The development and use of biodiversity indicators in business: an overview

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This publication has been made possible in part by funding from Agence Française de Développement under its work on "Entreprise, economie et finance", and through the UK's Natural Environment Research Council Knowledge Exchange Fellowship (NE/N005457/1) programme.

Published by:	IUCN, Gland, Switzerland, in collaboration with the Interdisciplinary Centre for Conservation Science, University of Oxford
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Citation:	Addison, P. F. E., Carbone, G., McCormick, N. (2018) *The development and use of biodiversity indicators in business: an overview.* Gland, Switzerland: IUCN. vi + 16pp.
Cover photo:	Shutterstock
Layout by:	Imre Sebestyén jr / Unit Graphics
Available from:	IUCN, International Union for Conservation of Nature Business and Biodiversity Programme Rue Mauverney 28 1196 Gland Switzerland Tel +41 22 999 0000 Fax +41 22 999 0002 biobiz@iucn.org www.iucn.org/resources/publications

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Acknowledgements

IUCN and the University of Oxford have developed the spectrum of business applications for biodiversity indicators through consultation with practitioners who work with business, and the IUCN business network.

We would like to acknowledge the following practitioners for their valuable comments on an earlier draft of the spectrum: PJ Stephenson (IUCN Species Survival Commission Chair Species Monitoring Specialist Group, Annelisa Grigg (WCMC), Liam Walsh (CISL), Johan Lammerant (Arcadis), Neil Cousins (Blue Dot), Leon Bennun (TBC), Joe Bull (University of Kent), EJ Milner-Gulland (University of Oxford), Pippa Howard (FFI), Xavier Font (Surrey University), Doris Cellarius (IUCN CEESP), and Francis Vorhies (Earthmind).

We would like to acknowledge the input received on the spectrum by a number of businesses and associations. Thank you to: Anna Gray (IPIECA); Catherine Athenes (Constellium); Eva Zabey (WBCSD); Julie Reneau (Nespresso); Heinz Zeller (Hugo Boss); and Warwick Mostert (Anglo-American).

We would also like to thank participants who attended the workshop on "*Bridging the gap between science and business practice for biodiversity indicator development*" at the University of Oxford on 7th September 2018: Tom Brooks (IUCN), Joe Bull (University of Kent), Mark Burgman (Imperial College), Michael Burgass (Imperial College), Philip Bubb (UN Environment World Conservation Monitoring Centre), Leah Gerber (Arizona State University), Pippa Howard (Fauna and Flora International), Louise McRae (Zoological Society of London), Kim Reuter (The Biodiversity Consultancy), and Malcolm Starkey (The Biodiversity Consultancy).

Finally, we would like to acknowledge Joe Bull (University of Kent), Frank Hawkins (IUCN), and Gerard Bos (IUCN) for helpful comments on earlier drafts of this paper.

Executive summary

Businesses are seeking biodiversity indicators to help assess performance for a variety of business applications to address a range of internal and external drivers. However, challenges exist to develop indicators that can cut through the complexity of natural systems, display clear and simple measures of biodiversity, and be relevant to different business applications. Whilst some businesses are seeking one indicator to be used across a variety of business applications, the reality is that assessing biodiversity performance for different business applications at different temporal and spatial scales will often require different indicators.

This paper introduces a spectrum of business applications for biodiversity indicators, which is designed to be a resource for businesses seeking to clarify the business application where biodiversity indicator(s) are required. This spectrum outlines four prominent scopes for business applications of biodiversity indicators, which range from site-level to corporate-level assessment of biodiversity performance (scopes A – C), through to third-party biodiversity performance assessment (scope D).

The spectrum illustrates the variety of business applications for biodiversity indicators, which can be differentiated depending on specific elements of biodiversity indicator use:

Why?	What is the context and objective for biodiversity indicator use?
What?	What aspect of biodiversity is measured by indicator(s) to address what objectives?
When?	Are biodiversity performance assessments for current or future operations?
For who?	What is the primary audience of the indicator assessment and reporting?
How often?	What is the temporal frequency of the assessment and reporting?
How detailed?	What is the spatial scale of the assessment and reporting?

