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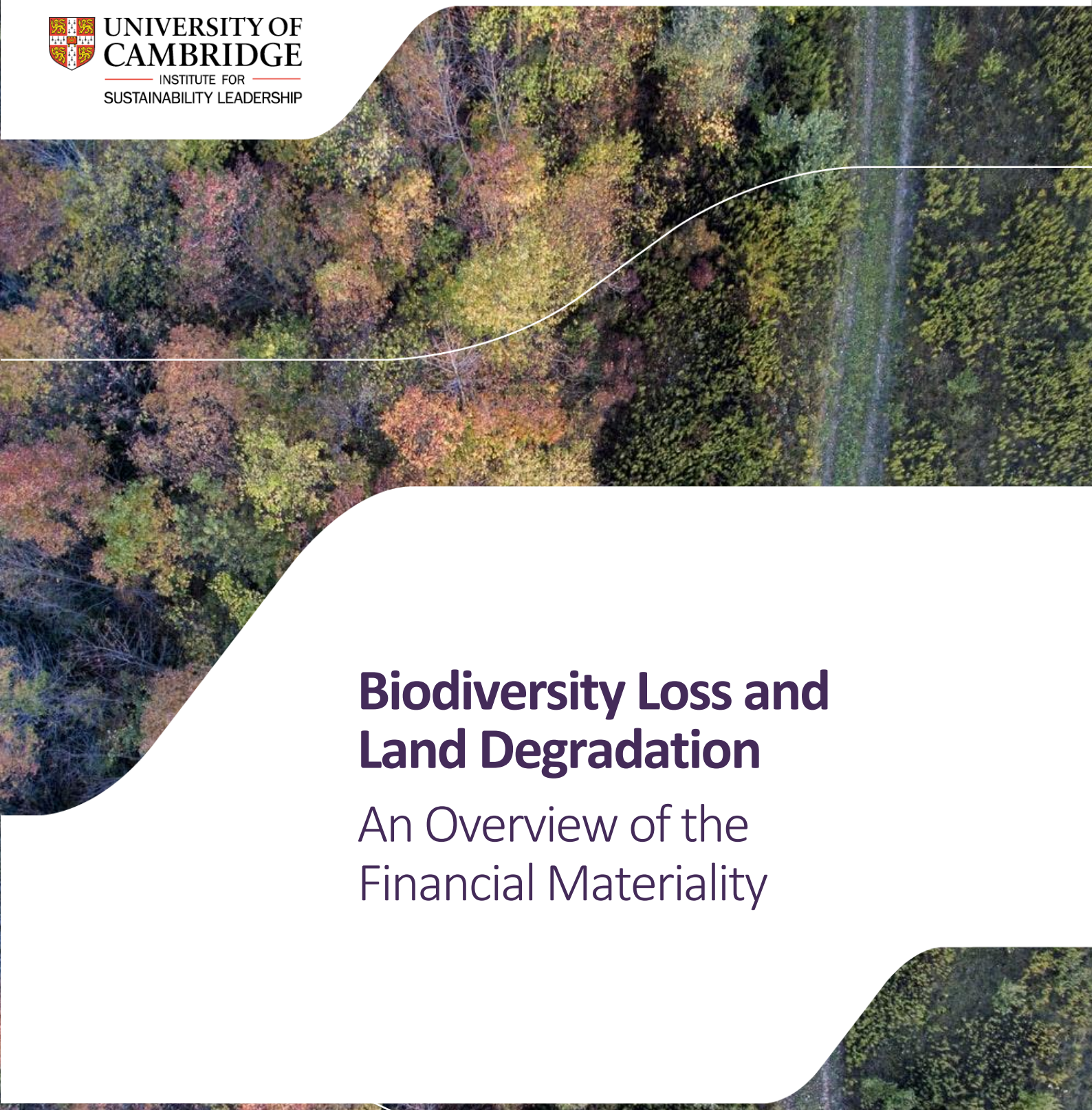
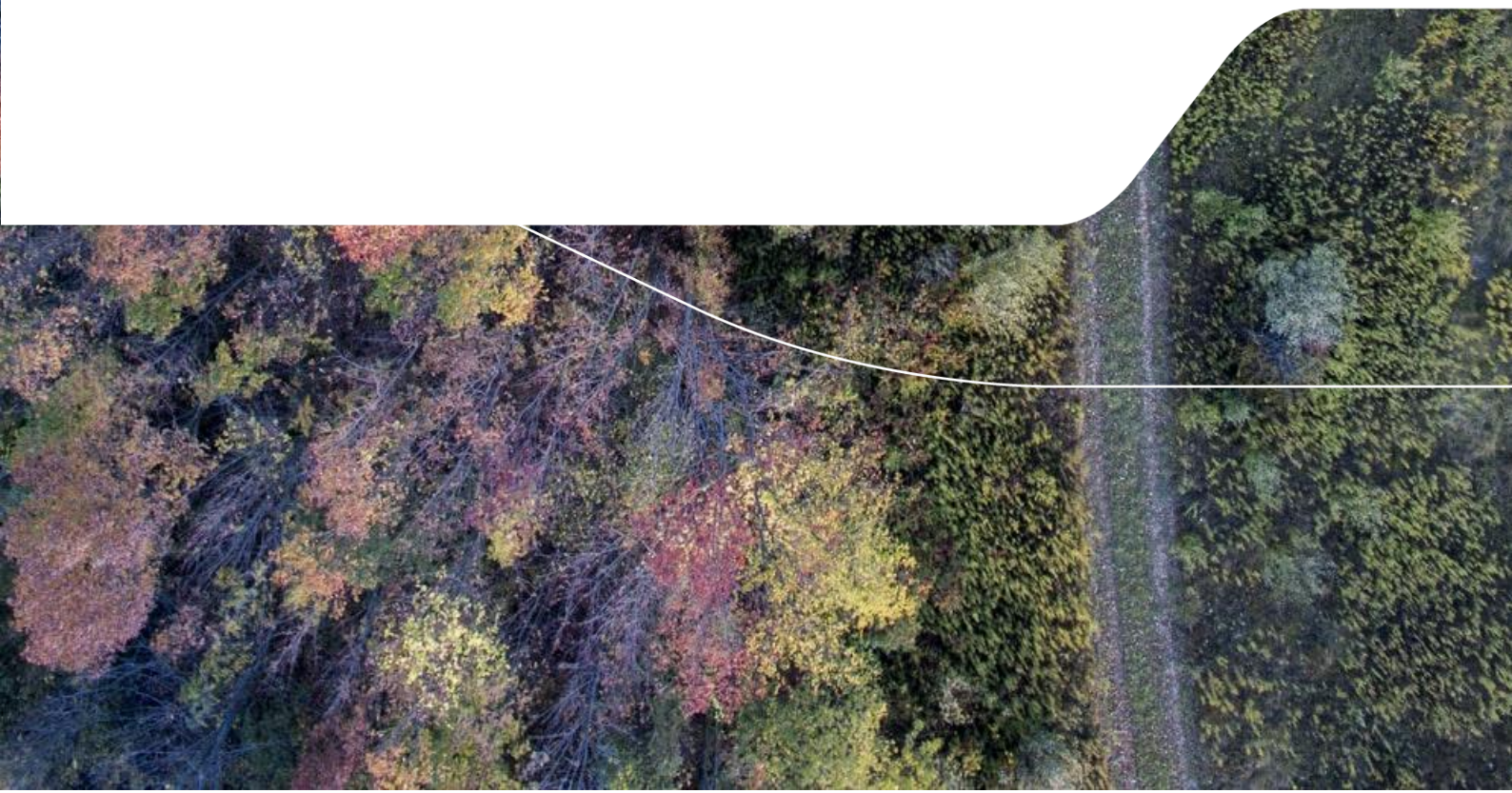


