Nature metrics: measuring progress and catalysing investment in sustainable food systems

GFFN Metrics Catalyst Group Brief

Good Food Finance Network

UN environment programme WCMC

TRADE, DEVELOPMENT & THE ENVIRONMENT HUB

Background

This brief on nature metrics is the third document published by the Good Food Finance Network (GFFN) Metrics Catalyst Group. The Inception and Climate Briefs of the GFFN Metrics Catalyst Group are available on the GFFN website.

The Good Food Finance Network (GFFN) is a multi-stakeholder collaborative platform, working to develop the critical innovations that will allow sustainable food system finance to become the mainstream standard. The network is coordinated by EAT, FAIRR (Farm Animal Investment Risk and Return) Initiative, Food Systems for The Future, United Nations Environment Programme, and World Business Council for Sustainable Development. As part of its activities, GFFN organises catalyst groups around various topics to facilitate discussion and support the development of knowledge resources for achieving its goals.

The Metrics Catalyst Group, coordinated by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) in partnership with UNEP, is intended to be a non-competitive and collaborative space, bringing together experts and practitioners on designing metrics and indicators for measuring progress toward sustainable food systems. Financial institutions and businesses that are part of the GFFN High Ambition Group were also invited to join the Catalyst Group.

The Metrics Catalyst Group intends to contribute to improved measurement of progress towards sustainable food systems by financial institutions by (a) increasing understanding of the challenges in measuring progress towards sustainable food systems and its importance, (b) identifying the need and opportunities for developing new metrics, (c) increasing opportunities for cross-sectoral collaboration on sustainable food systems metrics.

The brief was also developed in collaboration with the Trade, Development, and the Environment Hub (TRADE Hub) of the UK Research and Innovation Global Challenges Research Fund (UKRI GCRF). TRADE Hub aims to make sustainable trade a positive force in the world by focusing on the impact of trade in specific goods and seeking solutions to these impacts. It conducts research on all stages of various agricultural supply chains, revealing damaging links and potential ways to make lasting change.

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Members of the GFFN Metrics Catalyst Group[1]

AMERRA Capital Management

CDP

Center for International Forestry Research (CIFOR)

Climate Bonds Initiative (Climate Bonds)

DuAgro

EAT

FAIRR Initiative

Fideicomisos Instituidos en Relación con la Agricultura (FIRA)

Food and Land Use Coalition (FOLU)

Food Systems for the Future (FSF)

Global Alliance for Improved Nutrition (GAIN)

Global Canopy

Global Environment Facility (GEF)

Global Farm Metric

Global Impact Investing Network (GIIN)

Green Climate Fund (GCF)

International Union for Conservation of Nature (IUCN)

Johns Hopkins University

OmniAction

Planet Tracker

Rainforest Alliance

Signature Agri Investments

Stockholm Environment Institute

Sustainable Food Trust

United Nations Environment Programme (UNEP)

United Nations Environment Programme Finance Initiative (UNEP FI)

United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)

World Benchmarking Alliance

World Business Council for Sustainable Development (WBCSD)

World Wildlife Fund (WWF)

Yara International

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[1] The brief does not necessarily reflect the individual or institutional opinion of each member of the Catalyst Group.

Summary

1. Introduction

Food systems are intricately linked with global biodiversity. Land use change, including agricultural expansion, is a direct driver of biodiversity loss worldwide with one-third of the global terrestrial surface dedicated to cropping or animal husbandry[1]. On the other hand, biodiversity is essential to food and agriculture, contributing to the productivity and resilience of food systems[2]. Impacts and dependencies on nature are distributed throughout the agricultural value chain: production through processing to retail markets and can be highly localised and context specific. For example, demand for soy in European markets has been linked to a decline in habitat associated with the iconic giant anteater[3]. Ancillary impacts of agriculture can also be devastating: a recent review of deforestation data concluded that 90% of recent forest clearance was in landscapes where agricultural drove the loss, but only 50% of the land was converted to productive farming[4]. Possible mechanisms for non-productive conversion, among others, are land speculation, unrecorded agricultural area, and fires spreading from forest clearing.

An analysis of global investment themes found that agricultural investments account for the second highest volume of nature-based solution (NbS) projects, behind forestry, and third by total value, at USD 268 million, behind forestry (USD 854 million) and freshwater (USD 316 million)[5].

This brief provides an overview of the current state of metrics used, or available for use by, financial institutions to assess impacts and dependencies of food systems on nature. We identify the key gaps, challenges and trends for the application of these metrics, as well as suggest possible solutions. Nature metrics are extremely diverse, incorporating climate metrics as part of nature and much more. Coupled with the inherently more complex nature of accounting for biodiversity as opposed to abiotic components, one-size-fits-all approaches are unlikely. As it is difficult to ensure relevance in such a quickly shifting landscape, this brief seeks to provide a high-level overview of the topic: highlighting current trends and providing general recommendations, with illustrative examples of methods financial institutions (FIs) are employing to navigate physical, transition and systemic risks when financing agriculture.

Box: Definitions

Direct drivers: Natural and anthropogenic factors that affect biodiversity directly. Anthropogenic direct drivers can be conceptualized as the set of activities performed by humans that result in biodiversity loss (e.g. land clearance, intensification).

Ecosystem functioning: Flow of energy and materials through the arrangement of biotic and abiotic components of an ecosystem. It includes many processes such as biomass production, trophic transfer through plants and animals, nutrient cycling, water dynamics and heat transfer. The concept is used here in the broad sense and it can thus be taken as being synonymous with ecosystem properties or ecosystem structure and function.

Nature-based solutions: Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.

Sustainable intensive agriculture: Process or system where agricultural yields are increased without adverse environmental impact and without the conversion of additional non-agricultural land.

Second-growth forest: Regenerating forest after disturbance, such as fire or clear-cutting.

