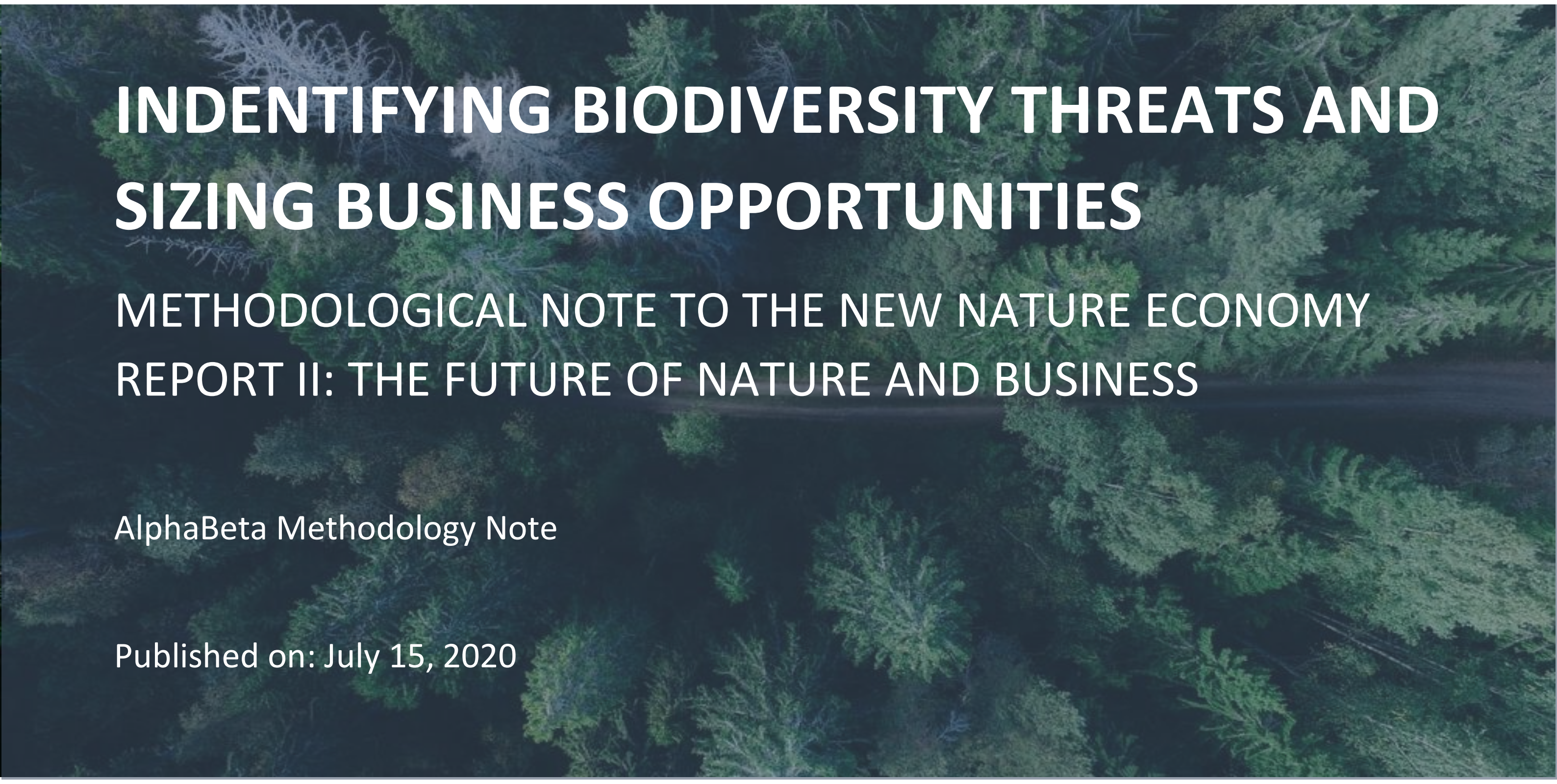

INDENTIFYING BIODIVERSITY THREATS AND SIZING BUSINESS OPPORTUNITIES

METHODOLOGICAL NOTE TO THE NEW NATURE ECONOMY REPORT II: THE FUTURE OF NATURE AND BUSINESS

AlphaBeta Methodology Note

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About this paper

This document has been prepared by AlphaBeta to document the approach taken to identify threats and size opportunities in the preparation of the *Future of Nature and Business* report published by the World Economic Forum, and it presents the methodology used to derive the estimates contained therein. All information in this document is derived or estimated by analysis from AlphaBeta using both proprietary and publicly available information. Where information has been obtained from third party sources and proprietary sources, this is clearly referenced in the footnotes.

About AlphaBeta

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Methodology for prioritising biodiversity threats

The International Union for Conservation of Nature's (IUCN) Red List of Threatened Species was established in 1964 and has evolved into the world's most robust and comprehensive database on the global conservation status of animal, fungus, and plant species.[1] The Red List lists 44 unique threats to biodiversity grouped among 11 threat classes (Exhibit A1). These have been used as the base classification to understand economic activities' relationship with biodiversity as these are sufficiently granular to systematically identify the role of formal economic activities impacting each threat. They also facilitate an analysis of the number of threatened and near-threatened species impacted by each threat. Species population is also the biodiversity variable with the most robust evidence in comparison to other variables.[2] Three criteria were then used to prioritise biodiversity threats for which business engagement is crucial: (1) Importance to biodiversity loss; (2) Role of business; and (3) Potential to disrupt business activities. These have been described in detail in the following subsections.

EXHIBIT A1

The IUCN Red List provides a list of 44 threats to biodiversity under 11 threat classes

Class		Threats
1	Residential and commercial development	1. Housing and urban areas; 2. Commercial and industrial areas; 3. Tourism and recreation areas
2	Agriculture and aquaculture	4. Annual and perennial non-timber crops; 5. Wood and pulp plantations; 6. Livestock farming and ranching; 7. Marine and freshwater aquaculture
3	Energy production and mining	8. Oil and gas drilling; 9. Mining and quarrying; 10. Renewables
4	Transportation and service corridors	11. Roads and railroads; 12. Utility and service lines; 13. Shipping lanes; 14. Flight paths
5	Biological resource use	15. Hunting and collecting terrestrial animals; 16. Gathering Terrestrial plants; 17. Logging and wood harvesting; 18. Fishing and aquatic resources
6	Human intrusions and disturbance	19. Recreational activities; 20. War, civil unrest and military exercises; 21. Work and other activities
7	Natural systems modifications	22. Fire and fire suppression; 23. Dams and water management/use; 24. Other ecosystem modifications
8	Invasive and other problematic species	25. Invasive non-native/alien species/diseases; 26. Problematic native species/diseases; 27. Introduced genetic material; 28. Problematic species/diseases of unknown origin; 29. Viral/prion-induced diseases; 30. Diseases of unknown cause
9	Pollution	31. Domestic and urban waste water; 32. Industrial and military effluents; 33. Agricultural and forestry effluents; 34. Garbage and solid waste; 35. Air-borne pollutants; 36. Excess energy
10	Geological events	37. Volcanoes; 38. Earthquakes/tsunamis; 39. Avalanches/landslides
11	Climate change and severe weather	40. Habitat shifting and alteration; 41. Droughts; 42. Temperature extremes; 43. Storms and flooding; 44. Other impacts

1. Threat class 12 ("Others") has been omitted from this analysis due to lack of specificity.
SOURCE: IUCN; AlphaBeta analysis

We recognise that there are three key limitations of using the IUCN Red List's assessment of the number of species impacted by threats to biodiversity as a measure of the threats' true impact on biodiversity:

[1] International Union for Conservation of Nature (2019), *The IUCN Red List of Threatened Species.* Available at: https://www.iucnredlist.org/
[2] Intergovernmental Panel of Biodiversity and Ecosystem Services [IPBES] (2019), *Global Assessment Report.* Available at: https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services

- **Limitations on insights for some taxonomic groups**: While the Red List's threat assessment is based on well-established research for birds and mammals, experts indicate that the analysis is less comprehensive for other taxonomic groups. This is particularly the case for mangroves and aquatic ecosystems that have lower coverage of known species and potentially large numbers of unknown species.
- **Number of species impacted by threat does not account for the scale of impact**: Number of species is not indicative of the scale of impact of biodiversity threats, and this may result in over- or -under estimation of the true impact of threats on biodiversity. For instance, marine and freshwater aquaculture may have a low number of threatened or near-threatened species impacted (197), but the impact of this threat is often very high and could lead to population collapse.[3] On the other hand, annual and non-perennial crops have a high number of impacted species (11,618), but this is often low or "background" impact and species may not be at particularly high risks from this specific threat.
- **Other essential biodiversity variables (EBVs) beyond species population are not included**: Although species population is generally accepted as the most robust EBV (IPBES has assigned its highest confidence level: *well-established*), there are five other EBVs to consider when measuring the full impact of threats on biodiversity.[4] At the time of writing, there are no similarly comprehensive databases that are able to match granular business activities to impact on these EBVs as the IUCN Red List does for species impact by different business- and non-business threats. IPBES groups these five EBVs across three confidence levels based on available evidence as below.
    - *Established but incomplete*: Community composition (e.g. local species richness, mean species abundance); Ecosystem structure (e.g. extent of intact forest landscapes, mangrove forest cover, percentage of live coral cover)
    - *Unresolved*: Species traits (e.g. mean length of fish); Ecosystem function (e.g. net primary productivity)
    - *Inconclusive*: Genetic composition

Criteria 1: Importance to biodiversity loss

Importance to biodiversity loss has been proxied by data on species population or extinction risk from the IUCN Red List of Threatened Species. Species population has the most robust available data and it is sufficiently granular to enable linkages of the 44 biodiversity threats to the biodiversity impact. Threat levels are indicators about population size and spread of a species, and the Red List also provides information about species habitat and ecology, use and/or trade, threats

[3] Species are periodically added the Red List – data used in this analysis was accessed in October 2019. For latest species count and more on the methodology behind the sorting species into categories, please refer to: International Union for Conservation of Nature (2019), *Raw Data to Red List.* Available at: https://www.iucnredlist.org/assessment/process

[4] Intergovernmental Panel of Biodiversity and Ecosystem Services [IPBES] (2019), *Global Assessment Report.* Available at: https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services

(which have been used in this analysis), and conservation actions. There are over 105,000 species that are presently on the Red List, and these have been divided into nine categories (Exhibit A2).[5] Consistent with Maxwell et al. (2016), this analysis focuses on five categories of threatened (i.e. critically endangered, endangered, and vulnerable) and near-threatened species (i.e. lower risk – conservation dependent, and near-threatened).[6] The impact or relevance of biodiversity threats is measured against all assessed species, and the number of species affected by each threat has been used in this analysis.

EXHIBIT A2

This analysis focuses on species in 5 categories of threat levels as classified by the IUCN Red List

Focus of this analysis

Categories of threat levels	Brief description	Total species in category (Oct 2019)	Focus classifications[1]
Extinct	No reasonable doubt that the last individual has died in known or expected habitats	873	Extinct
Extinct in the Wild	Species only survives in cultivation, captivity or as naturalised populations	73	Extinct
Critically Endangered	Faces extremely high risk of extinction in the wild.	**6,127**	**Threatened**
Endangered	Faces very high risk of extinction in the wild	**9,754**	**Threatened**
Vulnerable	Faces high risk of extinction in the wild	**12,457**	**Threatened**
Conservation Dependent	Species population levels dependent on conservation efforts	**205**	**Near-Threatened**
Near Threatened	Close to or likely to qualify for a threatened category in the near future	**6,453**	**Near-Threatened**
Least Concern	Does not qualify for any of the above threatened categories	54,039	Not Threatened
Data Deficient	Inadequate information to make assessment; species could we well-studied in general.	15,769	Not Threatened

1. Consistent with methodology adopted by Maxwell et. al. (2016) i.e. the "Big Killers" analysis.

SOURCE: Maxwell et. al. (2016); IUCN; AlphaBeta analysis

Criteria 2: Role of business

This criterion measures the degree to which business impacts the biodiversity threat. There are 3 levels of the direct impact of business activities on biodiversity threats – each of the 44 threats classified by the IUCN Red List were assigned a level of impact by AlphaBeta:

- **High:** Threat stems directly from activities of large economic actors, e.g. industrial agriculture, industrial effluents pollution from industry, etc.
- **Medium:** Threat stems from activities of small economic and business actors (individuals/households/smallholder farmers/artisanal fishers).

[5] Species are periodically added the Red List – data used in this analysis was accessed in October 2019. For latest species count and more on the methodology behind the sorting species into categories, please refer to: International Union for Conservation of Nature (2019), *Raw Data to Red List.* Available at: https://www.iucnredlist.org/assessment/process

[6] Sean L. Maxwell et. al. (2016), *Biodiversity: The ravages of guns, nets and bulldozers.* Nature Vol. 536, Issue 7615. Available at: https://www.nature.com/news/biodiversity-the-ravages-of-guns-nets-and-bulldozers-1.20381

- **Low:** Threat stems from either activities of individuals/households weakly connected with regional, global markets (e.g. subsistence activities), or it is not related to any economic activities (e.g. volcanoes).

Criteria 3: Potential to disrupt business activities

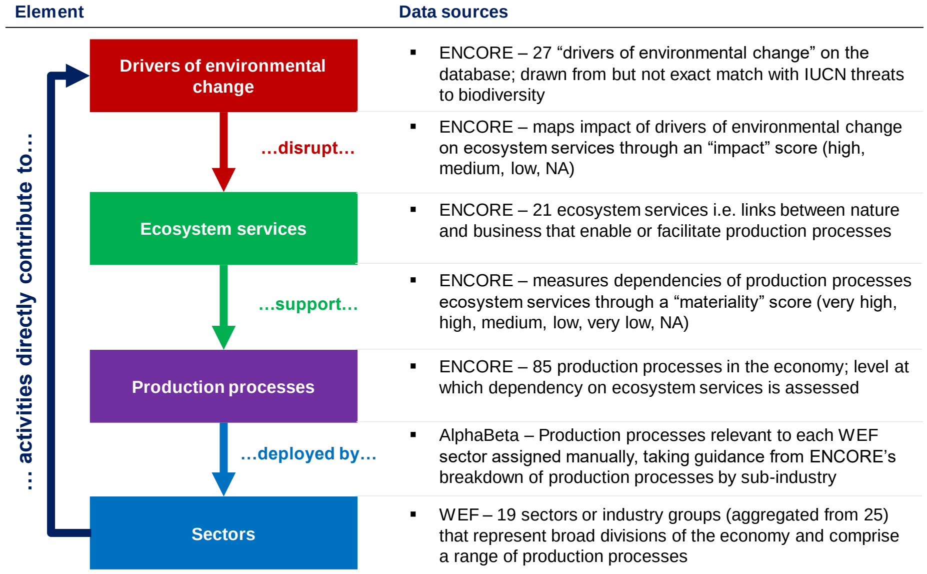
This criterion measures the degree to which biodiversity threats could impact ecosystem services which are crucial for business performance. Natural ecosystem "services" (e.g. pollination) support a range of production processes that are critical to many sectors of the economy; these production processes have a negative impact on biodiversity and nature; which in turn disrupts the provision of natural ecosystem services.

The analysis under this criteria draws upon the Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE) database[7], built by the Natural Capital Finance Alliance. ENCORE lists the impact of 27 drivers of environmental change on 21 ecosystem services provided by nature, which in turn enable 85 production processes across 19 sectors of the economy. The relationship between these three variables has been assessed based on a rigorous review of the prevailing scientific evidence. These 27 drivers of environmental change have been largely derived from the IUCN Red List classification of threats; some issues are aggregated, and some are disaggregated from this classification, and these differences have been accounted for in the threat prioritisation exercise. This data has been used to create the Disruption Index, which identifies the degree to which different sectors of the economy are impacted by drivers of environmental change (Exhibit A3).

