



INTEGRATING BIODIVERSITY INTO NATURAL CAPITAL ASSESSMENTS

Measuring and Valuing Guidance

Part of a series of Biodiversity Guidance to accompany the Natural Capital Protocol



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Key messages

- A number of measurement methods are available to help businesses quantify their impacts on biodiversity across the value chain.
- Methods to measure dependencies on biodiversity remain a gap.
- Progressing from measurement to valuation can help you understand the relevance and, to an extent, the magnitude of your impacts and dependencies on biodiversity in a defined context.
- Understanding the data available within your business and from external sources, and the strengths and limitations of different approaches, can help determine which biodiversity measurement and valuation approaches are feasible for your overall objective and scope.
- There are a variety of valuation approaches available (qualitative, quantitative, and monetary), all of which have advantages and disadvantages. Some aspects of biodiversity's value cannot be captured with monetary techniques. In those instances, qualitative and/or quantitative approaches can be applied to assess the value of biodiversity.
- All measurement and valuation approaches have limitations which are important to understand. These limitations must be disclosed to ensure transparency with key stakeholders. Sensitivity analysis should be conducted to understand the implications of the limitations of any approach with respect to decision-making.

MEASURE AND VALUE STAGE



What is the Measure and Value Stage?

The Measure and Value Stage of the Natural Capital Protocol introduces guidance on how impacts and dependencies can be **measured** and **valued**, building on information provided in the Scope Stage. This **Measuring and Valuing Guidance** details how to Measure (Steps 05 and 06 of the Protocol) and Value (Step 07 of the Protocol) biodiversity impacts and dependencies as part of your natural capital assessment and builds on information provided in the **Scoping Guidance**.

You may be incorporating biodiversity into your natural capital assessment for the first time, or you may be looking to strengthen the measurement and/or valuation of impacts and dependencies on biodiversity of previously completed assessments.

What additional biodiversity guidance is provided for the Measure and Value Stage?

Table MV.1 provides an overview of the questions and actions of the Measure and Value Stage in the Protocol and outlines the actions for which the **Measuring and Valuing Guidance** provides additional information.

Step 05: How can your biodiversity impact drivers and/or dependencies be measured?

Step 06: What are the changes in the state and trends of natural capital [biodiversity] related to your business impacts and/or dependencies and how can they be measured?

Step 07: What is the value of your natural capital [biodiversity] impacts and/or dependencies?

Table MV.1

The Measure and Value Stage: Mapping between the Protocol and the Biodiversity Guidance

Protocol Step	Questions this Step will answer	Protocol actions	Additional guidance included?
05 Measure impact drivers and/or dependencies	How can biodiversity objectives be set as part of my natural capital assessment?	5.2.1 Map your activities against impact drivers and/or dependencies	Yes See action 5.2.1
		5.2.2 Define which impact drivers and/or dependencies you will measure	No Refer to Protocol page 60 for guidance
		5.2.3 Identify how you will measure impact drivers and/or dependencies	Yes See action 5.2.3
		5.2.4 Collect data	No Refer to Protocol page 65 for guidance



Protocol Step	Questions this Step will answer	Protocol actions	Additional guidance included?
06 Measure changes in the state of natural capital [biodiversity]	What are the changes in the state and trends of natural capital [biodiversity] related to your business impacts and/or dependencies?	6.2.1 Identify changes in natural capital [biodiversity] associated with your business activities and impact drivers	Yes See action 6.2.1
		6.2.2 Identify changes in natural capital [biodiversity] associated with external factors	Yes See action 6.2.2
		6.2.3 Assess trends affecting the state of natural capital [biodiversity]	Yes See action 6.2.3
		6.2.4 Select methods for measuring change	Yes See action 6.2.4
		6.2.5 Undertake or commission measurement	Yes See action 6.2.5
07 Value impacts and/or dependencies	What is the value of your natural capital [biodiversity] impacts and/or dependencies?	7.2.1 Define the consequences of impacts and/or dependencies	No Refer to Protocol page 80 for guidance
		7.2.2 Determine the relative significance of associated costs and/or benefits	No Refer to Protocol page 82 for guidance
		7.2.3 Select appropriate valuation technique(s)	Yes See action 7.2.3
		7.2.4 Undertake or commission valuation	Yes See action 7.2.4

Additional notes

You should address all of the actions associated with each Step in the Measure and Value Stage of the Protocol. This Guidance provides additional information for some of the actions where biodiversity-specific considerations need to be taken into account. For a detailed appraisal of the suitability and potential accuracy of different methods of measurement and valuation please refer to the Protocol.

How should you plan for this Stage?

Before you get started with the Measure and Value Stage of your assessment, you should consider your planning requirements. The Protocol identifies some of the resource needs that should be considered for each Step of the assessment. For measuring impacts on your business, fewer external resources are typically needed, as some data may be available in your company or in published literature. For measuring your impacts on society and your business dependencies, however, more resources are likely needed and this may require specialist environmental/natural resource modeling expertise.

Progression from measurement to valuation is helpful to understand the relevance and magnitude of your impacts and dependencies on biodiversity in your business context. However, considerable training and applied experience are required to apply valuation techniques to biodiversity impacts and dependencies. You may need to commission external partners and consultants to assist your biodiversity valuation.



The availability of existing data and the ability to leverage biodiversity-specific published literature are planning considerations not only for measurement and valuation but also when scoping your natural capital assessment. For biodiversity, there are a number of resources for measuring and valuing including guidelines, frameworks, and measurement tools. Table MV.2 provides a non-exhaustive list summarizing some of these and illustrates how they may be useful for your assessment alongside this Guidance.

Table MV.2
Examples of biodiversity-specific resources relating to measurement and valuation

Author	Title/Name (Year)	Type	Stage	Description
<i>Convention on Biological Diversity (CBD)</i>	An exploration of tools and methodologies for valuation of biodiversity and biodiversity resources and functions (2007)	Report	Value	Compilation of methodologies for valuation of biodiversity and biodiversity resources and functions, as well as other tools for prioritization in decision-making. It includes 13 valuation case studies.
<i>Convention on Biological Diversity (CBD)</i>	Voluntary guidelines on biodiversity-inclusive impact assessments (2006)	Guidelines	Measure	Structured to match the steps outlined in environmental impact assessments (EIA), guidelines are provided to better integrate biodiversity-related considerations in the EIA process.
<i>Department for Environment, Food & Rural Affairs (UK)</i>	Enabling a Natural Capital Approach (ENCA): Guidance (2020)	Report	Measure	Data, guidance, and tools to help understanding of natural capital (including biodiversity).
<i>economics for the environment (eftec) and the Department for Environment, Food & Rural Affairs (UK)</i>	Environmental Valuation Look-up Tool (2015)	Database	Value	Database which contains indicative monetary values for a range of UK environmental impacts (including biodiversity).
<i>Environment and Climate Change Canada and Department for Environment, Food & Rural Affairs (UK)</i>	Environmental Valuation Reference Inventory (n.d.)	Database	Value	Searchable storehouse of empirical studies on the economic value of environmental assets and human health effects, which could be used in value transfer.
<i>EU Business @ Biodiversity Platform</i>	Assessment of biodiversity accounting approaches for businesses and financial institutions. Update Report 1 (2018)	Report	Measure	The first of a series of update reports assessing biodiversity measurement approaches for businesses and financial institutions. Methods using quantitative indicators are specifically assessed.
<i>EU Business @ Biodiversity Platform & UNEP-WCMC</i>	Assessment of biodiversity measurement approaches for business and financial institutions. Update Report 2 (2019)	Report	Measure	Second assessment report providing updates on measurement methodology developments with a focus on technical issues. Annex includes updates on each tool and explanatory notes on GLOBIO and ReCipe data tools.
<i>EXIOBASE Consortium</i>	EXIOBASE (n.d.)	Database	Measure	An example of an environmentally extended multiregional input-output database. Multiple input-output databases have been developed by different initiatives.
<i>Global Reporting Initiative</i>	GRI 304: Biodiversity 2016 Standard (2016)	Framework	Measure	GRI's main and current standard on biodiversity impact measurement and reporting. This guidance is being updated.
<i>PBL Netherlands Environmental Assessment Agency</i>	GLOBIO (n.d.)	Database	Measure	Model using a mean species abundance (MSA) metric to calculate impacts on biodiversity due to human pressures.



