WHAT ARE THE DIFFERENCES IN AGRICULTURAL SYSTEMS AND HOW DO THEY AFFECT BIODIVERSITY?

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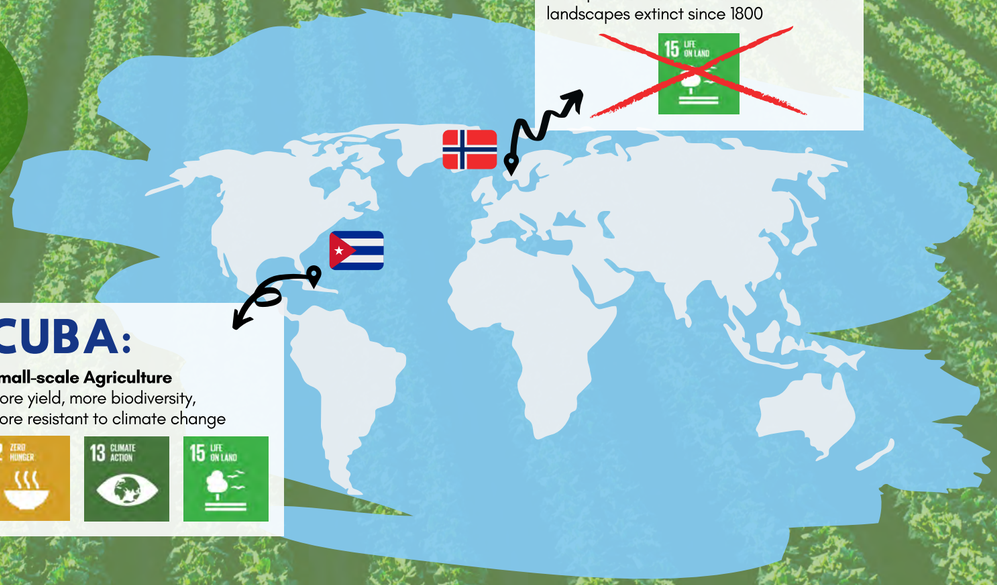
SCAN ME

INDUSTRIAL

- Humans have altered 75% land surface
- Pesticides kills plants and insects, including pollinators
- Fertilizers increase nitrogen flow, degrading ecosystems

SMALL SCALE

- More in accordance with nature
- Companion planting and cultural landscapes can attract more pollinators, increase yield & preserve and promote biodiversity.



NORWAY:

Industrial Agriculture
44 species associated with cultural landscapes extinct since 1800

15 LIFE ON LAND

CUBA:

Small-scale Agriculture
More yield, more biodiversity, more resistant to climate change

2 ZERO HUNGER · 13 CLIMATE ACTION · 15 LIFE ON LAND

THE YIELD GAP

Growing population: According to the UN Food and Agriculture organisation, agriculture must increase the amount of food we grow by 60% by 2050

Definition: "The difference between realized productivity and the best that can be achieved using current genetic material and available technologies and management" (Godfray, et. al)

Closing the yield gap: Low. yields may be due to technology constraints or economic conditions so the gap must be closed to increase food supplies BUT no guarantee of positive environmental impact, with method such as irrigation having the potential to be disruptive

REFLECTION FOR THE FUTURE OF AGRICULTURE

How can agriculture serve an uncertain future?
We must evaluate future projections in uncertain scenarios.

How do local weaknesses and global differences respond to this uncertain future?
We must understand the local conditions which may modify the impact.

How can we prioritise adaptation to better address the risks of climate change?
The strategy planning process should be assessed to address the risks resulting from temperature change or shortage in adaptive capacity.

THE FOOD SYSYTEM

In recent decades, agricultural land that was formerly productive has been lost to urbanisation and other human uses, as well as to desertification, salinisation, soil erosion, and other consequences of unsustainable land management.

References; *See paper for a full reference list* - UiB logo from https://www.uib.no/file/125585
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What are the differences in agricultural systems and how do they affect biodiversity?