Biodiversity Loss and Land Degradation

An Overview of the Financial Materiality



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Contents

Preface

The first report from our research project on the *Financial Risks of Biodiversity Loss and Land Degradation* tackles biodiversity loss and land degradation separately, highlighting knowledge, methods and tools that can be used to understand the financial materiality of each. To do this, the project team from the Centre for Sustainable Finance reviewed the existing literature and initiatives covering the subject area, in collaboration with the Business & Nature department of CISL. By focussing on the materiality of biodiversity loss and land degradation this report looks to (1) inform a typology of nature related financial risks and (2) lay the foundations for dialogue amongst the financial, policy and regulatory communities about these risks.

We welcome feedback from stakeholders in the financial community and beyond. All comments on this report can be sent to bei@cisl.cam.ac.uk.

Biodiversity Loss

Why Biodiversity Loss Matters

44 trillion US dollars of economic value generated each year is moderately or highly dependent on nature.[1] This is more than 50 per cent of global GDP.

Biodiversity, put simply, is "the variety of life on earth"[2]. Without it, nature cannot provide the goods and services that are worth trillions. It is indispensable for food security, disease prevention, clean water provision and so much more.

Yet biodiversity is experiencing a precipitous decline. One million species are threatened with extinction.[3] As a result, WEF ranks biodiversity loss as the third most impactful risk facing the global economy, and the fourth most likely to occur.

The financial materiality of biodiversity loss

A 2019 report prepared for the G7 concluded that approaches to valuing biodiversity remain limited.[4] As of today, the monetary worth of biodiversity has tended to be quantified in three ways:

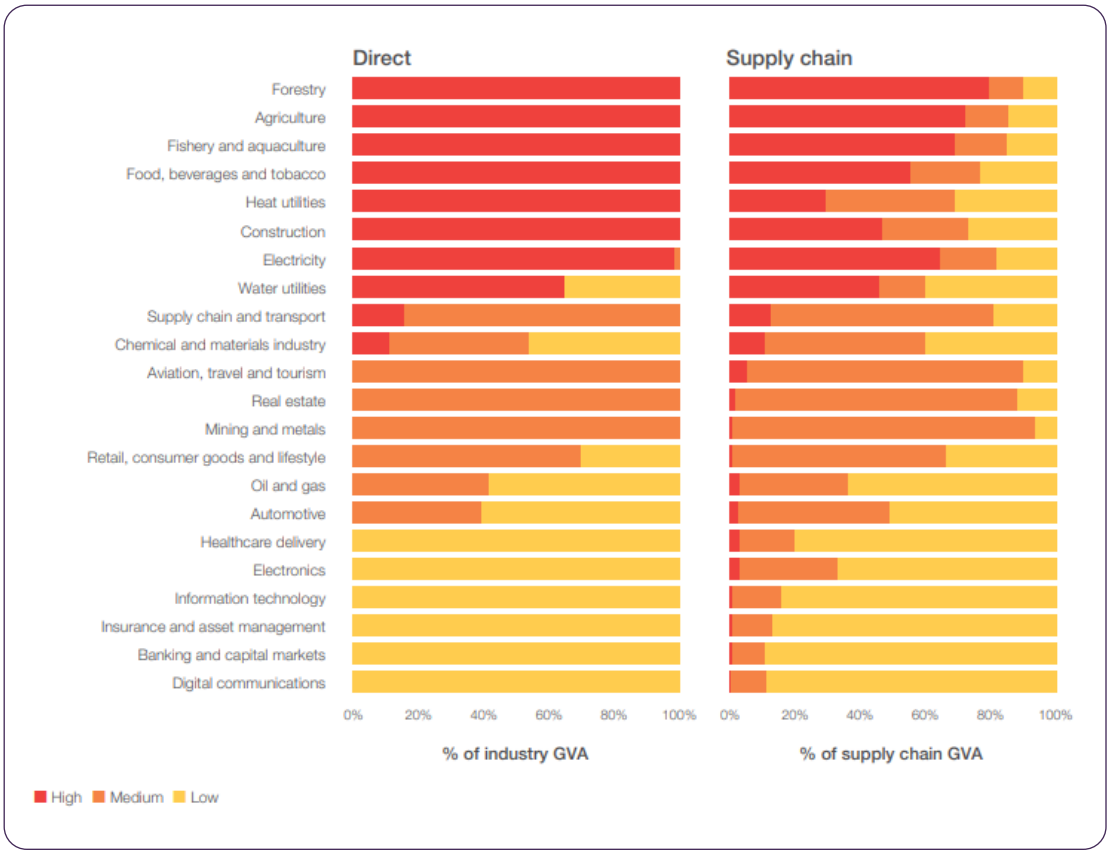
1. By the **cost to restore biodiversity** once it has been degraded. This follows the 'no net loss' approach,[5] of which the US Compensatory Wetlands Mitigation scheme is one prominent example.[6] Often referred to as 'mitigation banking', this method is estimated to offset more the $5 billion of degradation each year.[7] Such approaches do not value the economic benefits of biodiversity, but the cost of repair.