A variety of biodiversity indicators, tools, and guidance documents exist for businesses that address many specific business contexts, and these are highlighted in the spectrum. However, to help businesses successfully navigate the selection or development of indicators to measure their biodiversity performance, what is missing is a big picture perspective and process to navigate the variety of business contexts where indictors are relevant.

This paper introduces an overarching process, which acknowledges the full spectrum of business applications, to help businesses seeking to use existing indicators or embark on developing their own to measure their biodiversity performance. This process has many similarities with business decision-making frameworks, and offers a logical series of steps to work through in order to develop robust and reliable biodiversity indicators. As with other frameworks, this process emphasizes that indicators should always be built into larger management processes, with initial scoping phases being critical for indicator development answering questions that clarify the business application for indicator use (i.e., ‘why?’, ‘what?’, ‘when?’, ‘for who?’, ‘how often?’, and ‘how detailed?’).

The process introduced in this paper offers a contribution to the current dialogue on biodiversity indicators for business. It is designed to help businesses seeking to integrate biodiversity into their business know where to start, by asking the right questions upfront and to seek out existing indicators that could help measure and track their biodiversity performance.

This paper is aimed at businesses and practitioners already involved in the development of biodiversity indicators, to help provide context around the additional business applications where biodiversity indicators may be required for current or future business needs; and, also for businesses commencing their journey in exploring their impacts and dependencies on biodiversity, that may want to take the next step to assess their biodiversity performance for a specific business need.

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1. Introduction

Many businesses are aware of the importance to understand and measure their impacts and dependencies on biodiversity. The motivations for doing so relate to a variety of drivers, such as: external drivers (e.g., businesses needing to adhere to environmental regulation and policies, financial lending requirements, certification schemes, or standards, or to report against Sustainable Development Goals), and internal drivers (e.g., business can be internally motivated to improve operational efficiencies that have an environmental co-benefit, they may wish to gain a reputational or competitive advantage, or simply want to be an environmentally responsible business).

Businesses are now seeking biodiversity indicators to help assess performance for a range of business applications to address these internal and external drivers. However, challenges exist to develop indicators that can cut through the complexity of natural systems, display clear and simple measures of biodiversity, and be relevant to different business applications. The reality is that assessing biodiversity performance for different business applications at different temporal and spatial scales, will often require different indicators.

For many decades the conservation science community have been developing systems to monitor, evaluate and report on biodiversity outcomes from conservation activities like protected area and threatened species management. As a result, a range of frameworks for, and approaches to, biodiversity indicator development have been developed and used by governments and civil society groups (see reviews in Addison et al, 2018a&b). Much of this science has not reached the business world. There are many lessons that can be drawn from the conservation science community and applied to business contexts where biodiversity indicators are needed.

IUCN and Oxford University have a shared interest in bringing the latest thinking from the conservation science community to business. This project has worked in parallel with the initiatives that are developing and reviewing biodiversity indicators for business (e.g., Berger et al., 2018; Biodiversity Core Initiative, 2018; Lammerant, 2018; UNEP-WCMC, 2017), and acknowledges the substantial body of work that has gone into developing tools and guidelines that have been developed for specific business contexts to help integrate biodiversity into business decision-making (e.g., IUCN French Committee, 2014; Natural Capital Coalition 2014 & 2016). Building on this work, this paper:

1. Clarifies the variety of applications where biodiversity indicators are currently used by businesses, and may be adopted in the future, by presenting the spectrum of biodiversity indicator applications for business.

2. Recommends a process to guide companies and supporting practitioners in the development of fit-for-purpose biodiversity indicators for all business applications.

3. Proposes a way forward to support businesses in developing fit-for-purpose biodiversity indicators, including testing the process against a variety of business case studies representing a variety of business contexts.

Indicator – a definition

An environmental indicator is a parameter, or a value derived from parameters, that points to, provides information about and/or describes the state of the environment, and has a significance extending beyond that directly associated with any given parametric value. The term may encompass indicators of environmental pressures, conditions and responses (OECD, 2001).

