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Working paper

Impact of finance on biodiversity

How agricultural business models get financed and promoted

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Abstract

Worldwide, nature is deteriorating and with this the planet has suffered a great loss of biodiversity and ecosystem services. One of the main causes behind land degradation is the expansion and intensification of agriculture. This paper elaborates on four big trends that have taken place within the agricultural sector which have contributed to the degradation of soil and biodiversity. The paper proposes a solution to the issue by calling on the role of banks, as the current mainstream agricultural model is highly capital-intensive. Lastly, the researchers introduce some alternative production models that are already being developed, but in order to thrive these farming models require more scientific, policy and financial support to thrive.

Impact of finance on biodiversity: How agricultural business models get financed and promoted

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General Background

Nature has a vital contribution to people and human well-being. Nature is an abstract concept that people relate to and generally embody biodiversity and ecosystem functions and services (IPBES, 2019; see Box 1 for further definitions). According to OCDE (2021), nature (including biodiversity and ecosystem services) underpins all economic activities and human well-boing. Therefore, it can be considered the world's most important asset.

However, nature is deteriorating worldwide with an unprecedented loss of biodiversity and ecosystem services (MAE, 2005; IPBES, 2019). Human activity is the main driver for such global environmental degradation and threatens a safe operating space for humanity on Earth (Rockström et al., 2009; Steffen et al., 2015).

Expansion and intensification of agriculture are main drivers of the degradation of nature (Maxwell, et al., 2016; Benton et al., 2021). Humans manage agroecosystems to obtain food for humans, feed for livestock or bio-based materials, e.g. fibre, bioenergy or biochemicals (Muscat et al., 2020). The demand for those products has increased dramatically in the last century (Krausmann et al., 2013) and is expected to further increase due to population growth, switch to diets richer in animal-source foods and the promotion of bio-based materials (Haberl et al., 2007; Muscat et al., 2020). Hence, such trend is expected to further aggravate the environmental degradation and lead to a range of socio-economic impacts (Haberl et al., 2007; Muscat et al., 2020).

Box 1. Definitions of biodiversity and ecosystems services

Biodiversity is understood the "variability among living organisms [...], including diversity within species, between species and of ecosystems" (CBD, 1992).

Ecosystem services are the direct or indirect benefits people obtain from (agro)ecosystems (MEA, 2005; TEEB, 2010; Zhang et al., 2007). The notion of ecosystem services and the ecosystem services framework became popular after the Millennium Ecosystem Assessment (MEA, 2005; Rodriguez-Ortega et al., 2014). The ecosystem services are generally classified into four categories: i) Provisioning: products obtained from (e.g. food, timber or water); ii) Regulating: regulation of ecosystem processes (e.g. pollination, regulation of climate or water purification); iii) Cultural: non-material benefits (e.g. recreation, spiritual or cultural values); and iv) Supporting: precondition and maintenance of other categories. The MEA (2005) extensively report the relationships between ecosystem services and human well-being.

Biodiversity and ecosystem services have a multi-layered relationship. Biodiversity is a key contributor to a sustained delivery of ecosystem services, at all levels of the framework hierarchy (Mace et al., 2012). Hence, it is assumed that high levels of biodiversity relate to increased delivery of ecosystem services and higher levels of wellbeing in people.

Developments in agriculture

Agriculture and agroecosystems experienced a profound transformation after the WWII, particularly in western societies (e.g. European Union and North America). There was an urge to increase food production and at affordable prices. Around 1950, the development of technological innovations, such as new high-yielding varieties, synthetic fertilisers or agrochemicals for crop protection, allowed a boost in agricultural production.

Since then, the implementation of technological innovations has been (and continue to be) widely applied in farming systems worldwide, and has been accompanied with mechanization and structural changes (such as larger farms, buildings and machinery). These developments

in agriculture generally comprise four, sometimes concomitant, trends (see e.g. EC, 2018; MacDonald et al., 2016; Saavoss et al., 2021):

1. *Decrease in number of holdings*: number of farms continuously decrease, particularly smaller farms, run by older farmers (>55 and >65 years old) and with no generational turnover. Many of those farms disappear or are absorbed by other larger farms.
2. *Enlargement of holdings*: smaller farms disappear and are absorbed by larger farms. Hence, the overall number of farms declines and the average farm size increases. Likewise, in livestock production, the overall number of heads decrease, while the number of heads per farm increase.
3. *Specialisation of production*: farms focus on producing one or very limited range of goods to gain in efficiency. Specialisation is also related to farm size. For instance, holdings with no agricultural land are predominantly producing granivores (i.e. livestock species feed with grains, such as pig and poultry) or ruminants held in intensive systems (i.e. feedlots to fatten e.g. cattle for beef). Farms with bigger areas of agricultural land tend to specialise in field cropping or grazing livestock. The smallest farms show the greatest diversity in their farming activities and often practise mixed crop-livestock farming.
4. *Intensification of production*: increase use of inputs to sustain and raise productivity per production unit (i.e. per hectare or per animal). Current food production heavily depends on the use of inputs such as fertiliser, pesticides, energy, land and water, or practices such as monocropping and heavy tilling (Benton et al., 2021; Saavoss et al., 2021; portfolio.earth, 2021).

