seeds for oil and seeds for direct consumption. [3]NC= No change.

Additional changes

Below follows four (5-8) additional examples of changes. The results show that two (5 and 6) of these changes could reduce land use from 454 m^2 to 34.4 m^2:

5) Only 1% of the wheat grain is used for semolina

It is possible to reduce land use if the foods that are in the menu could be fully utilized. An example for this is semolina porridge. Only 1% of the wheat grain is semolina, the rest will be flour. When semolina is included in the wheat that the initial menu contains, there are still need of more wheat grain to the porridge. Consequently 151 m^2 more land per person is needed and at the same time there would be an overproduction of wheat in the scenario. Instead, the part of semolina that exceeds the wheat that are already included in the menu could be changed to a porridge made of *whole* wheat. The reduction in land use could be about 98%. This could save 148 m^2 (wheat) or 147 m^2 (oat).

6) Changing grapes to apples could reduce land use with 272 m^2

There are crops in the menu that could be changed to something less land demanding. In the initial menu, fresh grapes and raisins are included with 32.5 kg per person and year, including losses and waste. For one person and year 292 m^2 is needed with a yield in Sweden for about 0.1114 kg/m^2 (1114 kg/ha), (information available for year 2014 and 2017). If grapes and raisins are changed to apples (yield 1.62 kg/m^2) or pears (yield 1.37 kg/m^2) 272 m^2 per person and year (for apples) could be saved. However, the statistic from SBA shows that it is only small amounts of grapes cultivated in Sweden currently and therefore there is uncertainty in the numbers, thus these results should be interpreted carefully.

No calculations of changed land use was made on the raw products below:

7) Luxury food - Sugar could be minimized

The menu contains meals with sugar derived from sugar beets (desserts, wine and sweet drinks and in lentil-, bean- and tomato soups). To fulfil the energy demand sugar needs to be replaced, e.g., with something sweet but with nutrients such as fruit and berries and/or nutrient rich food, such as pulses or kale. Approximately 90 g of sugar (360 kcal) per person and week is included in the menu. The same amount of energy requires 113 g of dried beans. The sugar beets demand 7.6 m^2 for one person. For comparison, sugar beets demand about 17% of land use for the Swedish grown fruit (17% of 44.5m^2 per person and year) or about 21% of the Swedish grown beans, lentils, and peas (21% of 35 m^2 per person) in the menu. In Table 3.3 land use for sugar beets is the same in both menus, i.e., no changes were made. Conversion factor: For 1 part sugar 6.4 times more sugar beets are needed.

8) Additional examples of changes that can be considered

Additional changes can be done, yet these changes were not calculated for, but these crops are included in the changed menu. The changes that were considered (these are examples, other changes can be done) were to change some or all the tropical fruit and avocado, and to replace half of the tea with coffee (coffee was added to make the menu more realistic).

Appendix 7.5 show details about the different raw products (land use and amount, before and after food losses and waste) except for coffee.

Pineapples and oranges demand 79 m^2 per person and year including food losses and waste. It could be changed to Swedish grown fruit and berries. Pineapples and oranges are included in the menu with 700 g of juice and 270 g fruit for direct consumption per person and week, before food losses and waste. Conversion factor: For 1 part of juice 2.5 times fresh fruit is needed. Avocado demand 17 m^2 and could be replaced with Swedish grown raw products such as seeds and pulses.

Table 3.4. *Examples of crops in the initial menu that can be exchanged, and the demand of land (m^2). The numbers are per person and year and includes food losses and waste. Land use for the Initial menu could with these changes be reduced from 1790 m^2 to 1230 m^2.*

Initial raw product (Yield kg/m^2)	Land use (m^2)	Change (Yield kg/m^2)	Land use (m^2)	Difference in land use (m^2) and (%)
Imported raw product that was changed		**Changed to Swedish raw product →**		
(1) Rice (0.448)	12.8	Oat (0.411)	13.9	+1.1 (+9%)
(2) Millet (0.0876)	87. 5	Rye/barley/oat (yield mean value 0.501)	15.7	-71.8 (-82%)
(3) Chickpeas (0.0927)	92.9	Beans (0.150)	57.4	-35.5 (-38%)
(4) Olives (0.196)	48.2	Oilseed rape (0.368)	12. 6	-35.6 (-74%)
Total (1-4)	**241**	**Imported raw product changed to raw product grown in Sweden →**	**99.6**	**-142 (-59%)**
Swedish raw product that was changed →		**Changed to other Swedish raw product →**		
(5) Grapes (0.111)	292	Apples (1.62)	20.1	-272 (-93%)
(6) Wheat (0.49) semolina	152	Whole grain wheat (0.49)	3.3	-148 (-98%)
Total (5, 6)	**443**	**→**	**23. 4**	**-420 (-92%)**
TOTAL (1-6)	**684**	**ALL CHANGES 1-6 →**	**123**	**-561 (- 82%)**

Land use for the menu in total (Table 3.2), with the mentioned changes (1-6) can be reduced from 1790 m^2 to 1230m^2 per person and year including food losses and waste. This is a reduction with 31%. Since both Swedish land use and land for imported food were reduced with the Changed menu, the proportion (Table 3.3.) of Swedish and imported remained very close to the Initial menu.

The results in land use for the Initial and the Change menu is showed in Figure 3.1 in relation to the current average diet in Sweden, (Röös *et al.*, 2016), total arable land and a Fair diet (Röös *et al.*, 2016).

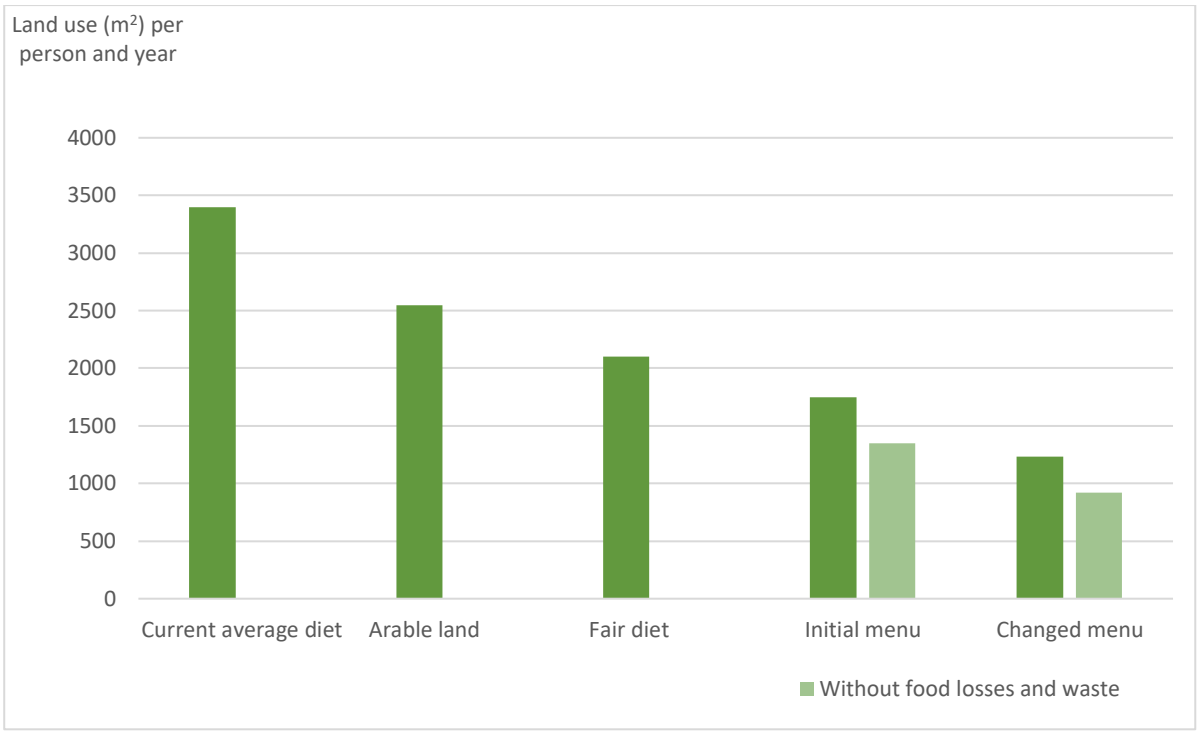

Figure 3.1. *The relation between land use for the current average diet (3400 m^2, see section 1.2.5), total arable land in Sweden available per person for 10 million people (2549,5 m^2), a Fair diet (2100 m^2, see section 1.2.5) and land use for the Initial menu (1750 m^2 and 1350 m^2) and the Changed menu (1230 m^2 and 922 m^2), with and without food losses and waste. Land use (m^2) is showed per person and year.*

4. Discussion

First there will be a separate discussion about each of the two results followed by a general discussion.