2. By the **volume of 'biodiversity finance'** available. This is defined by the OECD as expenditures that flow to the conservation, sustainable use and restoration of biodiversity. Valued at $78-91 billion,[8] this finance provides a signal about the value of biodiversity to some – usually impact investors and philanthropic sources in concert with public finance. However, it does not quantify the extent to which industries depend upon biodiversity.

3. By identifying **what industries are dependent on nature** and then totalling the value of the economic outputs of these industries. This method produces the $44 trillion figure above: a stark contrast with the $5 billion of 'mitigation banking' and $91 billion in 'biodiversity finance'.

   This dependence value is determined by layering specific biodiversity 'services', such as pollination, over the monetary value of outputs from sectors like agriculture that depend upon the 'service'. To this end, WEF recently estimated what percentage of the Gross Value Added (GVA) from an industry and its supply chain has a "high, medium or low" dependence on nature (see Figure 1).

Figure 1: Percentage of direct and supply chain GVA with high, medium and low nature dependency, by industry[9]



These dependency calculations demonstrate the vast extent to which the economy is reliant on nature and, therefore, biodiversity. However, it does not explicitly connect specific biodiversity mismanagement with suboptimal economic output. Examples of this connection being made also exist and include how:

- On land, a lack of genetic diversity in rice, wheat and maize reduces crop yields by 16 per cent because there is less resilience to pests (this missing yield is worth $96 billion).[10] Indeed, crop diversity has been shown to be correlated with crop yield.[11]
- At sea, mismanagement of fisheries is reducing the volume of wild catch by a monetary value of up to $83 billion each year.[12] This is because 90 per cent of marine fish stocks are either fully exploited, overexploited or depleted.[13]

This third approach (dependency) is of most interest. It is a step away from valuing the damage done in 'cost to restore' terms, and a step closer to understanding the risk of biodiversity loss to operational cash flows, asset values and the wider economy.

How biodiversity loss is measured (tools and data)

In order to measure the impact of business on biodiversity and the dependence of business on biodiversity, of sixteen prominent tools (see Appendix A below) three are worth highlighting:

1. The Integrated Biodiversity Assessment Tool (IBAT). The tool is used by businesses looking to understand their biodiversity impact and by the conservation finance community for project planning.[14] It is therefore applicable to the first two types of monetary value for biodiversity detailed above – 'mitigation banking' and 'biodiversity finance'. IBAT brings together a wide range of datasets[15] and is widely used by business, especially by extractive industries like mining.

2. The Biodiversity Footprint Financial Institutions (BFFI) effort. This is another biodiversity footprinting tool, but explicitly for financial institutions. It provides a biodiversity footprint of the economic activities of a financial institution and is used by ASN bank.[16]

   Although a highly commendable project, it is about the *attribution* of financial activity to negative biodiversity impact, rather than about defining the exposure of a financial institutions to biodiversity-related financial risks (other than future reputational or litigation risk).