All definitions from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

2. Trends

Around 768 million people suffer from hunger, over 2 billion suffer from at least one micronutrient deficiency, and diet-related non-communicable diseases are widespread and on the rise[6]. The agricultural sector is ripe for complete transformational change to address global hunger, diet, and nutrition challenges whilst minimising impacts on society, climate and nature. There are wider trends within agriculture already identified elsewhere in the literature: changes in demography, migration, technology, and diet. These are important to consider but are outside of the scope of this brief. There are emerging trends in the transition towards sustainable food systems that are relevant to be considered by financial institutions when setting their nature-related targets and tracking their contribution to a nature positive society. Many of these trends relate to social and economic issues that are interconnected with nature-related risks and impacts. This section covers some of these relevant trends that should be considered when identifying appropriate metrics to use.

- *Climate change:* Agriculture is arguably the sector most affected by changes in climate[7]. The agriculture sector also contributes a great deal to global emissions: agriculture, forestry and other land use produce an estimated 21% of annual greenhouse gas (GHG) emissions climate change[7], with energy inputs into the agrifood chain adding 10%[8]. A changing climate will increasingly disrupt crop productivity, impact manufacturing processes, capacity and distribution[9]. It correlates highly with demographic changes and social upheavals, and has a substantial impact on all other agricultural trends[8]. Food systems play a crucial role at the interface of nature and climate and their risks tend to overlap substantially; climate change itself is a key driver of biodiversity loss, compounding the impact of climate change on agriculture by reducing the resilience of the system. For an overview of metrics relating to climate, see the GFFN Climate Brief [insert link].

- *Competition for natural resources:* Agricultural land comprises 4.9 billion hectares globally[10]: roughly 37.7% of terrestrial land. This area has increased by 100 million hectares between 1980 and 2000 across the tropics, with 50% of this conversion replacing intact tropical forests[11]. Up to 33% of this land can be considered degraded. Further land degradation, deforestation and water scarcity are symptoms of this increasing land competition. Perversely, attempts to mitigate climate change through bioenergy have exacerbated competition. Freshwater extraction for the agricultural sector comprises 70% of all extraction; in many low-rainfall areas this can be as high as 90%. Resource competition this severe can lead to systemic risks to agricultural business activities when densely sited in a landscape.

- *Commitments to nature:* A recent review showed that biodiversity commitments have increased in the Global Fortune 100 since 2016, with seven financial institutions making public statements[12]. However, of these, only one – BNP Paribas – made measurable, time-bound targets. In part due to the recognition of the understood financial and economic risks of catastrophic biodiversity loss, the private sector and conservation organisations have shifted the discourse away from previous commitment iterations of no net loss or net positive impact to coalesce around "nature positive"[2]. This was reinforced in the lead up to the 15th Conference of the Parties to the Convention on Biological Diversity, and it is expected that, despite "nature positive" not appearing in the Kunming-Montreal Global Biodiversity Framework text, more such commitments will follow[13].

- *Nature disclosures:* Following recognition of climate-related risks to financial investments, organisations are becoming aware of analogous risks that result from impacts and dependencies on nature. The Network for Greening the Financial System (NGFS), comprising more than 100 central banks and financial supervisors, concluded the relevance of biodiversity

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[2] The term "nature positive" is not yet defined and is subject to different interpretations. A working definition can be found at: https://www.iucn.org/resources/file/summary-towards-iucn-nature-positive-approach-working-paper

loss to primary mandates, while studies are emerging that highlight material exposures within banks, insurers, global asset managers, pension funds, development finance institutions, and central bank asset portfolios[14]. Initiatives such as the Taskforce for Nature-related Financial Disclosures (TNFD) and Science Based Targets Network (SBTN) are driving development of guidance on how businesses and investors should assess and disclose their nature-related impacts, dependencies, risks and opportunities. New and updated sustainability reporting standards are emerging, including the International Sustainability Standards Board (ISSB) Sustainability Standards, European Sustainability Reporting Standards (ESRS) in the EU and the Global Reporting Initiative standards on impact reporting. With the Kunming-Montreal Global Biodiversity Framework explicitly referring to disclosure of biodiversity impacts and dependencies by business and finance in Target 15, many other initiatives are positioning themselves to cater for this emerging reporting landscape.

- *Definitions of nature:* **For a non-technical audience, nature can often be used interchangeably with terms with accepted scientific definitions, such as biodiversity. Nature, as defined by IPBES, is broader: "the natural world, with particular emphasis on biodiversity". Science Based Targets for Nature (SBTN), for example, aims to set science-based targets for nature through realm-based approaches, with methodologies for land and freshwater in their initial release, and planned developments related to oceans and greater coverage of biodiversity across all realms. Similarly, the Taskforce on Nature-related Financial Disclosures (TNFD) framework emphasises the four realms of the natural world: land, ocean, freshwater and atmosphere. The latter is included to highlight the feedback loops present between nature and climate. This brief focuses on a broader definition of nature, although a lot of the difficulties of measuring nature come from the complexities of measuring its most mercurial component, biodiversity.**

3. Current state of nature metrics in food systems

Corporate reporting on biodiversity, even more so than reporting on natural capital, is "extremely limited", with "little quantitative non-monetary information"[15]. To date, measuring biodiversity in financial institutions tends to be quantified in three ways[16]:

1. The cost to restore biodiversity once it has been degraded
2. The volume of biodiversity finance
3. Identifying industries dependent on nature and assessing their economic output.

Many businesses have identified a need to better grasp their impacts and dependencies on nature. The current state of nature metrics used, and available for use, by, financial institutions is discussed in the following section.

Non-financial organisations have attempted to develop their own approaches that can be applied cross-sector and cross-scale, including by financial institutions. Cambridge Institute for Sustainability Leadership (CISL) developed the Biodiversity Impact Metric through the Natural Capital Impact Group, including food companies Asda and Mars among others[17]. The metric aims for simplicity: multiplying the land area under production with the proportion of biodiversity loss, measured through mean species abundance (MSA), and finally with the biodiversity importance (mediated through a range rarity score that highlights regions with high number of species and/or species with limited ranges). What these more simplistic approaches gain in flexibility, they lose in specificity.