[7] Exploring Natural Capital Opportunities, Risks and Exposure (2019), *Explore Natural Capital Risks.* Available at: https://encore.naturalcapital.finance/en/

EXHIBIT A3

Overview of business dependency on ecosystem services impacted by drivers of environmental change



SOURCE: ENCORE; WEF; AlphaBeta analysis

There were four steps involved in this analysis:

- **Step 1: Understand the impact of drivers of environmental change on natural ecosystem services.** In this step, a data matrix was built with ENCORE's assessment of the impact of 27 drivers of environmental change on 21 ecosystem services provided by natural capital assets, across a four-point scale as below:
    - **NA (0)**: No relationship between driver and service
    - **Low (1)**: Ecosystem service not susceptible and largely undisturbed by the driver
    - **Medium (2)**: Service is susceptible and expected to consistently worsen if driver persists
    - **High (3)**: Service is extremely vulnerable with non-linear disruptions if driver persists

- **Step 2: Understand the dependency of production processes on natural ecosystem services.** In this step, a data matrix was built with ENCORE's assessment of the dependency (i.e. materiality) of 85 production processes on 21 ecosystem services provided by natural capital assets, across a six-point scale:
    - **NA (0):** No relationship between ecosystem service and production process
    - **Very low (1):** Production process can take place even with full disruption
    - **Low (2):** Most of the time, the production process can take place even with full disruption
    - **Medium (3):** Although not practical, the production process can take place without the ecosystem service due to the availability of substitutes
    - **High (4):** Production process can take place with some disruption, but a high degree of dependency on service makes this process high-risk
    - **Very high (5):** Production processes extremely vulnerable to even minimal disruption; the degree of service provision is critical and irreplaceable

- **Step 3: Identify whether a production process is disrupted by each driver of environmental change through its impact on dependent ecosystem services.** Using the data matrices from steps 1 and 2, a data matrix was built identifying the number of ecosystem services through which a production process was disrupted by each driver of environmental change. For this analysis, only high impact drivers (i.e. drivers with an impact score of 2 or 3 on ecosystem services) and high materiality production processes (i.e. processes with a materiality score of 3, 4 or 5) were considered as "disruptive".

- **Step 4: Understand the impact of disrupted production processes on sectors of the economy.** In this step, the 85 production processes were first assigned to the 19 industry sectors to which they belong. Then, using the number of production processes disrupted by each threat above, a matrix was constructed with the number of production processes relevant to each sector that were disrupted as a proportion of the overall production processes in that sector. This is the final output that is shown in Exhibit A4.

EXHIBIT A4

Drivers of environmental change have varying impact on business activities across the economy (1/2)

Disruption Index – Percentage of production processes disrupted by drivers of environmental change[1]

Disruption risk: High / Medium / Low

Drivers of environmental change

	Sector[2]	Diseases	Droughts	Earthquakes	Fire	Flooding	Habitat modification	Human modification of genes	Human movement	Industrial/ domestic activities	Industrial/ domestic construction	Intensive agri- /aqua- culture	Invasive species	Landslides	Ocean acidification
1	Advanced Manufacturing	33%	67%	33%	33%	67%	67%	33%	33%	67%	67%	67%	67%	67%	67%
2	Aerospace	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
3	Agriculture, food and beverage	85%	95%	85%	95%	95%	95%	85%	75%	95%	95%	90%	90%	95%	95%
4	Automotive	33%	67%	33%	67%	67%	67%	33%	67%	67%	67%	67%	67%	67%	67%
5	Aviation, travel and tourism	63%	88%	63%	88%	88%	88%	63%	13%	88%	88%	88%	88%	88%	88%
6	Banking, capital markets and investors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7	Chemical and advanced materials	6%	71%	6%	71%	71%	71%	6%	29%	71%	71%	35%	35%	71%	71%
8	Electronics	25%	50%	25%	25%	50%	50%	25%	25%	50%	50%	50%	50%	50%	50%
9	Energy and utilities	67%	92%	67%	92%	92%	92%	67%	50%	92%	92%	83%	83%	92%	92%
10	Health and healthcare	33%	67%	33%	33%	67%	67%	33%	17%	67%	67%	67%	67%	67%	67%
11	IT and digital communications	63%	75%	63%	63%	75%	75%	63%	25%	75%	75%	75%	75%	75%	75%
12	Infrastructure and urban development	38%	75%	50%	50%	75%	75%	38%	38%	75%	75%	75%	63%	75%	75%
13	Insurance and asset management	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	Media, entertainment and information	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	Mining and metals	38%	88%	38%	63%	88%	88%	38%	63%	88%	88%	88%	88%	88%	88%
16	Oil and gas	50%	75%	50%	75%	75%	75%	50%	13%	75%	75%	50%	50%	75%	75%
17	Professional services	0%	33%	0%	0%	33%	33%	0%	0%	33%	33%	33%	33%	33%	33%
18	Retail, consumer goods and lifestyle	56%	88%	56%	81%	88%	88%	56%	63%	88%	88%	88%	88%	88%	88%
19	Supply chain and transportation	86%	86%	86%	86%	86%	86%	86%	43%	86%	86%	86%	86%	86%	86%
	Disruption index score – driver[3]	**34%**	**59%**	**36%**	**43%**	**59%**	**59%**	**34%**	**28%**	**59%**	**59%**	**57%**	**55%**	**59%**	**59%**

1. Level of disruption is the impact of each of the 27 drivers of environmental change (i.e. biodiversity threats) on critical ecosystem services provided by nature to the production processes in each of the 19 sectors – score represents the percentage of production processes in the sector that are disrupted by biodiversity and nature loss issues. This has been calculated by first understanding the degree of impact of drivers on ecosystem services (on a scale of 0 to 3; issues with a score of 2 or 3 only were considered) via the ENCORE database, and understanding the dependency (or materiality) of sector-specific production processes on 21 ecosystem services (on a scale of 0 to 5; materiality scores of 3 and above only were considered) via the ENCORE database; then calculating the disruption caused by issues to production processes using these two scores, and then finally aggregating production processes relevant to each sector as classified by WEF. Disrupted production processes are those with a very high (5), high (4) or medium (3) materiality on ecosystem services; and for whom biodiversity and nature loss issues have a high (3) or medium (2) impact on those relevant ecosystem services.
2. Sectors based on WEF industry classification (aggregated where relevant e.g. oil and gas, banking, capital markets and investors) relevant production processes dependent on ecosystem services under the ENCORE database assigned manually.
3. Disruption Index score by driver is the sum of individual sector scores by driver, weighted by each sector's contribution to global GDP, calculated using global proxies. A high risk driver is one with a Disruption Index score of >55%; a medium risk driver has a score between 40%-55%, and a low risk driver has a score <40%.
4. Disruption Index score by sector is the average of the individual driver scores by sector. A high risk sector is one with a Disruption Index score of >75%; medium risk sector has a score between 50%-75%; and a low risk sector has a score <50%.

SOURCE: ENCORE; AlphaBeta analysis

Drivers of environmental change have varying impact on business activities across the economy (2/2)

Disruption Index – Percentage of production processes disrupted by drivers of environmental change[1]

Disruption risk: High / Medium / Low

Drivers of environmental change

	Sector[2]	Ocean current and circulation	Overfishing	Over-harvesting	Overhunting	Pests	Pollution	Population changes	Sea level rise	Sea surface temperature	Storms	Volcanoes	Water abstraction	Weather conditions	**Disruption Index score – sector[4]**
1	Advanced Manufacturing	33%	33%	33%	33%	33%	67%	33%	67%	67%	67%	33%	67%	67%	**52%**
2	Aerospace	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	**50%**
3	Agriculture, food and beverage	95%	85%	85%	85%	85%	95%	85%	95%	95%	95%	85%	90%	95%	**90%**
4	Automotive	67%	33%	33%	33%	33%	67%	33%	67%	67%	67%	33%	67%	67%	**56%**
5	Aviation, travel and tourism	88%	63%	63%	63%	63%	88%	63%	88%	88%	88%	63%	88%	88%	**76%**
6	Banking, capital markets and investors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
7	Chemical and advanced materials	71%	6%	6%	6%	6%	71%	6%	71%	71%	71%	6%	35%	71%	**44%**
8	Electronics	25%	25%	25%	25%	25%	50%	25%	50%	50%	50%	25%	50%	50%	**39%**
9	Energy and utilities	92%	67%	67%	67%	67%	92%	67%	92%	92%	92%	67%	83%	92%	**81%**
10	Health and healthcare	33%	33%	33%	33%	33%	67%	33%	67%	67%	67%	33%	67%	67%	**51%**
11	IT and digital communications	63%	63%	63%	63%	63%	75%	63%	75%	75%	75%	63%	75%	75%	**68%**
12	Infrastructure and urban development	50%	38%	50%	38%	38%	75%	38%	75%	75%	75%	50%	63%	75%	**60%**
13	Insurance and asset management	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
14	Media, entertainment and information	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
15	Mining and metals	63%	38%	38%	38%	38%	88%	38%	88%	88%	88%	38%	88%	88%	**68%**
16	Oil and gas	75%	50%	50%	50%	50%	75%	50%	75%	75%	75%	50%	50%	75%	**62%**
17	Professional services	0%	0%	0%	0%	0%	33%	0%	33%	33%	33%	0%	33%	33%	**19%**
18	Retail, consumer goods and lifestyle	81%	56%	56%	56%	56%	88%	56%	88%	88%	88%	56%	88%	88%	**76%**
19	Supply chain and transportation	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	**84%**
	Disruption Index score – driver[3]	**43%**	**34%**	**36%**	**34%**	**34%**	**59%**	**34%**	**59%**	**59%**	**59%**	**36%**	**55%**	**59%**	

1. Level of disruption is the impact of each of the 27 drivers of environmental change (i.e. biodiversity threats) on critical ecosystem services provided by nature to the production processes in each of the 19 sectors – score represents the percentage of production processes in the sector that are disrupted by biodiversity and nature loss issues. This has been calculated by first understanding the degree of impact of drivers on ecosystem services (on a scale of 0 to 3; issues with a score of 2 or 3 only were considered) via the ENCORE database, and understanding the dependency (or materiality) of sector-specific production processes on 21 ecosystem services (on a scale of 0 to 5; materiality scores of 3 and above only were considered) via the ENCORE database; then calculating the disruption caused by issues to production processes using these two scores, and then finally aggregating production processes relevant to each sector as classified by WEF. Disrupted production processes are those with a very high (5), high (4) or medium (3) materiality on ecosystem services; and for whom biodiversity and nature loss issues have a high (3) or medium (2) impact on those relevant ecosystem services.
2. Sectors based on WEF industry classification (aggregated where relevant e.g. oil and gas, banking, capital markets and investors) relevant production processes dependent on ecosystem services under the ENCORE database assigned manually.
3. Disruption Index score by driver is the sum of individual sector scores by driver, weighted by each sector's contribution to global GDP, calculated using global proxies. A high risk driver is one with a Disruption Index score of >55%; a medium risk driver has a score between 40%-55%, and a low risk driver has a score <40%.
4. Disruption Index score by sector is the average of the individual driver scores by sector. A high risk sector is one with a Disruption Index score of >75%; medium risk sector has a score between 50%-75%; and a low risk sector has a score <50%.

SOURCE: ENCORE; AlphaBeta analysis

Prioritisation of biodiversity threats

The three criteria – importance to biodiversity loss, role of business, and potential to disrupt business activities – were applied to the 44 threats over four steps to prioritise biodiversity threats:

1. **Threats with the highest biodiversity impact**: Select biodiversity threats over 4,500 (near-) threatened species affected; this yielded 6 threats.

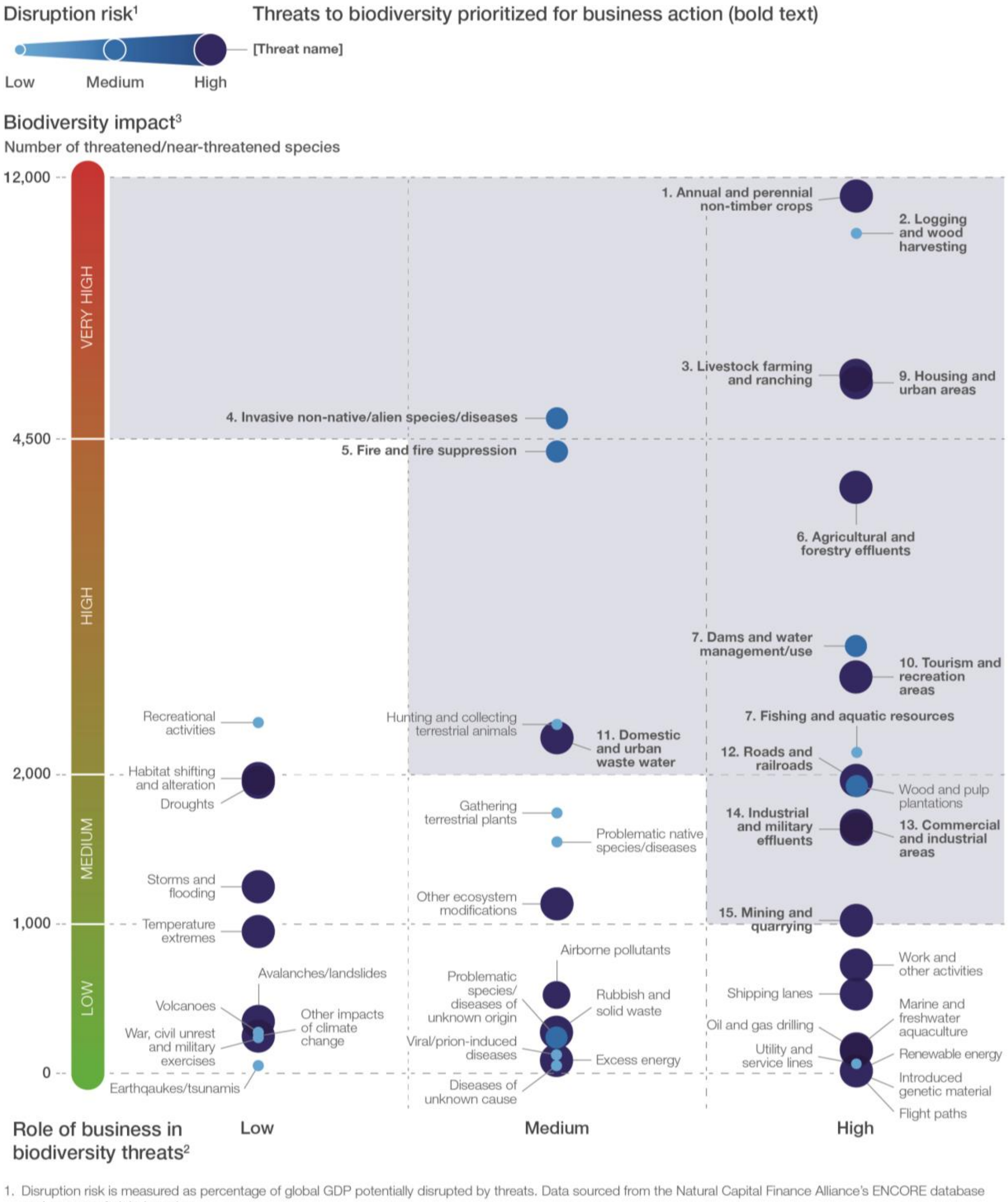
2. **Threats with high biodiversity impact and high role of business**: Consider biodiversity threats with "High" biodiversity impact, i.e. over 2,000 (near-) threatened species affected – of these threats, select biodiversity threats with "High" role of business, i.e. where the threat stems directly from activities of large economic actors. This resulted in 4 additional threats for a total of 10 prioritised threats.

3. **Threats with high disruption risk**: Evaluate threats with "Medium" biodiversity impact (1,000 to 2,000 species) and "High" role of business or vice-versa. Of these threats, select biodiversity threats with "High" disruption risk to the economy. This resulted in an additional 5 threats, for a total of 15 prioritised threats (Exhibit A5).

Climate change-related threats considered separately as an indirect driver of biodiversity loss from a business perspective.

EXHIBIT A5

Threats to biodiversity have been prioritized according to three criteria: their impact on biodiversity, the role of business in driving them and their disruptive potential for business



1. Disruption risk is measured as percentage of global GDP potentially disrupted by threats. Data sourced from the Natural Capital Finance Alliance's ENCORE database and a range of global proxies.
2. Score assigned for role of business were high (100), medium (50) and low (0). Select threats relating to agricultural and extractive activities have been given adjustments based on the share of smallholder activity as a share of overall activity in the threat, and have been rounded up or down to high or medium categories.
3. Consistent with nomenclature for threatened and near-threatened species adopted by Maxwell et. al. (2016) i.e. the "Big Killers" analysis. Data sourced from the IUCN Red List of Species.