3. The ENCORE tool (Exploring Natural Capital Opportunities and Risk Exposure).

   Most tools, such as those described above, are disconnected from the value of biodiversity to business. Instead, they help business understand the biodiversity impact of operations. ENCORE is an effort to rectify this. It connects how and where different segments of the economy depend on natural capital assets and ecosystem services, including biodiversity.[17] It does this through a qualitative 'materiality assessment' for users, making an assessment of how dependent a specific economic activity is on nature. For example, mining is identified as being "highly reliant upon [fresh and ground water]…" and that these "ecosystem services [are] critical and irreplaceable in [mining] production processors."[18]

Appendix A: Tools for understanding the relationship between business and biodiversity

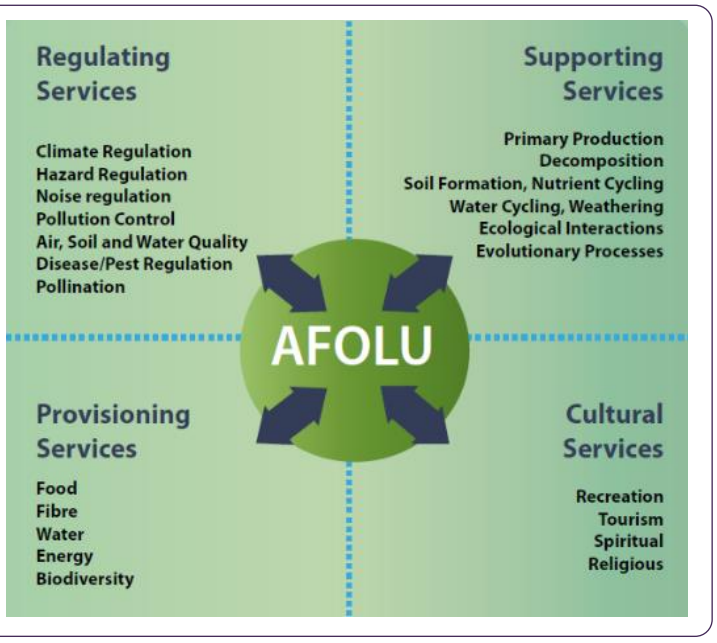
Approach/Tool	Organisation and link	Brief description
Agribiodiversity Index	Biodiversity International	Measurement of agrobioversity.
Biodiversity and ecosystem services fundamentals	IPEICA	Guidance for management of biodiversity impacts and risks for oil & gas
Biodiversity Footprint Calculator	Plansup	Company biodiversity footprinting tool
Biodiversity Indicator and Reporting System (BIRS)	IUCN	Biodiversity monitoring and management for cement and aggregates
Biodiversity Indicators for Monitoring Impacts and Conservation Actions	The Energy & Biodiversity Initiative	Method for assessing biodiversity impacts
Biodiversity Intactness Index (BII)	Biodiversity Indicators Partnership	Enables estimates of human impact on biodiversity.
ENCORE	Natural Capital Finance Alliance	Indicates and visualises how the economy depends on nature.
Environmental Profit & Loss	Kering	Includes measurement of business impact on biodiversity
Global Biodiversity Score, *due for release May 2020*	CDC Biodiversitie	Measure corporate and financial commitments for biodiversity
GRI Standards: 304	Global Reporting Initiative	Method for disclosing biodiversity information
Guide to Corporate Ecosystem Valuation	WBSCD	Process for business to value natural ecosystems, including biodiversity
Healthy Ecosystem Framework	CISL	Metric to calculate business impact on biodiversity.
Integrated Biodiversity Assessment Tool (IBAT)	IBAT Alliance	Planning tool, providing data about existing biodiversity.
Nature Map Explorer	Nature Map Initiative	Global map of terrestrial biodiversity and ecosystem carbon stocks
Product Biodiversity Footprint	icare & consult	Assess impact of products on biodiversity.
Species Threat Abatement and Recovery (STAR) Metric	IUCN	Metric to understand if investments achieve conservation outcome