Many financial institutions, in the absence of agreed standardised metrics, have developed their own in-house methodologies, often in collaboration with external partners, for assessing nature risks and dependencies. Many of these have resulted in metrics being disseminated externally. An October 2022 report written by Finance for Biodiversity Pledge highlights the following case studies of financial institutions developing their own approaches[18]:

- ASN Bank's development of Biodiversity Footprint Financial Institutions (BFFI): launched in 2014 with two consultancies, CREM and PRé Sustainability. BFFI aims to gauge a bank's impact hotspots in its portfolio; development of this metric led to the formation of Partnership for Biodiversity Accounting Financials (PBAF - see Annex A) in 2019. Use of BFFI has allowed some comparison of impact across investment categories (see Figure 1 below).
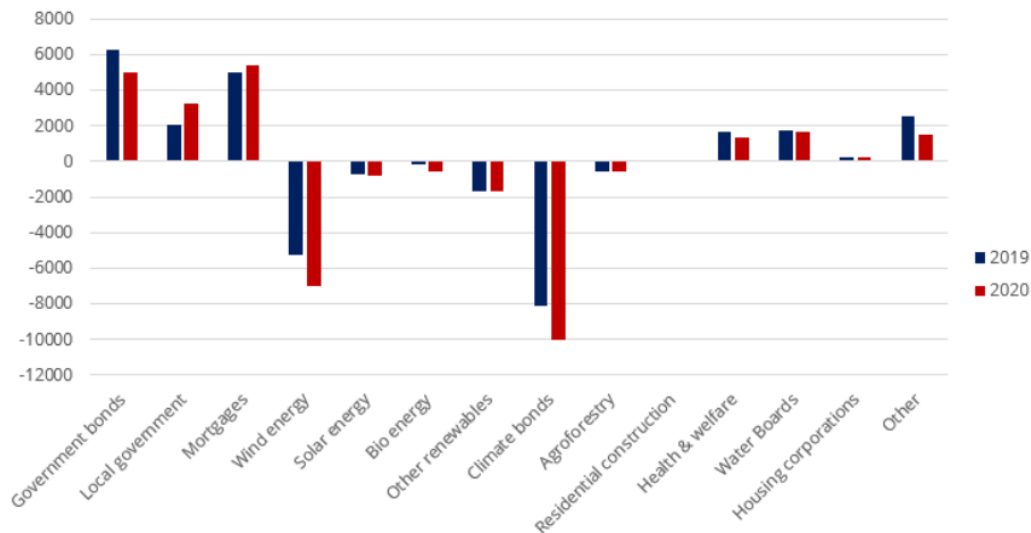

Figure 1: ASN Bank's net biodiversity impacts in ha per investment category 2019-2020. Source: ASN Bank[19].

- **La Financière de l'Echiquier's (LFDE) use of Biodiversity Impact Analytics, powered by the Global Biodiversity Score (BIA-GBS), and supported by CDC Biodiversité. LFDE uses BIA-GBS to measure the impact of its portfolios and provide quantitative information to its investment teams. Specifically for investment in sustainable agriculture, CDC Biodiversité provides a benchmark factsheet for the sector[20].**
- **In 2021 HSBC launched the Euronext ESG Biodiversity-screened Index, allowing investors to consider the impact on natural capital of their trading and investment decisions. The last stage of the index uses the Corporate Biodiversity Footprint (CBF) to exclude the top third of highest impact companies in each sector, including *Agri-Food & Tobacco*, which "stand[s] out with a high land use in their upstream value chain"[21].**
- **ABN AMRO's use of natural capital as one of its six capitals through use of the Global Impact Database (GID). Use of GID allowed the production of a report in May 2022 on the specific biodiversity impact of ABN AMRO's lending[22]. The GID expresses the impact of four different drivers of loss (air pollution, contribution to climate change, land-use, and water pollution) in single units: the loss of a hectare of pristine biodiversity (biodiversity ha) and monetary units (EUR). Cattle farming, through land-use, was far and above the biggest impact identified by the analysis.**
- **Use of the Integrated Biodiversity Assessment Tool (IBAT) by Allianz: when risks are flagged, physical assets are checked by sustainability teams with data from IBAT on species and protected areas, among other indicators.**

Some methodologies are being developed in tandem with emerging disclosure frameworks. One such measure is the Ecosystem Integrity Index (EII), currently in preprint[23], which is a first attempt to unite the full complexity of ecosystem condition and integrity into a single index. The EII has been developed partly to provide a mechanism for non-state actors, e.g. financial institutions, to demonstrate contributions to the Kunming-Montreal Global Biodiversity Framework. The metric aims to address the need for more metrics describing ecosystem *condition*, as opposed to merely extent, and comprises three inputs: structure, composition, and function. It then compares these to a natural baseline. The EII has been referred to within both the Taskforce for Nature Financial-related Disclosures (TNFD) and SBTN.

More simplistic approaches can also include use of proxies to estimate impact[24]. A recent report from ShareAction found that 10% of asset managers had a dedicated biodiversity policy (34% have a general responsible investment policy that broadly includes biodiversity); the most common commitment (14% of asset managers) is the No Deforestation, No Peat, and No Exploitation commitment[25]. This focus on deforestation does not cover all nature-related impacts (see Box). The Accountability Framework Initiative and SBTN developed the No Conversion of Natural Ecosystems Target for companies to address this and are working to better capture biodiversity values through identified natural areas.