SOURCE: IUCN; ENCORE; Literature review; AlphaBeta analysis

Methodology for sizing business opportunities

General sizing notes

In each of the three systems, the team engaged extensively with industry and academic experts, industry reports and academic literature to identify and size the major opportunities (worth at least US$15 billion in 2030) for the private sector. Some of the benefits of biodiversity actions are diffuse across the economy, such as densification of urban environments reducing traffic congestion costs to economic efficiency and air pollution. We focused instead on concentrated shifts in profit pools, generating specific opportunities for business. The opportunities that we selected are based on existing, commercialised technology, though we note that many important opportunities related to tackling biodiversity threats will arise from technologies as yet unknown or embryonic in their development.

The sizing reflects the annual opportunity in 2030 (calculated in 2019 US dollars and rounded to the nearest US$5 billion), based on the estimated savings (e.g., the value of land saved from improving smallholder yields) or market size (e.g., organic food demand). In each case, we have measured the incremental size of the opportunity in a “nature-positive” scenario versus a “business-as-usual” (BAU) scenario. For example, the opportunity to improve large-scale farm yields is calculated as the additional productivity improvement opportunity from the implementation of available technologies, above that expected in a BAU scenario (where yields grow at historical rates). The opportunities were also benchmarked to previous estimates used in relevant past research to ensure comparability.[8] The opportunities are not based on carbon pricing or other externalities (except for forest ecosystem services and other natural climate solutions, where carbon pricing is a principal revenue source and is based on the estimated cost of implementing opportunities deemed to be “low-cost” and “cost-effective”).[9] The BAU scenarios are derived from existing policies and policy announcements. The sizings are a bottom-up microeconomic perspective and do not consider interaction and general equilibrium effects.

The impact of COVID-19 on these estimates is difficult to understand, particularly given the 2030 timeframe, the multiple channels of impact, and the lack of understanding of the full duration and impact of the crisis at present. In each relevant opportunities, we have described the potential impact of COVID-19 on these opportunities qualitatively, and for opportunities related to consumer demand (mainly in the “food, land and ocean use” system), the growth rates over the next two years have been adjusted for the changes in GDP forecast by the International Monetary Fund (IMF) as of April 2020.[10]

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[8] This includes Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf; and Business & Sustainable Development Commission [BSDC] (2017), *Better Business Better World*. Available at: http://report.businesscommission.org/

[9] Bronson Griscom et. al./The Nature Conservancy [TNC] (2017), *Natural climate solutions – Supporting Information Appendix*. Proceedings of the National Academy of Sciences of the USA. Available at: https://www.pnas.org/content/114/44/11645#ref-18

[10] Prior to the COVID-19 pandemic, the IMF forecast global growth of 3.3% in 2020 and 3% in 2021. It has now forecast the global economy to shrink by 3% in 2020 and grow by 5.8% in 2021. The average global growth rates are now 41% of the predicted growth rates in the next two years that were forecast previously. This adjustment is made to the growth rates of specific opportunities for the next two years, and then it is assumed the pre-COVID estimates of growth return. 14 of the opportunities sized are impacted by these adjustments, and these have been selected based on three criteria; (1) Consumer demand-driven opportunities (e.g. organic food demand, eco-tourism); (2) Direction of COVID-19 impact is clearly negative with no “offsets” (e.g. circular models in plastic packaging was not considered as although consumer demand for products using packaging will fall, an increase in e-commerce channels of sales will likely increase packaging material per product); and (3) The methodology used to size these opportunities is adjustable based on the inputs used.

I. Food, land and ocean use system

Transition 1: Ecosystem restoration and avoided land and ocean use expansion

Description	*Sizing assumptions*	*Sources*
Eco-tourism (US$290 billion)		
Market opportunity related to eco-tourism in 2030	**Business-as-usual (BAU)**: The emerging eco-tourism industry was valued at US$302 billion in 2019.[11] This is estimated to grow at around 6% through 2030 in the BAU scenario, i.e. at the same rate as the overall tourism market, to create a market value of US$536 billion by 2030 (adjusting for currency and inflation).[12] **Nature-positive**: The market is estimated to grow at up to 14% through 2030, in line with expectations of accelerated growth driven by a sustained increase in demand for environmentally friendly tourism, to create a market worth US$827 billion by 2030.[13] Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	MarketWatch (2019) Oxford Economics (2017)
Natural climate solutions (US$85 billion)		

For further detail, see IMF (April 2020), *World Economic Outlook, April 2020: The Great Lockdown*. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020

[11] MarketWatch (2019), "Ecotourism Market Size 2020". Available at: https://www.marketwatch.com/press-release/ecotourism-market-size-share-2020-global-competitors-strategy-industry-trends-segments-regional-analysis-review-key-players-profile-statistics-and-growth-to-2026-analysis-2020-01-27

[12] TripAdvisor and Oxford Economics (2018), *Sizing Worldwide Tourism Spending (or "GTP") & TripAdvisor's Economic Impact*. Available at: https://mk0tainsights9mcv7wv.kinstacdn.com/wp-content/uploads/2018/09/Worldwide-Tourism-Economics-2017-compressed.pdf

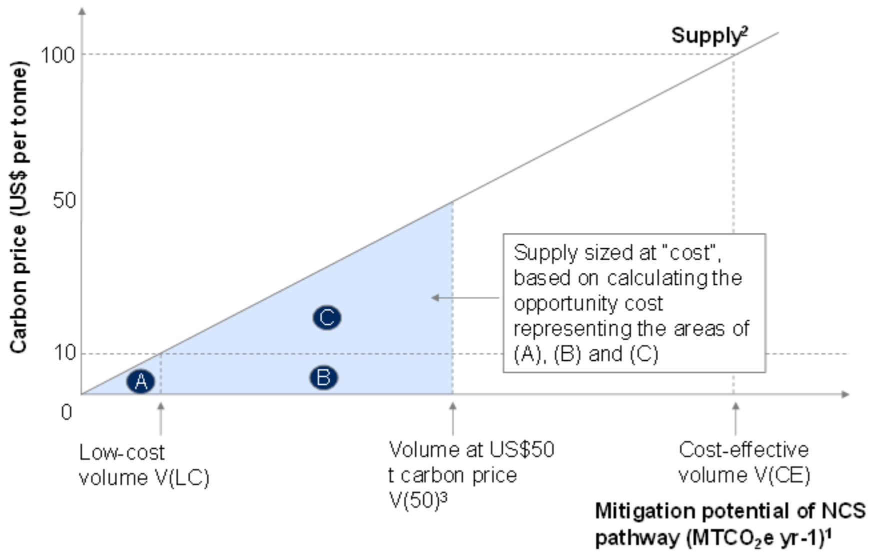
[13] MarketWatch (2019), "Ecotourism Market Size 2020". Available at: https://www.marketwatch.com/press-release/ecotourism-market-size-share-2020-global-competitors-strategy-industry-trends-segments-regional-analysis-review-key-players-profile-statistics-and-growth-to-2026-analysis-2020-01-27

Cost-based sizing of natural climate solutions (NCS)[14] financed through carbon markets	**BAU:** N/A, i.e. emissions from deforestation and forest degradation continue based on forecasts from the Intergovernmental Panel on Climate Change (IPCC) and United Nations Environment Programme (UNEP) and there is negligible development of ecosystem payment markets. **Nature-positive:** Griscom et al. (2017)[15] value the climate mitigation potential of 20 natural pathways – of these 20, five are relevant for this opportunity (cost-effective mitigation potential in parenthesis): (1) reforestation (temperate and tropical – 3.037 GtCO2e per year); (2) peatland restoration (tropical, temperate, and boreal – 0.394 GtCO2e per year); (3) avoided forest conversion (natural forests and clearing for subsistence agriculture – 2.897 GtCO2e per year); (4) avoided grassland conversion (temperate and boreal, tropical – 0.035 GtCO2e per year); (5) avoided peatland impacts (tropical, temperate, boreal – 0.678 GtCO2e per year). Of the total cost-effective potential of 7.041 GtCOe2 per year, 2.417 GtCO2e per year is considered "low-cost" mitigation potential. In addition to BAU, it is assumed that these opportunities are captured under this business opportunity. Methodologically, it is difficult to project effective carbon prices that emission reductions from natural climate solutions (NCS) may command in 2030, given the uncertainty on future policy regulation. Therefore, rather than estimating the opportunity at revenue, a cost-based approach has been used to size this opportunity. The size of the opportunity is therefore estimated as the integral of the supply curve, i.e. assuming the entire volume is sold at cost. As the exact shape of the supply curves is unknown, it has been assumed that these are linear between US$0-US$10 for low-cost volumes, and from US$10-US$100 for cost-effective volumes. Moreover, only the portion of the supply curve below US$50 per tonne has been included. The volume of mitigation available at this price (which we term V(50)) is estimated based on a linear supply curve inferred from the sequestration volumes available at low-cost (i.e. less than US$10) and cost-effective (i.e. less than US$100). See Exhibit A6 below for a detailed illustration. After interviews with the authors of Griscom et al. (2017), the estimates of the mitigation potential of NCS pathways and cost curves estimated in that research were determined to be useful middle-ground estimates to understand the size of the global opportunity in this research. It is important to note that varying estimates are available based on new evidence and analyses, and more recent studies can be used to further understand this opportunity for specific pathways and geographies. One such recent study is Griscom et al. (2020), which looks at NCS mitigation potential for relevant pathways in tropical countries – updated estimates provide lower mitigation potential for reforestation that those considered in this research.[16] Another such study is Bastin et al. (2019), which estimates a higher mitigation potential for reforestation than those considered.[17]	Bronson Griscom et. al. (2017)

Description	Sizing assumptions	Sources

EXHIBIT A6

Proposed cost-based approach to size value of natural climate solutions (NCS) pathways



1. Estimates of mitigation potential supplied by Griscom et. al. (2017), *Natural climate solutions*. PNAS October 31, 2017 114 (44) 11645-11650.
2. As the size of the supply curves are unknown, it is assumed that these are linear between US$0-US$10 for low-cost volumes (the upper limit for such volumes), and from US$10-US$100 for remaining cost-effective volumes (the upper limit for such volumes).
3. This volume is unknown but can be inferred knowing the low-cost volume and the cost-effective volume, and assuming a linear supply curve.

SOURCE: Griscom et. al. (2017); Team analysis

Restoring degraded land (US$75 billion) [*methodology derived from sizing by BSDC*[18]]

Description	Sizing assumptions	Sources
Cost savings from restoring degraded land with an IRR of over 10%	**BAU**: 10% of cropland degradation is prevented, with no restoration of previously degraded land.[19]	FAO World Soil (2015)[21]
	Nature-positive: The McKinsey Global Institute (MGI) estimates that 45% of cropland degradation could be prevented by 2030; that it is possible to restore 80% of land suffering low-to-moderate levels of degradation and 60% in the case of severe-to-very-severe degradation.[20] Translating this to returns for the private sector – 72% of these opportunities (low, moderate, and severe degradation) have returns of greater than 10%, while the remaining opportunity for restoring very severe degradation is less than 10%. We only consider the opportunities with returns greater than 10%.	MGI Resource Revolution (2011)

[14] Natural climate solutions are conservation, restoration, and/or improved land management actions that increase carbon storage and/or avoid greenhouse gas emissions across global forests, wetlands, grasslands, and agricultural lands

[15] Bronson Griscom et. al./The Nature Conservancy [TNC] (2017), *Natural climate solutions*. Proceedings of the National Academy of Sciences of the USA. Available at: https://www.pnas.org/content/114/44/11645#ref-18

[16] Bronson Griscom et. al. (2020), *National mitigation potential from natural climate solutions in the tropics.* Philosophical Transactions B 375: 20190126. Available at: http://dx.doi.org/10.1098/rstb.2019.0126

[17] Jean-François Bastin et. al. (2019), *The global tree restoration potential.* Available at: https://science.sciencemag.org/content/365/6448/76

[18] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

[19] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

[20] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

[21] FAO (2015), *Status of the World's Soil Resources*.

Transition 2: Productive and regenerative agriculture

Description	*Sizing assumptions*	*Sources*
Organic food and beverages (US$475 billion) [*methodology derived from sizing by FOLU*[22]]		
Market opportunity related to organic food and beverages in 2030	**BAU**: Market size of US$143 billion in 2018[23] grows at the same compounded annual growth rate (CAGR) of 5.9% as the estimated overall fruits and vegetables market through 2030[24] – creating a US$285 billion market (US$ 2019 values).	Zion Research (2017)
	Nature-positive: Market size of US$143 billion in 2018 grows at an accelerated CAGR of 14.56% through 2030 creating a US$784 billion (US$ 2019 values) market, implying an incremental opportunity of US$475 billion.[25] The accelerated market forecast is contingent on sustained consumer demand and increased supply.	MarketLine (2019)
	Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	
Technology in large scale farms (US$195 billion) [*methodology derived from sizing by BSDC*[26]]		
Value of land savings from yield improvements on large-scale farms (>2 hectares)	**BAU:** Yields grow at current rates. **Nature-positive:** MGI estimates intervention will lead to yield improvements over the base case of 15% in developed countries, and 50% in developing countries.[27] Producing the same amount of food will, therefore, require between up to 180 million fewer hectares – the cost savings opportunity is the economic value of the land saved.	MGI Resource Revolution (2011)
Bio-innovation (US$125 billion)		

[22] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf
[23] Zion Research (2018), *Organic Food and Beverages Market by Product Type*. Available at: https://www.zionmarketresearch.com/news/organic-food-beverages-market
[24] Market Line (2015), *Global Fruit and Vegetables.* Available at https://store.marketline.com/report/ohme1251--global-fruit-vegetables/
[25] Zion Research (2018), *Organic Food and Beverages Market by Product Type*. Available at: https://www.zionmarketresearch.com/news/organic-food-beverages-market
[26] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[27] McKinsey Global Institute (2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

Description	*Sizing assumptions*	*Sources*
Market opportunity for agricultural biotechnology and animal genetics	***Component 1: Agricultural biotechnology – US$117 billion (Market opportunity from sales of technology for advanced breeding and fertilisation in crops, e.g. multi-trait seeds improvements using gene editing)*** **BAU**: BCC Research estimates the agricultural biotechnology market to be worth US$30.8 billion in 2015, and this is forecast to be US$39 billion in 2030.[28] This is the same market growth as overall food demand of 1.5% through 2030, implying limited further application of technology. This market value includes end products as well as the technology for genetic testing for crops. **Nature-positive:** The US$30.8 billion market grows at an accelerated CAGR of 11% through 2030, implying an overall market value of US$147 billion by 2030.[29] Adjusting for currency and inflation, this implies an incremental opportunity of US$117 billion. This accelerated forecast is contingent on a range of levers being pulled, including higher R&D spending, regulatory approval of products, and increased consumer acceptance. ***Component 2: Animal genetics – US$6 billion (Market opportunity from sales of technology for advanced breeding in livestock, e.g. genetic sequencing)*** **BAU**: The global animal genetics market has been valued at US$2.5 billion in 2014 by MarketsandMarkets, and this is forecast to be US$3.4 billion in 2030.[30] This is the same market growth as overall food demand of 1.5% through 2030, implying limited further application of technology. **Nature-positive:** The US$2.5 billion market grows at an accelerated CAGR of 8.5% through 2030, implying an overall market value of US$9.2 billion by 2030.[31] Adjusting for currency and inflation, this implies an incremental opportunity of around US$6 billion. This accelerated forecast is contingent on a range of levers being pulled, including higher R&D spending, regulatory approval of products, and increased consumer acceptance.	BCC Research (2014) Markets and Markets (2016) International Service for the Acquisition of Agri-Biotech Applications (ISAAA)
Technology in smallholder farms (US$110 billion) [*methodology derived from sizing by BSDC*[32]]		

[28] BCC Research, (2014) *Agricultural Biotechnology: Emerging Technologies and Global Markets*.
[29] BCC Research, (2014) *Agricultural Biotechnology: Emerging Technologies and Global Markets*.
[30] MarketsandMarkets (2016), *Animal Genetics Market*.
[31] MarketsandMarkets (2016), *Animal Genetics Market*.
[32] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