Author	Title/Name (Year)	Type	Stage	Description
<i>International Association for Impact Assessment</i>	Biodiversity and Ecosystem Services in Impact Assessment (2018)	Framework	Measure	Provides best practice to improve development and capacity building within business to improve the EIA process.
<i>IBAT Alliance (Birdlife International, Conservation International, IUCN, UNEP-WCMC)</i>	Integrated Biodiversity Assessment Tool (IBAT) (n.d.)	Mapping tool	Measure	IBAT provides authoritative global biodiversity data. Users can import raw data on locations and create reports and map files
<i>Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)</i>	Diverse Values and Valuation (2016)	Guidelines	Value	Methodological guidance based on the IPBES Preliminary guide on diverse conceptualization of multiple values of nature and its benefits. Covers topics including "Contrasting Approaches to Values & Valuation" and a "Six Step Approach to Valuation."
<i>International Union for Conservation of Nature (IUCN)</i>	The development and use of biodiversity indicators in business: an overview (2018)	Report	Measure	Background information on the business need for biodiversity indicators related to specific business applications
<i>International Union for Conservation of Nature (IUCN)</i>	Threats Classification Scheme (n.d.)	Database	Measure	Hierarchical breakdown detailing the drivers of species decline.
<i>PRé Sustainability</i>	ReCiPe (2016)	Database	Measure	Developed for life cycle assessment, the model expresses potential disappearance of species as an indicator of impacts on biodiversity.
<i>The Economics of Ecosystems and Biodiversity (TEEB)</i>	The Economics of Ecosystems & Biodiversity (TEEB) Ecological and Economic Foundations (2010)	Report	Value	Conceptual foundation linking economics and ecology, highlighting the relationship between biodiversity and ecosystem services and showing their importance for human well-being. Chapter 4 (The socio-cultural context of ecosystem and biodiversity valuation) and Chapter 5 (The economics of valuing ecosystem services and biodiversity) are particularly relevant to Step 07 of the Protocol.
<i>The Economics of Ecosystems and Biodiversity (TEEB)</i>	Valuation Database (2010)	Database	Value	Estimates for monetary values of ecosystem services that could be used in value transfer.



05 Step 05 Guidance: Measure impact drivers and/or dependencies

5.2.1 Map your activities against impact drivers and/or dependencies

a. Identifying impact drivers

Once the impact pathway is understood, it is important to consider how biodiversity impact drivers and dependencies can be **measured**. In a practical sense, you could determine how your business activities drive impacts on **species** and **habitats**, as these two metrics are the most easily quantifiable measures of biodiversity, particularly for site-/project-level assessments. However, as noted in the **Framing Guidance**, biodiversity is much more than species and habitats alone. For an overview of concepts related to impact drivers and impact pathways, refer to page 44 of the Protocol.

Biodiversity impact drivers can be **direct** (impacting biodiversity immediately) or **indirect** (leading to changes in biodiversity as a consequence of something else). These are identifiable because they result in a measurable change to the environment. This can be through the measurable use of a natural resource called an **input** (e.g., area of wetland used during construction), or the creation of a non-product **output** (e.g. volume of pollutant emitted to the wetland during construction). Examples of direct and indirect biodiversity **impact drivers** are presented in table 5.1 below.

Table 5.1
Direct and indirect biodiversity impact drivers (adapted from IPBES 2017) and related biodiversity examples

Type of impact driver	Impact driver category	Input/ output	Examples of specific, measurable impact drivers related to biodiversity
<i>Direct</i>	Land-/sea-use change	Output	Area of land converted from natural forest to agricultural land, area of seabed used to install a windfarm
	Direct exploitation	Input	Number of animals displaced due to project installation
	Climate change	Output	Emission of GHGs into the atmosphere
	Pollution	Output	Wastewater entering the marine environment, agricultural runoff, operational noise
	Invasive alien species	Output	Movement of invasive species through shipping and transportation of goods
<i>Indirect</i>	Demographic and sociocultural	Output	Increase in human population near project site, change in consumption pattern of local resources (by humans)
	Economic and technological	Input	Trade of species

The **IUCN Threats Classification Scheme** (IUCN n.d.) details the categories of threats arising from impact drivers in a hierarchical structure. It details current drivers of decline for individual species, including historical threats that are no longer active and future threats that are likely to occur within three generations or ten years. This can be used to help identify impact drivers posing a threat to, and consequently impacting on, biodiversity. Activities highlighted as having a greater threat would be deemed as having a higher risk and should be prioritized for avoidance, mitigation, and offsetting in line with the mitigation hierarchy.

FOR AN OVERVIEW OF CONCEPTS RELATED TO IMPACT DRIVERS AND IMPACT PATHWAYS, REFER TO PAGE 44 OF THE PROTOCOL.

b. Identifying dependencies

As biodiversity is an integral part of **natural capital stocks**, and underpins the goods and services that stocks generate, businesses inherently depend on biodiversity. For example, a coffee plantation will be dependent on the pollination of its coffee plants to yield coffee beans (see figure 5.1). A successful coffee yield is dependent on the habitat (a component of biodiversity) used to grow the coffee plants and the pollinators within the area.

Glossary :

Impact driver

A measurable quantity of a natural resource that is used as an input to production or a measurable non-product output of business activity (Natural Capital Coalition 2016).

The definition and application of the term impact driver is similar to the term 'pressure'. To remain consistent with the Protocol, the term impact driver will be used throughout this Guidance.

Natural capital impact

Negative or positive effect of business activity on natural capital (Natural Capital Coalition 2016).

Dependency

A business reliance on or use of natural capital (Natural Capital Coalition 2016).

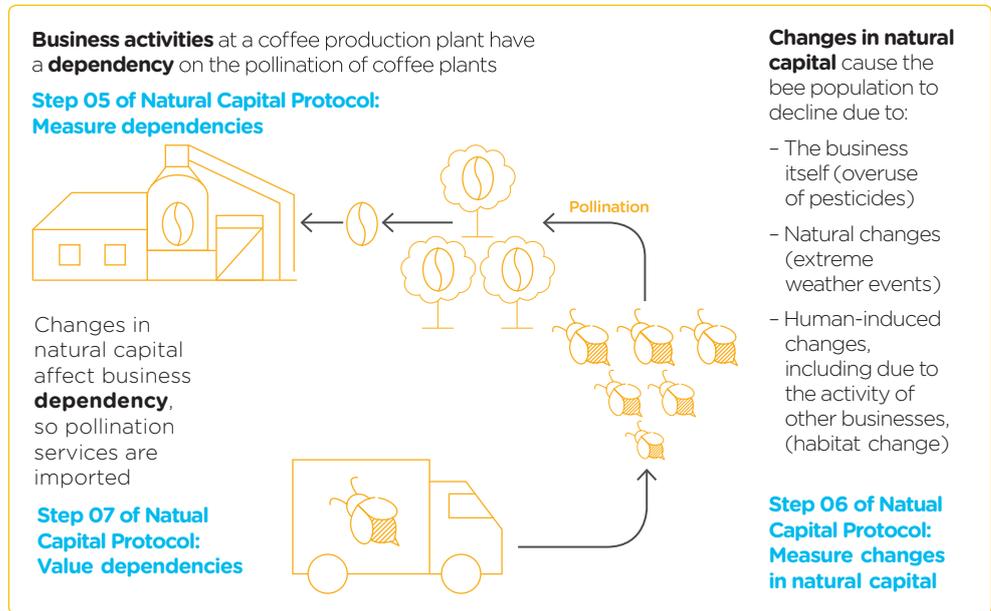


Figure 5.1

A coffee plantation’s dependencies on insect pollinators for the success of its business (Figure 4.2 in the Natural Capital Protocol, 2016)

ENCORE (Exploring Natural Capital Opportunities, Risks, and Exposure) is an online tool to help businesses identify the impact and dependency pathways related to their business activities. It is applicable to all business sectors and financial institutions and details how impacts and dependencies on natural capital may pose a business risk if environmental degradation occurs.