Agriculture is practiced in all different regions of the world, and under multiple combinations of socio -economic and physical conditions, which gives rise to many different agricultural systems. Since the agricultural revolution, agriculture has been reformed and modernised, and today's agricultural system is a threat to the natural species composition and biodiversity on earth. In this text we will discuss and present the different types of agricultural systems and what effect they have on the biodiversity of the ecosystem. We will conclude with what type of system has the least negative effect on biodiversity and how agriculture can develop more sustainably.

The Yield Gap:

According to the UN Food and Agriculture organisation, agriculture must increase the amount of food we grow by 60% by 2050 in order to feed a growing (and in some cases nutritionally unbalanced) population.

The yield gap can be defined as "the difference between realized productivity and the best that can be achieved using current genetic material and available technologies and management" (Godfray et al., 2010, p.813). In other words, yield potential vs the average yield a farmer may have over specific land and period of time. A few factors are important to consider here, such as irrigation, 'the watering of land by artificial means to foster plant growth' (Merriam-Webster dictionary), which may be important in enabling farmers to grow crops in multiple seasons (for example the dry season). Godfray et al., also highlight seeds, water, nutrients, pest management, soils, biodiversity, and knowledge as crucial factors for enabling high yields. In this text we want to focus on how biodiversity can help close the yield gap, which is important in producing enough food for this population and must be done so sustainably.

Industrial Agriculture:

Ever since humans started domesticating plants and animals we have wanted to do so in increasingly more efficient ways. The cost of this is that biodiversity related to agriculture is in decline (FAO, 2019). There are many reasons why biodiversity is in decline - humans have altered 75% of the earth's land surface since pre-industrial times (Hooke, 2012).

But it's not only the physical modification of the land that leads to biodiversity loss. In this section we want to focus on a few specific aspects of contemporary industrial agriculture, which we think especially affect biodiversity. The practices we want to focus on are pesticides and fertilizers. Like the fragmentation of land, pesticides and fertilizers have also contributed to the biodiversity loss. The increased use of different types of fertilizer has increased the nitrogen flow, which in turn has affected both life in water, and life on land. In other words, it affects both SDG 14 and 15. The use of nitrogen and fertilizer therefore prompts a classic dilemma: too little use will lead to starvation, whilst an exaggerated use leads to degradation of ecosystems and biodiversity loss. Here, SDG 2 (zero hunger) is put up against SDG 14 (life below water) and 15 (life on land).

The loss of biodiversity we experience today is also linked to the use of pesticides in modern agriculture. Pesticides don't just threaten plants and insects directly by killing them, but they have also been shown to lower effectiveness of pollinators like bees, and to also affect the organisms that attack crop pests (Ramancutty, 2018)

Small scale agriculture:

In this section we will present how more small scale agriculture may be organized contrary to industrial agriculture. We will do this by using examples from Norway and Cuba.

In smaller scale farms there are alternatives to using pesticides and fertilizers. One example of this is companion planting. Companion planting is when a minimum of two different species are planted on the same patch of land at the same time. This is done for many different reasons, two of which have to do with pesticides and fertilizers. When companion planting, you can plant certain plants together to scare away certain unwanted insects or to attract pollinators. By planting nitrogen fixating plants like clover or pulses you can also increase the productivity of the soil without using artificial fertilizers.

Another agricultural practice typically associated with small scale farming is the cultural landscapes. One definition of cultural landscapes given by Shepheard-Walwyn and Bhagwat (2018) is that any "anthropogenic activities", meaning activities carried out by humans, that take place within a natural environment, result in cultural landscapes. In their explanation, Shepheard-Walwyn and Bhagwat (2018) also elaborate on the importance of cultural landscapes. They point out that cultural landscapes are useful tools for interpreting how nature reacts to human intervention, and, as an extension of this, they point out that human use of the land can help promote biodiversity. According to Norwegian environmentalist organization Sabima, cultural landscape is the habitat in Norway that has lost the most species since 1800 (Sabima). The reason for this is that the cultural landscape is dependent on being tended to, either by humans or by other animals. Sabima is an organisation that comprises different biological organizations in Norway.