An indicator can be defined as, “a measure based on verifiable data that conveys information about more than itself”. This means that indicators are purpose-dependent - the interpretation or meaning given to the data depends on the purpose or issue of concern. Describing this need in the form of a ‘key question’ helps to guide indicator selection and communication (Biodiversity Indicators Partnership, 2011).

Biodiversity indicators are used to represent components of the environment that are relevant to decision-making - the **state** of biodiversity (e.g., a species or ecosystem), or the **pressures** (e.g., a threat) on biodiversity. Related indicators that are indirect measures of biodiversity, can also include business **response** or actions (e.g., the business response

to mitigate biodiversity impacts), and the **benefits** that people derive from biodiversity (e.g., ecosystem services). Indicators can be a **single measure** (e.g., the abundance of a species of bird), or a **composite/constructed measure** (e.g., an aggregation the abundance of a threatened species of bird, forest condition and extent).

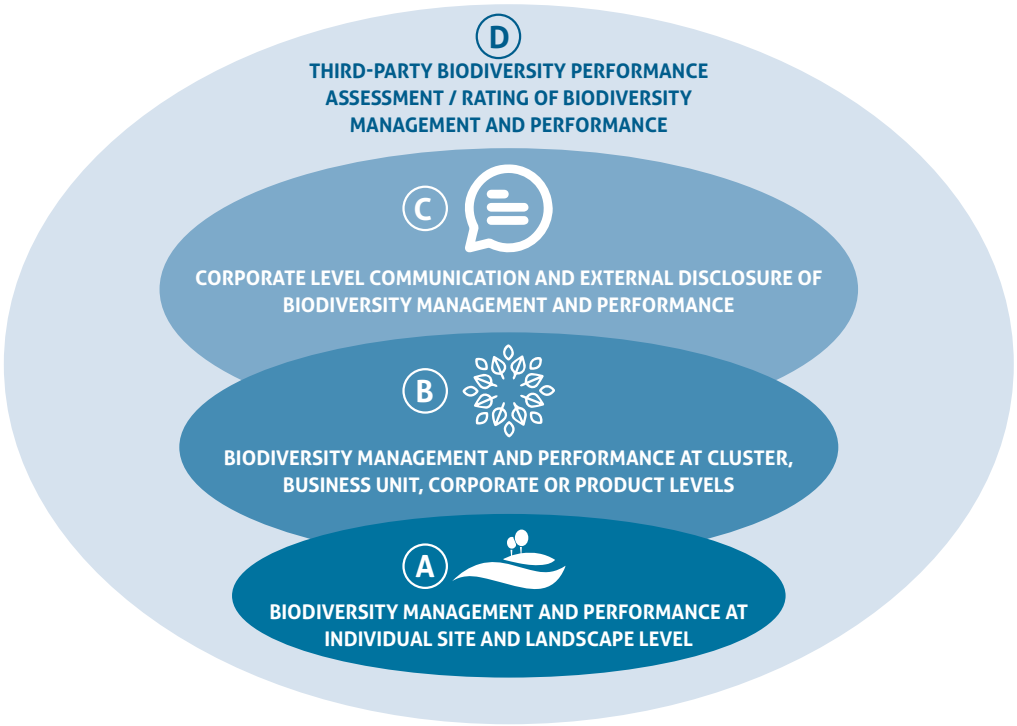
A number of reviews have been undertaken to assess existing biodiversity indicators that are being developed for, and already used by, business (as mentioned in the Introduction). These are useful accounts of the emerging variety of biodiversity indicators for business, illustrating that indicators are being developed for specific business contexts, and draw on specific biodiversity data, which means that the business use of these indicators is by necessity quite specific.

2. The spectrum of biodiversity indicator applications for business

Introduction to the spectrum

Through consultation with practitioners who work with business, and the IUCN business network, a spectrum of biodiversity indicator applications for business has been developed (Table 1). The spectrum provides an overview of the applications where biodiversity indicators are relevant to businesses, and highlights where existing indicators and resources where available to support specific applications. The spectrum will never be fully complete, as the business applications where biodiversity indicators are needed will likely evolve considerably across different sectors as recognition of the material risk and opportunities to business of biodiversity continues to increase.