Land degradation

Why land degradation matters

Land degradation is a decline of the economic and biological productivity of land because of human treatment.[19] It includes soil degradation, human impact on water resources, deforestation and the decline of rangelands used for grazing.[20] Each year this degradation costs the world 6.3 trillion US dollars,[21] equivalent to 7.3 per cent of global GDP. Degraded land is not only less productive (e.g. lower crop yields), but is less resilient – less able to provide services like fresh water or clean air and has less recreational value. These 'services' are typically split into four categories – regulating, supporting, provisioning and cultural services (see Figure 2). The value of each to humanity has received significant attention over the past decade. [23]

Figure 2: Services provided by land to the economy and humanity – provided in the form of agriculture, forestry and other land use (AFOLU)[22]



Land degradation often occurs because the financial materiality of the degradation is not factored into decision making; either because it is beyond the return horizon of the project ('tragedy of the horizon'[24]) or external to its borders ('tragedy of the commons'[25]). However, the benefits available from preventing degradation and restoring land have never been as clear:

- Demand for food is forecast to increase by more than 50 per cent between 2010 and 2050.[26]

  Clearing more land is not the answer: deforestation and forest degradation is responsible for around 15 per cent of annual global greenhouse gas emissions.[27] Instead of clearing land, the focus could be on enhancing the economic productivity of the 52 per cent of agricultural land that is already moderately or severely degraded.[28] A focus on enhancing degraded land, so that agricultural yield is higher, is both an opportunity to increase land value and capture price signals from additional food demand.

- Soil is needed as a sink for carbon to help mitigate climate change. Soils contain 50–70 per cent less carbon than they once did, with some agricultural practices eroding soils 100 times faster than they can replenish.[29, 30]

This is an untapped opportunity: using soil of agricultural land to capture carbon is estimated to be worth between 96-480 billion US dollars per year on carbon markets.[31] Investors and financiers that encourage a transition in land management practices could benefit, by extension, as the value of preventing the initial carbon loss from soil or promoting carbon sequestration by soil is recognised.

- Land that is not degraded is more resilient to climate change**.** This resilience value is of increasing importance as extreme weather events become more common – 70 per cent of extreme weather events studied since 2012 have been attributed to climate change.[32] Altered land management practices, like afforestation, micro-irrigation, and agroforestry are a low-cost way to increase resilience to extreme weather (flood, drought, high winds).[33]

  By incentivising business to restore land or avoid degradation, financial actors can reduce the vulnerability of individuals enterprises, protect asset values and safeguard future production and therefore future cash flows. They can also benefit by increasing the resilience of the wider supply chain and of the economies reliant on soft commodities. Disruption to either could negatively affect asset value and revenues at a country, region or global level.

The financial materiality of land degradation

The monetary value of land degradation can be derived in a number of ways, including by estimating:

1. Cost of restoring the land, if mandated. This is directly comparable to the cost to restore habitats where biodiversity has been lost.

   This could be defined by the cost to reforest or to return land to its previous state. Asset retirement obligations, including the cost of mine reclamation, are a good example.[34]

   Land restoration projects like afforestation tend to only be attractive investments if 'externalities', such as carbon stored, are given a value by policy. For instance, in South East Asia palm oil plantations are almost twice as profitable as sustainable timber plantations. Only by ensuring the co-benefits of the latter are valued (carbon storage, flood prevention) can the timber plantation become the more attractive option.[35]

2. The amount of 'biodiversity finance', which as a category of finance includes forest carbon credits, finance of certified soft commodities and funding for rehabilitating degraded habitats (land) – all of which help avert land degradation and/or restore degraded land. The 'biodiversity finance' category has been valued, overall, at $78-91 billion; a figure many orders of magnitude smaller than the $6.3 trillion economic impact of land degradation.[36] Indeed, such finance does not quantify the extent to which industries rely on the 'ecosystem services' provided by land, but provides a signal about the size of the pot available to support biodiversity conservation and restoration efforts.