4.1. Discussion of the results from the focus group discussion

The results from the FGD (focus group discussion), show that animals mostly were described from a human perspective not including the perspective of the animals themselves (although it is not possible to have a total nonhuman animal perspective because we are humans). It was not discussed what could be gained in a scenario where animals are not eaten, neither for the animals nor for humans – focus was instead on the obstacles for humans.

4.1.1. Maintenance of the meat culture

Living animals are described as a meat and function as a means to further distance ourselves
Animals are described as a meat when they are still alive and not as a pig or a cow. Descriptions used in the FGD was “a meat that have been cared for”, “as an exclusive product” and as a “meat that have walked on lean lands”. This is not unique for the FGD but is for example the terminology used in animal industry with words like beef cows, milk cows, layers etcetera (Glenn, 2004). It is exemplified in Karlsson *et al.* (2018) in which animals are described in terms of how they can be utilized: low-yielding dairy systems, pork production and dual-purpose poultry producing eggs and meat.

Weitzenfeld and Joy (2014) describe how carnism is maintained by keeping its operations hidden from the rest of the society. In this way most people seldom meet the animals they eat, except in the supermarket as a package (Joy, 2017). By making its activities invisible and thus not something that people need to think about, reduces the animals to the “meat on the plate”, not as the individual sentient beings as they once were, described by Adams (1990) as “the absent referent”.

Talking about an animal as a food item or raw material when it is still alive, can be a symptom of further disconnection from the individual animal (Weitzenfeld & Joy, 2014). In psychology it is named ”linguistic camouflage” (Zaraska, 2016).

It is just how it is and it would be hard to change

It was showed that there was an awareness that we live in a meat-eating culture but without question it. Some of the gaps in the reasoning why humans exploit animals was made visible in the FGD: "it would be hard to change" today's culture that objectifies the animals – and "that is just how it is". This, that the meat-eating culture is not seen as a choice is described by Weitzenfeld and Joy (2014) and Godfray *et al.* (2018). Karlsson *et al.* (2018) can once again represent *an example* of how the meat culture *is not much questioned in the research about sustainable food production*. Even if meat is substantially reduced in the Future food vision, created in Karlson *et al.* (2018), eating meat is only acknowledged as a diet and from a resource perspective and not that it builds on the use and killing of other animals (though, it is acknowledged by the researchers that the future food vision is based on normative decisions). That animals want to live and are beings just as humans is not described in the article, hence it is not considered as a problem. Instead, a plant-based diet was rejected because it was decided that the future diet should contain the produce that was currently eaten in the region and because of agroecological principles. It could be questioned if the participants in the study by Karlsson *et al.* (2018) were aware of all plant-based food that are developed where some of it is produced to taste and look like meat. Therefore, it is possible to eat dishes that are plant-based but still are very much like the original (meat or other animal derived food) dish[1].

In another article (Linné, 2014) the similar approach is described. The animal perspective and what human force them to go through when they are used for food and the ethical questions that can be asked are *seldom on the agenda in the news media*. The exploitation and killing of animals are not acknowledged as a problem in the general society. Not in the focus group discussion (except for the vegan participant), or in the news media as Linné (2014) describes. It is only acknowledged in the news media when something that considered as not acceptable, for example when a farmer has mistreated the animals, such as letting them starve, but the slaughtering of the animals is not considered as a problem as long it is done according to the law.

Focus on what could be lost

A scenario where the animals are not eaten was hard to accept according to the results from the FGD. When an ideal world was described, meat eating was an important part of it and similar approach can be seen in Karlson *et al.* (2018), previously described. It was demonstrated that the *focus was on what could disappear* in a plant-based scenario but not what could be *gained*. This is also what Svärd (2017) express, the discourse in the public discussions is still coloured by the fear of what will be taken from us.

[1] For examples, see: https://oumph.se 2021-11-26
Jävligt gott is a website that shares plant-based recipes, many of the recipies are made to mimic traditional diches based on meat and dairy. www.javligtgott.se. Kakboken is focusing on classical pastry, see kakboken.se or Instagram as Kakboken. 2021-11-26

4.1.2. Justifying eating meat

Eating meat is important in the dream world
The dream world is described by the FGD as something nice for the animals – the animals should be on places where they thrive and where they are cared for. The small amount of meat that would be eaten should be seen as something luxurious.

Madsen and Leth-Espensen (2019) have analysed a Danish TV show "Kill your favorite Dish" which is about the idea that the society lost its connection to food. In the show the participants meet the living animal and are there when it is killed, or the participants kill the animal themselves and prepare the body afterwards to a dish. Madsen and Leth-Espensen (2019:382) mean that the question *if it is necessary to eat animals* is ignored during the show: "...it remains an underlying premise that there is no alternative to eating meat."

Most of us do not want animals to suffer but still want to continue to eat meat. Choosing "nice meat" can mentally function as a means to come around this. By doing your part - buying nice meat, you can eat it and in the same time feel good about yourself (Joy, 2017). This is also described by Madsen and Leth-Espensen (2019) as the new carnivorism[2] (in Linné, 2014) in which the justifying of eating meat comes with the knowledge of how the animal was killed or even that you kill the animal yourself. Even if the animal is killed in front of the meat eater this can, instead of serving as a wakeup call that starts to question the killing of other animals, serve as a *justification* and a way to show respect to the animal, thus perpetrate the idea that eating meat is unproblematic (Madsen & Leth-Espensen, 2019), with other words: normal, natural and necessary (Joy, 2017).

Farmed animals are mostly framed in advertisements for food products and not in other media such as news or TV-shows (Philips, 1996; Molloy, 2011 see Linné 2014). Linné (2014) means that it is mainly from the advertisement the public gets its understanding of the life of a farmed animal, thus it is important to critically look into it. The happy cow and the tasty meat are combined and are formed to a meat you have cared for, "a caring exploitation" (Linné, 2014:21) or as the industry promotes it: happy/humane/ethical meat (Glenn, 2004). This narrated dream world also described in the FGD is thus not a new phenomenon, it is a public relations strategy - the industry benefit on peoples bad conscious (Zaraska, 2016; Joy, 2017:80; Svärd, 2017).