Across the broad range of nature-related financial initiatives (laid out in Annex A), there is no doubt that the participation and interest in, and use of, nature metrics in financial institutions is high: PBAF comprises 47 financial institutions with over US$9.6 trillion in assets; TNFD has 40 Taskforce Members, including financial institutions, representing more than US$20 trillion in assets, while the Science-Based Targets Network comprises 45+ organisations. The EU Business @ Biodiversity Platform also provides a comprehensive list of biodiversity measurement appraoches[26].

Box: Deforestation as a proxy for biodiversity

Land use change is arguably the most important direct driver of biodiversity decline globally (Balvanera *et al.* 2019). Agricultural expansion comprises a significant portion of this, currently accounting for a third of the global land surface.

Deforestation, while a subset of land use change, tends to attract attention as one of the starker examples of reductions in ecological complexity as well as its significant impact on the global climate. This is further bolstered with good data availability from well-established sources. There are also initiatives to further improve deforestation metrics, such as Global Canopy's *Aligned Accountability* project.

As such, deforestation is often thought of as an adequate proxy for biodiversity impact. Several tools and initiatives use deforestation data to highlight overseas impacts of agricultural commodity production, such as the CommodityFootprints.earth platform (SEI/JNCC; Croft *et al.* 2018).

While global forest biomes are indisputably important for the persistence of life on Earth, they are but one type of global biome. Many damaging ecological transitions occur within a category, eg species-poor versus species-rich grasslands, and are unlikely to be picked up by the same coarse tools that can detect the loss of a forest. Furthermore, many forest species have strict habitat requirements for *primary* forests and *intact forest landscapes*. This can undermine the efficacy of deforestation as a proxy for biodiversity in areas with high human impact where second-growth forest persists. However, highly resolved temporal and spatial forestry data is starting to be combined with biodiversity data to provide new products that can address this shortcoming (Hill *et al.* 2019). Conversely, as data improve so does evaluation of commitments to zero deforestation (zu Ermgassen *et al.* 2020).

Box sources: Balvanera et al. 2019[1]; Croft et al. 2018[27]; Global Canopy[28]; Hill et al. 2019[29]; zu Ermgassen et al. 2020[30].

4. Challenges in the application of nature metrics for food systems

Despite equalling or even surpassing climate change in urgency, the incorporation of nature risk into our economies to transition to sustainable food systems is under-developed; the assumption is that nature related disclosure will follow that of carbon's footprints[14]. However, this assumes that a plethora of challenges in implementation will be imminently solved. Some of the most pressing challenges are listed below.

Limited availability of data

Myriad reports reference data availability as a challenge for catalysing investment in sustainable food systems[5,9,31,32]. In reality, "data challenges" is a broad category: ranging from lack of information on returns on investment from sustainable food system projects, through difficulties in scaling site-level data, to lack of spatial resolution sufficient to disclose an organisation's interface with nature. The more localised context of nature risk as opposed to climate also forces the requirement of metrics that can facilitate like-for-like comparison of geographically distant projects. Views differ on the utility of secondary data: one study's approach to mapping the impact on biodiversity loss of international trade in soy from the Brazilian Cerrado is suggested to be applicable to a wide range of agricultural commodities[3], however the OECD recently highlighted significant differences in environmental impacts of producers, even within the same region[33]. Furthermore, more than 40% of commodities are often sourced "indirectly" via local intermediaries, which obscures exact points of origin and therefore impact[34]. This is not about the lack of nature data *per se*, but a lack of data measuring *direct* pressures, ie explicit operational data. Without explicit operational data, there is a reliance on modelled or secondary data that limits the ability to accurately assess impact and more suitable for screening potential impacts.

The availability of data on nature impacts and dependencies for financial institutions depends entirely on the use case. For investors, this could either be metrics for screening risks of business impacts and dependencies on nature (and opportunities for mitigation), and metrics for business performance with respect to managing impacts on nature. The latter requires more precise and responsive metrics and can be further split into site-based metrics and those for measuring value chain (both upstream and downstream) impacts (see the Align project - Box). Financial institutions investing in a specific project should be more concerned with site-based metrics, whereas those investing in a business should also consider value chain metrics to screen for risks.

Availability of nature data is often flagged as a challenge but in many areas, data have greatly increased thanks to significant investment in data architecture by conservation organisations[35]. However, this does vary by facet of biodiversity: knowledge of, for example, the *extent* of ecosystems, has improved significantly. Data on the *condition* of ecosystems remains sparse, and genetic diversity, despite recent advances in environmental DNA, has a similar outlook (the Evolutionarily Distinct and Globally Endangered – EDGE – data from the Zoological Society of London remain the exception). Global knowledge products like Protected Planet, the IUCN Red List of Threatened Species, and the Key Biodiversity Areas database provide a fantastic springboard to further analysis of the state of nature. These are made available through tools targeted at financial institutions like IBAT. The TNFD Tools Catalogue details myriad other data and tools to explore available nature data. There is also a tools catalogue that supports trade and supply chain assessments, the TRADE Hub Trade Tools Navigator[36].

The other side of the same coin for data availability is data on business operations. Contrary to climate metrics for sustainable food systems (see the previous brief from the Good Food Finance Network), where an emissions reduction somewhere can be considered an emissions reduction everywhere, nature metrics are inherently spatially explicit and require detailed knowledge of the interface of business activities with specific locations. This can be challenging for organisations not used to thinking

spatially, and who might not have the capacity for spatial analysis to interrogate this kind of information. This is exacerbated by difficulties in many cases in *obtaining* the spatial data in the first place, whether this is internally, or beyond their direct operations. Financial institutions may only possess coarse spatial data, e.g. country of operation, for investment portfolios. While this level of granularity cannot be used to understand performance, it can be used to screen and prioritise where more detailed measurement may be needed.