This spectrum outlines four prominent scopes for business applications of biodiversity indicators. These four scopes are summarised in the infographic below:



Within each scope, a variety of business applications are listed in Table 1, which define the main business uses of the biodiversity indicators. While there may seem to be overlaps between each application, they are further differentiated depending on specific elements of biodiversity indicator use:

Why?
What is the context and objective for biodiversity indicator use (Column 2)

What?
What aspect of biodiversity is measured by indicator(s) to address objectives (Column 2)

When?
Are biodiversity performance assessments for current or future operations (Column 2)

For who?
What is the primary audience of the indicator assessment and reporting (Column 3)

How often?
What is the temporal frequency of the assessment and reporting (Column 4)

How detailed?
What is the spatial scale of the assessment and reporting (Column 4)

This spectrum demonstrates the breadth of decision contexts where biodiversity indicators are relevant to businesses, to assess biodiversity performance: based on risk, dependencies, and impacts (positive and negative); for internal decision-making (e.g., relating to risk management and accounting), and to meet a variety of external reporting requirements (e.g., certification, non-financial disclosure, and regulation).

Companies may wish to assess their corporate biodiversity performance for their current operations (e.g., environmental management of assets), or future operations (e.g., forecasting to screen for risk and differentiate between alternative investments or operations). Corporate biodiversity performance assessment may only need to be undertaken once, or may need to be repeated through time. Finally, companies have a variety of spatial contexts in which businesses may need to measure biodiversity performance indicators – from their site-level operations, through their supply chains, and at aggregated levels such as business unit, product, or corporate-level.

Matching biodiversity indicators with business applications

Within the spectrum of business applications, existing biodiversity indicators and tools that are being used by business are matched to the business applications (see Column 2, example biodiversity indicators used). The spectrum refers to some of the most prominent biodiversity indicators for business that have been developed and reviewed recently, such the UNEP-WCMC impact-focused biodiversity indicators for extractive companies, and the Global Biodiversity Score (GBS) to measure a company's biodiversity footprint. The spectrum also references prominent tools and guidance that have been developed for businesses that provide biodiversity information that can be used by businesses as biodiversity indicators for specific applications; such as, the Integrated Biodiversity Assessment Tool for site-level screening of biodiversity risks, the Biodiversity Indicator and Reporting System (BIRS) for cement and aggregates sector, and the Global Reporting Initiative Sustainability Reporting Guidelines.

The spectrum highlights that indicators of biodiversity state are generally more common for site or landscape level applications (e.g., assessment of threatened species; Scope A). Whereas, for higher orders through the value chain, such as corporate-level biodiversity performance assessment (Scope B and C) the focus of the indicators switches to inferring the state of biodiversity through measurement of indicators of pressure (e.g., reduction in pressures on threatened species) and response (e.g., avoiding operating in or near protected areas).

The indicators and tools shown in Table 1 have been developed and tested for very specific contexts – to address specific business objectives, for a specific business sector, to communicate to specific audience, and for assessments that are for a restricted scope (e.g., site level assessment) and frequency (e.g., one-off assessment only, as biodiversity data used is not updated through time), and focus on specific elements of biodiversity state, pressures and responses. Some level of adaptation will generally be necessary when applying these to new business contexts.

The spectrum also illustrates a lack of existing indicators that measure corporate-level biodiversity state. Developing corporate-level biodiversity state indicators (e.g., which could be inferred from global datasets, or aggregated from the site / business unit / product level) could help provide a clearer assessment of corporate biodiversity performance, rather than performance inferred through measurements of reduction in pressure or business action. These are often based on untested assumptions that those reductions in pressure or actions will generate positive outcomes for biodiversity. The benefit of such measurements to businesses would also enable reporting directly against international goals like the Aichi Biodiversity Targets, included in the Convention on Biological Diversity's Strategic Plan for Biodiversity 2011-2020 or the United Nations Sustainable Development Goals (see these reframed as corporate biodiversity goals in Smith et al., 2018).