5.2.2 Define which impact drivers and/or dependencies you will measure

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 60 FOR GENERAL GUIDANCE.

Examples are given in table 5.2 of business activities that result in an impact driver, including its associated quantitative indicator, key data gaps, and uncertainties to consider before undertaking measurement.



5.2.3 Identify how you will measure impact drivers and/or dependencies

To measure an impact driver and or dependency, you need to determine the type of data required. Many data sources exist and are described in detail within the Protocol (page 60). To measure biodiversity impact drivers and/or dependencies, there are generally two forms of data to consider acquiring and/or collecting. Each is described below with examples.

Primary data:

- Internal business data
- Site-level impact driver data collected through field surveys and sampling
- Data collected from suppliers or customers

Secondary data:

- Published, peer-reviewed, and grey literature (for example, life-cycle impact assessment (LCIA) databases; industry, government, or internal reports)
- Estimates derived using modeling techniques, including:
 - Environmentally extended input-output (EEIO) models. Many EEIO initiatives exist, including the commonly used EXIOBASE, EORA and GTAP.
 - Productivity models
 - Mass balance models
- Past natural capital assessments

Data collection techniques are highly variable and often dependent on location, project, and area of the value chain being assessed. For this reason, one technique may not be practical or well suited across multiple applications (however techniques should be compatible to ensure consistency and comparability as far as possible). For example, a site-level project (e.g., an environmental assessment for a prospective mine) may involve habitat surveys to assess area of habitat that would be lost, whereas data collection for a wholesaler looking at impact drivers related to commodity sourcing may require information provided by individual farmers through a survey. Both techniques result in the collection of primary data.

Data should be collected and organized in a consistent manner, so that the various data collected are compatible with each other and with the scope of analysis, and are easily comparable, shareable, and interoperable across sites, countries, time, and organizations (where applicable). Users should consider how impact driver data, and the various assessments undertaken, may need to be compared over time when selecting data and methods that are compatible.

The Protocol provides more detail on the limitations and considerations when collecting and using primary or secondary data to measure impact drivers. This includes the use of intermediate indicators (see table 5.6 in the Protocol).

For examples of business activities and their associated impact drivers, indicators, and data sources required, refer to table 5.2. This also includes important considerations on data gaps and related uncertainties.



Table 5.2
Examples of business activities that result in an impact driver, associated quantitative indicator, and key data gaps or uncertainties to consider before undergoing measurement

Activity	Impact driver	Quantitative indicator	Data source	Example data gaps and key issues to consider
<i>Site-level impact: mining for ore</i>	Land-use change (i.e., habitat loss)	Hectares of habitat lost	Primary data: Direct collection	<ul style="list-style-type: none"> - Need to determine physical boundaries for site. - Determine if cumulative effects are being included.
	Water use	Volume of water used annually	Primary data: Direct collection	<ul style="list-style-type: none"> - Need to consider timescales. For example, land-use change is likely to occur primarily during project construction, whereas water use will continue on an annual basis and require repeated surveys.
	Water pollutants (i.e., tailing ponds)	Tons of deleterious chemicals released to surface water	Primary data: Direct collection	<ul style="list-style-type: none"> - Need to determine physical boundaries of where water pollutant assessment will occur. - Need to consider which pollutants will be assessed and the local (i.e., regional or national) water quality assessment guidelines that will be used.
<i>Product-level impact: manufacturing leather shoes</i>	Direct exploitation (i.e., species lost from sourcing materials)	Quantity of leather sourced per year (measured by weight or volume of materials purchased)	Secondary data: Global datasets	<ul style="list-style-type: none"> - Consider parts of the value chain being assessed (upstream, downstream, and/or direct impacts). - Will rely on proxy data to understand impact driver through the supply chain.
	Pollution (i.e., wastewater from production plant)	Tons of deleterious chemicals released to surface water	Primary data: Direct collection	<ul style="list-style-type: none"> - Need to determine physical boundary of assessment (i.e., over what geographic area of direct operations will impacts and dependencies be considered). - Need to determine time period when field work will be completed, and number of repeat measurements necessary.
	Water use	Volume of water used annually	Primary data: Direct collection	<ul style="list-style-type: none"> - Need to consider area of the value chain being assessed (upstream, direct operations, and/or downstream). - If unable to collect direct data from manufacturing facility, may rely on secondary data (i.e., proxy or modeled data) based on size of the company.
<i>Portfolio-/sector-level impact: food production</i>	Land-use change (i.e., biodiversity footprint of a food industry portfolio)	Hectares of land converted to monoculture	Secondary data: Public data (annual reports), private databases (fee required), and internal data collected (at global level)	<ul style="list-style-type: none"> - Data likely come from multiple sources and in multiple formats requiring heavy data pre-treatments. - Transforming multiple datasets into the same format is generally completed by experts. - Different levels of confidence may result for different aspects of the data.
	GHG emissions (e.g., from land-use change or fertilizer use)	Volume of carbon dioxide (CO ₂) emitted into the atmosphere	Secondary data: Global datasets	<ul style="list-style-type: none"> - Need to consider part of the value chain being assessed (i.e., upstream, downstream emissions associated with product). - May rely on modeled data for some aspects of operations if direct measurements are not available.
	Marine ecosystem use (e.g., shellfish grown in terrestrial-based aquaculture facility)	Area of aquaculture used to grow blue mussels	Primary data: Direct collection	<ul style="list-style-type: none"> - Availability of approaches for measuring impacts and dependencies on marine ecosystem use are currently limited.



In the case of a business's dependencies on biodiversity, once these are identified they will need to be measured in a standardized way. Currently, changes to the **stocks** (i.e., the impacts on biodiversity) and **flows** (i.e., impacts to ecosystem services) are relatively well understood. However, the relationship between stocks and flows are poorly understood and hard for businesses to quantify.

There are some tools such as ENCORE (focused on identifying impact and dependency pathways for financial institutions), LIFE (applicable at all Organizational Focuses), InVest, and ARIES, which identify relevant ecosystem services for business activities. Currently, standardized corporate **measurement approaches** to quantify biodiversity dependencies are very limited and this is an area which will require innovation. Meanwhile, you can use the approach of the Natural Capital Protocol to incorporate dependencies on biodiversity as part of your assessment.

5.2.4 Collect data

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 65 FOR GENERAL GUIDANCE.



06 Step 06 Guidance: Measure changes in the state of natural capital [biodiversity]

6.2.1 Identify changes in natural capital [biodiversity] associated with your business activities and impact drivers

This action considers the changes in biodiversity resulting from the impact drivers measured or estimated in Step 05. Example impact drivers resulting in changes to the state of biodiversity, and potential challenges when determining impacts on biodiversity, are described in table 6.1. Refer to the Protocol (page 68) for further detail.

Table 6.1
 Examples of impact drivers resulting in changes (i.e., impacts) to the state of biodiversity.