Description	Sizing assumptions	Sources
Value of land savings from yield improvements on smallholder farms (<2 hectares)	**BAU:** Yields grow at current rates. **Nature-positive**: MGI estimates intervention will lead to cumulative yield improvements over the base case of 15% in developed countries, and 50% in developing countries.[33] Producing the same amount of food will, therefore, require between 75 million and 105 million fewer hectares of land – the cost savings opportunity is the economic value of the land saved. Price assumptions derived from BSDC analysis.	MGI Resource Revolution (2011)
Micro-irrigation (US$90 billion) [*methodology derived from sizing by BSDC[34]*]		
Value of cost savings from a more efficient application of water in crop irrigation	**BAU:** Yields and adoption rates increase at current levels. **Nature-positive**: In sprinkler irrigation systems, MGI assumes an efficiency improvement of 15% with a 10% increase in adoption of micro-irrigation systems over current rates.[35] With regard to drip irrigation systems, MGI assumes an efficiency improvement of 45%, with a 10% to 20% increase in adoption over base case. These lead to water savings in a range of 250 to 300 cubic kilometres (the economic value of which has been sized as cost savings). Price assumptions derived from BSDC analysis. This does not account for associated energy savings and higher food production.	MGI Resource Revolution (2011)

[33] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

[34] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

[35] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

Description	*Sizing assumptions*	*Sources*
Livestock intensification (US$65 billion)		
Cost savings from cattle intensification and market opportunity from animal health diagnostics	***Component 1: Feed improvements – US$55 billion (Cost savings to farmers from the improved application of feed in livestock, e.g. cattle ranching intensification with cotton, marginal grazing, etc.)* [*methodology derived from sizing by BSDC*[36]]** **BAU:** N/A. **Nature-positive**: In addition to BAU, TNC estimates a US$58 per year per hectare annuity of cost savings from cattle intensification intervention (updated to US$ 2019 values).[37] A 20% penetration rate of this intervention was assumed by BSDC on total cattle-intensive agricultural land of 4.9 million hectares, creating cost savings of US$55 billion in 2030. ***Component 2: Animal health diagnostics – US$10 billion (Market opportunity from the sales of animal health diagnostics technology to tackle livestock and aquaculture disease)*** **BAU**: The global animal health diagnostics market has been valued at US$4.1 billion in 2015.[38] It is assumed that this market grows at the same rate as overall food demand of 1.5% through 2030 to create a market opportunity of US$5.1 billion, implying limited further application of technology. **Nature-positive:** The US$4.1 billion market grows at an accelerated CAGR of 8.6% through 2030, creating an overall market value of US$14.1 billion by 2030.[39] Accelerated growth is contingent on decreasing technology costs and increased access to smallholders. Adjusting for currency and inflation, this implies an incremental opportunity of around US$10 billion.	TNC, Cattle intensification in Para (2015) Markets and Markets (2015)
Sustainable inputs (US$105 billion)		

[36] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[37] The Nature Conservancy (2015), *Green growth and sustainable cattle intensification in Para*.
[38] MarketsandMarkets (2016), *Veterinary diagnostics market*.
[39] MarketsandMarkets (2016), *Veterinary diagnostics market*.

Market opportunities for biopesticides, biofertilisers, and organic fertilisers, and avoided loading and runoff from improved application and soil nutrient management	***Component 1: Green inputs market – US$55 billion (Market opportunities for biopesticides, biofertilisers, and organic fertilisers)*** The market includes three sub-segments: 1) biopesticides, 2) biofertilisers; and 3) organic fertilisers **BAU:** 1) Biopesticides: Market size in 2030 is based on the growth of the overall pesticides market of 3.09%[40] from a $3.36 billion market in 2016.[41] 2) Biofertilisers: Market size in 2030 is based on the growth of the overall fertilisers market of 4.5%[42] from a $2.3 billion market in 2018.[43] 3) Organic fertilisers: Market size in 2030 based on the growth of the overall fertilisers market of 4.5%[44] from a US$6.7 billion market in 2018.[45] **Nature positive:** 1) Biopesticides: Market size in 2030 is based on an accelerated CAGR of 17.4% from a $3.36 billion market in 2016.[46] 2) Biofertilisers: Market size in 2030 is based on an accelerated CAGR of 14.08% from a $2.3 billion market in 2018.[47] 3) Organic fertilisers: Market size in 2030 based on an accelerated CAGR of 14% from a US$6.7 billion market in 2018.[48] ***Component 2: Cropland nutrient management (Avoided nitrogen loading through reduced fertiliser use and improved application methods on croplands)*** **BAU**: N/A. **Nature-positive**: In addition to BAU, it is assumed that there is a capture of benefits of avoided nitrogen emissions from better application of fertiliser valued at 0.635 GtCO2e per year through 2030 – all of which is achievable through "low-cost" pathways.[49] This primarily involves reducing over-application of fertiliser (improving timing, placement, the form of application, and improved efficiency in manure usage), which can be done without decreasing crop yields. ***Component 3: Cover cropping (Additional carbon sequestration by planting cover crops in post-harvest seasons)***	Markets and Markets (2016) TechSci Research (2018) Markets and Markets (2019) Grand View Research (2018) Technavio (2018) Bronson Griscom et al. (2017)

Description	*Sizing assumptions*	*Sources*
	BAU: N/A. **Nature-positive**: In addition to BAU, it is assumed that there is capture of benefits from additional soil carbon sequestration by planting cover crops during the part of the year when main crop is not growing valued at 0.372 GtCO2e per year through 2030 – 0.248 of this opportunity is available through "low-cost" pathways with the remainder being cost-effective.[50] Commonly referred to as conservation agriculture, this opportunity excludes land planted with perennial crops, climate systems requiring a fallow period, or benefits from no-till agriculture which have mixed impacts on nitrogen emissions. For components 2 and 3; given that these are natural climate solutions (NCS) pathways, a cost-based approach has been used to size the opportunity. The opportunity is worth US$6 billion in sum. For more details, please see the corresponding opportunity under Transition 1: Ecosystem restoration and avoided land and ocean use expansion.	
Agro-forestry (US$20 billion)		

[40] TechSci Research (2018), "Global Pesticides Market By Type (Synthetic Pesticides & Bio Pesticides), By Application (Cereal, Fruits, Plantation Crops, Vegetables & Others), By Formulation (Dry & Liquid), By Region, Competition Forecast & Opportunities, 2013 – 2023" Available at: https://www.techsciresearch.com/report/global-pesticides-market/1311.html

[41] Markets and Markets (2016), "Biopesticides Market by Type , Source, Mode of Application, Formulation, Crop Application, and Region-Global Forecast by 2023" Available at: https://www.prnewswire.com/news-releases/biopesticides-market-worth-882-billion-usd-by-2022-600684121.html

[42] Grand View Research (2018), "Nitrogenous Fertilizer Market Size, Share & Trends Analysis Report By Product (Urea, Ammonium Nitrate), By Application (Cereals & Grains, Oilseeds & Pulses), By Region, And Segment Forecasts, 2019 - 2025" Available at: https://www.grandviewresearch.com/industry-analysis/nitrogenous-fertilizer-market

[43] Markets and Markets (2019, "Biofertilizer Market by Type, Microorganism, Mode of Application, Crop Type, Form, Region – Global Forecast to 2022." Available at: https://www.marketsandmarkets.com/Market-Reports/compound-biofertilizers-customized-fertilizers-market-856.html

[44] Grand View Research (2018), "Nitrogenous Fertilizer Market Size, Share & Trends Analysis Report By Product (Urea, Ammonium Nitrate), By Application (Cereals & Grains, Oilseeds & Pulses), By Region, And Segment Forecasts, 2019 - 2025" Available at: https://www.grandviewresearch.com/industry-analysis/nitrogenous-fertilizer-market

[45] Technavio (2018), "Global Organic Fertiliser Market 2019-2023" Available at: https://www.technavio.com/report/global-organic-fertilizers-market-industry-analysis?utm_source=t9&utm_medium=bw_wk1&utm_campaign=businesswire

[46] Markets and Markets (2016), "Biopesticides Market by Type , Source, Mode of Application, Formulation, Crop Application, and Region-Global Forecast by 2023" Available at: https://www.prnewswire.com/news-releases/biopesticides-market-worth-882-billion-usd-by-2022-600684121.html

[47] Markets and Markets (2019, "Biofertilizer Market by Type, Microorganism, Mode of Application, Crop Type, Form, Region – Global Forecast to 2022." Available at: https://www.marketsandmarkets.com/Market-Reports/compound-biofertilizers-customized-fertilizers-market-856.html

[48] Technavio (2018), "Global Organic Fertiliser Market 2019-2023" Available at: https://www.technavio.com/report/global-organic-fertilizers-market-industry-analysis?utm_source=t9&utm_medium=bw_wk1&utm_campaign=businesswire

[49] Bronson Griscom et. al./The Nature Conservancy [TNC] (2017), *Natural climate solutions*. Proceedings of the National Academy of Sciences of the USA. Available at: https://www.pnas.org/content/114/44/11645#ref-18

[50] Bronson Griscom et. al./The Nature Conservancy [TNC] (2017), *Natural climate solutions*. Proceedings of the National Academy of Sciences of the USA. Available at: https://www.pnas.org/content/114/44/11645#ref-18

Description	*Sizing assumptions*	*Sources*
Value of sequestration in above- and below-ground tree biomass and native vegetation in croplands	**BAU**: N/A. **Nature-positive**: It is assumed that there is a capture of benefits from three discrete forms of trees in cropland, valued at 0.439 GtCO2e per year through 2030 – all of which is achievable through cost-effective solutions[51]: 1. Windbreaks/shelterbelts (0.122 GtCO2e per year), 2. Alley cropping (0.185 GtCO2e per year), and 3. Farmer managed natural regeneration (FMNR; 0.132 GtCO2e per year) Given that these are natural climate solutions (NCS) pathways, a cost-based approach has been used to size the opportunity. For more details, please see the corresponding opportunity under Transition 1: Ecosystem restoration and avoided land and ocean use expansion.	Bronson Griscom et. al. (2017)

Transition 3: Healthy and productive ocean

Description	*Sizing assumptions*	*Sources*
Sustainable aquaculture (US$115 billion) [*methodology derived from sizing by BSDC*[52]]		
Market opportunity from increased demand for aquaculture products farmed sustainably in 2030	**BAU**: Aquaculture is expected to meet a baseline demand of 93.6 million tons in 2030.[53] **Nature-positive**: We forecast a growth in demand of up to 30%. This assumes improvements in aquaculture practices (e.g., waste management) and an increase in consumer demand for higher-value aquaculture (mainly from China). Price estimates derived directly from BSDC (updated to US$ 2019 values). Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	World Bank Fish to 2030 (2013)
Wild fisheries management (US$40 billion)		

[51] Bronson Griscom et. al./The Nature Conservancy [TNC] (2017), *Natural climate solutions*. Proceedings of the National Academy of Sciences of the USA. Available at: https://www.pnas.org/content/114/44/11645#ref-18
[52] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[53] The World Bank Group (2013), *Fish to 2030: Prospects for Fisheries and Aquaculture*.

Description	*Sizing assumptions*	*Sources*
Reduction of losses in wild fisheries by 2030 through sustainable fishing	**BAU**: Fishing continues at ecologically unsustainable levels, creating roughly US$83 billion of annual losses to the fishing industry.[54]	World Bank (2013)
	Nature-positive: Restorative fishing and policy interventions result in 50% of the US$83 billion per year lost to unsustainable fisheries being recouped.[55]	Food and Land Use Coalition (2019) [56]
Bivalves production (US$15 billion)		
Market opportunity from increased demand for bivalve molluscs and protection of estuary habitats	**BAU**: Market size of US$21 billion in 2018[57] grows at the same CAGR of 3.6% as the estimated overall seafood market through 2030[58] – creating a US$31 billion market.	Allied Market Research (2018)
	Nature-positive: Market size of US$21 billion in 2018 grows at an accelerated CAGR of 7.4% through 2030 creating a US$46 billion market, implying an incremental opportunity of US$15 billion (adjusting for currency and inflation). Accelerated growth is contingent on sustained demand and restoration of coastal wetland habitats for production. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	FAO (2016)

[54] World Bank (2017), *The Sunken Billions Revisited: Progress and Challenges in Global Marine Fisheries*. Available at: https://openknowledge.worldbank.org/handle/10986/24056

[55] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

[56] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

[57] Allied Market Research (2019), “Global seafood market to garner 155.32 billion by 2023 at 3.6 CAGR, says Allied Market Research” Available at: https://www.globenewswire.com/news-release/2019/09/17/1916759/0/en/Global-Seafood-Market-to-Garner-155-32-Billion-by-2023-at-3-6-CAGR-Says-Allied-Market-Research.html

[58] UN Food and Agriculture Organization [FAO] (2016), *The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all.*

Transition 4: Sustainable management of forests

Description	*Sizing assumptions*	*Sources*
Sustainable forestry management (US$165 billion)		
Revenues from areas certified under sustainable forestry management (SFM) in 2030	**BAU**: Barbier et al. (2017) estimate that over US$300 billion of revenues are available from sustainable forestry management (SFM) in timber, pulp, and paper products globally if all forest areas were placed under SFM.[59] In 2017, approximately 54% of all forest areas were certified under SFM – it is assumed that this does not change through 2030. The market size is expected to grow at the rate of tropical timber harvest growth between 2010-16 – 0.81% – this conservative growth has been taken as revenues in the forest sector have been volatile over the past decade.[60] **Nature-positive**: It is assumed that SFM-certified forest areas increase to 100%, and US$165 billion is the incremental opportunity.	Barbier et al. (2017) ITTO (2020)
Non-timber forest products (US$65 billion)		
Market opportunity for non-food non-timber forest products (NTFPs; e.g. medicinal herbs) in 2030	**BAU:** As a proxy for NTFPs, the market size for herbal medicines, powders, and extracts is taken, valued at US$71 billion in 2016.[61] In this scenario, it is assumed that this grows at the same rate as tropical timber harvest (0.81%) in the absence of other proxies[62], to reach a market value of US$80 billion. **Nature-positive**: The market size increases at a rate of 5.2% through 2030 to reach a market value of US$145 billion to more than double through 2030.[63]	Hexa Research (2017) ITTO (2020)

Transition 5: Planet-compatible consumption

Description	*Sizing assumptions*	*Sources*
Reducing consumer food waste (US$380 billion)		

[59] Consistent with data sources used by Edward B. Barbier et. al. (2017), *How to pay for saving biodiversity.* Including PwC (2016), *Global Forest, Paper, and Packaging Industry Survey: 2016 edition survey of 2015 results.* Available at: https://www.pwc.com/gx/en/industries/assets/pwc-annual-fpp-industry-survey-2016-10.pdf

[60] International Tropical Timber Organization (2020), *Biennial review statistics.* Available at: https://www.itto.int/biennal_review/?mode=searchdata

[61] Hexa Research (2017), "Herbal Medicine Market Size and Forecast, By Product (Tablets & Capsules, Powders, Extracts), By Indication (Digestive Disorders, Respiratory Disorders, Blood Disorders), And Trend Analysis, 2014 – 2024" Available at: https://www.hexaresearch.com/research-report/global-herbal-medicine-market

[62] International Tropical Timber Organization (2020), *Biennial review statistics.* Available at: https://www.itto.int/biennal_review/?mode=searchdata

[63] Hexa Research (2017), "Herbal Medicine Market Size and Forecast, By Product (Tablets & Capsules, Powders, Extracts), By Indication (Digestive Disorders, Respiratory Disorders, Blood Disorders), And Trend Analysis, 2014 – 2024" Available at: https://www.hexaresearch.com/research-report/global-herbal-medicine-market

Description	***Sizing assumptions***	***Sources***
Cost savings from reducing food waste in consumption, foodservice, and food retail	**BAU**: The FAO estimates 1.3 billion tonnes or US$1 trillion worth of food was wasted globally in 2011.[64] An estimated 30% of this or 0.39 billion tonnes occurred at food service or consumption stages. Applying a growth rate of demand for food of 1.5%, assuming a similar share of waste at this stage in 2030 and taking a price of US$1,487 per tonne (in 2019), this implies US$756 billion worth of food wasted globally in 2030. Price per tonne is based on FAO sources and estimates of food prices at different stages of the value chain by Jensen et. al. (2016).[65] **Nature-positive**: WRI estimates that food waste is reduced by 50% in 2030, in keeping with SDG targets, creating a cost savings of US$380 billion.[66] Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	FAO Food Loss (2011) Jensen et. al. (2016) WRI Reducing Food Loss and Waste (2013)
Diversified vegetables and fruits (US$310 billion)		
Market opportunity for the increased consumption of diversified vegetable supply in line with reference dietary intakes	**BAU**: The global fruits and vegetables market is worth approximately US$2 trillion in 2017 and is forecast to grow to approximately US$2.45 trillion by 2030 (based on a range of estimates).[67] **Nature-positive**: EAT-Lancet Commission estimates that global reference dietary intakes of vegetables and fruits are 65% and 50% of recommended consumption respectively.[68] For this opportunity, it is conservatively assumed that global reference intakes in 2030 will match the best-in-class region (below 100% reference intake). For vegetables, the best-in-class region is the Middle East and North Africa (100%) and for fruits, the best-in-class region is Latin America and the Caribbean (75%). As a result of this additional growth, the global fruits and vegetables market will be worth approximately US$2.76 trillion in 2030. The incremental opportunity is US$310 billion. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	MarketLine (2019) EAT-Lancet Commission (2018)
Circular economy – textiles (US$130 billion)		