Linné (2014) have analysed two Swedish dairy companies' accounts on Instagram and Facebook: Bregottfabriken[3] and Hjordnära. Linné (2014) discusses how the accounts are supposed to look like there are cows behind them and are portrayed as subjects with names and personalities, although as subjects designed to fit an idea, not the real subject. The idea is to give the consumers an insight in the life of a dairy cow and can at a first look seems like it is about transparency. However, what is shown from their life is the nice parts when they are grazing green fields, although that is only a fraction of the cows in the dairy industry that have this possibility (Linné, 2014). The accounts play

[2] New carnivorism or neocarnism - where the meat eater sees and knows the animal that will be eaten and, in this way, considered her/himself as conscious about the process and therefore the killing are justified (Madsen & Leth-Espensen, 2019).
[3] Bregott is a soft (a mix between cream and rape seed oil) butter used suitable as spread for sandwiches.

with the idea that the cows are like human influencers and for example posing with cute looking cats to get likes. With this approach the account can be interpreted as funny and ironic because everyone is aware that cows do not do such things (Linné, 2014). Pedersen (2010) means that this is not a way for the consumer to understand the life of a cow and what she is going through. Instead, Pedersen (2010) continue, it can serve as a way to further disconnect us from them. She describes how the animals will continue to be *less than us*, they are *simply animals*.

The happy cow that voluntary rent out her body to only focus on producing calves and milk and finally admit her to be killed is not for the sake of her, but for the companies to earn money and for the consumers to not feel bad about themselves. A so called "win-win" (Pedersen, 2010).

4.1.3. Humans decide the value of an animal

The animals are of instrumental value
It was emphasized in the FGD that the value of an animal is based on its capacity to be as affordable as possible. If an animal does not contribute with any value for humans there is no reason for the animal to exist. In other words, if they weren't resources, they wouldn't even have a life.

This perception is inherited through generations and is not questioned (Weitzenfeld & Joy, 2014). As discussed in the FGD we have animals for different purposes – as family members like cats and dogs and for food like cows, pigs and hens. This phenomenon, to love some animals and eat others and strategies to cope with the ambivalence, is called the meat-paradox (Buttlar & Walther, 2019). Röcklinsberg (2021) describes in her lecture how we value different species of animals different, e.g., dogs are considered more valuable than fish, is referred to as the socio-zoological scale. In other cultures it works in the same way but differs about what animals are chosen as pets and what animals are chosen as edible (Joy, 2017). This illustrates that the interests of humans are what decides the value of an animal (instrumental) and means that the animal has no value for itself (Weitzenfeld & Joy, 2014).

4.1.4. Other ways of thinking

Expanding the moral circle to include all sentient beings
Another perspective than the dominant anthropocentric view was pointed out: what if we expand our moral circles and see animals as persons with right to their own body and life? The result suggests that we are unaware of how we value other sentient beings, which is from the *human* perspective and not from the nonhuman animal perspective. It is not that the animals have or not have a specific trait that makes their life less valuable, it is *how humans have chosen* to see them as less valuable and that is how we assure ourselves about *our right to exploit them*.

However, compassion and empathy towards other sentient beings is probably not the solution for all humans, noted by Madsen and Leth-Espensen (2019). Some of us do not seem to find the interests

of another being as something to respect or not as important as human interests. In their conclusion Madsen and Leth-Espensen (2019) discuss how the new carnivorism, exemplified as "from nose to tail" by Linné (2014), can hinder the genuine feelings of objection against the violence towards the animals:

> ...it might actually be the show that alienates us, not from nature or animals but from the genuine impulses to oppose, or simply abstain from, taking part in acts of violence that the majority of people...are uncomfortable performing, witnessing, or knowing about. (Madsen & Leth-Espensen, 2019:391)

Further they mean that the TV show "Kill your favorite dish", use the visibility as an argument to the justification. With other words, the killing of another being is not acknowledged as a problem as long as you are ready to kill the animal yourself, something that is uncomfortable for most of us. They suggest that future research should focus more on compassion for other beings.

The discussion was an opportunity for reflection
The results indicate that a discussion could serve as an opportunity to self-reflection and perhaps generate a tolerance and even curiosity for other perspectives. For example, it could serve to reflect about our ethical thinking towards animals.

4.2. Discussion of results about land use

It was showed in this study that the Initial plant-based menu needs 1790 m^2 per person and year including losses and waste (1 789 000 ha for 10 million people). It was shown that with a few changes in the menu (Table 3.3), land use could be reduced with 31%, to 1230 m^2 per person[4]. Both results are inside the planetary boundaries (Rockström *et al.*, 2009a) in the aspects of land use that was estimated to 2100 m^2 per person and year by Röös *et al.* (2016). The results confirm earlier studies which have shown that a plant-based diet needs less land (Hallström *et al.*, 2015; Chai *et al.*, 2019; Rabès *et al.*, 2020) than current average diet (3400 m^2) in Sweden (Röös *et al.*, 2015).

Since arable land in Sweden year 2020 was 2 549 500 ha (SBA, 2020), there is enough land to cover the need of food for the Swedish population, with conventional agricultural methods. The rest of the land gives opportunities. The land could be used to support other countries with food and it could be used to cultivate ley for biogas and fertilizing crops with digestate and in the same time use less intensive food production systems, created to be beneficial for the ecological systems such as soil health and biodiversity.

A current plant-based diet compared with the current omnivorous diet
The Initial menu is based on a food survey made 2014, hence it can be considered as a "current plant-based diet". The estimated land use of 1790 m^2 are based on a weekly menu but what people

[4] All numbers for land use include food losses and waste and are presented in m^2 per person and year if nothing else is specified.

eat will not be the same every week, thus the result can vary. In comparison Röös *et al.* (2015) shows that the current omnivorous diet in Sweden year 2015 needed 3400 m^2 agricultural land per person and year. At the time, Sweden was about 50% self-sufficient for beef, 65% for pork and poultry, 90% for dairy, 100% for cereals and 20% for fruit and vegetables (Röös *et al.*, 2016).

A few changes can reduce land use and make Sweden less dependent on imported produce
It was shown in the results (Table 3.3) that land use could be reduced significantly when three of the imported produce were changed to Swedish grown produce, from 241 m^2 abroad to 99.6 m^2 in Sweden. One of the examples was imported olive oil, which requires relatively large amounts of land, so replacing half of the olive oil with domestically produced rape seed oil led to a large reduction in land use. When half of the olive oil in the menu was replaced by rape seed oil, the demand of land was decreased from 48 m^2 abroad to 13 m^2 in Sweden. Currently in Sweden, about 980 million m^2 (98 000 ha) (SBA, 2020) are used for the cultivation of rape seed and this change would increase the demand of land for rape seed to 1171 million m^2. This is considered a feasible increase since there are possibilities to cultivate rape seed in other regions than what is done today (Carlsson, 2021). Also, ongoing research and breeding at SLU Grogrund (SLU, 2021) aims to develop rape seed varieties that can be grown further north in Sweden. Replacing rice with oat will increase land use but there can be other reasons to change to oat/other cereals or potatoes. In general, more pesticides are used for rice than for cereals (Karlsson Potter *et al.*, 2020; SFA, 2021) and for potatoes (Scherer & Huang, 2021).

The results also show that there are possibilities for additional changes of the raw products grown in Sweden. Two changes in the menu resulted in a huge reduction of land use. Semolina porridge is made of the core of the wheat seed. It is an example of a meal that is not utilizing the whole produce, only 1%. When changing to a porridge to instead contain the whole wheat seed it could reduce land use for this meal with 98%. Grapes is another example of a crop that demand a lot of land if grown in Sweden. By replacing grapes and raisins with apples and dried apples land use could be drastically reduced (Table 3.3). The reduction of land use is substantial and there might be uncertainties in the yield levels because of the very small number of grapes that currently are cultivated in Sweden.

Sugar could be changed to more nutrient rich food. Sugar is recommended to be reduced as much as possible since it is solely a source of energy and not a source of nutrients (Swedish Food Agency, 2021b). It is a luxury product that takes up additional land than what is necessary for a healthy life. This land could instead be used for healthy food.

In total, these changes of the Initial menu could result in a land use reduction of 31%. 55% (677 m^2) depends on Swedish land and 45% (555 m^2) depends on land abroad. Since both Swedish land use and land for imported food were reduced with the Changed menu, the proportion of Swedish and imported remained very close to the Initial menu, (see Table 3.3 for details).