Finally, the interconnectivity of the issues covered by metrics described here can open financial institutions to transition risks: climate and nature, although intrinsically linked, do not always pull in the same direction; an investment that performs well for the climate may not always do so for nature. In an ideal world, data would be needed that cover all elements of nature-related risks and dependencies. Furthermore, social metrics must also be accounted for to protect against transition risks in a portfolio while supporting a *just* transition. However, insufficient metrics coverage of livelihoods, labour conditions and equality was identified as a current knowledge gap by the first brief in this series[37]: the UKRI GCRF TRADE Hub project has carried out research to understand the full scope of social impacts associated with agricultural commodity production and trade and the available metrics that can be used to measure social performance. Both TNFD and SBTN agree that metrics are lacking and have both released stakeholder guidance to ensure social issues are considered as part of nature-related strategies[38,39].

In-house capacity

Capacity within financial institutions is another common challenge in scaling investment in sustainable food systems. Capacity here refers to two main categories: *technical* capacity, ie spatial analysis with geographic information systems, and *subject matter* capacity, ie deep expertise in nature-related concepts. For the former, financial institutions staff have highlighted the difficulty in "find[ing] their way in the number of tools available"[24]. For the latter, many nature definitions, for example nature positive, are still in flux and contribute to perceived capacity shortfall. This can be seen as an inevitable consequence of the complexity of nature itself, but even where guidance exists, documents can be long and very technical. Technical capacity may exist in organisations but is hampered by mismatches in the accuracy of nature-related data and operational data and methods to integrate these when the mismatch is large.

Uncertainties generated from this, as well as the wide range of possible methodologies and approaches, can make disseminating results difficult. As a result of lack of capacity, organisations tend to employ external consultants to analyse and interpret results, meaning in-house capacity is never built.

Lack of standardization and comparability

Several sources highlight the current disparity between traditional financial products and nature-focused sustainable food system investments. Unfortunately, quick wins in nature are rare: nature-related opportunities tend to be higher risk investments with significant upfront costs and long lead times. Nature projects are also difficult to spatially define: at what scale do you measure outcomes? Financiers have also highlighted that nature-related investments tend to have poor financial fundamentals: remote locations, reliance on SMEs, risky markets and are vulnerable to reputational risks. Many challenges in the productisation of nature reinforce each other: small project pipelines produce limited information on the returns of sustainable food systems, which in turn discourages risk averse investors; this keeps investment in projects low, leading to limited numbers of projects and small pipelines. Respondents to a 2021 working paper identified this lack of evidence application as a major challenge of measuring biodiversity[24].

Lack of standardisation and comparability extends to financial institutions' desire to feed into global biodiversity processes. More than half of respondents to the working paper disagreed that current measurement approaches are suitable for setting and tracking company and global targets.

5. Possible solutions to improve the use of nature metrics

Development of standardized methodologies and metrics

One way to improve the use of nature metrics in sustainable food system investment is to facilitate the uptake of standardised methodologies and metrics. The Align project (Box) and Regen10 are two such initiatives attempting to do just this. The Align project provides a standardised approach for measuring the state of biodiversity for all sectors and for a range of purposes, whereas the Regen10 approach is focused on measuring social and environmental outcomes of regenerative agricultural systems. Standardisation as a solution has the benefit of responding to multiple challenges.

Box: Align

The European Commission funded *Align* project, led by UNEP-WCMC, the Capitals Coalition, Arcadis, ICF and WCMC Europe, was formed to address the need for agreed principles and criteria for biodiversity measurement and valuation.

Align released its recommendations November 2022 (UNEP-WCMC, Capitals Coalition, Arcadis, ICF, WCMC Europe 2022), splitting its recommendations into two main categories: site or project level, and supply chain. The project provides one solution to non-standardisation of nature metrics, consistently mentioned as a challenge of catalysing investment, and provides technical input into all initiatives mentioned in this brief. The project focused on business applicability, with the recommendations intended for primarily the standard setters, as well as "environmental/sustainability and finance managers within a business". See Annex B for more comprehensive information on the best practice measurement criteria for site and supply chains proposed by Align.

Box sources: UNEP-WCMC, Capitals Coalition, Arcadis, ICF and WCMC Europe[15].

Box: Regen10

Regen10 is a multi-stakeholder platform that serves existing leaders and practitioners in regenerative food systems and brings others into the regenerative journey through a principles- and evidence-based approach. A key area of Regen10's work is the development of a holistic Outcomes Framework with a core set of metrics to collect, measure, and understand the changes that occur over time on farms and in the landscapes in which they operate. This in turn builds the evidence base for how to shift to more regenerative food systems that deliver positive environmental, socio-cultural, and economic outcomes. This evidence base will inform practices, create incentives, unlock investment, and drive learning, innovation, and adaptation. Regen10 is taking a consultative approach to the framework's development, involving farmers, Indigenous Peoples groups, corporates and landscape leaders. Regen10 will test the first draft of the Outcomes Framework with key stakeholder groups, both conceptually and on-the-ground in farms and landscapes and plans to publish the findings of this work at the end of 2024.

Box sources: Regen10[40].

Standardised methodologies and metrics would:

- allow resources to be focused on improving a narrower range of data inputs, stopping the trend of financial institutions developing new metrics for specific use cases

- reduce the technical skill ceiling for developing in-house capacity as every initiative would rely on the same methodologies
- facilitate more meaningful comparability between investment categories, businesses and landscapes, as well as facilitating more meaningful aggregation to company level and beyond.

From the investment side, the European Union is continuing to develop its Green Taxonomy to assist companies, project promoters and issuers in getting access to green finance by standardising the definition of "sustainable" across its classifications for varying economic activities. The taxonomy hinges on three key aspects: substantially contribute (to one of six environmental objectives, including the protection and restoration of biodiversity and ecosystems), do no significant harm, and comply with minimum safeguards[41]. Standardised taxonomies can help direct investments to more sustainable food systems and can also provide a mechanism to apply punitive capital requirements to the most impactful[14]. For impact investing, the Global Impact Investing Network, GIIN, released the second iteration in their performance benchmarks series, focusing on agriculture and implemented through their analytics system, IRIS+. The tool allows investors to understand impacts over time, set targets, identify strengths and weaknesses in their portfolio, and effectively disseminate results to the public[42].