[64] FAO (2011), *Seeking an end to loss and waste of food*.
[65] Jensen et al (2016). *Estimates of European food waste levels*. Available at: https://www.researchgate.net/figure/Cost-per-tonne-of-edible-food-waste_tbl5_301216380
[66] World Resources Institute (2013), *Reducing Food Loss and Waste*.
[67] Market Line (2015), *Global Fruit and Vegetables.* Available at https://store.marketline.com/report/ohme1251--global-fruit-vegetables/
[68] Walter Willett et. al. (2019), *Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems.* The Lancet Commissions, Vol. 393, Issue 10170, P447-492. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

Description	*Sizing assumptions*	*Sources*
Adoption of circular economy models in the textiles sector through shift towards improved regeneration and material recovery	**BAU**: The Pulse publication estimates that there will be 148 million tonnes of global textile waste in 2030 (up from 91 million in 2015).[69] The EMF estimates that only 14% of this waste is recycled.[70] **Nature-positive**: Conservatively, it is estimated that recycling could reach 30% globally by 2030. The value of recycled textile is taken to be US$5,495 per tonne, based on a range of estimates.[71]	Global Fashion Agenda (2017) Ellen MacArthur Foundation (2017)
Alternative meats (US$85 billion) [*methodology derived from sizing by FOLU*[72]]		
Market opportunity related to alternative meat and fish, including plant-based, microbial, hybrid and cell-based	**BAU**: Allied Market Research estimates that the global meat substitutes market was worth US$4.2 billion in 2017, growing at a CAGR of 7.7% through 2030, reaching a market value of US$10.1 billion (adjusting for potential negative impact of COVID-19).[73] This forecast assumes current levels of R&D spending and consumer interest. **Nature-positive**: Barclays estimates that the alternative meats could capture up to 10% of the US$1.4 trillion global meat market in 2030.[74] Accounting for potential negative impact of COVID-19 on growth between 2020 and 2022, we adjust this estimate to US$95 billion. This forecast is contingent on a range of levers being pulled to scale R&D, rapidly reduce production costs, increase the availability of protein feedstocks, and increase consumer product differentiation across geographies.	Allied Market Research (2019) Barclays (2019)
Plant-based dairy substitutes (US$70 billion) [*methodology derived from sizing by FOLU*[75]]		

[69] Global Fashion Agenda and The Boston Consulting Group (2017), *Pulse of the Global Fashion Industry.* Available at: https://globalfashionagenda.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf
[70] Ellen MacArthur Foundation (2017), *A new textiles economy: Redesigning fashion's future.* Available at: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report_Updated_1-12-17.pdf
[71] Ellen MacArthur Foundation (2017), *A new textiles economy: Redesigning fashion's future.* Available at: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report_Updated_1-12-17.pdf
[72] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf
[73] Allied Market Research (2019), "Global Meat Substitute Market to Garner $7.55 Billion by 2025 at 7.7% CAGR, Says Allied Market Research" Available at: https://www.globenewswire.com/news-release/2019/04/17/1805404/0/en/Global-Meat-Substitute-Market-to-Garner-7-55-Billion-by-2025-at-7-7-CAGR-Says-Allied-Market-Research.html
[74] Barclays (2019), *I can't believe it's not meat*. Available at: https://eu16.salesforce.com/sfc/p/#1t000000wCuV/a/1t000000Xg33/q3Bm_z_oiIm8K7s4mnGLApU.WpmqvU6rEsBaiqGRob4
[75] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

Description	*Sizing assumptions*	*Sources*
Market opportunity for alternative dairy products, including milk, yoghurts, butter, etc.	**BAU**: Market size of US$14 billion in 2018[76] grows at the same CAGR of 4.3% as the overall dairy products market through 2030[77] – creating a US$23 billion market. **Nature-positive**: Market size of US$14 billion in 2018 grows at an accelerated CAGR of 17% through 2030 creating a US$90 billion market[78], implying an incremental opportunity of US$70 billion (adjusting for currency and inflation). Accelerated growth is contingent on sustained increase in demand due to perceived health benefits and widening dietary choices, and falling prices enabled by scale of production. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	Grand View Research (2019) Statista (2020)
Nuts and seeds (US$60 billion)		

[76] Grand View Research (2019), "Dairy Alternatives Market 2019-2025" Available at: https://www.grandviewresearch.com/industry-analysis/dairy-alternatives-market
[77] Statista (2018), "Milk products – Worldwide overview" Available at: https://www.statista.com/outlook/40010000/100/milk-products/worldwide
[78] Grand View Research (2019), "Dairy Alternatives Market 2019-2025" Available at: https://www.grandviewresearch.com/industry-analysis/dairy-alternatives-market

Description	*Sizing assumptions*	*Sources*
Market opportunity for nuts and seeds required to be consumed according to reference intakes	**BAU**: The global edible nuts market was estimated to be worth US$89 billion in 2018 and is expected to grow by 3.5% through 2030 to reach a market value of US$129 billion.[79] The global seeds market (proxied by taking sunflower seeds[80] and chia seeds[81] – the two largest edible seed markets) was estimated to be worth US$15 billion in 2018 and is expected to grow by 6.2% through 2030 to reach a market value of US$19 billion. Therefore, the total global nuts and seeds market is expected to be US$148 billion in 2030. **Nature-positive**: EAT-Lancet Commission estimates that global reference dietary intakes of nuts and seeds is 10% of recommended consumption.[82] For this opportunity, it is conservatively assumed that global reference intakes in 2030 will match the best-in-class region – North America (20%). As a result of this additional growth, the global fruits and vegetables market will be worth approximately US$209 billion in 2030. The incremental opportunity is US$60 billion. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	Zion Market Research Hexa Research Grand View Research EAT-Lancet Commission (2018)
Preventing food from reaching landfills (US$25 billion) [*methodology for individual components derived from sizing by FOLU*[83]]		

[79] Zion Market Research (2019), "Global Edible Nuts Market Will Reach Around USD 92.1 Billion by 2026: Zion Market Research" Available at: https://www.globenewswire.com/news-release/2019/09/23/1919253/0/en/Global-Edible-Nuts-Market-Will-Reach-Around-USD-92-1-Billion-by-2026-Zion-Market-Research.html

[80] Hexa Research (2019), "Sunflower Seeds Market Size And Forecast, By Application (Edible Oil, Bakery Products, Snacks), By Distribution Channel (Offline, Online), By Region, And Trend Analysis, 2019 – 2025" Available at: https://www.hexaresearch.com/research-report/sunflower-seeds-market?utm_source=referral&utm_medium=prnewswire.com&utm_campaign=prn_12march_sunflowerseeds_rd1

[81] Grand View Research (2019), "Chia Seeds Market Size, Share & Trends Analysis Report By Form (Oil, Milled/Ground, Whole, Pre-hydrated), By Type (Black, Brown, White), By Region (North America, APAC, Europe, MEA), And Segment Forecasts, 2019 – 2025" Available at: https://www.grandviewresearch.com/industry-analysis/chia-seeds-market

[82] Walter Willett et. al. (2019), *Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems.* The Lancet Commissions, Vol. 393, Issue 10170, P447-492. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31788-4/fulltext

[83] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

Description	*Sizing assumptions*	*Sources*
Market opportunities for converting agricultural waste to biogas and composting	***Component 1: Agricultural waste to biogas – US$10 billion (Market opportunity for biogas created using agricultural waste)*** **BAU**: The market for agricultural waste to create biogas was estimated to be US$13 billion in 2018[84], and this is forecast to grow at the same rate of food demand of 1.5% through 2030, implying limited further application of this technique, resulting in a market size of US$15 billion. **Nature-positive**: Market size in 2030 is based on CAGR of 6.5% from US$13bn in 2018.[85] Adjusting for currency and inflation, this implies a market value of US$26 billion and an incremental opportunity of US$10 billion. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022. **Component 2: Composting – US$15 billion *(Cost savings from directing inedible food waste to composting as opposed to disposal in landfills)*** **BAU**: The Ellen MacArthur Foundation (EMF) estimates that composting 230 million tonnes of inedible food between 2018-2030 results in avoided costs of food waste disposal averaging US$127 per tonne.[86] Under BAU, it is assumed that half of this can actually be composted, in line with SDG targets.[87] **Nature-positive**: It is assumed that the entire opportunity can be captured, in line with forecasts by the Food and Land Use Coalition (FOLU).[88]	Future Market Insights (2017) Ellen MacArthur Foundation (2019) WRI Reducing Food Loss and Waste (2013) Food and Land Use Coalition (2019)

[84] Future Market Insights (2017), "Report Global Biogas to Reach $50 billion by 2026" Available at: https://waste-management-world.com/a/report- global-biogas-market-to-reach-50-billion-by

[85] Future Market Insights (2017), "Report Global Biogas to Reach $50 billion by 2026" Available at: https://waste-management-world.com/a/report- global-biogas-market-to-reach-50-billion-by

[86] Ellen MacArthur Foundation (2019), *Cities and Circular Economy for Food: Technical Appendix – Global Modelling*. Available at: https://www.ellenmacarthurfoundation.org/assets/downloads/Cities-and-Circular-Economy-for-Food-Appendix.pdf

[87] World Resources Institute (2013), *Reducing Food Loss and Waste*.

[88] Food and Land Use Coalition [FOLU] (2019), *Growing Better: Ten critical transitions to transform food and land use.* Available at: https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

Transition 6: Transparent and sustainable supply chains

Description	*Sizing assumptions*	*Sources*
Reducing food waste in the value chain (US$365 billion)		
Cost savings from reducing food waste and loss in post-harvest supply chains	**BAU**: The FAO estimates 1.3 billion tonnes or US$1 trillion worth of food was wasted globally in 2011.[89] An estimated 30% of this or 0.39 billion tonnes occurred at the post-harvest stage, and 40% or 0.52 billion tonnes along the supply chain. Applying a growth rate of demand for food of 1.5%, assuming a similar share of waste at these stage in 2030, and taking a price of US$178 per tonne for post-harvest loss and US$948 per tonne along the supply chain (in 2019), this implies US$733 billion worth of food wasted globally in 2030. Price per tonne is based on FAO sources and estimates of food prices at different stages of the value chain by Jensen et. al. (2016).[90] **Nature-positive**: WRI targets that food waste could be reduced by 50% in 2030,[91] in keeping with SDG targets, creating a cost savings of US$365 billion. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	FAO Food Loss (2011) Jensen et. al. (2016) WRI Reducing Food Loss and Waste (2013)
Farm-to-fork models (US$65 billion)		

[89] FAO (2011), *Seeking an end to loss and waste of food*.
[90] Jensen et al (2016). *Estimates of European food waste levels*. Available at: https://www.researchgate.net/figure/Cost-per-tonne-of-edible-food-waste_tbl5_301216380
[91] World Resources Institute (2013), *Reducing Food Loss and Waste*.

Description	*Sizing assumptions*	*Sources*
Market opportunity related to the direct sales of agricultural produce from farms to consumers	**BAU:** Direct farm sales to customers account for around 1% of total farm sales in the US.[92] Applying this percentage to total agricultural GDP in high-income countries only (as assume largely a high-income country opportunity[93]), implies an opportunity of US$8.7 billion in 2015. Direct-to-consumer food sales doubled between 1997 and 2007, implying a CAGR of 7.2% over the decade. It is assumed that the same growth through 2030 – a conservative figure based on a range of literature showing the increasing significance of this sales channel.[94] The market is then estimated to be worth US$23 billion in 2030. **Nature-positive**: It is assumed that the market of US$8.7 billion in 2015 grows through 2030 at the same rate as overall global retail ecommerce sales, forecast by eMarketer to be roughly 18.34% through 2023, creating a market size of US$90 billion.[95] Adjusting for currency and inflation, this implies an incremental opportunity of US$65 billion in 2030. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	USDA (2015) USDA (2016) eMarketer (2020)
Urban agriculture (US$40 billion) [*methodology derived from sizing by BSDC*[96]]		
Market opportunity from agricultural produce grown in urban areas	**BAU**: The productivity of urban farms remains constant, while the population grows at current rates. Academic estimates are that a quarter (of the 800 million people (i.e. 200 million) engaged in urban agriculture earn an income from urban farms. The average annual income of farmers from case studies by the FAO in Africa and Latin America indicates an annual income of US$600–1,320 per household.[97] The population is estimated to grow at 1.3% and a household is assumed to include four people. This implies a BAU value of US$80 billion by 2030. **Nature-positive**: We assume a 50% yield improvement (using the MGI estimate of smallholder yield growth potential in developing countries).[98] This implies an incremental opportunity of US$40 billion.	FAO Urban Agriculture (2016)[99] Urban Agriculture: A Review (2013) MGI Resource Revolution (2011)
Certified sustainable foods (US$20 billion)		

[92] US Department of Agriculture (2015), *Facts on Direct-to-Consumer Food Marketing*.
[93] High-income countries as defined by the World Bank – countries with GNI per capita of US$12,376 or more (fiscal year 2018). See World Bank (2020), "World Bank Country and lending Groups" Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups
[94] US Department of Agriculture (2016), *Facts on Direct-to-Consumer Food Marketing (Incorporating Data from the 2007 Census of Agriculture)*.
[95] eMarketer (2020), *Global eCommerce 2020.* Available at: https://www.emarketer.com/content/global-ecommerce-2019
[96] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[97] Agronomy for Sustainable Development (2013), *Urban Agriculture in the developing world: a review*.
[98] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution
[99] FAO (2016), *Urban Agriculture*.

Description	*Sizing assumptions*	*Sources*
Market opportunity for certified sustainable produce for four key deforestation-related commodities – palm oil, soybean, cocoa, coffee	Market opportunity is based on historical growth rates in certified sustainable produce across four categories of deforestation-linked commodities – soybeans, palm oil, cocoa, and coffee. Under BAU, a generally slower period of growth in the preceding 10 years is assumed to apply through 2030, whereas nature-positive growth is taken as growth in addition to BAU in periods of high output growth in the preceding 10 years. Prices taken are the average for the latest full year of market prices data available and premium assigned for sustainable produce has been sourced from a range of publications. The data below has been used in calculations for the **BAU** business opportunity: 1. Soybeans – approximately 8.3 million tonnes in 2030, valued at US$370 per tonne 2. Palm oil – approximately 23.4 million tonnes in 2030, valued at US$604 per tonne 3. Cocoa – approximately 2.6 million tonnes in 2030, valued at US$2,582 per tonne 4. Coffee – approximately 6 million tonnes in 2030, valued at US$2,785 per tonne The data below has been used in calculations for the **nature-positive** business opportunity: 1. Soybeans – approximately 18.1 million tonnes in 2030 valued at US$370 per tonne 2. Palm oil – approximately 35.3 million tonnes in 2030, valued at US$604 per tonne 3. Cocoa – approximately 3.2 million tonnes in 2030, valued at US$2,582 per tonne 4. Coffee – approximately 8.7 million tonnes in 2030, valued at US$2,785 per tonne Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	**Soybeans** Round Table for Sustainable Soy (2020)[100] IDH/KPMG (2013)[101] **Palm oil** Roundtable for Sustainable Palm Oil (2020)[102] Mongabay (2013)[103] **Cocoa** Cocoa Barometer (2018)[104] FairTrade (2019)[105] **Coffee** Coffee Barometer (2018)[106] ICO Composite (2020)[107] FairTrade America[108] **Commodity base prices** IndexMundi (2020)[109]

Description	*Sizing assumptions*	*Sources*
Technology in wood supply chains (US$20 billion)		
Value of DNA fingerprinting and DNA mapping technologies in timber supply chains	**BAU**: No significant increase in the use of DNA technology in timber supply chains.	WRI and WBCSD (2016)
	Nature-positive:	IPBES (2019)
	Component 1: DNA fingerprinting – US$2 billion (Market opportunity from sales of technology to fingerprint DNA from wood samples in timber supply chains)	ITTO (2020)
	DNA fingerprinting costs between US$0.75 to US$1 per cubic metre of timber sourced.[110] Assuming this is applied to all industrial roundwood harvest in 2030 (estimated at 2.2 billion cubic metres)[111], this results in an opportunity worth approximately US$2 billion.	Global Wood (2017)
	Component 2: DNA mapping – US$18 billion (Market opportunity from sales of DNA mapping technology applied to a sample of tree population in timber sourcing regions)	
	DNA mapping costs roughly 1% of product value in industrial roundwood.[112] At a price of US$829 per cubic metre of roundwood[113] and the above forecast for harvest in 2030, this results in an opportunity worth US$18 billion in 2030.	