Impact driver	Change in biodiversity state	Cause of change in state	Points to consider
<i>Pollution (kilograms of nitrates released to surface water)</i>	Reduction in the number of species present in a given area.	Reduced oxygen levels within a waterway (river, lake, or stream) due to the input of chemicals.	<p>Changes in biodiversity due to water pollution are location specific.</p> <p>The type of pollution, quality of receiving water etc., can present challenges for accurate measurement in large-scale assessments. Available modeling approaches are likely to require in-house training or consultant expertise.</p> <p>Water quality assessments are likely to be required on a monthly basis over a long period of time.</p>
<i>Land use (hectares of natural land converted to agricultural land)</i>	Decreased habitat availability and connectedness within a given area.	Land use transforms the amount of natural habitat available and fragments the landscape.	<p>Changes in biodiversity due to land use need to consider the amount of area lost in combination with the loss in connectivity between available (natural) habitat.</p> <p>Loss in connectivity (i.e., fragmentation) can lead to a loss of habitat quality; remaining fragmented habitats may be less resilient to future environmental change or extreme events affecting the provision of ecosystem services.</p>

REFER TO THE PROTOCOL PAGE 68 FOR FURTHER GUIDANCE.

6.2.2 Identify changes in natural capital [biodiversity] associated with external factors

a. Determining external factors related to impacts

You should identify external factors that could result in changes to the state of biodiversity within the bounds of your assessment. These factors may directly or indirectly affect the perceived significance of impacts resulting from your business. This becomes important when required to compensate for biodiversity losses relating to your activities.

An optimum method for assessing changes in biodiversity associated with external factors at the site-level is through the comparison of impacts within the assessment area and a reference site at a secondary location where your business activities are not occurring. It can be very challenging to disentangle these external factors and the use of a reference site is often not feasible.

b. Determining external factors related to dependencies

You should consider identifying external factors affecting, or potentially affecting, your business's dependencies on biodiversity. Considering the coffee plantation example, if a nearby river supplying water to the farm were dammed, there would be less water available to activities dependent upon the water supply. Or, if the forest surrounding the coffee plantation were to be degraded, this would reduce the protection from fire and flooding that is inherently provided by the surrounding, natural habitat.

The ENCORE tool can help identify impact and dependency pathways to determine external factors that may affect your business.



6.2.3 Assess trends affecting the state of natural capital [biodiversity]

You should distinguish between changes in biodiversity driven by impact drivers over which your company has some control from changes due to drivers which the company does not control. A number of tools and databases are available to assist in the assessment of background rates of change in biodiversity. See the Biodiversity Guidance **Navigation Tool**.

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 72 FOR GENERAL GUIDANCE.

6.2.4 Select methods for measuring change

Data requirements will change based on selected measurement methods and need to be reviewed in each instance. You should also bear in mind that actions 5.2.3 through 6.2.4 can be used iteratively to ensure that data and methods are compatible.

For example, measurement methods using primary biodiversity data usually involve **on-the-ground** data collection. If budget, time restrictions, or the objective of your assessment do not allow for the use of primary data, then secondary data can be used instead. Using secondary data, such as on climate change, land use, and pollution, can allow you to model biodiversity impacts through a variety of methods. However, modeled results often convey less detail. Table 6.2 provides additional biodiversity-specific considerations for the use of primary and secondary biodiversity data. For a detailed appraisal of the suitability and potential accuracy of different techniques, refer to the Protocol.

Table 6.2
Biodiversity-specific considerations for primary and secondary data approaches

Type of data	Biodiversity-specific considerations
<i>Primary data</i>	Challenges to consider when collecting primary biodiversity data: <ul style="list-style-type: none"> - Timescales - data collected may not span the time required for impacts on biodiversity to manifest - Seasonal variations - biodiversity can vary across seasons, therefore full impacts may not be captured if data are limited seasonally. Primary data collection will need to be planned so it is completed in relevant seasons (for example breeding bird surveys) - Spatial variations - data may not be collected over an appropriate spatial scale to incorporate many impact drivers - Technical expertise is often required such as from biology/ecology consultancies, non-governmental organizations, or academia. - Other challenges more broadly applicable to primary data collection include: <ul style="list-style-type: none"> - Remote-sensing data (i.e., satellite data) can be reliant on clear weather conditions, restricted in temporal scale, and costly - Land access - Cost
<i>Secondary data</i>	Challenges to consider when utilizing secondary data: <ul style="list-style-type: none"> - Data required are often location-specific and complex - Data gaps result in the use of data assumptions, which decrease accuracy - Models of the distribution of biodiversity, and of the effects of impact drivers, are often not robust enough for reliable assessments - Underlying assumptions and limitations need careful consideration to ensure the modeling scenario is appropriate for your situation — often models are built for other purposes and are not applicable to new circumstances - Some models require expertise to be used effectively - Proprietary rights of data sources must be considered as biodiversity data are sometimes restricted for commercial use

Other specific limitations will exist for each method reviewed, and these limitations need to be considered in the greater context of your assessment. Refer to the EU Business @ Biodiversity Assessment report and associated annexes for further explanation of issues related to data and specific limitations/applicability for each method. Examples of various measurement and estimation methods are provided in table 6.3.



Table 6.3
Examples of measurement and estimation methods for biodiversity

Measuring changes in biodiversity	Direct measurement	Proxies	Modeling methods
<i>Species</i>	<p>Direct measurement of species richness and abundance through field surveys.</p> <p>Organizational Focus: product, project, site, company</p>	<p>Use of the Integrated Biodiversity Assessment Tool (IBAT) to identify the presence of IUCN Red List threatened species. This includes freshwater species that are present upstream and downstream of a specified water basin.</p> <p>Organizational Focus: project, company</p>	<p>Use of GLOBIO model to estimate the mean species abundance (MSA) change as a result of a given impact driver.</p> <p>Use of species specific habitat suitability models to estimate changes in the likelihood that local populations of species will persist after land use change (Durán et al. 2020)</p> <p>Organizational Focus: site/sector/ portfolio</p>
<i>Habitat</i>	<p>Direct measurement of habitat area and assessment of quality through field surveys.</p> <p>Organizational Focus: site, project</p>	<p>Use of the Integrated Biodiversity Assessment Tool (IBAT) to identify the presence of Key Biodiversity Areas and Critical Habitat in terrestrial and freshwater habitats.</p> <p>Use of Ocean+ data to identify the presence and extent of key marine and coastal habitats.</p> <p>Use of Global Mangrove Watch to download data and identify mangrove extent by region.</p> <p>The Defra biodiversity metric provides a method for estimating habitat quality and extent.</p> <p>Organizational Focus: project, company</p>	<p>Use of Global Forest Watch to obtain data on deforestation and forest biodiversity intactness in area/region of interest.</p> <p>Organizational Focus: site, project</p>

Several biodiversity measurement approaches for business are under development globally. Here, we define “measurement approaches” as encompassing indicators, frameworks, and tools for assessing corporate biodiversity impacts and dependencies. The majority are currently in the piloting phase (see figure 6.1 and box 6.1). They are currently classified by Business Application (see **Framing Guidance**) and Organizational Focus (see **Scoping Guidance**), but these are indicative and not restrictive.

Box 6.1: Aligning Biodiversity Measures for Business

The Aligning Biodiversity Measures for Business collaboration, in conjunction with the EU Business @ Biodiversity platform, aims to provide clarity on available corporate biodiversity measurement approaches. The partners are working to develop a systematic means of determining the most appropriate measurement approach for any biodiversity-inclusive natural capital assessment. Refer to the EU Business @ Biodiversity Assessment (Update Report 2, 2019) for description of the current methods available (as of December 2019), the data required to use each approach, and associated limitations. The Business Applications identified by the collaboration have been used within this Guidance. See the **Biodiversity Guidance Navigation Tool** and **Framing Guidance** for more information. The matrix in table 6.1 has been developed to visualize the available measurement approaches and their applicability across the value chain. The information included in the matrix is self-reported by the measurement approach developers, and the EU Business @ Biodiversity platform is assessing various case studies from piloting of these methods to determine the validity of this self-assessment (results expected end of 2020). For this reason, the matrix may be updated as the collaboration continues to convene method developers and expand beyond the approaches identified below. It is suggested that you review all applicable approaches, and choose the one most suited to your business needs. This can be achieved through the use of the online **Biodiversity Guidance Navigation Tool**.