Table 1. The spectrum of biodiversity indicator applications for business
(see key definitions on p.9)

BUSINESS APPLICATION (Column 1)	CONTEXT WHERE BUSINESS QUESTION IS RELEVANT (Column 2)	PRIMARY AUDIENCE (Column 3)	SCALE OF APPLICATION (Column 4)
SCOPE A. BIODIVERSITY MANAGEMENT AND PERFORMANCE AT *INDIVIDUAL SITE AND LANDSCAPE LEVEL*			
1. What's the biodiversity performance of the management interventions at site level?	Monitoring and evaluation of the effectiveness of management interventions (i.e., action taken to mitigate impacts) for sites (managing direct impacts) and surrounding landscape (addressing indirect & cumulative impacts beyond the footprint of an operation). Assess performance against:		
	1.1 Site-level business commitments (e.g., based on corporate commitments such as commitments to No Net Loss or Net Biodiversity Gain). These may integrate the below external requirements: e.g., biodiversity indicators used: commonly site-specific measures of biodiversity state, pressure and response (e.g., outlined in the Good Practices for the Collection of Biodiversity Baseline Data Guidance and Accounting for Mitigation tool). Undertaken by: operations, or environment teams Reporting format: Internal reports / dashboards	Internal – operations, environment, corporate compliance, or sustainability teams	Spatial scale: Site Temporal scale: repeated through time (e.g., monthly / annual)
	1.2 Environmental management system requirements (e.g., ISO 14001, BS 8583:2015). e.g., biodiversity indicators used: indicators required by management systems, commonly site-specific measures of biodiversity state, pressure and response Undertaken by: operations, or environment teams Reporting format: Internal reports / dashboards, and external reports	Internal – corporate compliance or sustainability teams	Spatial scale: Site Temporal scale: repeated through time (e.g., monthly / annual)
	1.3 Regulatory and permitting requirements. e.g., biodiversity indicators used: indicators required by regulation, commonly site-specific measures of biodiversity state, pressure and response Undertaken by: operations, or environment teams Reporting format: reports to regulators.	External – regulators	Spatial scale: Site Temporal scale: repeated through time (e.g., monthly / annual)
	1.4 Lender requirements including the guarantees required by the lenders (e.g., International Finance Corporation Performance Standard 6). e.g., biodiversity indicators used: critical habitat assessment indicators, such as threatened and restricted-range species and ecosystems, and protected areas Undertaken by: operations, or environment teams Reporting format: reports to lenders.	External – lenders	Spatial scale: Site Temporal scale: repeated through time (e.g., monthly / annual)
	1.5 Site to landscape level collective impact program commitments, such as collectively mitigating impacts at ecologically and socially important scales (e.g. catchment, as defined by stakeholders and partners). e.g., biodiversity indicators used: indicators developed in consultation with stakeholders Undertaken by: operations, or environment teams or by external stakeholders with contributions from the company Reporting format: reports to stakeholders.	External – stakeholders, civil society groups	Spatial scale: Site – Landscape Temporal scale: repeated through time (e.g., monthly / annual)