[100] Round Table for Responsible Soy [RTRS] (2020), *Certified volumes and production.* Available at: http://www.responsiblesoy.org/mercado/volumenes-y-productores-certificados/?lang=en
[101] IDH and KPMG (2013), *The Roadmap to Responsible Soy.* Available at: https://www.idhsustainabletrade.com/uploaded/2016/11/KPMG-Roadmap-to-responsible-soy-2013.pdf
[102] Roundtable for Sustainable Palm Oil [RSPO] (2020), *Impact*. Available at: https://rspo.org/impact
[103] Mongabay (2014), "Despite falling palm oil prices, premium for sustainable products rises" Available at: https://news.mongabay.com/2014/02/despite-falling-palm-oil-price-premium-for-sustainable-product-rises/
[104] Antoine Fountain and Friedel Huetz-Adams (2019), *Cocoa Barometer 2018.* Available at: https://www.voicenetwork.eu/wp-content/uploads/2019/07/2018-Cocoa-Barometer.pdf
[105] Confectionery News (2018), "Fairtrade to increase its Minimum Price for cocoa and farmers Premium payments" Available at: https://www.confectionerynews.com/Article/2018/12/03/Fairtrade-to-increase-its-Minimum-Price-for-cocoa-and-farmers-Premium-payments
[106] Sjoerd Panhuysen and Joost Pierrot (2019), *Coffee Barometer 2018.* Available at: https://www.hivos.org/assets/2018/06/Coffee-Barometer-2018.pdf
[107] International Coffee Organization [ICO] (2020), "ICO Indicator Prices" Available at: http://www.ico.org/
[108] Fairtrade America (2019), "We love coffee. Are we willing to pay the price?" Available at: http://fairtradeamerica.org/Media-Center/Blog/2019/June/The-Price-of-Coffee
[109] IndexMundi (2020), *Commodity Price Indices.* Available at: https://www.indexmundi.com/commodities/?commodity=soybeans&months=60
[110] World Resources Institute [WRI] and World Business Council on Sustainable Development [WBCSD] (2016), *Sustainable Forest Products: Traceability – Where do the products come from?* Available at: https://sustainableforestproducts.org/
[111] Intergovernmental Panel of Biodiversity and Ecosystem Services [IPBES] (2019), *Global Assessment Report.* Available at: https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services; growth rate obtained from International Tropical Timber Organisation [ITTO] (2020), *Biennial review statistics*. Available at: https://www.itto.int/biennal_review/?mode=searchdata
[112] World Resources Institute [WRI] and World Business Council on Sustainable Development [WBCSD] (2016), *Sustainable Forest Products: Traceability – Where do the products come from?* Available at: https://sustainableforestproducts.org/
[113] Global Wood (2017), "Wood products prices in Europe" Available at: http://www.globalwood.org/market/timber_prices_2017/aaw20170302e.htm

II. Infrastructure and built environment system

Transition 1: Densification of the built environment

Description	*Sizing assumptions*	*Sources*
Repurposing freed land from parking (US$310 billion)		
Commercial rental value of land freed from parking due to increased application of shared mobility	Past analysis by AlphaBeta has shown that of the total 46,000 hectares of prime commercial and residential land set aside for parking in Indonesia in 33 cities, there are over 6,000 hectares of commercial land allocated for parking needs that could be repurposed. The annual rental value of this land was estimated to be US$7.2 billion in 2017, at roughly US$108 per square metre.[114] Assuming that a similar proportion of parking land could be repurposed in all countries globally by 2030, adjusting for land value and commercial rents using available proxies, this would create a global commercial annual rental opportunity of around US$624 billion. This is a conservative estimate given that it assumes no new parking land will be developed together with new infrastructure spending. **BAU**: It is assumed that half of this opportunity is captured, in line with the expectations of current investment levels in levers such as public transport and shared mobility that will reduce parking needs.[115] **Nature-positive**: It is assumed that this entire opportunity can be captured with appropriate expenditure in public transport and shared mobility that will reduce parking needs and repurpose freed land for other purposes.	AlphaBeta (2017) McKinsey Centre for Business and Environment (2016)
Residential sharing (US$210 billion)		
Market opportunity from temporary home-sharing models for visitors and tourists	**BAU**: The global short-term rentals market was valued as US$101 billion in 2018 and is expected to grow at 10.4% CAGR through 2023 – largely driven by Asia-Pacific.[116] Between 2023-30, it is assumed that market will grow in line with historical growth rates for tourism over 2009-19 (5%)[117], reaching a value of US$103 billion in 2030. **Nature-positive**: In this scenario, it is assumed that the higher growth rate of 10.4% will sustain through 2030, with the residential sharing market reaching a value of US$316 billion,	DBS (2019) UN World Tourism Organisation (2020)

[114] AlphaBeta (2017), *Rethinking urban mobility in Indonesia: The role of shared mobility services.* Available at: https://www.alphabeta.com/wp-content/uploads/2018/08/fa-uberreport-indonesia_english.pdf

[115] McKinsey Center for Business and Environment (2016), *Financing change: How to mobilize private sector financing for sustainable infrastructure*. Available at: https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Financing_change_How_to_mobilize_private-sector_financing_for_sustainable-_infrastructure.pdf

[116] DBS Asian Insights (2019), *The Rise of Home Sharing Platforms – Friend, Foe or Frenemy?* DBS Group Research, Sector briefing 79 (August 2019). Available at: https://www.dbs.com.sg/sme/aics/pdfController.page?pdfpath=/content/article/pdf/AIO/082019/190802_insights_HSP.pdf

[117] UN World Tourism Organisation (2020), "International tourism growth continues to outpace the global economy" Available at: https://www.unwto.org/international-tourism-growth-continues-to-outpace-the-economy

	implying an incremental opportunity worth US$210 billion.[118] It is expected that drivers of initial growth including increased tourist arrivals, increasing supply of shared spaces and mediums, new models of sharing, etc. will continue, supported by accelerated growth in new regions. Estimates in both scenarios have been adjusted for the expected negative impact of COVID-19 on growth between 2020 and 2022.	
Flexible offices (US$140 billion)		
Market opportunity from increased office sharing and flexible office models	**BAU**: The global flexible office market was worth around US$25 billion in 2018.[119] Under BAU, it is assumed that this grows at 3.7% through 2030, in line with expected growth in construction spending on non-residential buildings.[120] **Nature-positive**: It is assumed that the US$25 billion market in 2018 registers around 17% CAGR through 2030 to create a market worth US$180 billion[121], or an incremental opportunity of US$140 billion, with appropriate expenditure in modular office spaces and new sharing models.	Zion Market Research (2019) IHS Markit (2014)

Transition 2: Nature-positive built environment design

Description	*Sizing assumptions*	*Sources*
Energy efficiency – buildings (US$825 billion) [*methodology derived from sizing by BSDC*[122]]		

[118] DBS Asian Insights (2019), *The Rise of Home Sharing Platforms – Friend, Foe or Frenemy?* DBS Group Research, Sector briefing 79 (August 2019). Available at: https://www.dbs.com.sg/sme/aics/pdfController.page?pdfpath=/content/article/pdf/AIO/082019/190802_insights_HSP.pdf
[119] Zion Market Research (2019), "Global Flexible Office Market Will Reach USD 111.68 Billion By 2027: Zion Market Research" Available at: https://www.globenewswire.com/news-release/2019/09/24/1920019/0/en/Global-Flexible-Office-Market-Will-Reach-USD-111-68-Billion-By-2027-Zion-Market-Research.html
[120] IHS Markit (2014), *Global Construction Outlook.* Available at: https://ihsmarkit.com/pdf/IHS_Global_Construction_ExecSummary_Feb2014_140852110913052132.pdf
[121] Zion Market Research (2019), "Global Flexible Office Market Will Reach USD 111.68 Billion By 2027: Zion Market Research" Available at: https://www.globenewswire.com/news-release/2019/09/24/1920019/0/en/Global-Flexible-Office-Market-Will-Reach-USD-111-68-Billion-By-2027-Zion-Market-Research.html
[122] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

Description	*Sizing assumptions*	*Sources*
Cost savings from improving energy consumption in building lighting, cooking, heating, cooling, and appliances	**BAU**: Energy efficiency improves in line with the International Energy Agency's (IEA) "4DS" scenario.[123] **Nature-positive**: NCE estimates energy cost savings from incremental improvements in efficiency in residential and commercial buildings based on three levers: new building heating efficiency, heating retrofits, and appliances and lighting (a fourth lever, solar PV, is included in a separate renewables opportunity in the energy and extractives system).[124] NCE also assumes energy price increases of 2.5% per year, but this has been excluded for consistency with other opportunities.[125]	IEA World Energy Outlook (2015) NCE Cities Low-Carbon Development (2015) MGI Resource Revolution (2011)
Smart metering (US$95 billion) [*methodology derived from sizing by BSDC*[126]]		
Market opportunity from the application of smart meters in consumer applications	**BAU**: Navigant Research estimates the market size for smart meters in 2030 as US$20 billion.[127] **Nature-positive**: To identify the incremental opportunity from additional penetration, MGI's estimation of the value of advanced metering and consumer applications in the US is used.[128] This estimate is scaled globally based on the US's share of OECD GDP (assuming benefits are concentrated in more developed countries) – an overall market opportunity of US$110 billion. Adjusting for currency and inflation, this implies an incremental market opportunity of US$95 billion.	Navigant Research (2013) McKinsey (2010)
Urban green roofs (US$15 billion)		

[123] International Energy Agency (2015), *World Energy Outlook 2015.* Available at: https://www.iea.org/reports/world-energy-outlook-2015
[124] The Global Commission on Climate and the Economy (2015), *New Climate Economy: Accelerating Low-Carbon Development in the World's Cities: Working Paper*.
[125] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution
[126] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[127] Navigant Research (2013), *Smart Electric Meters, Advanced Metering Infrastructure*.
[128] McKinsey (2010), *U.S. smart grid value at stake: The $130 billion question*.

Description	*Sizing assumptions*	*Sources*
Market opportunity for green roof solutions in buildings	The global green roof market is expected to be worth US$9 billion in 2020 and is forecast to grow at around 12% annually through 2030 to reach a value of US$25 billion. [129] **BAU**: It is assumed that half of this opportunity is captured, in line with the expectations of current investment levels in residential infrastructure investment.[130] **Nature-positive**: It is assumed that this entire opportunity can be captured with increased levels of infrastructure spending and focus on green building design.	MarketWatch (2020) McKinsey Centre for Business and Environment (2016)

[129] MarketWatch (2020), "Global Green-Roof Market Share,Size 2020 Global Business Growth, Industry Revenue, Demand and Applications Market Research Report to 2024" Available at: https://www.marketwatch.com/press-release/global-green-roof-market-sharesize-2020-global-business-growth-industry-revenue-demand-and-applications-market-research-report-to-2024-2020-01-07

[130] McKinsey Center for Business and Environment (2016), *Financing change: How to mobilize private sector financing for sustainable infrastructure*. Available at: https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Financing_change_How_to_mobilize_private-sector_financing_for_sustainable-_infrastructure.pdf

Transition 3: Planet-compatible utilities

Description	*Sizing assumptions*	*Sources*
Waste management (US$305 billion)		
Market opportunity in global solid waste management	**BAU**: The global waste management market was estimated at US$330 billion in 2017. [131] It is assumed that this grows at the same rate as the generation of solid waste in human settlements (i.e. 1.56%) through 2030, implying that there is no average increase in the rate of collection and recycling of solid waste.[132]	Allied Market Research (2019)
	Nature-positive: The US$330 billion market more than doubles by 2030 to reach a value of US$710 billion[133], implying an incremental opportunity of US$305 billion. This additional growth in collection and recycling of solid waste is driven by supportive municipal policies, innovation in waste sorting technologies and recycling opportunities, consumer education, etc.	World Bank (2016)
Water and sanitation infrastructure (US$155 billion) [*methodology derived from sizing by BSDC*[134]]		
Spending on water and sanitation infrastructure in unserved or underserved areas	**BAU**: MGI estimates based on historical data that there could be around US$9.6 trillion of spending on water and sanitation infrastructure globally between 2013 and 2030, or around US$565 billion per year (US$2010 values).[135]	MGI Infrastructure Productivity (2013)
	Nature-positive: MGI estimates the annual investment needed in global water and sanitation infrastructure needs to be US$11.7 trillion between 2013-30, or around US$690 billion per year(US$2010 values).[136] As against BAU levels of investment, this implies an additional investment opportunity of around US$155 billion per year (in US$ 2019 values).	
Municipal water leakage (US$115 billion)		

[131] Allied Market Research (2019), *Waste Management Market by Waste Type (Municipal Waste, Industrial Waste, and Hazardous Waste) and Service (Collection and Disposal): Global Opportunity Analysis and Industry Forecast, 2018–2025*. Available at: https://www.alliedmarketresearch.com/waste-management-market

[132] World Bank (2016), "Urban development – Solid Waste Management" Available at: https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management

[133] Allied Market Research (2019), *Waste Management Market by Waste Type (Municipal Waste, Industrial Waste, and Hazardous Waste) and Service (Collection and Disposal): Global Opportunity Analysis and Industry Forecast, 2018–2025*. Available at: https://www.alliedmarketresearch.com/waste-management-market

[134] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

[135] McKinsey Global Institute (2013), *Infrastructure productivity: How to save $1 trillion a year*. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Infrastructure%20productivity/MGI%20Infrastructure_Full%20report_Jan%202013.ashx

[136] McKinsey Global Institute (2013), *Infrastructure productivity: How to save $1 trillion a year*. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Infrastructure%20productivity/MGI%20Infrastructure_Full%20report_Jan%202013.ashx

Description	*Sizing assumptions*	*Sources*
Cost savings from reduced water leakage in municipal water supply networks	**BAU**: Current rates of leakage in municipal water systems continue. **Nature-positive**: MGI estimates that the volume of water that can be saved through better controlling water leaks is 100 to 120 cubic kilometres.[137] This is based on analysis of country case studies where actual leakage estimates are available, and then scaling these to the global level. The average price of water saved is around US$0.97 per cubic metre.	MGI Resource Revolution (2011)
Wastewater reuse (US$50 billion)		
Market opportunity from wastewater reuse in urban and industrial areas	**BAU**: The global opportunity for wastewater reuse was estimated at US$14 billion in 2017.[138] It is assumed that this grows at the same historical rates as global water usage (i.e. 1.12%) through 2030, implying that there is no average increase in the rate of wastewater reuse.[139] **Nature-positive**: The US$14 billion market more than quadruples by 2030 to reach a value of US$65 billion, implying an incremental opportunity of around US$50 billion.[140] This additional growth is driven by supportive municipal policies and investment in water treatment and purification infrastructure.	Zion Market Research (2018) International Resources Panel (2019)
Energy access (US$45 billion) [*methodology derived from sizing by BSDC*[141]]		
Market opportunity from providing renewable electricity and fuel to poor households	**BAU**: The current demand gap for modern lighting, cooking fuels and electricity remains unaddressed. **Nature-positive**: The IFC estimates that there are 274 million households without modern lighting and electricity, and 426 million without modern cooking fuel (IEA estimates that under BAU, this will remain steady to 2030). Using those households' current energy expenditures, the addressable market is estimated at US$45 billion based on various technologies (adjusting for inflation).[142]	IFC Business Models for Scaling Up Energy Access (2012)

[137] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution
[138] Zion Market Research (2018), "Global Water Recycle and Reuse Market Expected to Reach USD 32.17 Billion by 2024" Available at: https://www.globenewswire.com/news-release/2018/09/10/1568603/0/en/Global-Water-Recycle-and-Reuse-Market-Expected-to-Reach-USD-32-17-Billion-by-2024-Zion-Market-Research.html
[139] Derived using a range data used by International Resources Panel (2018), *Global Resources Outlook 2019*. Available at: https://www.resourcepanel.org/reports/global-resources-outlook
[140] Zion Market Research (2018), "Global Water Recycle and Reuse Market Expected to Reach USD 32.17 Billion by 2024" Available at: https://www.globenewswire.com/news-release/2018/09/10/1568603/0/en/Global-Water-Recycle-and-Reuse-Market-Expected-to-Reach-USD-32-17-Billion-by-2024-Zion-Market-Research.html
[141] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[142] *From Gap to Opportunity: Business Models for Scaling Up Energy Access*, IFC, 2012.