A common objection to small scale farming is that it is utopian and would not be able to feed entire countries. But the system actually exists in practice in Cuba today. After the Soviet Union collapsed, Cuba lost its main supplier of pesticides, fertilizers, machines, oil. etc. Political commentators around the world predicted Castro's fall, but instead of protesting and overthrowing the government, the cuban people turned to the elders in the country and learned how agriculture was organized before the Green Revolution (Nærstad, Randen, 2012). When pesticides and fertilizers ran out the agriculture was organized in littles pastels with plants that grow well together, rather than large monocultures. Not only did Cuba manage to become self-sufficient, but small-scale agriculture produced three times as much food as the country did with industrial agriculture in 1988 (Randen, Nærstad 2012). This way of organising the agriculture also had some surprising positive effects. Small-scale agriculture has also proved to be more resistant to climate change and extreme weather events. And by attracting different pollinators rather than using chemical fertilizers, it better preserved biodiversity (Nærstad, Randen, 2012).

The food system

Before the first idea they had when food was lacking, it was to increase land for agriculture. However, there is a great need for humans to use these lands for other purposes. Human beings think less and less about protecting biodiversity.

In recent decades, agricultural land that was formerly productive has been lost to urbanization and other human uses, as well as to desertification, salinization, soil erosion, and other consequences of unsustainable land management (lecture 5.1)

The future of agriculture

Food production is the most essential of economic activities to humans; yet, food production systems are strained by human activities and will be further affected by anthropogenic climate change (Intergovernmental Panel on Climate Change (IPCC, 2007))

Over the past twenty years, projections of temperature change are incorporated in scenarios of the evolution of all sectors and play a crucial role for projections associated with natural resources use. Above all, projections of agriculture under temperature change dominate the discourse on future food production, hunger and population displacement. The effect of changes in agriculture significantly impacts on the results of major global economic projections (Stern, 2007) and in Europe (Ciscar et al., 2011)

Analysing the long term of agriculture raises three challenging questions:
How can agriculture serve an uncertain future? How do local weaknesses and global differences respond to this uncertain future? How can we prioritize adaptation to better address the risks of climate change?

We address these questions for agriculture while there is a change in the climate. In order to answer the first question, we have to look at Figure 1, where we see the structure of the studies carried out. This question is addressed by evaluating future projections in uncertain scenarios.

The second question requires an understanding of the local conditions that can modify the impacts. Adaptability should be considered here when developing a list containing specific social responses. Finally, with respect to the third question, an assessment of the strategy planning process should be carried out to address the risks resulting from temperature change or shortage of adaptive capacity.

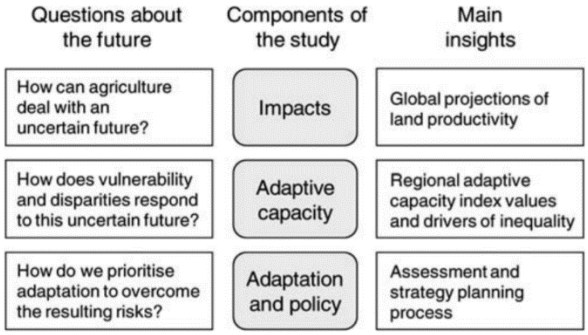

Figure 1

Conclusion

To conclude, we have looked at what is the best method for practicing agriculture, with regards to biodiversity. It is clear that the use of pesticides and fertilizers is not, because this is one of the methods that causes the most negative effects on our animals, plants, lands, etc. For this situation we can put Norway (Sabima) as a clear example in the loss of biodiversity.

Thanks to the small-scale study carried out, we have been able to verify that the use of fertilizers, although they facilitate growth, is not always good to use. Cuba is the greatest example of this, its inhabitants managed to reorganize their agriculture, in addition to preserving and guaranteeing biodiversity without the use of fertilizers or pesticides (Randen, Naerstad)

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