BUSINESS APPLICATION (Column 1)	CONTEXT WHERE BUSINESS QUESTION IS RELEVANT (Column 2)	PRIMARY AUDIENCE (Column 3)	SCALE OF APPLICATION (Column 4)
	1.6 Corporate-level biodiversity commitments (e.g., to avoid operating in high biodiversity value areas (e.g., World Heritage Areas), and to mitigate impacts on biodiversity; as detailed in corporate biodiversity policy/strategy)). e.g., biodiversity indicators used: site-specific measures of biodiversity state, pressure and response (e.g., avoidance of protected areas) Undertaken by: corporate operations, financial, procurement, sustainability, or environment teams Reporting format: sustainability reports	External – stakeholders, civil society groups	Spatial scale: Site Temporal scale: repeated through time (e.g., monthly / annual)
2. What is the biodiversity return on investment of a project?	2.1. Ex-ante or ex-post impacts of investments at a range of scales and over a range of timeframe (e.g., to track specific dimension of a project ROI). e.g., biodiversity indicators used: Biodiversity Return on Investment Metric Undertaken by: investment and finance teams Reporting format: internal reports	Internal - Finance and senior management	Spatial scale: Site Temporal scale: one off (ex ante and/or ex post)
SCOPE B. BIODIVERSITY MANAGEMENT AND PERFORMANCE AT *CLUSTER, BUSINESS UNIT, CORPORATE OR PRODUCT LEVELS*			
3. How are the business unit /country operations performing overall on biodiversity?	Monitoring and evaluation of the effectiveness of management interventions (i.e., action taken to mitigate impacts) aggregated for a cluster of sites, business unit and corporate levels, against:		
	3.1 Corporate-level biodiversity commitments (e.g., to avoid operating in high biodiversity value areas (e.g., World Heritage Areas), and to mitigate impacts on biodiversity; as detailed in corporate biodiversity policy/strategy) or linked to national and/or internationally recognized biodiversity targets (e.g. CBD Aichi Targets, SDG 14 and 15) generating internal reports and dashboards. e.g., biodiversity indicators used: indicators that aggregate information from site to cluster to corporate level, e.g. UNEP-WCMC impact-focused biodiversity indicators for extractive companies, Biodiversity Indicator and Reporting System (BIRS) for cement and aggregates sector, Global Biodiversity Score (GBS) Undertaken by: corporate operations, financial, procurement, sustainability, or environment teams Reporting format: internal reports / dashboards; Natural Capital Assessment	Internal – operations, environment, risk, sustainability, or finance teams	Spatial scale: Corporate Temporal scale: repeated through time (e.g., to meet internal / external reporting requirements)

BUSINESS APPLICATION (Column 1)	CONTEXT WHERE BUSINESS QUESTION IS RELEVANT (Column 2)	PRIMARY AUDIENCE (Column 3)	SCALE OF APPLICATION (Column 4)
4. What is the biodiversity performance of current and future end-user products?	Evaluate current and future end user product impacts on biodiversity, to identify where greatest impacts are occurring and additional management is required (e.g., working with suppliers to increase management standards, or change suppliers). Performance assessed against:		
	4.1 Corporate-level business commitments (e.g., specified in a biodiversity strategy). e.g., biodiversity indicators used: BioScope, Healthy Ecosystem Metric, Product Biodiversity Footprint. Undertaken by: corporate operations, financial, procurement, sustainability, or environment teams Reporting format: Internal reports / dashboards; Natural Capital Assessment; Life Cycle Assessment	Internal – operations, financial, procurement, sustainability, environment teams	Spatial scale: product / commodity / supply chain Temporal scale: repeated through time (e.g., to meet internal / external reporting requirements)
	4.2 Product or commodity business commitments (e.g., specified by the business, and undertaken by suppliers) e.g., biodiversity tools used: Sustainable Tobacco Programme, Cool Farm Biodiversity Tool Undertaken by: Suppliers Reporting format: Internal reports / dashboards	Internal – operations, environment, risk, sustainability, or finance teams	Spatial scale: Site, Supply chain Temporal scale: repeated through time (e.g., to meet internal / external reporting requirements)
5. What are the biodiversity risks and opportunities associated with site level future projects and operations?	Screening and assessment of biodiversity risks and opportunities of future projects operations (e.g., an extractives company's interactions with critical areas for biodiversity) under future scenarios of change to ensure that the risks are within an acceptable level, as defined by.		
	5.1 Risk screening criteria developed based on corporate-level business commitments (e.g., avoid operating in World Heritage Areas). e.g., biodiversity indicators used: risk assessment based on biodiversity information (e.g. operations in/near Protected Areas) derived from the Integrated Biodiversity Assessment Tool Undertaken by: corporate operations, financial, procurement, risk, or environment teams Reporting format: Internal reports / dashboards	Internal: corporate operations, financial, procurement, risk, or environment teams	Spatial scale: Site Temporal scale: one-off
	5.2 Assessment undertaken by investors to differentiate between investment options based on the biodiversity performance or return on investment of different companies. Or undertaken by lenders to assess biodiversity risk and inform pricing credit. e.g., biodiversity indicators used: Biodiversity Return on Investment Metric Undertaken by: investment, procurement, finance teams Reporting format: Internal reports / dashboards	Internal – procurement, finance teams External – investors, lenders	Spatial scale: Corporate Temporal scale: one-off