Guidance for applying existing methodologies

There are several large initiatives already set up (Annex A). While projects like Align and Regen10 can contribute some alignment in data inputs and methodologies, there is always likely to be multiple initiatives for different audiences and objectives.

Accepting this, another key solution is developing concise, simple to use guidance on adhering to each initiative. The most helpful target audience for guidance is supply chain managers and sustainability managers, but the guidance should be accessible to organisations throughout the supply chain. In terms of specificity, organisations should be able to differentiate themselves by organisational focus, sub-sector and business application. There are already several examples of guidance relevant to investments in sustainable food systems, either published or in development:

- Global Reporting Initiative (GRI) is developing guidance for both Agriculture, Aquaculture and Fishing, as well as Financial Services
- Science-based Targets Network (SBTN) has already had significant engagement from the food and agricultural sector: five of the Corporate Engagement Program members focus on the sector and are featured case studies on the website. Many of the initial land and freshwater targets released in May relate to agricultural sectors, with guidance for finance planned
- The agriculture and food sector is one of the priority sectors for TNFD guidance development
- The UN Environment Programme Finance Initiative (UNEP-FI) has a workstream on seafood that has released extensive guidance, an exclusions list for activities not to invest in, examples of real-world case studies of investment in seafood, and launched a year-long collaboration with investors of seafood companies
- The Principles for Responsible Banking (PRB) Nature Target Setting Working Group is working with the Finance for Biodiversity Foundation to update UNEP-FI guidance
- The Accounting Framework Initiative and SBTN are working to emphasise consensus-based guidelines for ethical supply chains in the agriculture and forestry sectors.

Guidance led by practitioners would ensure that current data and methodologies are used wisely[18]. In the absence of actual impact data, most data inputs to current methodologies are modelled. This restricts their current correct usage screening, understanding relative impacts of asset classes, and estimating portfolio impacts. However, well written guidance can encourage financial institutions to supplement data with spatial tools like IBAT and engage with partners to replace modelled data with actual data as much as possible. Agricultural actors, with such strong interactions with their local environment, are in a fantastic position to do this.

Tools are also being made to help financial institutions to select the right input data given their specific situation. The Navigation Wheel, developed by EU Business @ Biodiversity[26], provides a performant

decision framework for businesses based on criteria like context, pressures, scope, etc. In the latest iteration, it was acknowledged the "different perspective of the financial sector" (p19) requires modification of the current methodology. Besides bespoke decision framework tools like the Navigation Wheel, comprehensive tools catalogues like the TNFD Tools Catalogue can assist companies in taking the first step. Importantly, the TNFD Catalogue specifies exactly where in the LEAP (Locate-Evaluate-Assess-Prepare) approach a specific tool can be justifiably used.

Capacity building in financial institutions

Aligning initiatives and methodologies as much as possible, as well as providing sector-led guidance, has the added co-benefit of reducing the complexity of nature metrics. This may reduce the incentive for financial institutions to rely on external partners to analyse and interpret nature methodologies and result in more technical capacity being built in-house.

To catalyse this shift, nature organisations need to respond to the dual capacity needs of financial institutions: spatial expertise and subject matter expertise. For the former, pseudo-spatial tools like IBAT and ENCORE that provide the ability to explore datasets make for good entry points to geospatial analysis. As industry professionals become more skilled, spatial data architecture can start to be built that can accommodate operational data as it develops and integrates it with more advanced spatial and earth observation data[31]. For the latter, subject matter expertise, external nature organisations can continue to provide guidance and training whilst responding to industry requests for updated delivery modes: respondents to the Align working paper emphasised a need to "steer away from the standard 'PDF report format', and aim towards a more interactive and engaging process"[24] (p11). One such example of online training is UN Global Compact, in collaboration with UNEP-WCMC.

6. Conclusions

The protection and restoration of biodiversity is one of ten critical transitions needed to transform global food systems[43].

Catalysing investment in sustainable food systems through a nature lens is being stymied by three key overarching barriers:

1. Data quality and availability: as the abundance of nature-related data has grown and become more resolved, operational data has not kept pace.
2. In-house capacity in financial institutions: split into spatial expertise, as spatial analysis is a crucial component of effective biodiversity analysis, and technical expertise in nature subject matter. Both tend to be outsourced as the complexity of emerging frameworks and metric landscapes have increased.
3. Lack of standardisation and comparability: the wide variety of methods and data inputs prevent meaningful aggregation across different geographies and value chains. Furthermore, without these kinds of standardisations, nature investments struggle to break free from a cycle of under investment without demonstrable returns comparable to traditional investment portfolios.

Here, we propose the following solutions, all of which are already in place but need recognition, upscaling and support:

1. Standardisation of metrics and methodologies
2. Developing industry-led, or industry-driven, guidance for existing initiatives
3. Upskilling financial institutions professionals in spatial analysis and the interpretation of nature methodologies

It is important to emphasise that actioning these solutions is not enough in itself to catalyse investment in sustainable food systems; the insights garnered from these methodologies and analyses must be incorporated into corporate decision-making at the highest level[17]. Continued collaboration between

corporate entities, their partners both downstream and upstream, and national actors, is also crucial to drive investment in sustainable food systems for nature recovery. Driving traceability and disclosure of upstream impacts is also crucial: if financial institutions are to understand what's happening on the ground and reward sustainable production, traceability must be required, invested in, and incentivised.

Moreover, nature metrics and the food system are evolving rapidly, with major changes to be confirmed in the next two years that will accelerate mandatory requirements (eg, TNFD final framework released in September 2023 or the clarification from The Convention on Biological Diversity as to the use of nature credits). It is therefore crucial that financial institutions closely monitor market intelligence with respect to nature, keep abreast of its evolutions, and adjust strategies as the field develops.