The raw products grown in Sweden for the Initial menu for 10 million people, demands 39% of total arable land in Sweden. In comparison, the Changed menu demands 27% of total arable land in Sweden (Table 3.2).

The Initial menu is also presented *without* food losses and waste (Table 3.2) and needs almost the same amount of land as the Changed menu *with* food losses and waste. This visualizes that there are a lot of resources to gain if food losses and waste could be reduced. It also shows that there can be a big difference in land use depending on what raw products a diet contains.

The amount of food grown abroad could possibly be reduced more. The share of total land use for cultivation of fruit grown abroad is 76 %. The changed menu also suggests a reduction of oranges, pineapples, and avocado. This change could reduce land use abroad and instead demand more land in Sweden, but the amount of land needed for the replaced crops was not studied. Although, an increased use of arable land in Sweden is possible according to the results. However, this study only takes the aspects of land use in consideration and has not considered any other challenges for those changes. Avocado is an example of a crop that have high environmental impact on other aspects than land use. The production can demand high amounts of water and have a big negative impact on the biodiversity (Karlsson Potter *et al.*, 2020). Organically grown avocado is recommended by WWF (2020a) and only for consumption in small amounts, but better is to leave it out from the menu (WWF, 2020a).

At the same time when self-reliance of food supply is discussed in current society debates (the Swedish Government, 2017; Kihlström, 2020), it does not mean that domestic food production always needs to be the most resource effective way or even if it is possible to grow all food in Sweden. Grapes is one striking example of this. The global average yield is about 10 kg per m^2 (100 ton per ha) (FAO, 2020b) compared to the very small yields in Sweden (SBA) with about 0.1-0.15 kg per m^2. However, because of the very small amounts that is cultivated in Sweden, yield levels are probably quite uncertain. Without knowing anything about the causes for this difference and if this difference can be changed towards higher yield levels in Sweden, grapes is an example of a crop that is more resource efficient to cultivate abroad, from a land use perspective.

Crop rotations

Based on discussion with my supervisor Carlsson (2021), the following are examples of crop rotations that could match the land area requirements for different groups of crops according to results for the Initial and Changed menus. The examples are based on the premise that all fruit trees and berry bushes are grown separated from the annual crops.

Initial menu, example 1a; crop rotation of six years:	**Initial menu, example 1b; crop rotation of six years:**
Year 1: rapeseed	Year 1: rapeseed
Year 2: cereals	Year 2: cereals
Year 3: cereals	Year 3: cereals
Year 4: legumes	Year 4: vegetable (including potatoes or sugar beets)
Year 5: cereals	Year 5: cereals
Year 6: cereals	Year 6: cereals

Changed menu, example 2a; crop rotation of five years	**Changed menu, example 2b; crop rotation of five years:**	**Changed menu, example 2c; crop rotation of five years:**
Year 1: rapeseed Year 2: cereals Year 3: legumes Year 4: cereals Year 5: cereals	Year 1: rapeseed Year 2: cereals Year 3: vegetable (including potatoes or sugar beets) Year 4: cereals Year 5: cereals	Year 1: rapeseed Year 2: cereals Year 3: vegetable (including potatoes or sugar beets) Year 4: cereals Year 5: legumes

All five crop rotations are possible, although it is not beneficial to cultivate legumes as often as every five years because of the increased risk for diseases harming the crops (similar risks exist for rapeseed). The crop rotations could be improved if also ley is included. The time between the cultivation of legumes and rapeseed would increase with ley in the crop rotation. Because of the beneficial effects ley has on the soil health, it is possible to also consider these crop rotations in organic systems (Carlsson, 2021).

Opportunities with spare agriculture land

One possible way to make use of the spare land could be to use cultivation methods that are less intensive and beneficial for long-term soil fertility (Röös & Torpman, 2021). Ley could be cultivated and benefit the society in terms of bioenergy. Ley will improve the crop rotations and be beneficial for the soil fertility. Since not all countries have the possibilities to cover its own demand of food, another way to make use of the land could be to cultivate food for an increased export, contributing to the global food security (Karlsson *et al.*, 2018).

Opportunities to reduce food losses and waste

There are ongoing projects investigating if there are unused resources in the parts going to feed that instead could be beneficial for human food. One example is the protein rich rapeseed cake developed to be suitable for human consumption by Östbring and co-workers at Lund University (Lindgärde, 2017). However, this will not be discussed further in this study.

Future research

The three scenarios in Röös *et al.* (2016) are described as:

> ...a diet based on the principle of limiting livestock production to what can be produced from ecological leftovers... (Röös *et al.*, 2016:7)

It is built on following four principles: 1) Arable land will mainly be used for human food. 2) Animals will eat rest products not wanted or suitable for human food. 3) Semi-natural grassland will be grazed for biodiversity conservation. 4) Fair diet: the diet must reach the nutritional recommendation and use not more arable land than what is available global for each person and year (2100 m^2). Land use for the three scenarios was 2040, 1950 and 1930 m^2 per person and year of what 180 m^2 or 9% was for imported produce.

The Initial menu in this study is based on a food survey, thus a plant-based "current" diet. For future research it could be interesting to see what could happen with the land use if a plant-based menu was designed in similar manner with the four principles and some additional principles: 5). The menu must contain food that is needed for a good health. Unnecessary food such as sugar and alcohol should be excluded initially. 6) Land that is still available after securing food supply for the Swedish people, then additional food, e.g., sugar, could be part of the menu or it could be a democratic decision of how Sweden should take care of and use this land.

If food is imported, it is possible to shorten the food chain (it is possible also with long distances such as between countries according to Gliessman and Engles (2015)), to make sure that the growers and the environment that are affected by the cultivation of the food we want them to grow for us – guided by the agroecological principles, also have the same possibilities as the Swedish people, to a good and healthy life.

Since democratic decisions should be decisions grounded in knowledge it could be beneficial for our common future to include education for children about food production and agriculture and its effects on the environment and our health. We could learn to not make egocentric decisions or limit ourselves to an anthropocentric view, about our common future, for all life on Earth.

4.3. A general discussion

4.3.1. The food system is disconnected from the society

Agroecology aims to adjust the food system to the local conditions, meaning to produce what is ecologically beneficial, with a long-term perspective where the social and economic perspectives are interlinked and participating, with a sustainable food system as a common mission.

How the food system works and what it takes to produce food – all activities and resources that was needed to create it, is not common knowledge today. All food and food waste - animals included - are reduced to a commodity. One step towards a society that value food because of an understanding of what it is, and a sustainable food system, is to reconnect the society and the food system (Gliessman & Engles, 2015).

The results from the FGD describes how the nature and the food system today is disconnected from the rest of the society and that food – the animal – is reduced to the meat on the plate. The results from the FGD expressed how the political system forces the farmers to produce food as efficient as possible as this is the only way to survive on the market, even if they wanted to do something different.

4.3.2. Reconnecting society and the food system

It was exemplified earlier in this study that land use not always will be reduced when imported food is changed to Swedish grown food, but it can be other benefits with domestic produced food.

Produce food close to consumer

One beneficial aspect when food is produced in the same country is the opportunities for the society to reconnect to the food system (Gliessman & Engles, 2015). This could lead to an increased value for the food. When the ones that produces food and eat food, i.e., the society, can participate and be part of the food chain in a democratic way, such as having a say of how and what food is produced and how it is distributed, it could lead to engagement and a willingness to act responsibly. If consumer and producers come in direct contact with less middle hands it could lead to less food losses and waste because of the increased knowledge about and a new perspective of what food is - how food is valued could change (ibid). However, the reconnection, e.g., to have knowledge of and see with your own eyes, how the food is raised and slaughtered, could serve as a way to show respect to the animal and thus justify meat eating (Madsen & Leth-Espensen, 2019), - it is normal, natural and necessary (Weitzenfeld & Joy, 2014).