Hence, farms have generally embraced the idea of “economies of scale” or “economies of size” (Saavoss et al., 2021). According to MacDonald (2016) “costs are a driving force behind structural change. The largest farms earn substantially higher net returns per hundredweight of milk produced, and they have strong incentives to expand”. In other words, and according to Benton et al. (2021) “our food system has been shaped over past decades by the cheaper food paradigm. Policies and economic structures have aimed to produce ever more food at ever lower cost”.

Generally, that also meant the continued replacement of traditional farming systems, which are generally regarded as low-input and relaying on ecological processes, by modern, intensive or high-input farming systems, which generally relay on technological innovations and capital. Since 1970, the increased production of food, feed or biomaterials from agroecosystems (i.e. provisioning services in the ecosystem services framework) has been achieved at the cost of biodiversity and non-material ecosystem services (i.e. regulating and cultural ecosystem services) (Foley et al., 2005; IPBES, 2019).

Impact of agriculture on biodiversity

The relationship between agriculture and biodiversity is complex and multifaceted (Kok et al., 2020). On the one hand, agriculture and its sustained production is underpinned by biodiversity and ecological processes and services, such as pollination, pest control or dung burial (Zhang et al., 2007).

Then, in occasions, agriculture and livestock production underpin and contribute to the delivery of ecosystem services and enhancement of biodiversity (Zhang et al., 2007; Cooper et al., 2009; Rodriguez-Ortega et al., 2014; Kok et al., 2020). For example, the High Nature Value (HNV) farmland in Europe is a concept that involve long-established, low-intensity and often complex farming systems (Keenleyside, 2014) and is crucial for the conservation of biodiversity and meeting the growing demands for ecosystem services (Moran et al., 2021).

However, and on the other hand, agriculture and the recent development trends of expansion and intensification (described above) are generally driving biodiversity loss. Biodiversity loss applies within agroecosystems, i.e. biodiversity for food and agriculture (FAO, 2019), as well as to wildlife and natural ecosystems (IPBES, 2019; Benton et al., 2021). Within agroecosystems, local varieties and breeds of domesticated plants and animals are disappearing worldwide (FAO, 2019). This loss of diversity, including genetic diversity, poses a serious risk to global food security by undermining the resilience of many agricultural systems to threats such as pests, pathogens and climate change (IPBES, 2019; FAO, 2019). Moreover,

intensive production and practices can degrade soils and ecosystems, driving down the productive capacity of land and necessitating even more intensive food production to keep pace with demand (Benton et al., 2021).

Agriculture is also a main driver for biodiversity loss and threatens nature and wildlife through expansion (e.g. land use and land use change) and intensification of production (Newbold et al., 2015; Maxwell et al., 2016). This biodiversity loss has been reported for species (Hallmann et al., 2017; Stanton et al., 2018), agroecosystems favourable to biodiversity, such as HNV (EEA, 2019; Figure 1 below), and for natural ecosystems that are disturbed or replaced by expanding agriculture (Giam, 2017; Barlow, 2016). In occasions, deforestation (of e.g. tropical forests) and loss of biodiversity occur to sustain intensified forms of agriculture elsewhere, trough international trade (WWF, 2021). The destruction of natural ecosystems and the loss of its biodiversity due to agricultural expansion and intensification has been largely reported, and the role of the banking and wider financial system has increasingly been debated (Portfolio.Earth, 2021; WWF, 2021; Global Witness, 2021).

Moreover, agriculture is also a main driver for climate change (IPCC, 2006), which in turn, is also a direct driver for biodiversity loss (IPBES, 2019). Recent research suggests that common and coordinated efforts are needed to bend the curve of biodiversity loss and combat climate change altogether (Leclere et al., 2020; Pörtner et al., 2021; Pettorelli et al., 2021).

Financial sector and other support mechanisms can be harmful to biodiversity

The current mainstream agricultural model and its development (e.g. intensification, enlargement of farms, mechanisation, reduced labour, etc.) make it a capital-intensive activity, which can only be achieved through investments. Investments generally account for the land (enlargement of farms), but also buildings, machinery or livestock (Kay et al., 2012).

Sources of capital in agriculture are generally own equity (often by inheritance) and credits (loans). Credit is important to capital acquisition and use. It depends on the ability to borrow money with a promise to return (and pay interest) with the benefit generated (Kay et al.,

2012). Also, family loans are becoming more important in obtaining bank loans for agricultural business (Berkhout et al., 2013).