Annex A. Initiatives tackling the challenge of measuring nature for disclosure[3]

European Sustainability Reporting Standards (ESRS)

In July 2023, the European Commission adopted the European Sustainability Reporting Standards (ESRS) for use by all companies subject to the EU Corporate Sustainability Reporting Directive (CSRD). The subjected companies will have to report environmental, social and governance sustainability related information according to the ESRS. The standards were developed by the EFRAG, previously known as the European Financial Reporting Advisory Group.

The adopted ESRS take a double materiality perspective, and its 12 ESRS have covered a full range of sustainability issues, including two cross-cutting standards (ESRS 1-2), five environmental standards (ESRS E1-E5), four standards on social topics (ESRS S1-S4) and one on governance (ESRS G1).

Relevance to catalysing investment in food systems:
- Based on the EU's CSRD directive, the ESRS are mandatory to report against for all companies previously subject to the Non-Financial Reporting Directive (NFRD) and large non-EU listed companies with more than 500 employees will have to start reporting under ESRS in financial year 2024. The requirement to report in line with the ESRS will gradually apply to a larger pool of companies, and will become applicable to some companies based outside the EU with activities in the EU as well.
- EFRAG are planning to develop sector-specific standards for all sectors of the economy, including food- and agriculture-related sectors.

Global Reporting Initiative (GRI)

GRI's Global Sustainability Standards Board (GSSB) drives corporate transparency and accountability by maintaining the most widely used global sustainability reporting standards. The 2023-2025 GSSB Work Program is currently out for consultation; the Sector Program will eventually develop standards for 40 sectors, prioritised for their impact on sustainable development.

GRI originally released its Biodiversity Standard in 2016, the revision of which has been identified as a top priority for the organisation. The latest exposure draft was out for consultation until 28 February 2023, with the following significant changes to *GRI 304: Biodiversity 2016*:

- facilitate reporting across the supply chain
- focus on the most significant impacts on biodiversity
- emphasis on providing location-specific information on impacts
- new disclosure to report on the direct drivers of biodiversity loss, changes to the state of biodiversity, requirements on the impacts on people resulting from an organisation's impacts on biodiversity, and biodiversity-specific management disclosures
- revised definitions
- more extensive guidance throughout the draft.

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[3] Initiatives are listed in alphabetical order.

Relevance to catalysing investment in food systems:

- **Agriculture, Aquaculture and Fishing and Financial Services guidance forthcoming**
- **One of the more recognised standards for sustainability[24].**

International Sustainability Standards Board (ISSB)

The ISSB was formed in November 2021 in Glasgow at COP26 by the International Financial Reporting Standards Foundation (IRSF Foundation). Its aim is to service the needs of investors and the financial markets through the creation of public-interest sustainability standards. The initiative's objectives include, beyond the standards themselves, meeting informational needs of financial institutions, enabling companies to provide comprehensive sustainability disclosures, and easing the use of disclosures across sectors and across scales. The ISSB works with GRI to complement the latter's broader audience with more specific guidance for the capital markets.

The ISSB provided guidance on biodiversity-related disclosures, developed initially by the Climate Disclosure Standards Board (CDSB) before its consolidation into the IFRS Foundation to support the work of the ISSB. The primary audience for the guidance is investors looking for more useful land use and biodiversity-related disclosures in listed company reports. The guidance is supported by the Land use and biodiversity working group, comprised of 40 members from all backgrounds.

IPBES Business and Biodiversity Assessment

In April and May 2019, IPBES adopted a new work programme that includes the *methodological assessment of the impact and dependence of business on biodiversity and nature's contributions to people*. Part of the scope of the assessment includes identifying appropriate metrics for use in categorising impacts and dependencies on nature and how they can assimilate into other aspects of sustainability.

The scoping report was approved at IPBES 9 in Bonn, Germany July 2022, with a fast-track two-year process, with the aim of approval at IPBES 11 in 2025.

Partnership for Biodiversity Accounting Financials (PBAF)

PBAF, which builds on the Partnership for *Carbon* Accounting Financials (PCAF) in much the same way as TNFD and TCFD, provides resources specifically tailored for financial institutions to conduct biodiversity impact and dependency assessments. The partnership comprises 47 financial institutions with over US$9.6 trillion in assets under management, and recently released (June 2022) their new standard. The standard consists of three documents: an overview of different approaches for biodiversity accounting, a technical document on biodiversity footprinting, and a Q&A. Many PBAF members have been using guidance produced by the partnership in agricultural lending, "to move from assessing risks to generating positive impacts"[44].

The introductory Q&A document lists agricultural products as the sector with the highest dependency on ecosystem services and second highest impact on biodiversity[45]; the second document in the standard provides a good overview of approaches to biodiversity accounting, as well as explicitly laying out how PBAF interacts with projects like Align and initiatives such as TNFD[46].

Relevance to catalysing investment in food systems:

- **Similar to TNFD, PBAF is made with and for financial institutions**
- **The standard is designed to cater for all audiences with three documents targeted at financial institutions & impact investors with no, limited and some experience of impact assessment.**

Science-Based Targets Network (SBTN)

SBTN, part of the Global Commons Alliance, builds on the momentum gained through the Science Based Targets initiative (SBTi). The first SBTN targets for nature were launched in May of this year[47].

SBTi ensures the private sector sets targets aligned with a 1.5°C future; SBTN is developing methods and resources to do the same for nature. The network comprises 45+ organisations, including leading global non-profits and mission-driven organisations, with the goal of the world's major companies and cities adopting science-based targets for climate and nature by 2025.

SBTN takes a wide view of nature, developing methodologies for the realms of freshwater, land and oceans, with biodiversity as an issue cross-cutting all three. The process is ongoing, but the ambition is for nature targets to be aligned with the newly adopted Kunming-Montreal Global Biodiversity Framework agreed in Montreal in December 2022.