Animals are seen as important contributors

Agroecology sees animals as an important part of a circular system contributing with several values important for humans, where their ability to convert biomass (which humans cannot or do not want to eat) to protein rich food is one of them, (Gliessman & Engles, 2015; Röös *et al.*, 2016; Karlsson *et al.*, 2018). Less addressed in the context of sustainable food system is that a plant-based diet is beneficial for a reduced suffering experienced by other animals (Svärd, 2017:10).

The vision Gliessman and Engles (2015) have on a sustainable food system is similar to what was expressed in the FGD regarding animals. The results in the FGD express a win-win relation: animals give themselves to the farmer because of the care they get – "a meat that is cared for" and the needs for the farmer in terms of values are satisfied, also described by (Lund, 2002a). This is discussed more in Chapter 4.1.

4.3.3. Two perspectives: Resources versus Sentient beings

The result from the FGD reveals two opposite standpoints answering the question of how the perspectives of animals are described if there is no need to eat other animals: the dominant view in the group, and well represented in the western society mirrored in the SDGs goals, is that other animals are resources. The result from the FGD also shows that humans have a responsibility to treat other animals well. If the treatment is well, it is what justifies slaughtering them. The opposite view presented in the FGD, a minority view in the western society, is that we need to realize that animals are *individuals* who have the same needs as you and me; they want to live, they have social lives where they can feel love and friendship as well as sorrow and fear and pain. The minority view has not yet been accepted on a societal level. That animals are sentient and do not want to die is not seen as a reason to involve when talking about diets and sustainable food systems (Svärd, 2017).

One ongoing example is the SDGs that are created for the benefit of humans. It is about our common future and how we act now will have consequences for a long time ahead. In the creation of the SDGs, 193 (UN, 2015a) countries were involved and none of them succeeded to include the interests of other animals in the goals, as Torpman and Röcklinsberg (2021) suggests.

Röös *et al.*, (2016) and Karlsson *et al.*, (2018) are examples in the research field. In Karlsson *et al.* (2018) several stakeholders together created a model for a future food vision. In this vison, animals are taking part as resources based on agroecological principles and are not mentioned as sentient beings but instead as "low yielding dairy systems", "lamb production...slaughtered in the autumn"; "pork production"; "dual-purpose poultry producing eggs and meat by rearing cockerels" (Karlsson *et al.*, 20186). The future food vison is chosen to not include alternative ways to produce proteins, such as cultured meat and algae because it was decided that the diet should be designed based on what currently were consumed in the area. Hence it could be asked if it was considered at all how this decision affect other sentient beings and their future.

The result from the FGD reveals that the major part was focused on how the scenario could affect humans, not what could be positive with the scenario and most interesting, how it could affect other animals. On the other hand, the participant representing the minority view, suggested possible solutions for a society not built on the eating of other animals. Is it possible to eat a plant-based diet and at the same time sustain the biodiversity?

Conflict between different goals for sustainable land use: using less than 2100 m^2 *per person and maintaining seminatural pastures*

The SDGs state that the animal food production must decrease to reduce the climate impact. It also states that the biodiversity needs to be sustained.

The results show, from a land use perspective, that it is possible to stop using animals for food production by adopting a plant-based diet that is inside the planetary boundaries of 2100 m^2 per person and year. What can be challenging is to sustain the biodiversity of semi natural pastures by grazing and the cultivation of ley in the crop rotation, but as discussed earlier (Chapter 4.2) there are opportunities to grow ley.

It is possible to sustain the biodiversity even without an animal-based diet. Alternative methods can be used (Carlsson *et al.*, 2014). One possible way could be to let animals' graze part of the semi natural pastures and use alternative methods on the rest of the semi natural pastures. Since the results suggests that there will be agricultural land not needed for domestic food production, it is possible to use these areas to grow ley to benefit the soil health and to have crop rotations that increases the time between the cultivation of legumes to hinder the risk of diseases when legumes are cultivated on the same field every five years as showed in the five examples of crop rotations, earlier described (Carlsson, 2021).

In the plant-based scenario in this study, the hay can be used as winter fodder for the grazing animals and no additional arable land is needed for the cultivation of feed (Carlsson, 2021). Regarding the hay, the results from the FGD expressed a concern that in a plant-based scenario it was needed to throw the hay. This reveals that there can be assumptions that hinder the imagination of possible solutions to make a plant-based scenario realistic.

The result from the FGD suggested that the animals could die of age, e.g., bovines can be up to 20 years, instead of being slaughtered in the beginning of their life as done today. This argument is not

a new idea, for example it is suggested by Lund (2002a). It is possible to continue as today, i.e., use the animal bodies for food (if they are without risks to consume), and for biogas and the digestate to fertilize crops (Röös *et al.*, 2016), but in a much less amount. The result in the FGD also expressed concerns regarding not eating the animals but let them live their whole life.

4.4. Conclusion

Land use for the initial plant-based menu stays inside the planetary boundaries and demands less arable land than the three scenarios in Röös et al. (2016). Additionally, it was showed that land use could be reduced with only a few changes of the initial menu. From a land use perspective, the results suggests that a plant-based scenario is possible and there will be excessive arable land that can be used for other purposes and for a food production based on more gentle methods that also includes the cultivation of ley.

The society is built on the exploitation of other animals and so is the food system. Therefore, a major part of the solutions developed to be sustainable build on the exploitation of other animals. The concepts of agroecology and sustainability build on the anthropocentric view and are similar to what the FGD reveals - that the dominant view is based on assumptions that humans are superior to animals.

It seems like it is nearly impossible to not exploit other animals in solutions created for sustainable food systems. What could be learned from this study is that the perspectives of other animals are often neglected when discussing sustainable land use and that it can be difficult for participants to imagine and accept a scenario which is very different from the current reality. More importantly, this standpoint is not reflected upon: “it’s just how it is” (FGD). In any other subject that has not to do with the human exploitation of animals, it is not a satisfying explanation. The oppression of other animals needs to be recognized as a problem.

Agroecology and sustainable development should explain its human centred view clearly and what this means for other animals. Alternatively, take the responsibility as humans and society, choose to challenge the anthropocentric view and instead of creating solutions that build on the exploitation of other animals actively work towards sustainable solutions that include the interests of other animals.

This suggests that knowledge about how the food system impacts the environment could be of great importance to be known for every individual and in all levels of the society.

There are challenges when it comes to the society in general to adopt a plant-based diet thus it is important to discuss how this can become reality. From the FGD it could be learnt that depending what perspective we have on the environment the impact will be different. How we prioritize in our moral concern, for example the anthropocentric view, is one of the main reasons why we objectify animals and our environment and thus make it possible for us to treat those as recourses.

Unless we leave assumptions behind and accept the challenge to explore the scenarios with an open mind, potential solutions to a more sustainable food system can be lost, and that is not beneficial for any human – vegan or not.

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All inspiring and brave people in history and now
Believing and fighting for the simple idea that all living beings should have right to their own body and life is what makes us human. I think we have forgot that, but it does not mean it is lost, maybe it is just hidden? We need to look into ourselves and genuinely listen.

You who stays curious and want to learn and explore new perspectives – the future is in your hands
What you do matters. Educate yourselves. Find people with similar mind set and get stronger together. The only world we have belongs to all beings and we are able to take care of each other with compassion and respect.

With the curious, wonderful pigs and all defenceless ones in mind
I did not save these amazing pig individuals. Even though there was a sign next to them saying "Meat boxes" and a phone number.

For them it is too late. Even for the ones not yet born, it is too late.
How can it be important to talk about if they feel pain or not or if they are aware or not about their own death? We do not deserve animals. Your life belongs to you and my life belongs to me and together we should do our best to protect each other.