The agricultural sector is largely composed of small- and medium-size enterprises (SME) (EIBG, 2021). SMEs are highly dependent upon banks for their financing (Treur, 2012). Commercial banks, therefore, are the single largest source of loans for agriculture (Kay et al., 2012).

Hence, banks have a large say in how the agricultural business needs to develop (i.e. invest) before a loan can be approved. As explained by Berkhout et al. (2013), "when loan capital is required for new investments, the financiers will not only look at the entrepreneurship and cash flows, but also at the solvency of the company when assessing the credit application. The new investments in scaling up and modernising the companies will eventually lead to a greater payment capacity. After all, companies with a lot of debt have to pay a larger part of the income in the form of interest and repayments to the capital providers".

This logic in financing in agriculture is observed in several narratives (EIB, 2012; Zijlstra et al., 2012; Treur, 2012 or Berkhout et al., 2013). Agriculture and the bioeconomy sector have a continuing need for investments to e.g. upgrade physical assets or adopt technology in production processes to enhance efficient production at low prices (EIB, 2021; Benton et al., 2021). For instance, agricultural business in the Netherlands, and particularly dairy farms, grow almost continually (Zijlstra et al., 2012; Berkhout et al., 2013) and the growth requires investment (Zijlstra et al., 2012). This makes continuity in lending crucially important to them. If lending were to stagnate, these entrepreneurs would face serious trouble. It would immediately have a negative impact on their ability to make investments, which would in turn hamper economic growth (Treur, 2012). Banks are therefore, more likely to finance an investment to enlarge farm enterprises.

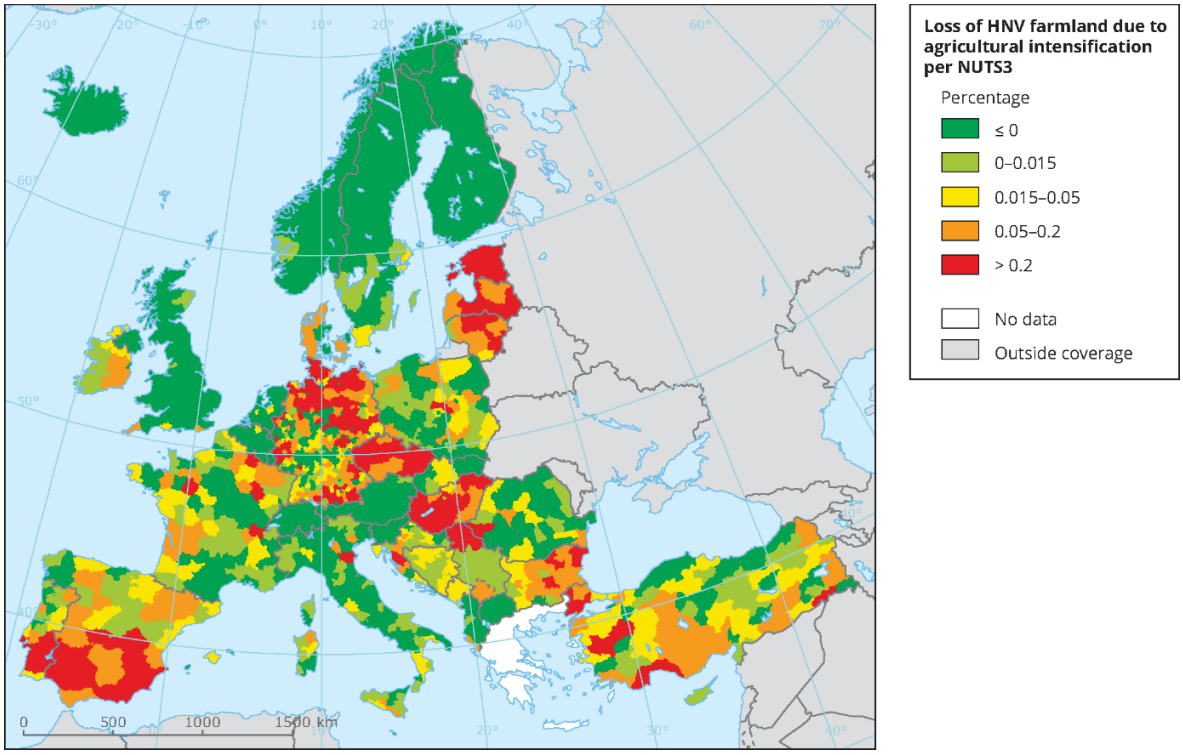
There are feedback loops between the financial sector (i.e. granting bank loans to farmers for expansion), the developments in agriculture (i.e. expansions and intensification) and the impacts on biodiversity. There is evidence on the role of banking (and concession of credits

and loans) to steer and promote intensive agricultural business models that result in detrimental effects to biodiversity (Van der Weijden et al., 2021; Portfolio.Earth, 2021; Global Witness, 2021). However, further transparency and research is needed to comprehend the direct and indirect impacts on biodiversity of financing of (all types and sizes of) companies along the supply chain (Portfolio.Earth, 2021).