It is recommended that you refer to the **Biodiversity Guidance Navigation Tool** to determine the measurement approaches appropriate for your business and assessment objectives. You may need to adopt multiple approaches to provide a comprehensive assessment. Additionally, the combination of measurement approaches that works for one organization may not be relevant for another. Once measurement approaches have been selected, the Guidance presented here will assist you in data collection, measurement, and valuation of your business's impacts on biodiversity. Choosing an appropriate measurement approach is also described in more detail below.

It is noted that the measurement approaches identified below (see figure 6.1) are primarily used for determining impacts and dependencies with regard to terrestrial biodiversity. It is recognized that these approaches are limited in addressing and incorporating aquatic (freshwater) and marine biodiversity (see table 10 of the EU Business @ Biodiversity Assessment Update Report 2 (2019)).

Business application supported	Organisational focus					
	Product/service	Site/project	Supply chain	Corporate	Portfolio/sector	Country/region
1. Current performance	ABD, PBF	ABD, LIFE, BISI, STAR, BD, BMS, BPI	ABD, LIFE, BD, PBF, BIM, BMS, EPL	BD, GBS, BISI, LIFE, BIM, BMS, EPL	BFFI, LIFE, GBS	ABD, LIFE
2. Future performance	PBF	LIFE, STAR, BPT	LIFE, PBF	GBS, LIFE	BFFI, LIFE, GBS	LIFE
3. Tracking target progress	ABD, PBF	ABD, BISI, BD, LIFE, STAR	ABD, STAR, BD, LIFE	ABD, BIM, BD, LIFE, GBS, STAR	ABD, LIFE, BFFI, STAR, GBS	ABD, STAR
4. Comparing options	ABD, PBF	ABD, STAR, BISI	ABD, LIFE, BIM, EPL	ABD, BIM, BISI, GBS, EPL	ABD, GBS, BFFI, LIFE	ABD, LIFE
5. Third party assessments/ratings		LIFE		GBS, LIFE	GBS, LIFE, BFFI	LIFE
6. Third party certification		BD, LIFE, BMS	BD, LIFE, BMS	BD, LIFE, BMS	LIFE	LIFE
7. Risk & opportunity assessment	ABD	ABD, BISI, BPI	ABD, EPL	ABD, BISI, EPL	ABD	ABD
8. Biodiversity accounting		ABD	ABD	ABD		

Key

- ABD Agrobiodiversity index
- BFFI Biodiversity Footprint Financials
- BIM Biodiversity Impact Metric
- BMS Biodiversity Monitoring System for the Food Sector
- BISI Biodiversity Indicators for Site-based Impacts
- BD Biological Diversity Protocol
- GBS Global Biodiversity Score
- EPL Environment Profit & Loss
- LIFE LIFE Impact index
- PBF Product Biodiversity Footprint
- STAR Species Threat Abatement & Recovery
- BPT Biodiversity Performance Tool
- Addresses biodiversity
- Addresses ecosystem services
- Biodiversity & ecosystem services

Figure 6.1

Examples of corporate biodiversity measurement approaches, with Business Applications and Organisational Focus they support indicated.

Source: EU Business @ Biodiversity Assessment Update Report 2 (2019). The approaches identified in the matrix were self-reported and will be updated through further developments of the Aligning Biodiversity Measures for Business collaboration. Refer also to the **Biodiversity Guidance Navigation Tool** for a list of measurement approaches available for your biodiversity-inclusive natural capital assessment.



The categorizations of measurement approaches as relevant to various Business Applications and Organisational Focus areas (figure 6.1) are indicative and self-reported by method developers. The indicated approaches may not be applicable for all specific decisions requiring biodiversity measurement.

Once an applicable measurement approach has been selected and reviewed (using the **Biodiversity Guidance Navigation Tool** and the visual matrix in figure 6.1 above), it is important to consider the different datasets and associated metrics required. The method chosen will dictate what input data are needed, the level of granularity, and the information gained once measurement is completed. Different underlying metrics are described in detail under action 6.2.5.

Once measurement approaches have been used to quantify biodiversity impacts and dependencies, this information can then feed into the next step of valuation. Progression from measurement to valuation is helpful to understand the relevance and magnitude of your impacts and dependencies on biodiversity in your business context. There are a variety of valuation approaches available (qualitative, quantitative, and monetary) all of which have advantages and disadvantages, refer to action 7.2.3 for more details. No single approach can fully capture the value of biodiversity or communicate its complexity. Multiple valuation approaches can be used to complement each other. For example, where monetary techniques are unable to capture certain aspects of biodiversity, qualitative and/or quantitative approaches can be used to complement (or instead of) monetary valuation.

[Click here to see how a financial institution has reviewed biodiversity measurement approaches to assess their applicability for a portfolio-level biodiversity-inclusive natural capital assessment.](#)

6.2.5 Undertake or commission measurement

The most commonly used metrics underlying biodiversity measurement approaches (in figure 6.1) include; **mean species abundance** (MSA), **potentially disappeared fraction of species** (PDF), and the **risk of species extinction** (e.g., through the **Species Threat Abatement and Restoration** (STAR) metric) (for a non-exhaustive list see table 6.4). A particular metric may be more applicable depending on the activity or impact driver that you want to assess. Metrics such as MSA and PDF do not capture changes to all aspects of biodiversity, such as **genetic diversity** or **ecosystem diversity**. This is a current data gap within biodiversity measurement approaches requiring innovation.

There is a large ongoing effort to develop biodiversity indicators for state actors and public policy decision-making, coordinated by the Biodiversity Indicators Partnership. There is potential for these metrics to be applied by business with additional analysis. For example, the Biodiversity Intactness Index measures the effects of different land use and land use intensities on community composition.



Table 6.4
Selected examples of underlying metrics within corporate biodiversity measurement approaches

Example Metric	Description	Data used	Level of applicability	Limitations
<i>Mean species abundance (MSA)</i>	<ul style="list-style-type: none"> – Indicator of biodiversity intactness – Considers mean abundance of species relative to their abundance in undisturbed ecosystems (i.e., reference site) – Relative abundance giving a value from 0 (completely destroyed ecosystem with no original species) to 1 (species abundance is unchanged) 	<ul style="list-style-type: none"> – Often estimated using the GLOBIO model, which aims at assessing scenarios of human-induced changes in biodiversity – No weighting factors are applied to different taxonomic groups or to reflect gaps in biodiversity data 	<ul style="list-style-type: none"> – Product – Project – Company 	<ul style="list-style-type: none"> – Does not weight areas by species richness – No distinction is made between species with potentially different conservation values (e.g., common vs. Red-listed) – Based on modeled data in many instances and requires significant handling before it provides company- or project-level insights
<i>Potentially disappeared fraction of species (PDF)</i>	<ul style="list-style-type: none"> – Provides indicator of decline in species richness in an area over a time period – Larger PDF values indicate a higher level of impact for the activity – PDF impact factors focus on the species richness of plants 	<ul style="list-style-type: none"> – Often estimated using the ReCiPe model, which links economic activity to changes in biodiversity – Three European data sources used <ul style="list-style-type: none"> o UK (Crawley & Harral 2001) o Countryside Survey (2000) o Switzerland (Koellner 2003) 	<ul style="list-style-type: none"> – Product – Project – Company 	<ul style="list-style-type: none"> – No distinction is made between species with potentially different conservation values (e.g., common vs. Red-listed) – Reliant on estimates based on species-area relationship – Focused on species richness rather than abundance
<i>Species and habitat diversity (richness and abundance)</i>	<ul style="list-style-type: none"> – On-the-ground monitoring / measurement of species and habitats determine species richness, abundance and trends over time 	<ul style="list-style-type: none"> – Direct measurement – Reliance on local datasets 	<ul style="list-style-type: none"> – Product – Project 	<ul style="list-style-type: none"> – Time bound – Costly – Potential for species measured to vary depending on approaches used
<i>Risk of extinction (e.g., STAR metric)</i>	<ul style="list-style-type: none"> – Assesses potential reduction in extinction risk gained from removal of threats (such as mining) in a given area 	<ul style="list-style-type: none"> – IUCN STAR layer (based on IUCN Red List data) 	<ul style="list-style-type: none"> – Product – Project – Company 	<ul style="list-style-type: none"> – Assesses extinction risk to threatened species and does not consider common species
<i>Presence of protected species and/or protected areas</i>	<ul style="list-style-type: none"> – Screening of sites for the presence of protected species or the location of protected areas, for example through the Integrated Biodiversity Assessment Tool 	<ul style="list-style-type: none"> – IUCN Red List data – World Database of Protected Areas 	<ul style="list-style-type: none"> – Project 	<ul style="list-style-type: none"> – Screening potential impacts rather than quantitative measurement