Many of us will try to raise awareness to end this normalised, legal violence because we believe it is possible and we believe in humans, but it will take time and time is scarce.

Now it is war in Ukraine, and in many other places as well. Defenceless humans and animals are in acute and great danger and they are suffering. For many it is already too late. Many of us feel that we want to help them. This feeling, that we should save them because they are in danger, is genuine. If I did not feel this, I would wonder what is going on with me. It is the same genuine feeling when it comes to the treatment and killing of animals. *But killing animals is something we learnt is ok.* Can we unlearn? I believe it is possible to stop learn next generations to suppress their feelings of compassion towards animals. I do not only believe these feelings are *essential for a societal change*, I do also believe that they will generate a *faster* societal change, towards a sustainable and wonderful future.

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7. Appendix

Appendix 7.1. Invitation letter

Hej!
Nedanstående mejl vill jag ska nå personer som arbetar med naturvård. Om Du fått detta mejl men inte är en person som arbetar med detta, så skulle jag vara mycket tacksam om Du vill vidarebefordra det till någon lämplig.

Med vänlig hälsning,
Blenda Agell

Hej!

Mitt namn är Blenda Agell, jag läser ett mastersprogram vid SLU Alnarp som heter Agroekologi. Nu kontaktar jag Dig med anledning av mitt examensarbete då jag söker deltagare till en fokusgrupp. Fokusgrupp är en sorts gruppintervju, där en liten grupp inbjudna personer diskuterar och tar del av varandras synsätt utifrån en gemensam frågeställning. Den övergripande frågeställningen i mitt examensarbete handlar om hur djurens perspektiv beskrivs i kontexten hållbar markanvändning om en övergång till en växtbaserad kost skulle ske. Jag är intresserad av att höra hur personer som arbetar med naturvård resonerar kring detta.

Jag har utgått från ett scenario där jag räknat ut hur mycket jordbruksmark som behövs för en helt växtbaserad kost för Sveriges befolkning. I ett sådant scenario behövs inte några livsmedelsproducerande djur, vilket i sin tur kan ha inverkan på hur naturbetesmarker sköts. Jag tror att Dina kunskaper om olika metoder för naturvård – med eller utan djur – är värdefulla för mig att ta del av då jag vill utforska alternativ för hållbar markanvändning i scenariot för en växtbaserad kost.

Fokusgrupp med det webbaserade verktyget Zoom
Eftersom fysiska möten ska undvikas med anledning av Corona är tanken att det webbaserade verktyget Zoom ska användas istället. Vi kommer alltså inte att träffas fysiskt. Zoom gör det möjligt för alla deltagare att se och höra varandra. Trots att jag själv inte använt verktyget mer än några gånger de senaste veckorna tycker jag att det är lätt att förstå sig på. Om Du bestämmer Dig för att delta så kan vi istället för att höras på telefon eller mail, höras på Zoom så att vi båda får lära känna

verktyget lite men också för att “träffas” inför fokusgruppen. Då kommer jag att skicka ett mail till dig med en länk som tar Dig till vårt möte. Du behöver en webbkamera och en mikrofon på Din dator.

Fokusgruppen kommer att utgöras av ungefär 6 personer och kommer att ta ca 1,5 timme. Eftersom det är online så kan det kännas svårt att slappna av i mötet med andra människor men jag hoppas att vi kommer att kunna känna oss bekväma med konceptet efter att vi har presenterat oss och småpratat lite. Jag kommer vid mötets början presentera upplägget och även tydliggöra att det är helt frivilligt och att man kan välja att avbryta sitt deltagande när som helst. Sedan kommer jag att ställa frågor till Er som grupp som jag vill att ni diskuterar. Jag kommer finnas där synlig för alla men mer som en moderator. Det är deltagarnas resonemang som jag är intresserad av. Alla ska få ge sin syn på frågan och ska ges samma utrymme. Om vi glider ifrån ämnet så kommer jag att kliva in och hjälpa Er att hitta tillbaka till rätt spår, inte för att det Ni talar om inte är intressant utan eftersom vi behöver avgränsa oss.

Om det efter fokusgruppen finns intresse från deltagare att gå djupare i någon fråga kan jag göra en uppföljande individuell intervju, vid ett tillfälle som vi kommer överens om.

Hur ska materialet användas?
På Zoom finns en funktion som kan spela in hela samtalet med ljud och bild, vilket jag behöver göra för att kunna analysera vad som sägs under fokusgruppen. Ingen annan utöver mig kommer att ha tillgång till materialet. Efter analysen kommer allt material att raderas.

Det färdiga examensarbetet kommer sedan att publiceras online och vara sökbart för allmänheten. Texten kommer att utformas på ett sätt som gör att det inte går att identifiera vem som har sagt vad. Deltagarna erbjuds att ta del av det färdiga materialet innan publicering för att kunna komma med synpunkter.

När?
Fokusgruppen är tänkt att äga rum i maj eller när jag hittar en dag som passar för samtliga deltagare.

Var?
Via det webbaserade mötesverktyget Zoom. Länk till mötet mejlas till samtliga deltagare.

Intresserad?
För mig skulle Ditt deltagande vara mycket värdefullt och jag hoppas att Du tycker det vore intressant att delta.

Vid frågor eller funderingar tveka inte att kontakta mig på telefon eller mail som sedan kanske kan bli ett första möte på Zoom så att vi får träna på det.

Med vänlig hälsning,

Blenda Agell

Appendix 7.2. Themes and questions from the author during the focus group discussion

Inledning
Beskrivning av vad ämnet handlar om. (Texten kopierades in i chatten också):

Hur beskrivs djurens perspektiv i kontexten hållbar markanvändning om en övergång till en växtbaserad kost skulle ske?

Jag har utgått från ett scenario där jag räknat ut hur mycket jordbruksmark som behövs för en helt växtbaserad kost för Sveriges befolkning. I ett sådant scenario behövs inte några livsmedels-producerande djur, vilket i sin tur kan ha inverkan på hur naturbetesmarker sköts. Jag tror att Era kunskaper om olika metoder för naturvård – med eller utan djur – är värdefulla för mig att ta del av då jag vill utforska alternativ för hållbar markanvändning i scenariot för en växtbaserad kost.

Jag har fått en meny av Livsmedelsverket som jag har översatt till mängd jordbruksmark. Och det beror på lite vad som ingår i den menyn; om det är svenskproducerat eller om det är importerat. Så, vi vill ju ha kvar de här naturbetesmarkerna, det handlar ju om att hävda dem, men hur ska vi göra det? Det är därför jag vill prata med er om det. Den exakta arealen är inte riktigt fastställd. Som sagt den kan variera och det beror ju också på vilka odlingsmetoder man använder sig av till exempel. Men det här är ju en masteruppsats så då måste jag begränsa mig i hur jag gör. Ni är fria att diskutera. Det finns ingenting som är fast bestämt utan jag vill höra vad ni tänker om det här, om vi skulle äta helt växtbaserat i Sverige, vad skulle hända då?

Om vårt behov av animaliska livsmedel slutar helt då behöver det ju inte födas upp så mycket djur längre men det är upp till er att diskutera, det är det som är intressant i detta.

Svarar på en deltagarfråga: Det är det diskussionen handlar om lite grann. Ni har fått en beskrivning av detta men sen ska jag vara ganska tillbakadragen. Jag kommer kanske komma med lite teman till er som jag vill att ni ska diskutera närmare, men det är klart att det är ju viktigt att ni, förklarar vilken kontext ni har när ni beskriver era tankar.

Avbryter diskussionen för ett inspel: Ursäkta jag vill bara behöva flika in här. Jag skulle gärna höra X, du var ju inne på det här med andra material, skulle du vilja prata lite mer om det?