It is at this point that methods indicating the value of land degradation diverge from today's leading efforts to understand the financial materiality of biodiversity loss. Recent efforts on the latter have used *'top-down'* methods, which total the Gross Value Add of industries dependent on biodiversity in order to highlight the materiality of biodiversity decline to the economy. Meanwhile, the valuation of land degradation often begins with the value of the *'services'* that land provides, rather than the value of industries dependent on land. Such methods not only include a monetary valuation of 'services', but a look at the sub-optimal yield of enterprises directly reliant on land or the increased vulnerability of asset values because land is degraded. It is from these methods that the $6.3 trillion at the beginning of the article is derived. More specifically, these approaches can:

3.1 Value climate regulation, freshwater provision, pollution purification or erosion prevention, all of which can be negatively impacted by land degradation. *[Valuing the 'regulating' and 'supporting' services in the above Figure 2.]*

In the UK alone, wetlands provide water quality benefits of approximately £1.5 billion (pounds sterling) and flood control and storm buffering services worth £1.9 billion.[37]

3.2 Highlight cash flow risks for agriculture, forestry or tourism, because the land is degraded. *[The risk posed to some 'provisioning' services in Figure 2 if there are less 'regulating' and 'supporting' services.]*

Sub-optimal land productivity has a market value, be that of crops or livestock, and can also undermine asset values. Between 1999 and 2013 the productivity of 20.4 per cent of vegetated land declined.[38] Lower crop yields are one part of this and it has been estimated that, if managed 'sustainably',[39] crop production could be 2.3 billion tonnes higher, equivalent to a gain of 1.4 trillion dollars.[40]

3.3 Quantify the cost of drought, flood, dust storm, etc. that could have been avoided if land was not degraded. *[Vulnerability to extreme weather is an increased risk if there are less 'regulating' and 'supporting' services provided by land.]*

Studies in China showed that degraded land used for grain production had 30 per cent less yield because of the reduced resilience to flood and drought.[41]

Land that has not been degraded also protects existing property during extreme weather. $625 million of flood damage was avoided during Hurricane Sandy, the strongest hurricane of the 2012 Atlantic season, because of the protection afforded by coastal wetlands.[42] Consequently, it is also possible to connect degraded land with the increased vulnerability of real estate and infrastructure assets.

3.4 Recreational value, which is no longer available if the land is degraded. *[One of the 'cultural' services of land]*

Tropical and temperate forests have been estimated to provide between $800 and $1000 per hectare of recreational value.[43]

There are also market and litigation risks related to land degradation. Deforestation is the prominent example: data exists to identify where deforestation is taking place and it is increasingly possible to trace it through the supply chain, connecting it with enterprises and, by extension, those that provide those enterprises with capital.[44] This creates both reputational risk and the risk of future litigation.

How land degradation is measured (tools and data)

Establishing that land has lost some of its economic productivity (has been degraded) tends to be measured by looking at vegetation cover, abandoned cropland, biophysical models (that compare actual productivity to potential productivity), cost benefit analysis and soil studies. Notable contributions include, but are not limited to:

- The GLASOD project (1988-1991), which was a global assessment of human-induced soil degradation.[45]
- The UN FAO mapping of land degradation from 1981-2003, using rainfall efficiency measurements and vegetation cover indexes. This was satellite enabled.[46]
- Imhoff et al. (2004)[47] and Haberl et al. (2007)[48] use of satellite images to model the difference between possible productivity and actual productivity of the land.
- Hansen et al. (2013), which tracks global forest change.[49] Now updated to cover 2000-2018.

These data and analyses are used to help estimate the extent to which the 'services' land provides to the economy are being restricted. Reclamation and restoration costs for land vary on a case-by-case basis, dependent on jurisdiction.

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