Most impacts on biodiversity manifest over **time horizons** that do not match real-time decision-making. Companies need to select appropriate **measurement intervals** to best address this mismatch. For example, yearly monitoring surveys are likely more appropriate than monthly surveys when assessing response of a mammal population to noise from a power plant. Whereas monthly surveys (likely for a year or more) are most appropriate when looking at changes to water quality in relation to a mine's effluent.



All measurement methods have limitations, which are important to understand before selecting the most appropriate approach. There is a trade-off when selecting measurement approaches between generality/comprehensiveness and precision/specificity. This trade-off influences the interpretation of assessment results for business decision-making in the Apply Stage (**Application Guidance**).

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 78 FOR GENERAL GUIDANCE.

Case Study

Company example: Finance (asset management)

BNP Paribas Asset Management completed an initial piloting of the **Measuring Guidance** to 1) determine the measurement approaches available to a financial institution completing a portfolio-level natural capital assessment, and 2) complete a gap analysis and identify the pros and cons of each measurement approach identified. The assessment of biodiversity measurement approaches revealed the importance of combining approaches to address some of the existing information gaps associated with different measurement approaches and ensure a comprehensive assessment that fully encompasses biodiversity.

After reviewing the actions outlined within the **Measuring Guidance**, the Aligning Biodiversity Measures for Business matrix (figure 6.1) was used to identify the measurement approaches most relevant for corporate and portfolio assessments. The approaches identified were the **Global Biodiversity Score** (GBS), the **Biodiversity Footprint for Financial Institutions** (BFFI), and the **LIFE index**. These approaches were chosen based on their ability to support corporate and portfolio-level assessments.

Additional measurement approaches were assessed based on their ability to resolve limitations of the primary approaches. These approaches included the **Species Threat Abatement and Restoration** (STAR) metric and the **Biodiversity Impact Metric** (BIM). The **TRASE** tool was also considered.

In the context of this pilot, it was identified that a combination of approaches is needed to cover the spectrum of biodiversity goals. For example, combining the STAR and Global Biodiversity Score measurement approaches would capture information relating to species extinction and ecosystem integrity. BFFI and GBS are similar in their methods and data requirements—however their applicability is heavily dependent upon the objective of the assessment, highlighting the importance of using the online **Biodiversity Guidance Navigation Tool**. The tool is designed to help you understand what you need to analyze and why (based on your overall objective) as these are the most important factors when deciding which measurement approach to use. The **Scoping Guidance** is an important resource for determining which approaches should be further explored.

Where financial institutions hold large portfolios of companies, biodiversity assessments can be complex and time consuming. To fully assess and compare companies in a portfolio, a standardized approach for biodiversity measurement is considered necessary, but it is recognized that using a single measurement approach will not allow for a comprehensive understanding of the impacts and dependencies on biodiversity. Similarly, in assessments identifying impacts and dependencies on biodiversity at the portfolio level, it is difficult to attribute or allocate the impacts of specific companies within the same area. This is a recognized gap even when using a combination of approaches and requires investigation by measurement approach developers.

Although it is recommended that a combination of measurement approaches be used to better assess corporate impacts and dependencies on biodiversity, users still need to investigate the use of these measurement approaches individually to ensure the assumptions of each produce results that build upon one another and avoid the misinterpretation of data (e.g., through double counting, etc.). Additionally, a measurement approach that works for one company may not be relevant for another. Determining the most viable combination of tools for your specific sector and/or company is important. Ultimately, the combination of approaches is a suggested method to fill current gaps in available approaches, but a more permanent solution will be required.



07 Step 07 Guidance: Value impacts and/or dependencies

7.2.1 Define the consequences of impacts and/or dependencies

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 80 FOR GENERAL GUIDANCE.

7.2.2 Determine the relative significance of associated costs and/or benefits

FOR THIS ACTION, REFER TO THE PROTOCOL PAGE 82 FOR GENERAL GUIDANCE.

7.2.3 Select appropriate valuation technique(s)

You can use valuation to understand the importance of biodiversity in a particular context. A variety of approaches are available. When selecting an approach, you must understand its applicability and limitations.

Your choice of valuation technique will depend on whether you want to estimate qualitative, quantitative, or monetary values for biodiversity:

- **Qualitative** values inform the scale of costs and benefits in non-numerical terms.
- **Quantitative** values use numerical data as indicators of costs and benefits.
- **Monetary** values translate costs and benefits into a common currency.

FOR FURTHER INFORMATION ABOUT QUALITATIVE, QUANTITATIVE, AND MONETARY VALUATION APPROACHES, REFER TO THE PROTOCOL PAGE 37.

Different types of values offer different ways to examine the consequences of your impacts and dependencies on biodiversity. **Hybrid approaches** involve using different types of value (i.e., qualitative, quantitative, and/or monetary) in combination to assist your decision-making. You may find hybrid approaches particularly helpful for ensuring that both of the following values are captured in your assessment: 1) the value of biodiversity as part of a natural capital stock underlying continued provision of benefits; 2) the value of the final benefits provided by biodiversity.

You may find it easier to measure the condition of biodiversity (as part of a natural capital stock) in biophysical units, such as the number of individuals of a species or the area of a habitat. If you wish to progress to valuation, you could then convert measurements into qualitative, quantitative, or monetary values. For example, expressing the number of individuals of a species at a site (measurement) as a proportion of the total population could give a quantitative indication of the biodiversity value of the site.

It can be challenging to place monetary values on biodiversity stocks. It is often more straightforward to apply monetary valuation techniques to the goods and services flowing from biodiversity (i.e., the value of the final benefits provided by biodiversity). For example, you could value the benefits provided by wild pollinators using market prices for crops.

Even where monetary valuation is your ultimate goal, you may only be able to convert some aspects of biodiversity's value to monetary units. Qualitative and/or quantitative approaches can be applied to aspects of biodiversity's value that cannot be assessed with monetary techniques. For example, you could apply qualitative approaches to spiritual values associated with biodiversity, and/or might use quantitative values to understand health benefits associated with biodiversity.

You may wish to apply a sequential approach where you first estimate values qualitatively and/or in quantitative units, and then convert them into monetary values (TEEB 2010). You can develop biodiversity values over several iterations. For example, in initial valuation analysis with limited scope you may estimate qualitative values, and then convert progressively more values to monetary units in subsequent assessments with increasing complexity and assumptions.



a. Qualitative and quantitative valuation techniques

The qualitative and quantitative valuation techniques described in the Protocol can be applied to estimating values for biodiversity (box 7.1). The advantages and disadvantages of applying different techniques to biodiversity are the same as for other aspects of natural capital. Therefore, you are encouraged to look at the Protocol for information about valuing biodiversity using qualitative or quantitative techniques. Note that while this Guidance only provides further biodiversity-specific information about monetary valuation techniques, qualitative and quantitative techniques are often more appropriate for capturing some aspects of biodiversity’s value.

REFER TO THE PROTOCOL PAGE 84 FOR INFORMATION ON QUALITATIVE AND QUANTITATIVE VALUATION TECHNIQUES.