Ny fråga: Nu tänkte jag avbryta er och komma in med ett annat tema som jag vill att ni ska diskutera. Vad är era tankar om hållbarhet i relation till hur vi använder djur?

Ny fråga: Vad är era tankar om (hållbarhet med avseende) djuretik?
Vad är era tankar om att djur betraktas som objekt? Vad era tankar är om att djur behandlas eller att man ser på dem som objekt?

Var tror ni att de tankarna kommer ifrån? Det blir ju ändå som objekt som vi ser dem eftersom vi bestämmer vad som ska ske?

Avbryter diskussionen för ett inspel: Nu vill jag flika in här lite. Jag tycker vi kommer lite från ämnet. Det handlar om djur som objekt. Och jag har hört att ni inte tycker att de är objekt men samtidigt så vill ni att de ska gynna era syften. Människans syften, och det är den problematiken som jag vill att ni ska diskutera. Det är en konflikt. Hur kommer det sig att vi tycker att vi får bestämma över djuren om vad de vill? Om man skulle säga samma sak till varandra ”Du får ha det jättebra här, du får vara på spa hela ditt liv tills jag bestämmer att jag ska döda dig”. Och du säger ”Javisst det går jag med på. Vi har en överenskommelse”. Kan ni komma in lite mer på det?

Inspel: Där kan man ju dra in hur vi ser på andra människor genom tiderna, på svarta, homosexuella, kvinnor. Om man utvidgar den cirkeln att också gälla djuren - vad är det för skillnad?

Avslutande kommentarer: Nu börjar det dra ut på tiden. Är det något som ni vill tillägga till det vi pratat om?

Svarar en deltagare på hens funderingar: Jo, det är klart att jag förstår det att man har en yrkesroll och sin personliga åsikt.

Avslutande kommentar: Det har varit jätteintressant att höra era diskussioner. Jag hoppas att ni också har tyckt det varit intressant att komma hit.

Avslutande kommentar: Vad roligt. Är det någon som vill säga någonting sista, eller vill tillägga någonting som vi inte har tagit upp?

Appendix 7.3. Nutrient content for the Initial menu

Nutrient content for the Initial menu for a woman with [1]PAL 1.6, fortified products

Description	Total	Mean/day	[2]NNR 2012
Enkj(kJ)	65962	9423	9400
Ener(kcal)	15765	2252	2256
Kolh(g)	1902	(53 E%) 272	40 -60 E%
Fat(g)	635	(36 E%) 91	25-40 E%
Prot(g)	406	(11 E%) 58	10-20 E%
Fibe(g)	331	47	25
Alko(g)	20	2.88	
Whole grain/tot(g)	801	114	70
Mfet(g)	128	(7.2 E%) 18.21	Max 10 E%
Mone(g)	290	(16 E%) 41.5	10-20 E%
Pole(g)	162	(9 E%) 23.21	5- 10 E%
VitA(µg)	6692	956	700
VitD(µg)	60	8.5	10
VitE(mg)	181	25.9	8
Tiam(mg)	11	1.5	1.1
Ribo(mg)	13	1.9	1.3
VitC(mg)	1043	148.9	75
Niek(mg)	178	25.4	15
VitB6(mg)	18	2.6	1.3
VitB12(µg)	14	2.0	2
Folat(µg)	4005	572	400
P(mg)	8667	1238	600
Fe(mg)	108	15.5	15
Ca(mg)	6743	963	800
K(mg)	22804	3258	3100
Mg(mg)	3345	478	280
Na(mg)	20773	2968	
Se(µg)	216	31	50
Zn(mg)	62	8.8	9

[1]PAL, physical activity level during 24 hour.
[2]NNR, Nordic nutrition recommendations

Appendix 7.4. The Changed menu

The Changed menu, based on the Initial menu but with some changes

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
BREAKFAST	Oat porridge with oat drink and apple puree 1 soft rye bread 1 soft white bread Margarine, bean pasty paprika	Oat-based natural yoghurt with cereals, nuts, dried fruit and berries 1 soft rye bread 1 crisp breads Margarine, green peas and bean hummus	Oat- and berry smoothie 1 crisp bread 1 soft rye bread Margarine, nut- and almond butter, bean pasty alfalfa sprouts	Oat-based natural yoghurt with cereals, nuts, dried fruit and berries 1 soft rye bread 1 crisp bread Margarine, sprouts, bean and seed pasty	Molino porridge with oat drink and apple puree 1 soft rye whole grain bread 1 soft white bread Margarine, bean pasty, paprika	Oat drink with cereals orange 1 crisp breads 1 soft rye bread margarin nut and almond butter sprouts	Semolina porridge with oat drink and apple puree 1 soft rye bread 1 soft white bread Margarine, green pea and bean hummus, Marmite paprika Juice 1 dl
	Banana Coffee/tea with oat drink	Apple Coffee/tea with oat drink	Clementine Coffee/tea with oat drink	Banana Coffee/tea with oat drink	Apple Coffee/tea with oat drink	Pear Coffee/tea with oat drink	2 Crusts with margarine Coffee/tea with oat drink
LUNCH	Green peas- and bean steaks with broccoli and tomato sauce with bulgur Salad: different kinds of lettuce, carrot with vinaigrette sauce Pear	Bean pasta with tomato sauce and soy-based cheese Salad: different kinds of salad cucumber, paprika, olives with rape seed/olive oil Pineapple 1 crisp bread, margarine	Lasagne with a mix made of red lentils Salad: different kinds of lettuce, cucumber, tomato, carrot, pumpkin seeds and rape seed/olive oil apple 1 crisp bread, margarine	Falafel made of yellow peas, pita bread Salad: cucumber, tomato, carrot, corn, dressing rape seed/olive oil Orange	Carrot steaks with tomato sauce and mashed potatoes Salad: cucumber, tomato, lettuce, olives, corn, cabbage and vinaigrette Honeydew melon walnuts	Potato buns with mushroom sauce Salad: spinach, cabbage, green beans, olive- and flaxseed oil, cashews, mango	Warm quinoa salad with tofu, lettuce, cashews, alfalfa sprouts and rape seed/olive oil Orange
	1 rye bread margarine tomato Coffee/tea with oat drink	2 Sandwich wafers margarine Coffee/tea with oat drink	2 Sandwich wafers margarine, tomato Coffee/tea with oat drink	2 Sandwich wafers whole grain, margarine tomato Coffee/tea with oat drink	1 rye bread margarine pasty Coffee/tea with oat drink	Dark Chocolate, dried fruit, banana chips, Pistachios Coffee/tea with oat drink	1 cinnamon bun Coffee/tea with oat drink
DINNER	Tofu pai Salad: different kinds of lettuce, white beans, tomato and sunflower seeds Dressing: Rape seed/olive oil and lemon juice	Lentil soup 2 ryebread whole grain margarin red beet hummus Salad: 100 g mixed salad Banana	Pizza Salad: cabbage, rucola and cucumber Dressing: Flaxseed oil and lemon juice Pear	Aubergine with soy mince sauce and boiled grains (a mix of rye, wheat and oat) Salad: rucola, spinach, corn, alfalfa sprouts, tomato grapes	Mushroom stew with coconut milk brown rice Salad: fermented mixed vegetables, marinated beans with baby spinach and tomato Dessert: pannacotta with raspberries Drink: 3.5% beer 3.3. dl	Veg burger with bread, tomato, lettuce, dressing Salad: lettuce, sprouts, beans, cucumber and rape seed/olive oil Pear Drink: 1.5 dl white wine 12%	Bean stew cooked whole grain pasta with soy cheese Salad: carrot, orange, lettuce different varieties and rape seed/olive oil Dessert: Apple pie with ice cream (oat)
	Whole grain unsweetened crusts with blackberry jam Oat drink 1.5 dl	Semolina pudding with juice sauce	1 soft graham bread hummus margarine, red beet pasty Oat drink 1.5 dl	Buckwheat pudding (cold buckwheat with oat yoghurt, sugar and hazel nuts) strawberry jam	Nuts and seeds 40 g (walnuts, pumpkin seeds, squash seeds, sunflower seeds)	1 Crust whole grains with blackberry jam Coffee/tea with oat drink	1 Sandwich wafer whole grain, margarine and pasty, oat drink 1.5 dl

Oat drink, oat yogurt and margarine are fortified

	Nutrient content per 100 gram				
Product:	Vitamin A (µg)	Vitamin D (µg)	Riboflavin (µg)	Vitamin B12 (µg)	Calcium (mg)
Oat drink, fortified	36,3	1,62	0,239	0,46	120
Oat yoghurt fortified	-	2,0	0,25	0,6	120
Margarine, fortified 70 % fat	800	7,5/20			
Yeast extract (B vitamins)	-	-	1,8	0,5	25

Appendix 7.5. Land use and raw product in quantity for the Initial menu, per person and year.