BUSINESS APPLICATION (Column 1)	CONTEXT WHERE BUSINESS QUESTION IS RELEVANT (Column 2)	PRIMARY AUDIENCE (Column 3)	SCALE OF APPLICATION (Column 4)
SCOPE C. CORPORATE LEVEL COMMUNICATION AND EXTERNAL DISCLOSURE OF BIODIVERSITY MANAGEMENT AND PERFORMANCE			
6. How can I disclose my company's overall efforts in biodiversity management with external stakeholders and shareholders?	Share information on corporate performance, to demonstrate effective management of impacts and risks and opportunities (e.g. secure supply chains, improved accessed to financing, access to new markets, and improved social license), against:		
	6.1. Corporate-level biodiversity commitments (e.g., to achieve no net loss of biodiversity across all operations; as detailed in corporate biodiversity policy/strategy) and societal goals (e.g., the CBD Aichi targets and the Sustainable Development Goals) e.g., biodiversity indicators used: Protected Areas avoided; Threatened species impacted; Biodiversity Action Plans implemented as recommended by Environmental, Social, and Governance (ESG) reporting standards (e.g., <IR> Framework, ISO26000 on Corporate social and environmental responsibility, OECD Guidelines for multinational enterprises; the Global Reporting Initiative Sustainability Reporting Guidelines) Undertaken by: corporate operations, financial, procurement, sustainability, or environment teams Reporting format: Sustainability, non-financial and/or financial reports	External – shareholders, stakeholders, civil society groups, national governments, lenders, investors, certification bodies	Spatial scale: Corporate Temporal scale: repeated through time (e.g., to meet internal / external reporting requirements)
	6.2 Biodiversity regulations that require reporting on non-financial performance, including biodiversity performance (e.g., in France, and the EU) e.g., biodiversity indicators used: specific to regulator requirements Undertaken by: corporate operations, financial, procurement, sustainability, or environment teams Reporting format: Report to regulators	External – shareholders, stakeholders, civil society groups, national governments, lenders, investors, certification bodies	Spatial scale: Corporate Temporal scale: repeated through time (e.g., to meet internal / external reporting requirements
SCOPE D- THIRD PARTY PERFORMANCE ASSESSMENT / RATING OF BIODIVERSITY MANAGEMENT AND PERFORMANCE			
7. What is a company's biodiversity performance rating?	7.1. Third party assessment of a company's environmental, social and governance disclosure and performance, which specifically includes biodiversity against an externally defined benchmark. Can be used to compare companies performance across a sector. e.g., biodiversity indicators used: biodiversity indicators similar to those used in corporate reporting, assessed Earth Dividend, Dow Jones Sustainability Indices, Supply Change, SPOTT, Carbon Disclosure Project, Water Disclosure Project and FTSE4Good. Undertaken by: Third party groups	External – civil society groups, lenders, investors, stakeholders, tertiary sector	Spatial scale: Corporate
8. Does a company meet certification requirements for acceptable biodiversity performance?	8.1. External certification requirements of product or commodity (e.g., FSC, MSC, or Wildlife Friendly certification). Generally, this will require a third party assessment of biodiversity performance to meet certification requirements (e.g., FSC and MSC certification). e.g., biodiversity indicators used: e.g., FSC and MSC assessments of indirect effects of resource extraction Undertaken by: Certification bodies	External – certification bodies, tertiary sector, stakeholders	Spatial scale: Corporate

Box 1. Key definitions

Scale of business applications:
Site – a discrete area where there is a direct business footprint (and therefore potential impact on biodiversity) which can include upstream production sites and downstream offices, warehouses, stores, etc.

Landscape – an area surrounding a site, which is defined as an ecological unit (e.g., a catchment) or important area by stakeholders, where there is a potential for a business to contribute to indirect or cumulative impacts with other key operators in a landscape.

Business-unit – sub-group of overall corporate, typically grouping at regional or brand or subsidiary level

Corporate – accounts for the entire business operations (multiple sites, landscapes, supply chains, commodities, and products) and investment portfolio.