While intensive farming is the dominant business model in Europe and North-America, alternative production models exist and develop. A clear example is organic farming, which is slowly but steadily increasing. Moreover, the European Commission has set a target of "at least 25% of the EU's agricultural land under organic farming and a significant increase in organic aquaculture by 2030" under the Green Deal's Farm to Fork strategy (EC, 2020). Currently, in Europe, the organic farming area is 8.5 per cent of total utilised agricultural area (Eurostat; see Figure 1). In North-America, the organic farming is 0.8 per cent (0.6 per cent in the United States and 2.0 per cent in Canada) (Willer et al., 2021). While organic farming is a well-recognised and stablished production system, it is not the only alternative. Other agricultural models are being proposed that could benefit biodiversity and the environment and meet other societal demands, such as circular agriculture (Muscat et al., 2021), agroecological approaches (Wezel et al., 2018), nature-inclusive farming (Runhaar, 2017) or agroforestry (Nerlich et al., 2013). These alternative farming models, however, will require more scientific, policy and financing support to thrive.

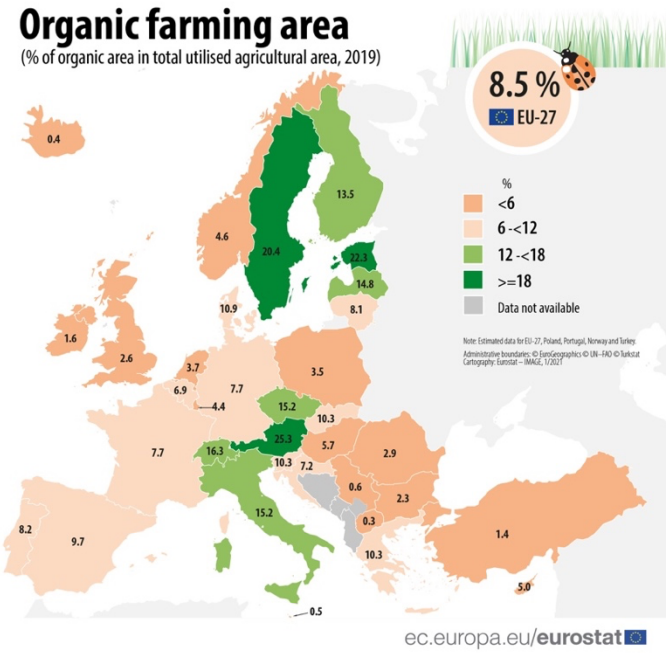
For finance, this implies a shift from managing on financial value to steering on financial, social and ecological values (Schoenmaker and Schramade, 2019). Banks can thus become a driver of the transition from intensive to extensive farming to restore degraded soil and biodiversity. Incorporating the consideration of the multiple values of ecosystem functions and of nature's contributions to people into economic incentives has been shown to permit better ecological, economic and social outcomes (Ferwerda, 2015; IPBES, 2019).

Figure 1: Loss of High Nature Value (HNV) farmland in Europe due to agricultural intensification (EEA, 2019)



Source: https://www.eea.europa.eu/data-and-maps/figures/loss-of-hnv-farmland-due

Figure 2: Organic farming across the European Union



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Organic_farming_area_2019_map.jpg

Findings

- Economic incentives, including those from financiers, have generally favoured expanding agricultural activity, and often environmental harm, over conservation or restoration.
- Harmful economic incentives and policies associated with unsustainable practices in fisheries, aquaculture, agriculture (including fertiliser and pesticide use), livestock management, forestry, mining and energy (including fossil fuels and biofuels) are often associated with land- and sea-use change and overexploitation of natural resources, as well as inefficient production and waste management.
- Intensive farming is the dominant business model in Europe and North-America. There are feedback loops between the financial sector, the developments in agriculture and the impacts on biodiversity. There is evidence on the role of banking to steer and promote intensive agricultural business models that result in detrimental effects to biodiversity.

Recommendations

- Incorporating the consideration of the multiple values of ecosystem functions and of nature's contributions to people into economic incentives permits better ecological, economic and social outcomes.
- Banks, as main financier of farms, need to steer on financial, social and ecological values instead of solely on financial value and economies of scale. Banks can thus become a driver of the transition from intensive to organic and other forms of extensive farming to restore degraded soil and biodiversity.
- More transparency is needed to understand the direct and indirect impacts on biodiversity of financing of farms and agricultural companies along the supply chain.

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