Land use (m^2), raw product (kg) for the Initial menu, per person and year.

Swedish	Yield	Including losses and waste	No losses and waste	Including losses and waste	No losses and waste
Raw product	kg/m^2	Land use m^2	Land use m^2	Raw product (kg)	Raw product (kg)
oat	0.41	66.30	46.55	27.22	19.11
barley	0.49	1.64	1.15	0.81	0.57
corn	0.67	25.91	18.19	17.44	12.24
rye	0.60	48.11	33.78	28.80	20.22
wheat	0.50	281.55	197.67	140.34	98.53
TOTAL		*423.51*	*297.33*	*214.61*	*151.00*
beans	0.15	11.90	10.64	1.79	1.60
lentils	0.15	22.93	20.50	3.44	3.07
yellow peas	0.31	0.44	0.40	0.14	0.12
TOTAL		*35.28*	*31.54*	*5.36*	*4.79*
melon	5.27	1.08	0.75	5.71	3.95
plum	0.59	6.04	4.19	3.58	2.48
pear	1.37	13.69	9.46	18.74	12.94
apple	1.62	23.72	16.32	38.41	26.42
TOTAL		*44.53*	*30.71*	*66.43*	*45.80*
blueberries	0.08	0.72	0.50	0.06	0.04
raspberries	0.32	6.09	4.22	1.94	1.34
strawberries	0.64	1.46	1.01	0.94	0.65
TOTAL		*8.28*	*5.73*	*2.94*	*2.04*
grapes	*0.11*	*291.63*	*198.40*	*32.49*	*22.10*
cauliflower	1.76	0.16	0.11	0.28	0.20
broccoli	0.79	11.75	8.14	9.32	6.46
cucumber	5.47	1.61	1.12	8.83	6.11
iceberg lettuce	22.10	2.06	1.43	5.01	3.47
pot lettuce	1.03	2.33	1.62	2.40	1.66
onions	4.54	2.63	1.82	11.93	8.26
mâche lettuce	0.91	0.82	0.57	0.75	0.52
Paprika	7.59	1.33	0.92	10.12	7.00
Parsley	0.70	0.83	0.58	0.58	0.40
leek	2.88	0.43	0.29	1.22	0.85
Roman lettuce	0.91	0.41	0.29	0.38	0.26
Ruccola lettuce	0.91	3.61	2.50	3.29	2.28
salad cabbage	1.83	0.70	0.48	1.28	0.88
spinach	1.83	8.51	5.89	10.33	7.15
tomatoes	39.10	1.21	0.83	47.25	32.33
cabbage	4.53	3.81	2.64	17.28	11.97

Swedish	Yield	Including losses and waste	No losses and waste	Including losses and waste	No losses and waste
Raw product	kg/m^2	Land use m^2	Land use m^2	Raw product (kg)	Raw product (kg)
garlic	0.55	0.69	0.48	0.38	0.27
sprouts	22.10	0.14	0.13	3.20	2.86
green beans	1.25	1.17	1.04	1.45	1.30
TOTAL		*44.21*	*30.87*	*135.30*	*94.23*
carrots	5.88	3.80	2.84	22.33	16.69
parsnips	2.53	0.42	0.31	1.05	0.79
TOTAL		*4.21*	*3.15*	*23.38*	*17.48*
potatoes	3.00	14.45	10.78	43.29	32.29
potatoes for starch	4.17	1.24	0.79	5.17	3.29
TOTAL		*15.69*	*11.56*	*48.46*	*35.57*
sugar beets	6.15	10.96	6.96	46.59	29.61
pumpkin seeds	1.83	0.61	0.55	1.12	1.00
linseed	0.17	13.12	11.73	2.23	1.99
oilseed rape	0.37	104.55	62.06	38.47	34.39
TOTAL		*118.28*	*74.34*	*41.82*	*37.38*

Imported	Yield	Including losses and waste	No losses and waste	Including losses and waste	No losses and waste
produce	kg/m^2	Land use m^2	Land use m^2	Produce (kg)	Produce (kg)
pineapples	2.43	33.92	23.05	82.39	56.00
oranges	1.78	45.11	30.78	78.37	54.68
apricots	0.70	15.78	10.71	11.11	7.54
bananas	2.04	22.92	15.82	46.66	32.20
lemons	1.55	0.89	0.61	1.38	0.94
clementines	1.20	5.92	4.10	7.13	4.94
dates	0.63	0.69	0.47	0.43	0.29
figs	0.36	1.60	1.09	0.57	0.39
mangoes	0.81	7.65	5.30	6.17	4.28
peaches	1.43	7.50	5.19	10.72	7.43
TOTAL		*141.60*	*96.85*	*244.95*	*168.68*
cacao	*0.04*	*48.30*	*32.78*	*2.15*	*1.46*
blackberries	*0.71*	*0.27*	*0.18*	*0.19*	*0.13*
aubergine	1.78	6.04	4.19	10.74	7.44
avocados	0.95	17.16	11.88	16.22	11.23
TOTAL		*23.20*	*16.07*	*26.96*	*18.67*
millet	0.09	87.51	61.44	7.67	5.38
quinoa	0.08	46.40	32.57	3.70	2.60
rice	0.45	12.78	8.97	5.72	4.01
TOTAL		*146.68*	*102.98*	*17.09*	*12,00*
cashews	0.07	40.39	36.11	2.91	2.60
hazelnuts	0.14	11.20	10.01	1.54	1.38
sweet almonds	0.11	36.19	32.35	4.09	3.66

Imported	Yield	Including losses and waste	No losses and waste	Including losses and waste	No losses and waste
Raw product	kg/m^2	Land use m^2	Land use m^2	Raw product (kg)	Raw product (kg)
walnuts	0.31	12.42	11.10	3.84	3.43
pistachios	0.13	17.46	15.60	2.33	2.08
TOTAL		*117.66*	*105.17*	*14.71*	*13.15*
sesame seeds	0.06	1.22	1.09	0.07	0.06
sunflower seeds	0.16	2.56	2.28	0.41	0.36
sunflower oil	0.16	15.80	14.13	2.52	2.26
olive oil	0.20	96.33	86.11	18.88	16.87
palm oil. fruit	1.41	0.86	0.77	1.21	1.08
olives	0.20	25.39	22.70	4.98	4.45
TOTAL	*2.18*	*142.16*	*127.07*	*28.06*	*25.09*
chickpeas	0.09	92.93	83.07	8.62	7.70
soybeans	0.25	68.55	61.27	17.43	15.58
TOTAL	*0.35*	*161.49*	*144.34*	*26.04*	*23.28*
tea	*0.15*	*14.44*	*9.80*	*2.11*	*1.43*