Box 7.1: The UK National Ecosystem Assessment

The United Kingdom’s National Ecosystem Assessment (UK NEA) provides an example of how non-monetary valuation techniques can be used to consider biodiversity’s value alongside monetary values. In this assessment, impacts on farmland bird species and bird diversity were valued using multi-criteria analysis (MCA; refer to the Protocol table 7.1 for more information on this and other valuation techniques). Monetary valuation techniques were applied to other impact drivers such as agricultural output, greenhouse gas emissions, as well as to recreation and urban greenspace under different scenarios (Bateman et al. 2011). The different types of value could then be considered in parallel in decision-making—this is therefore also an example of a hybrid approach.

The NEA synthesis report shows how this hybrid approach has been applied and a study by Defra (UK, Department for Environment, Food, and Rural Affairs) also highlights the difficulty of assessing cultural goods through monetary techniques alone, emphasizing the importance of recognizing their values using a range of techniques, such as MCA. The collective value of biodiversity and ecosystem services requires a hybrid approach, using both quantitative and qualitative techniques (UK NEA 2011). Businesses would be able to apply this approach to integrate both the values of biodiversity stocks and final benefits when undertaking natural capital assessments.

b. Monetary valuation techniques

Monetary valuation allows you to compare costs and benefits in a single, readily understood unit. It can simplify the assessment of trade-offs, not only incorporating biodiversity values, but also other environmental, social, and economic considerations.

The valuation techniques included in this Guidance are the same as those already included in the Protocol, but there are some additional considerations that you should take into account when selecting a technique to apply to biodiversity.

Table 7.1 in this Guidance outlines key biodiversity-specific considerations for each technique. Note that this table builds on table 7.1 in the Protocol, which should be read alongside it. Table 7.1 in the Protocol provides a description of each technique, and an indication of the data requirements, duration, budget, skills required for application, and advantages and disadvantages in the general context of natural capital.

REFER TO THE PROTOCOL PAGE 84 FOR INFORMATION ON THE MONETARY VALUATION TECHNIQUES IN TABLE 7.1.

Table 7.1 below provides you with information on the benefits and limitations of each technique in the context of biodiversity, including what type of biodiversity values it can capture and whether it captures impacts and/or dependencies on biodiversity. Table 7.1 also provides examples of how each technique can be used to estimate biodiversity values.

Refer to the **Framing Guidance** action 1.2.1 (B) for more information on the different types of values used in table 7.1.



Table 7.1
Biodiversity considerations relevant to different monetary valuation techniques

Monetary valuation technique		Biodiversity considerations*
<i>Market and financial prices</i>		<p>Benefits: Well-suited to identifying and valuing final benefits provided by biodiversity.</p> <p>Limitations: The extent to which the value of biodiversity is captured is heavily dependent on the degree to which variation in biodiversity influences demand for the market good.</p> <p>Biodiversity values: Direct, some underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p> <p>Examples of use: The market price of an agricultural output could be used to value an expected increase in crop yield associated with interventions to increase wild pollinator populations accessing a plantation. Previous studies have been used to make the case for biodiversity-positive investments to protect and increase pollinator populations given their direct potential to influence the quality and quantity of the crop that is produced.</p>
<i>Production function (change in production)</i>		<p>Benefits: Can be used to assess the value of complex and unclear business dependencies on biodiversity.</p> <p>Limitations: Requires complex modeling which may introduce a high level of uncertainty.</p> <p>Biodiversity values: Underpinning, insurance, and options</p> <p>Impacts or dependencies: Dependencies</p> <p>Examples of use: More diverse forests tend to absorb and store more carbon. The increase that is derived from biodiversity in the carbon value of a forest may be estimated using production function modeling. Businesses looking to invest in forests as part of their climate mitigation and adaptation strategies can use this approach to understand their options, and to seek investments which support their biodiversity and climate objectives.</p>
<i>Cost-based approaches</i>	<i>Replacement costs</i>	<p>Benefits: Reflects business costs that would be needed to maintain operations with changes in biodiversity. Can be used to look at the biodiversity underpinning flows of benefits.</p> <p>Limitations: Despite valuing biodiversity requiring measurement of the demand for biodiversity, cost-based methods report the costs that would be associated with a particular action with no relationship to demand.</p> <p>Biodiversity values: Direct, underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p>
	<i>Damage costs avoided</i>	<p>Examples of use: Businesses can use these approaches to look at the costs of adhering to the mitigation hierarchy (avoid, minimize, restore, offset) as part of a financial analysis of how to mitigate their impacts on biodiversity. The costs of restoration and offsets are examples of replacement costs, and the difference between these costs and costs associated with avoidance and minimization of impacts can represent damage costs avoided. Replacement cost has also been used to highlight the costs of pollinator decline where the next best alternative is hand pollination by humans. The costs of bringing in managed pollinator populations can also be used if this is a feasible alternative.</p>
<i>Revealed preference (indirect)</i>	<i>Hedonic pricing</i>	<p>Benefits: Can isolate the contribution of particular ecosystem services from biodiversity to human well-being.</p> <p>Limitations: A proxy-based method that may have context-dependent inaccuracies, for example hedonic pricing methods will struggle to distinguish a value of biodiversity if levels of biodiversity are not noticeably variable across the assessment area. Similarly, where there are many potential biodiversity sites in a given area travel costs may be low. To an extent both methods reveal what people have to pay to receive a benefit rather than the value they receive.</p> <p>Biodiversity values: Direct, underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p>
	<i>Travel costs</i>	<p>Examples of use: Research in England has shown substantial values (reflected in house prices) associated with proximity to high-value biodiversity habitats and designations. This technique allows businesses to understand the values of biodiversity to consumers, and use it to their advantage when considering pricing. For example, a housing developer may be able to determine the benefit of leaving a natural space within their housing development based on the increase in cost of the houses that are in close proximity to the natural area.</p>

*The "biodiversity considerations" column in table 7.1 draws heavily from eftec (2015) and TEEB (2010). Annex B of the Protocol also provides more information about different monetary valuation techniques.



Monetary valuation technique		Biodiversity considerations*
Stated preference	Contingent Valuation (CV)	<p>Benefits: Focus on estimating demand, therefore offer a theoretically justified method to estimate use and non-use values for biodiversity. Non-use values cannot otherwise be easily estimated.</p> <p>Limitations: Highly subjective, and there is often variation between what people claim they are willing to pay with regard to biodiversity (especially summed across a number of surveys) and what is revealed by their behavior and affordable within their budget constraints. Results can be subject to numerous problems connected to participants' lack of experience attributing monetary values to non-market goods (such as many of the benefits that biodiversity provides to society), and capacity to distinguish values across different levels of their provision (sensitivity to scope).</p> <p>Biodiversity values: Direct, some underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p> <p>Examples of use: Stated preference methods have been applied in different contexts ranging from valuing individual species to estimating the benefits of country-level biodiversity action plans. Businesses can use this approach to understand the wider benefits they are delivering through biodiversity-positive action, and estimate values associated with the impact of biodiversity loss on society.</p>
	Choice Experiments (CE)	<p>Benefits: Bypasses requirements for investment in new primary research.</p> <p>Limitations: Relationships between biodiversity and provision of benefits are often complex and context-specific. Value transfer requires the study used as input to have a very similar ecological and socioeconomic context as the current assessment in order to transfer values in a justifiable way. Validity of results is likely to be questionable, especially if the cultural/temporal/ecological context of the source study is not similar.</p> <p>Biodiversity values: Direct, underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p> <p>Examples of use: Context-specific values for different ecosystem services provided and/or supported by biodiversity (estimated using techniques outlined previously in this table) have been compiled in databases such as the TEEB valuation database (see table MV.2) and can be applied to estimate biodiversity values in similar contexts, or used in different contexts with suitable adjustments. This is the most common technique used by businesses to develop natural capital accounting. For a more detailed example, refer to the case study for Repsol's natural capital valuation methodology.</p>
Value (benefits) transfer		<p>Benefits: Bypasses requirements for investment in new primary research.</p> <p>Limitations: Relationships between biodiversity and provision of benefits are often complex and context-specific. Value transfer requires the study used as input to have a very similar ecological and socioeconomic context as the current assessment in order to transfer values in a justifiable way. Validity of results is likely to be questionable, especially if the cultural/temporal/ecological context of the source study is not similar.</p> <p>Biodiversity values: Direct, underpinning, insurance, and options</p> <p>Impacts or dependencies: Both</p> <p>Examples of use: Context-specific values for different ecosystem services provided and/or supported by biodiversity (estimated using techniques outlined previously in this table) have been compiled in databases such as the TEEB valuation database (see table MV.2) and can be applied to estimate biodiversity values in similar contexts, or used in different contexts with suitable adjustments. This is the most common technique used by businesses to develop natural capital accounting. For a more detailed example, refer to the case study for Repsol's natural capital valuation methodology.</p>