Transition 4: Nature as infrastructure

Description	*Sizing assumptions*	*Sources*
Natural systems for water supply (US$140 billion)		
Cost savings from restoring and using source watersheds and catchments for water supply versus human-engineered infrastructure	**BAU**: There is no significant investment in protection or usage of natural watersheds. **Nature-positive**: There could be a global cost savings opportunity of US$140 billion by 2030 from natural watersheds protection, drawing on a range of research and case studies. New York City (NYC) draws water from the Catskills watershed. Assuming 65 years as the average lifespan of a reservoir and/or water treatment plant[143], the city annually saves US$330 million per year in annualised capex and operation costs, or around US$99 per person served.[144] [145] Abell et al. estimates that over 1.4 billion people could be served by similar natural watersheds globally.[146] Other potential estimates of cost savings per person could also be used to calculate this opportunity. For instance, the Greater Cape Town Water Fund is funding the restoration and conservation the Western Cape Water Supply System – this is projected to provide at least a sixth of Cape Town's water supply at an annual cost saving of US$67 per person as against other options. The NYC case study is used as a high case of the potential value linked to this opportunity.	American Rivers (2019) NYC Office of the Mayor (2013) Union of Concerned Scientists USA (2017) Robin Abell et al. (2018) The Nature Conservancy (2018)[147]

[143] Union of Concerned Scientists USA (2017), *Built to Last: Challenges and opportunities for climate-smart infrastructure in California.* Available at: https://www.ucsusa.org/sites/default/files/attach/gw-smart-infrastructure-table-life-expectancy.pdf
[144] American Rivers (2019), "What is green infrastructure" Available at: https://www.americanrivers.org/threats-solutions/clean-water/green-infrastructure/what-is-green-infrastructure/
[145] Office of the Mayor (2013), "NYC's reservoir system" Available at: http://www.nyc.gov/html/nycwater/html/drinking/reservoir.shtml
[146] Based on global estimates of cost savings in water supply projects. See Appendix for more details on sizing.
[147] The Nature Conservancy (2018), *The Greater Cape Town Water Fund: Assessing the return on investment for ecological infrastructure restoration.* Available at: https://www.nature.org/content/dam/tnc/nature/en/documents/GCTWF-Business-Case_2018-11-14_Web.pdf

Description	*Sizing assumptions*	*Sources*
Building resilience to climate shocks (US$20 billion)		
Savings for insurance companies from avoided payouts for flood damage in coastal areas	**BAU**: Hallegatte et al. (2013) estimate that potential economic losses from flooding will rise to US$52 billion in 2050, up from US$6 billion in 2005; assuming compound annual growth due to the increasing effects of climate change on extreme weather events, this implies losses of US$20 billion by 2030.[148] It is assumed that these losses are insured and paid out by the insurance industry, consistent with Barbier et. al. (2017).[149] **Nature-positive**: We assume that requisite investments in coastal wetlands restoration can reduce these additional losses from flooding in coastal areas, saving the insurance industry the equivalent in payouts.	Hallegatte et al. (2013) Barbier et al. (2017)

[148] Estimates constructed using Hallegatte et. al. (2013), which estimated average global flood losses in 2050 to be up to US$52 billion, up from US$6 billion in 2005. See Stephane Hallegatte et. al. (2013), *Future flood losses in major coastal cities.* Nature Climate Change 3, pp.802-806(2013). Available at: https://www.nature.com/articles/nclimate1979
[149] Barbier E.B., Burgess, J.C., Dean,T.J., (2018) "How to pay for saving biodiversity". Science: 360(6388), pp. 486-488 DOI: 10.1126/science.aar3454

Transition 5: Nature-positive connecting infrastructure

Description	*Sizing assumptions*	
Sustainable infrastructure finance (US$295 billion)		
Financing from private institutional investors in sustainable transport infrastructure	**BAU:** McKinsey estimates that around US$16 trillion of investment will be made between 2015-30 in transport infrastructure globally, or around US$1.1 trillion annually.[150] **Nature-positive**: The estimated required investment in transport infrastructure is around US$27 trillion, implying a finance gap of around US$11 trillion between 2015-30 or around US$730 billion per year.[151] It is further assumed that 40% of this opportunity is amenable to private investors based on research by McKinsey.	McKinsey Centre for Business and Environment (2016)
Green long-range transport (US$220 billion)		
Market opportunity for renewable electricity and second-generation liquid biofuels and biogas in the transport sector	**BAU**: The application of renewables in transport is assumed to match IRENA's Reference Case 2050 (extrapolated linearly through 2030), i.e. roughly 21% of the REMap case target is achieved.[152] **Nature-positive**: Market opportunity for the value of renewable electricity and liquid biofuels and biogas in the transport sector is calculated using IRENA's REMap 2050 scenario for penetration in transport (extrapolated linearly through 2030) over and above the Reference Case scenario. It is estimated that an additional 12,133 PJ per year of renewables in electricity could be deployed by 2030, at an average estimated price of US$0.04 per KwH.[153] It is estimated that an additional 8,538 PJ per year of liquid biofuels and biogas could be deployed by 2030, at an average estimated price of US$0.06 per KwH. [154]	IRENA (2018) IRENA (2018) IRENA (2013)
4IR-enabled long-distance transport (US$75 billion)		

[150] McKinsey Center for Business and Environment (2016), *Financing change: How to mobilize private sector financing for sustainable infrastructure*. Available at: https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Financing_change_How_to_mobilize_private-sector_financing_for_sustainable-_infrastructure.pdf

[151] McKinsey Center for Business and Environment (2016), *Financing change: How to mobilize private sector financing for sustainable infrastructure*. Available at: https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/Financing_change_How_to_mobilize_private-sector_financing_for_sustainable-_infrastructure.pdf

[152] International Renewable Energy Agency [IRENA] (2018), *Global Energy Transformation: A roadmap to 2050*. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf

[153] International Renewable Energy Agency [IRENA] (2018), *Renewable power generation costs in 2017.* Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf

[154] International Renewable Energy Agency [IRENA] (2013), *Road transport: The cost of renewable solutions*. Available at: https://www.irena.org/-/media/Files/IRENA/Costs/Renewable-Costing-Alliance/Road_Transport.pdf?la=en&hash=A0E526B4D007F3E759DDBD9A27205E409DF40CF5

Transition 5: Nature-positive connecting infrastructure

Description	***Sizing assumptions***	
Market opportunity for autonomous trucks and drone package logistics	***Component 1: Autonomous trucks – US$27 billion (Market opportunity for self-driving trucks in the logistics sector)*** **BAU**: The global market for autonomous trucks is worth US$1 billion today.[155] It is assumed that this will grow at 5% through 2030, i.e. growth of the overall transportation and logistics industry based on global proxies, implying limited application of the technology.[156] **Nature-positive**: The market registers over 40% annual growth through 2030 to reach a market value of US$29 billion by 2030, implying an incremental opportunity of US$27 billion.[157] ***Component 2: Drone logistics and transportation – US$45 billion (Market opportunity for logistics and transportation enabled by drones)*** **BAU**: The global drone logistics and transportation market was estimated to be worth US$6.3 billion in 2019. [158] It is assumed that this will grow at 5% through 2030 i.e. growth of the overall transportation and logistics industry based on global proxies, implying limited application of the technology.[159] **Nature-positive**: The market registers over 20% growth through 2030 to reach a value of around US$51 billion, implying an incremental opportunity of US$45 billion. [160]	Allied Markets Research (2018) Markets and Markets (2018) Markets and Markets (2018)

[155] Market size source from: Allied Market Research (2018), "Self-Driving Truck Market" Available at: https://www.alliedmarketresearch.com/self-driving-truck-market;
[156] Based on global proxies of sectoral GDP.
[157] CAGR sourced from: Markets and Markets (2018), "Autonomous Truck Market by ADAS Feature (ACC, AEB, BSD, HP, IPA, LKA & TJA), Sensor (Camera, LiDAR, Radar, & Ultrasonic), Level of Automation (L1 to L5), Truck Class (Class 1 to Class 8), Propulsion, and Region - Global Forecast to 2030" Available at: https://www.marketsandmarkets.com/Market-Reports/semi-autonomous-truck-market-224614273.html?gclid=Cj0KCQjwjcfzBRCHARIsAO-1_OqGEaW0JZwxeVRu5QMP_6XytJwkuxvhvd2odd2Dn0GEvsic4EPeuVoaAvaqEALw_wcB
[158] Markets and Markets (2018), "Drone Logistics and Transportation Market by Solution (Warehousing, Shipping, Infrastructure, Software), Sector (Commercial, Military), Drone (Freight Drones, Passenger Drones, Ambulance Drones), and Region - Global Forecast to 2027" Available at: https://www.marketsandmarkets.com/Market-Reports/drone-logistic-transportation-market-132496700.html?gclid=Cj0KCQjw6sHzBRCbARIsAF8FMpUCfdsoIH14D2gUWVsBOhGetxkBSJezteQG42XONg6sGMNZA6y4-5saAm1nEALw_wcB
[159] Based on global proxies of sectoral GDP.
[160] Markets and Markets (2018), "Drone Logistics and Transportation Market by Solution (Warehousing, Shipping, Infrastructure, Software), Sector (Commercial, Military), Drone (Freight Drones, Passenger Drones, Ambulance Drones), and Region - Global Forecast to 2027" Available at: https://www.marketsandmarkets.com/Market-Reports/drone-logistic-transportation-market-132496700.html?gclid=Cj0KCQjw6sHzBRCbARIsAF8FMpUCfdsoIH14D2gUWVsBOhGetxkBSJezteQG42XONg6sGMNZA6y4-5saAm1nEALw_wcB

III. Energy and extractives system

Transition 1: Circular and resource-efficient models for materials

Description	***Sizing assumptions***	***Sources***
Circular economy – automotive (US$870 billion) [*methodology derived from sizing by BSDC*[161]]		
Value from reducing material use, and increasing recycling and reuse of materials in the automotive sector and new ownership models	**BAU**: Collection and refurbishment rates remain at current levels. **Nature-positive**: Collection rates in EU for vehicles are maintained, but refurbishment rate is lifted to 50%, with remaining 50% recycled. In the EU, the Ellen MacArthur Foundation (EMF) estimates this could generate net material cost savings of up to US$200 billion.[162] The EU has roughly 27% share of global GDP and 39% share of OECD GDP, so the estimate is scaled globally based on this range and updated to US$ 2019 values.	Ellen MacArthur Foundation (2011)
Circular economy – appliances (US$565 billion) [*methodology derived from sizing by BSDC*[163]]		
Value from reducing material use, and increasing recycling and reuse of materials in appliances	**BAU**: The collection rate in the EU for machinery and equipment remains at 40%. **Nature-positive**: The EU collection rate for machinery and equipment increases to 95% (from 40%), with half recycled and half refurbished. In the EU, EMF estimates this could generate net material cost savings of up to US$130 billion.[164] The EU has roughly 27% share of global GDP and 39% share of OECD GDP, so the estimate is scaled globally based on this range and updated to US$ 2019 values.	Ellen MacArthur Foundation (2011)
Circular economy – electronics (US$390 billion) [*methodology derived from sizing by BSDC*[165]]		
Value from reducing material use, and increasing recycling and reuse of materials in electronics	**BAU:** The collection rate in the EU remains at 20%. **Nature-positive**: The EU collection rate for electrical equipment increases to 95% (from 20%), with half recycled and half refurbished. In the EU, EMF estimates this could generate net material cost savings of up to US$90 billion.[166] The EU has roughly 27% share of global GDP and 39% share of OECD GDP, so the estimate is scaled globally based on this range and updated to US$ 2019 values.	Ellen MacArthur Foundation (2011)

[161] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[162] Ellen MacArthur Foundation (2011), *Towards the Circular Economy Vol. 1*.
[163] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[164] Ellen MacArthur Foundation (2011), *Towards the Circular Economy Vol. 1*.
[165] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[166] Ellen MacArthur Foundation (2011), *Towards the Circular Economy Vol. 1*.

Description	*Sizing assumptions*	*Sources*
End-use steel efficiency (US$210 billion) [*methodology derived from sizing by BSDC*[167]]		
Cost savings from increased efficiency of steel use in construction, machinery, and automobile sectors	**BAU**: Material efficiency improves in line with the IEA's New Policies scenario.[168] **Nature-positive**: IEA estimates that material efficiency measures, including light-weighting and increased scrap recycling, could reduce steel requirements globally by 550 tonnes in 2040.[169] BSDC estimates that this target could be brought forward by 2030 through concerted action.[170] We take half of this reduction opportunity to reflect construction's share of steel use. Assume steel price of US$768 per tonne based on MGI research (updated to US$ 2019 values).[171]	IEA World Energy Outlook (2015) MGI Resource Revolution (2011)
Additive manufacturing (US$135 billion) [*methodology derived from sizing by BSDC*[172]]		
Cost savings from reduced materials usage through 3D printing	**BAU**: In product manufacturing, MGI estimates an addressable market of US$770 billion in 2025. Assume 30% of this is captured at 40% cost saving. For tools and moulds, the addressable market is estimated at US$360 billion in 2025.[173] Assume 30% of this is captured. **Nature-positive**: We assume that 50% of the direct product market is captured at 40–55% cost saving. For tools and moulds, we assume 50% of the market is captured, at cost saving of 30%. Then scale conservatively at global GDP growth rate to 2030.	MGI Disruptive Technologies (2013)

[167] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[168] International Energy Agency [IEA] (2015), *World Energy Outlook – 2015.* Available at: https://www.iea.org/reports/world-energy-outlook-2015
[169] International Energy Agency [IEA] (2015), *World Energy Outlook – 2015.* Available at: https://www.iea.org/reports/world-energy-outlook-2015
[170] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[171] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution
[172] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[173] McKinsey Global Institute (2013), *Disruptive technologies: Advances that will transform life, business, and the global economy*.