Relevance to catalysing investment in food systems:

- SBTi already has the Forest, Land and Agriculture (FLAG) guidance: something on which SBTN intends to build on for their land-based targets
- SBTN targets are designed to tackle multiple issues at once, helping to resolve problems of interdependency of, for example, nature and climate
- Significant engagement already from the food and agriculture sector; five of the SBTN Corporate Engagement Program members focus on the sector and are featured case studies on the website[48].

Taskforce on Nature-related Financial Disclosures (TNFD)

TNFD aims to provide a harmonised reporting framework for financial institutions akin to the Taskforce on Climate-related Financial Disclosures (TCFD)[14], with the "ultimate aim of supporting a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes"[49]. The Taskforce comprises 40 Taskforce Members, including financial institutions, representing more than US$20 trillion in assets. It is supported by a wide range of consultative bodies including institutional supporters and leading scientific organisations.

TNFD recently released the third iteration of its beta framework, with plans to release a fourth in March 2023 and aiming for a September 2023 release of the full framework for market adoption.

Relevance to catalysing investment in food systems:

- the TNFD framework was specifically created to harmonise disclosure for financial institutions and financial decision-making
- the Taskforce includes diverse financial institutions providing input to the framework in addition to the extant *Draft Additional Guidance for Financial Institutions* released with v0.3, agriculture and food is a priority sector for development.

Annex B. Align project[15]: biodiversity measurement practices

SITE & PROJECT LEVEL

● GOOD PRACTICE   ● BEST PRACTICE

	WHAT TO MEASURE	CHARACTERISTICS OF MEASUREMENT APPROACH	MOST APPLICABLE METHODS
SCREEN	○ Potential presence & proximity to material species & ecosystems ○ Potential impacts based on sector-average impact drivers	○ **Feasibility (screening) - High** (able to apply screening at multiple sites) ○ **Spatial precision - Medium** ○ **Accuracy - Medium** (measures reflect potential presence & impacts on species & ecosystems, but are not ground-truthed)	✔ Spatial overlays with static biodiversity data layers (ecosystem extent / condition) ✔ Species threat & range layers ✔ Screening using modelled state based on pressures
MEASURE	○ Ecosystem extent & condition indicators; or ○ Measurement of material impact drivers (at least land use change) ○ Periodic measurements that start from a baseline, & measurements that reflect changes in state resulting from company-specific impact drivers	○ **Responsivness - Medium** (able to reflect how changes in pressures affects biodiverisity state) ○ **Spatial precision - Medium** ○ **Accuracy - Medium** (measures reflect potential presence & impacts on species & ecosystems, but are not grounded-truthed)	✔ Primary data based on surveys ✔ Measuring using responsive biodiversity data layers ✔ Measuring using modelled state based on pressures
SCREEN	○ Potential presence & condition of material species & ecosystems, results ground-truthed ○ Species extinction risk indicators ○ Potential impacts based on company specific impact drivers	○ **Feasibility (screening) - High** (for screening, able to apply for screening at multiple sites) ○ **Spatial precision - High** (captures species & ecosystems at site level) ○ **Accuracy - High** (measures reflect actual, ground-truthed presence of/impacts on species & ecosystems)	✔ Modelled state based on pressures (using company specific impact driver data) for screening only ✔ Species threat & range layers
MEASURE	○ Ecosystem extent & condition for individual ecosystem assets ○ Species extinction risk indicators ○ Periodic measurements that start from a baseline, & measurements that reflect changes in state resulting from site-level mitigation measures Based on primary data on material impact drivers	○ **Responsiveness (measuring impacts) -** reflects effects of site-level mitigation measures ○ **Spatial precision - High** (captures species & ecosystems at site level) ○ **Accuracy - High** (measures reflect actual, ground-truthed presence of/impacts on species & ecosystems)	✔ Primary data based on surveys

SUPPLY CHAIN LEVEL

GOOD PRACTICE ● **BEST PRACTICE** ●

	WHAT TO MEASURE	CHARACTERISTICS OF MEASUREMENT APPROACH	MOST APPLICABLE METHODS
SCREEN	○ Ecosystem extent & condition & species extinction risk at broad-scale sourcing regions	○ Feasibility (applicable for screening) - High ○ Spatial precision - Low ○ Accuracy - Low (e.g., can measure potential impact based on sector-average impact diver-data)	✓ Spatial overlays with biodiversity data layers (ecosystem extent / condition) ✓ Species threat & range layers
MEASURE	○ Potential impacts on ecosystems based on volumes of materials sourced (or revenue) within each country sourced from	○ Responsivness - Medium (responsive to changes in impact drivers along supply chain) ○ Spatial precision - Low (screening/measuring can use models based on global data) ○ Accuracy - Low (e.g., can measure potential impact based on sector-average impact driver-data)	✓ Modelled state based on pressures (sector averages)
SCREEN	○ Ecosystem extent & condition & species extinction risk at specific sourcing locations ○ Potential impacts on ecosystems based on volumes of material sourced (or revenue) within each country sourced from	○ Feasibility (applicable to screening) - High ○ Spatial precision - Medium (reflects differences in potential impact based on sourcing region) ○ Accuracy - Medium (screens potential impact based on company-specific impact driver data)	✓ Modelled state based on pressures (using company specific impact driver data) for screening only ✓ Species threat & range layers
MEASURE	○ Measurement of potential impacts reflects differences in biodiversity between sourcing locations and production processes at sourcing locations ○ Measurement of impact driven & state at sampled sites using primary data is used to complement full-supply chain measures	○ Responsiveness - Medium - (reflects changes in production practices at source location) ○ Spatial precision - Medium (reflects differences in potential impact based on sourcing regionl) ○ Accuracy - Medium (screens/measures potential impact based on company-specific impact driver data)	✓ Modelled state based on pressures (including land use intensity) ✓ Primary data based on species/habitat surveys (for measuring impact) at sampled sites

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