*The "biodiversity considerations" column in table 7.1 draws heavily from etfec (2015) and TEEB (2010). Annex B of the Protocol also provides more information about different monetary valuation techniques.

Selection of a valuation technique will often be aligned with the risks and opportunities you identified through your materiality assessment. For example, if your business is facing legal risks from its biodiversity impacts, the consequences could be understood through costs of non-compliance. Alternatively, to understand the business value of your dependency on biodiversity, you could estimate the costs of replacing biodiversity benefits.

Click here to see how a leading energy company is integrating biodiversity within its natural capital valuation methodology.

7.2.4 Undertake or commission valuation

Applying these techniques to estimate values for biodiversity requires significant training and applied experience. You should consider whether you have the necessary skills and experience within your business to undertake valuation internally. If necessary, you should commission external partners, such as appropriate consultants, academics, or non-governmental organizations to assist with your biodiversity valuation.

Avoiding double-counting and considering the condition of biodiversity stocks

Double-counting can be a concern when you value biodiversity and ecosystem services. This is because biodiversity delivers benefits in multiple ways. For example, in production of agricultural crops, biodiversity supports nutrient cycling and pollination. These ecosystem services (and other benefits from biodiversity) combine to provide one final benefit to a business—increased crop yields. If you value each ecosystem service individually you may count the role of biodiversity several times.

To avoid double-counting, you can focus on final benefits, such as the crop yield, rather than intermediate or supporting services, such as nutrient cycling or pollination.



However, when you value final benefits (if they are flows resulting from values other than biodiversity's direct value) the connection between business benefits and the underlying condition of biodiversity stocks may be overlooked. For example, if you focus on valuing final crop yields the importance of pollinators may not be recognized. Where biodiversity is being degraded, it is particularly important that you consider these connections, as the final benefit being valued may also be degraded in the long term.

To address the limitations of only valuing final benefits, it is important to try to identify where the condition of biodiversity stocks has been overlooked in estimated values, and consider the importance of biodiversity for continuing to provide benefits to your business in the future.

Refer to action 1.2.1 (C) of the **Framing Guidance** for more information on the hidden values of biodiversity.

Further potential limitations and how to address them

Whether you are undertaking or commissioning valuation, there are several important limitations, particularly to monetary valuation, which you should consider and try to address when designing and implementing methodologies and interpreting valuation results (Sukhdev et al. 2014):

- **Subjectivity** – Values are a reflection of how a single group of people perceive their relationship with biodiversity at a single point in time. To address this limitation, you should try to identify and engage with all relevant stakeholders to understand their perceptions of biodiversity and its importance. You should avoid influencing these perceptions when designing your assessment.
- **Incommensurability** – The problem of incommensurability remains, even where some aspects of biodiversity's values have been converted to monetary units, as the full value, which cannot be expressed in monetary units, remains difficult to take into account. For example, it is impossible to use monetary units to express intrinsic values associated with biodiversity, and very difficult to calculate accurate values associated with rights, responsibilities, and care. Biodiversity provides multiple benefits to business and society, and even when all are expressed in monetary units it may be inappropriate to mix market values associated with biodiversity with values that biodiversity provides linked to the welfare of wider society. By exploring non-monetary techniques, you can look at the impact of weighting and scoring different values and begin to reduce the risk of missing intrinsic and ethical values in the valuation.
- **Economic uncertainty** – Economic uncertainty can contribute to the complexity of valuations (particularly where ecologically uncertain relationships exist) and risks reducing the reliability of the results. Using the best available information on forecasted market prices and revising these market prices periodically to incorporate deviations on the state and values of your impacts and dependencies on biodiversity will help reduce the economic uncertainty of the results.
- **“Commoditization”** – Expressing biodiversity values in monetary units can be misinterpreted as pricing and marketing biodiversity. Even if the results of your monetary valuation indicate that greater economic value could be obtained through land uses or activities that would have negative impacts on biodiversity, you should not interpret these results as suggesting biodiversity is replaceable. To reduce concerns surrounding commoditization you should make clear that biodiversity has many hidden values and intrinsic value that it is not possible to assess through monetary values. You could use qualitative techniques alongside monetary values to better incorporate biodiversity's intrinsic value in your assessment, or perhaps include a condition to always maintain a certain level of biodiversity in calculations of potential economic values associated with different business options.

It is important that you recognize these limitations and try to address them where possible. You should interpret values estimated for biodiversity with caution, and use them alongside other information to assist (rather than replace) deliberation in your decision-making. You should always present the approach taken, and the assumptions made, clearly alongside your valuation results. Remember that values for biodiversity are likely to represent minimum estimates.

These issues notwithstanding, biodiversity valuation can provide a useful aid to your decision-making.

Having now measured and potentially also valued your biodiversity impacts and dependencies, please continue to the **Application Guidance** to explore how to interpret, apply, and act on the results of a natural capital assessment.



Case Study

Company example: Energy company

Repsol, an energy company operating globally, is committed to being at the forefront of the industry in its efforts to measure, mitigate, and minimize the negative impacts of its projects and operations on society and the environment. Repsol is adopting a natural capital approach for environmental decision-making because it enables them to clearly link ecological systems with their contributions to human well-being.

Repsol has developed a novel methodology for the comprehensive valuation of the environmental impacts and dependencies of its projects and operations worldwide, called the Global Environmental Management Index (GEMI). The GEMI has been piloted with Repsol's operations in the Block 57 concession located in the Amazonia region of Cusco, Peru. This is one of the richest areas for biodiversity in Peru.

The GEMI methodology analyzes improvements (impact reductions) derived from application of the mitigation hierarchy. Environmental impacts are first measured in biophysical units, then converted into monetary values, primarily using value transfer. Modulation factors are then applied to the monetary values to calculate dimensionless "Impact Units." Repsol has applied the GEMI at Block 57 to estimate the value associated with natural capital loss, comparing the on-ground scenario, where measures to mitigate impacts on biodiversity were implemented, and a counterfactual scenario with no biodiversity mitigation measures. Monetary values for ecosystem services were estimated through collation of 119 values for similar ecosystem services from 27 studies, and then applying site-specific adjustments. Biodiversity is incorporated through adjustment of ecosystem service values for specific biodiversity features, such as the abundance of protected species, and threats such as habitat loss and fragmentation.

Repsol are currently refining the GEMI methodology, and will use the Valuing Guidance to support this process. For example, Repsol can more explicitly consider the importance of biodiversity for delivery of different ecosystem services, and how the economic values for ecosystem services may change with changes in the condition of biodiversity. Furthermore, they can use the Guidance to broaden the scope of their method to also assess business dependencies on biodiversity and ecosystem services, and ensure that limitations to valuation techniques and implications for interpretation of biodiversity valuation results are consistently recognized. Repsol are currently working to ensure these considerations are integrated within their GEMI methodology.



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