Description	*Sizing assumptions*	*Sources*
Circular models – construction (US$70 billion)		
Materials cost savings from reuse of construction waste, durable and modular components, and the market opportunity for reclaimed lumber	***Component 1: Reuse of construction waste – US$19 billion (Cost savings from reduced materials cost in construction by recycling and reusing materials from construction waste)*** **BAU**: Global recycling rates remain match EU's current recycling rates – 20%.[174] **Nature-positive**: It is estimated that there is 1.1 billion tonnes of construction waste globally in 2018. In 2030, it is assumed that global recycling rates match EU targets of 70% (up from 20% today; this is conservative as we do not factor in growth of construction waste). Assuming that cost of recycling materials is roughly half the cost of virgin materials (roughly US$34 per tonne), there is a cost savings opportunity of US$19 billion. ***Component 2: Reclaimed lumber – US$8 billion (Cost savings from reduced lumber costs in construction by recycling and reusing end-of-life waste generated by lumber in buildings e.g. flooring, furniture, etc.)*** **BAU**: The market for reclaimed lumber is estimated to grow from US$11 billion in 2017[175] to US$20 billion in 2030 at a CAGR of 0.81% (the same rate as tropical timber)[176], implying no increase in the rate of reclamation. **Nature-positive**: The market grows from US$11 billion in 2017 to US$20 billion in 2030 at a CAGR of 5%[177], driven by increased reclamation for furniture and flooring during renovation and demolishment. ***Component 3: Durable and modular buildings – US$41 billion (Cost savings derived from lower material costs in buildings by designing more durable components and those with higher modularity in application)* [*methodology derived from sizing by BSDC*[178]]** **BAU**: The take-up of durable and modular designed buildings remains at current levels. **Nature-positive**: The EMF estimates the annual primary resource benefit in 2030 from shifting to more durable and modular buildings in Europe.[179] The EU accounts for roughly 27% of global GDP and 39% of OECD GDP, so the estimate is scaled globally based on this range, resulting in a cost savings opportunity of approximately US$42 billion.	Construction Dive (2018) Grand View Research (2017) ITTO (2020) Ellen MacArthur Foundation (2015)

Description	*Sizing assumptions*	*Sources*
Reducing packaging waste (US$70 billion) [*methodology derived from sizing by BSDC*[180]]		
Value from reducing material use, and increasing recycling and reuse of materials in plastic packaging	**BAU:** The market for packaging plastics in 2030 is estimated to grow to US$270 billion (US$ 2019 values).[181] The proportion of value recaptured through recycling remains at the current 5% - at a recycling rate of 14%, volume yield of 72% from recycled volume, and 50% of price yield of virgin materials. **Nature-positive:** The value captured by recycling is grown to 30%. This increase in value capture is composed of an increase in amount captured for recycling to 50%, an increase in yield of recycled product from 80%, and an increase in price yield to 75%.	Ellen MacArthur Foundation (2016)

Transition 2: Nature-positive metals and minerals extraction

Description	*Sizing assumptions*	*Sources*
Resource recovery (US$225 billion) [*methodology derived from sizing by BSDC*[182]]		
Value of energy and minerals obtained using improved extractive efficiency mechanisms	**BAU**: The current progression of investment and technology adoption in mechanisation continues.[183] **Nature-positive**: Increased mechanisation could enhance recovery rates by up to 50% in some small coal mines in developing countries.[184] In oil and gas recovery, it is assumed that in well life for poorly performing wells can be increased by 10% – these are largely concentrated in the Middle East and the former Soviet Union countries and represent 23% of global production. In iron ore and copper, a range of new techniques improve recovery rates. Quantity increase, price assumptions, and value of business opportunity derived directly from BSDC sizing (updated to US$ 2019 values).	MGI Resource Revolution (2011)

[174] Construction Dive (2018). *Report: Global construction waste will almost double by 2025*. Available at: https://www.constructiondive.com/news/report-global-construction-waste-will-almost-double-by-2025/518874/
[175] Grand View Research (2019), "Reclaimed Lumber Market Size, Industry Analysis Report, 2019-2025" Available at: https://www.grandviewresearch.com/industry-analysis/reclaimed-lumber-market
[176] International Tropical Timber Organisation [ITTO] (2020), *Biennial review statistics*. Available at: https://www.itto.int/biennal_review/?mode=searchdata
[177] Grand View Research (2019), "Reclaimed Lumber Market Size, Industry Analysis Report, 2019-2025" Available at: https://www.grandviewresearch.com/industry-analysis/reclaimed-lumber-market
[178] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[179] Ellen MacArthur Foundation (2015), *Growth within: A circular economy vision for competitive Europe*.
[180] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[181] Ellen MacArthur Foundation (2016), *The New Plastics Economy.*
[182] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[183] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution
[184] McKinsey Global Institute (November 2011), *Resource Revolution: Meeting the world's energy, materials, food, and water needs*. Available at: https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution

Description	*Sizing assumptions*	*Sources*
Shared infrastructure (US$130 billion) [*methodology derived from sizing by BSDC*[185]]		
Value of spending on shared infrastructure in extractives operation for oil and gas and mining	**BAU:** No shared infrastructure development in extractives. **Nature-positive**: Resource-driven countries need to spend more than US$1.3 trillion per year on infrastructure, about 9% of which relates to resources (represents a US$117 billion annual opportunity).[186] Assume that as much as 100% of spending related to resources can be shared, resulting in an upside of US$130 billion (adjusting for inflation).	MGI Reverse the curse (2014)
Water efficiency in mining (US$75 billion)		
Cost savings from reducing water usage in mining, extraction, and purification	**BAU**: An estimated 490 cubic kilometres of water will be used in mining by 2030, up from 430 cubic kilometres in 2019, based on historical growth rates.[187] Leading mining companies have set targets stating that at least 20 percent of this water usage can be saved through improving water efficiency[188], representing US$27 billion in cost savings at an average rate of US$0.28 per cubic kilometre of water.[189] **Nature-positive**: With the development of new technologies, it is estimated that 75% of water used in mining can be saved[190], representing a savings of US$102 billion. The incremental opportunity is US$75 billion.	International Resources Panel (2019) Anglo American (2020) MGI (2014) Herlmholtz-Zentrum Dresden-Rossendorf (2019)
Mine rehabilitation (US$70 billion) [*methodology derived from sizing by BSDC*[191]]		

[185] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf
[186] McKinsey Global Institute (2013), *Reverse the curse: Maximizing the potential of resource-driven economies*. Available at: https://www.mckinsey.com/industries/metals-and-mining/our-insights/reverse-the-curse-maximizing-the-potential-of-resource-driven-economies
[187] Derived using a range data used by International Resources Panel (2018), *Global Resources Outlook 2019*. Available at: https://www.resourcepanel.org/reports/global-resources-outlook
[188] For instance, Anglo American has established this target for 2020. See Anglo American (2020), "Designing our water future" Available at: https://www.angloamerican.com/futuresmart/our-world/environment/defining-our-water-future
[189] Water prices sourced from Stefan Heck and Matt Rogers (2014), *Resource Revolution: How to Capture the Biggest Business Opportunity in a Century*. Full report by the McKinsey Global Institute (MGI) available at: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Resource%20revolution/MGI_Resource_revolution_full_report.ashx
[190] Helmholtz-Zentrum Dresden-Rossendorf (2020), *Reducing water consumption in mining.* Available at: https://www.sciencedaily.com/releases/2019/03/190328102647.htm
[191] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

Description	*Sizing assumptions*	*Sources*
Market opportunity in environmental remediation of mines and wells	**BAU**: The global remediation and industrial services market was worth US$39.5 billion in 2011, according to EBI.[192] Assume that around half of this – US$23 billion (US$ 2019 values) – is attributable to mine, and oil and gas remediation (the remainder is industrial site remediation) in 2015, and that the market grows to US$43 billion in 2030 at historical growth rate of 3.8%. This forecast accounts for a modest increase in mine rehabilitation rates, which is currently around 20-25%.[193] **Nature-positive**: Assume that all mines and wells can begin being properly rehabilitated by 2030, and that the size of the market increases proportionally from US$23 billion in 2015 to US$112 billion in 2030, implying an incremental value of US$70 billion.	Environmental Business International (2012) US BLS (2014) Independent Australia (2016)
Sustainable substances in extraction (US$20 billion)		
Increasing the use of Market opportunity for sustainable chemicals in extractive sites	**BAU**: No significant uptake in the use of sustainable materials in the extraction process to replace mercury, cyanide, arsenic, etc. **Nature-positive**: The mining chemicals market is expected to be worth US$55 billion in 2030.[194] It is assumed that sustainable chemicals and/or less harmful chemical replacements could comprise up to 40% of this market, based on the proportion of green chemicals (US$152 billion[195]) in the overall speciality chemicals market in 2030 (US$388 billion[196]).	Grand View Research (2018) Pike Research (2011) Roland Berger (2015) Allied Market Research (2019)

[192] In "Environmental Goods and Services: Export Opportunities and Challenges especially for developing economies", Jane Drake-Brockman, International Trade Centre, August 2014.
[193] "Abandoned Mine Lands", Bureau of Land Management, US Department of the Interior, April 2014; "Who will pay the more than $17.8 billion mining rehabilitation bill?", Lachlan Barker, *Independent Australia*, 1 June 2015.
[194] Derived using data from Grand View Research (2018), "Mining Chemicals Market Size, Share & Trends Analysis Report By Product (Grinding Aids, Frothers, Flocculants, Collectors), By Application (Mineral Processing, Explosives & Drilling), And Segment Forecasts, 2018 – 2024" Available at: https://www.grandviewresearch.com/industry-analysis/mining-chemicals-market
[195] Pike Research (2011), "Green Chemicals Industry to Soar to US$98.5 billion by 2020" Available at: https://www.businesswire.com/news/home/20110620005045/en/Green-Chemical-Industry-Soar-98.5-Billion-2020
[196] Allied Market Research (2019), "Specialty Chemicals Market by Type (Food Additives, Cosmetic Chemicals, Water Treatment Chemicals, Textile Chemicals, Construction Chemicals, Paper & Pulp Chemicals, Oil Field Chemicals, and Ink Additives) - Global Opportunity Analysis and Industry Forecast, 2019 – 2026" Available at: https://www.alliedmarketresearch.com/specialty-chemicals-market

Transition 3: Sustainable materials supply chains

Description	*Sizing assumptions*	*Sources*
Technology in energy and extractives supply chains (US$30 billion)		
Value of blockchain market in energy and mining supply chains	**BAU**: No significant uptake of blockchain technology in mining supply chains beyond initial pilot projects and limited applications. **Nature-positive**: The value of the market for blockchain technology in supply chains is expected to grow rapidly from just US$9 million in 2017 to US$10 billion in 2025, at a CAGR of 80.5%[197] It is assumed that this market grows at the overall blockchain market growth rate of 69.4% between 2025-30.[198] It is further assumed that around 23% of this market is related to supply chains in energy and extractives, based on its share of global GDP[199], resulting in a market value of US$31 billion in 2030.	Allied Market Research (2019) Grand View Research (2018) World Development Indicators (2019)

Transition 4: Nature-positive energy transition

Description	*Sizing assumptions*	*Sources*
Expansion of renewables (US$650 billion) [*methodology derived from sizing by BSDC[200]*]		
Market opportunity for renewables in electricity generation	**BAU**: Total global electricity generation is forecast to be 36,800 TWh/year in 2030. The share of renewable energy in electricity generation given current trend is expected to increase from 23% today to 30% by 2030.[201] **Nature-positive**: In its REmap case, IRENA forecasts that the share of renewable energy could increase to 45% in 2030. Total global electricity generation is forecast to be 38,000 TWh per year in 2030.[202] The business opportunity is calculated as the incremental increase in renewable electricity generated at an assumed average wholesale renewable electricity cost of US$107 per MWh (updated to US$ 2019 values). The assumptions in this case are consistent with BSDC.	IRENA Roadmap for Renewable Energy (2016)
Redesigned dams (US$15 billion)		

[197] Ledger Insights (2019), "World Energy Council, PwC survey: blockchain immature" Available at: https://www.ledgerinsights.com/world-energy-council-pwc-blockchain/

[198] Grand View Research (2019), *Blockchain Technology Market Size, Share, Industry Report, 2019-2025.* Available at: https://www.grandviewresearch.com/industry-analysis/blockchain-technology-market

[199] GDP contribution derived from a range of sources, including market research and:
World Bank (2019), *World Development Indicators: Structure of output.* Available at: http://wdi.worldbank.org/table/4.2
Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

[200] Business and Sustainable Development Commission [BSDC] (2017), *Valuing the SDG Prize.* Available at: http://s3.amazonaws.com/aws-bsdc/Valuing-the-SDG-Prize.pdf

[201] IRENA (2016), *Roadmap for a renewable energy future*.

[202] IRENA (2016), *Roadmap for a renewable energy future*.

Description	*Sizing assumptions*	*Sources*
Additional spending on redesigning dams to reduce ecological damage	IRENA's REMap case estimates that installed hydropower capacity will be 4,651 TwH per year by 2030 (assuming linear growth between 2015 and 2050).[203] Given annual operation costs at large, small, and very small hydropower (VSHP) units and their respective share of the global dams market, the average annual operation cost of dams globally is calculated to be US$78.22 per MWh.[204] Taken together, global operating costs for dams in 2030 is expected to be US$364 billion. IRENA has previously estimated that major upgrades to dams are on average 28% of the levelised cost of electricity (LCOE) provision.[205] Grill et. al. estimate that two out of every three rivers globally do not flow freely, owing to human intervention[206]. It is assumed that a similar ratio of dams – i.e. 66% of all dams – a require redesign. By multiplying annual operating costs with the cost of major upgrades and the percentage of dams that will be redesigned, we obtain a total cost of US$68 billion in 2030. **BAU**: It is assumed that 25% of the dams that require redesign are actually redesigned. By multiplying annual operating costs with the cost of major upgrades and the percentage of dams that will be redesigned, we obtain a total cost of US$17 billion in 2030. **Nature-positive**: It is assumed that 50% of dams that require redesign are actually redesigned. By multiplying annual operating costs with the cost of major upgrades and the percentage of dams that will be redesigned, we obtain a total cost of US$34 billion in 2030, implying an incremental opportunity worth US$17 billion. This opportunity can be captured with increased levels of infrastructure spending and policy interventions targeting aged and damaging hydropower infrastructure.	IRENA REMap (2018) IRENA (2012) Grill et. al. (2019) McKinsey Centre for Business and Environment (2016)

[203] International Renewable Energy Agency (2018), *Global Energy Transformation: A Roadmap to 2050.* Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf
[204] International Renewable Energy Agency (2012), *Renewable energy technologies: Cost analysis series.* Volume 1: Power Sector, Issue 3/5. Available at: https://www.irena.org/documentdownloads/publications/re_technologies_cost_analysis-hydropower.pdf
[205] International Renewable Energy Agency (2012), *Renewable energy technologies: Cost analysis series.* Volume 1: Power Sector, Issue 3/5. Available at: https://www.irena.org/documentdownloads/publications/re_technologies_cost_analysis-hydropower.pdf
[206] G. Grill et. al. (2019), *Mapping the world's free-flowing rivers.* Nature Vol. 569, pg.215-221. Available at: https://www.nature.com/articles/s41586-019-1111-9

Methodology for sizing capital expenditure requirements and job opportunities

Capital expenditures

Capital expenditure related to each of the 59 business opportunities covered under the 15 transitions were calculated using one of three methods:

1. **Direct inputs**: Where business opportunities that had been sized by past literature had investment requirements estimated, these were directly utilised after making necessary adjustments to estimate annual capex requirements in 2030 in US$ 2019 values.

2. **Using net capex to sales ratios**: For new business opportunities, a range of global estimates of net capital expenditure to sales ratios by relevant sector and industry were considered to calculate capex requirements for new business opportunities.[207]

3. **Case studies and expert inputs**: A range of case studies with capex estimates related to new business opportunities (extrapolated to global estimates) were also used. Expert inputs, particularly from the private sector, were sought to add to and "sanity test" assumptions taken.

Job opportunities

Job opportunities associated with the 59 business opportunities covered under the 15 transitions were calculated using two steps. The first step was to estimate the value of the business opportunities by region. Consistent with past literature (such as research by the Business & Sustainable Development Commission on the business value of the SDGs), the value of each business opportunity was broken down into opportunities for 11 global regions by considering a range of "scaling factors" unique to each opportunity, (e.g. opportunities related to tropical reforestation were distributed by extent and loss of tropical forest area in each of the regions considered):

1. The US and Canada
2. Latin America (including Mexico and the Caribbean)
3. Europe (including the EU and OECD members)
4. Russia and Eastern Europe
5. Africa
6. The Middle East
7. China
8. India
9. Developed Asia-Pacific

[207] For instance, see Aswath Damodaran (2020), *Capital Expenditures by Sector (US)*. New York University Stern School of Business. Available at: http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/capex.html

10. Rest of developing Asia
11. Rest of the world.

The second step was to calculate job opportunities by region using one of two methods:

1. **Investment opportunities method**: Where business opportunities relate to substantial investment (e.g. alternative proteins, food waste in the value chain, infrastructure-related opportunities), capex requirements were multiplied by estimates of jobs created per dollar of investment in each region (differentiated for infrastructure-related and non-infrastructure-related opportunities), using a range of global proxies, to obtain the total number of jobs created for each opportunity.

2. **Operational improvement opportunities method**: Where business opportunities relate to operational improvements or market opportunities not requiring significant investment (e.g. organic food markets), the value of the business opportunity was divided by average labour force productivity in each region for relevant sectors and/or industries to obtain the total number of jobs created for each opportunity.

It is important to note that, given substitution effects (e.g. reduced meat consumption due to increased demand for alternative proteins that could reduce demand and labour requirements in the meat sector), not all of these jobs will translate to net increases in employment.