Supply Chain – a system of organisations from resource extraction/production through to product development and delivery to customers and eventual waste/recycling of materials.

Commodity - a raw material or primary agricultural product.

Product – a finished product made up of multiple commodities

Audiences of business applications:
Internal (teams/managers):

Operations – responsible for managing business operations

Finance– responsible for financial accounts and reporting

Procurement – responsible for sourcing products and raw materials

Sustainability/corporate social responsibility – responsible for directing and reporting on sustainability initiatives

Environment – responsible for managing environmental impacts of company operations, sometimes addressed under HSE (Health, Safety, and Environment)

Risk - responsible for risk management relating to environmental impacts and due diligence

Asset – responsible for management of investment portfolios

External:
Shareholders – shareholders of publicly listed companies

Stakeholders – the general public with an interest in the company (e.g., through Sustainability Reports) or interaction with company operations (e.g., within the landscape where a company operates)

Certification bodies – organisations like the Marine Stewardship Council and Forest Stewardship Council who provide independent certification of sustainably sourced natural resources

Regulators – government agencies that require reports from companies (e.g., through compliance & regulation)

Lenders – Financial institutions that invest in specific projects (i.e., banks)

Investors – Banks or firms that invest (e.g., purchase shares) in companies

Civil society groups – NGOs and charities that act as watchdogs to assess the environmental performance of companies

Tertiary sector – Businesses that provide services (e.g., transport, distribution, wholesale, and retail), which rely on the secondary sector (e.g., manufacturing), and the primary sector (e.g., mining).

3. A process to develop and use biodiversity indicators

So where would a business start if they wanted to start assessing their biodiversity performance using biodiversity indicator(s)?

Given the wide variety of business applications for biodiversity indicators, an overarching process, which acknowledges the full spectrum of business applications, is needed to help businesses seeking to use these indicators or embark on developing their own to measure their biodiversity performance.

The following guidance is based on a synthesis of a large body of academic research and practice on biodiversity indicator development that is directly relevant to businesses (see Addison et al (2018b) for more details about these specific approaches). An overarching process is introduced to help businesses seeking to use indicators to help measure their biodiversity performance (Table 2).

Table 2. An overarching process to help businesses seeking to use indicators to measure biodiversity performance

Step in the process	Description of the step
1. Define the decision context	• Define all elements of the business application for biodiversity indicators (i.e., 'why?', 'what?', 'when?', 'for who?', 'how often?', and 'how detailed?' outlined in the infographic).
2. Set management objectives	• Set clear objectives that relate to what the business wants to achieve (in relation to management of biodiversity), and how that can be measured (set monitoring objectives that link to management objectives). • The objectives should align with corporate biodiversity commitments (which may be voluntary, regulatory, or could relate to international biodiversity goals, like the Sustainable Development Goals).
3. Explore & set management actions	• Explore and prioritise management actions that could be implemented to help achieve management objectives.
4. Develop or select indicators	• Select existing indicators, or develop new indicators, that will help measure whether management or monitoring objectives are being achieved, which take into consideration an understanding of the natural system, and uncertainty in how the system will respond to management.
5. Conduct monitoring, assessment, and reporting	• Begin monitoring, assessment and reporting, to meet the decision context requirements. • Assess whether management and monitoring objectives are being achieved. • Ensure an information management system is in place to ensure the quality control and accessibility of data collected.
6. Adapt and refine	• As new information is revealed about the system, adapt management and/or monitoring as required.

This process outlined in Table 2 has many similarities with business decision-making frameworks, like the Plan-Do-Check-Act (PDCA) process which is used to guide the control and continual improvement of business processes (BSI, 2015a), environmental management systems (BSI, 2015b), and the Natural Capital Protocol (Natural Capital Coalition, 2016). These all emphasise that indicators should always be built into larger management processes, with the initial scoping phases (steps 1 & 2; Table 2) being critical for indicator development. The initial stages focus strongly on answering the following questions:

What do you want to measure? The answer to this question is rooted in the aim and objectives of the business management interventions for biodiversity. Those will define not only what you should measure but also what type of indicators would be most suitable for the objective and application: an indicator that will represent the pressure on biodiversity? Or the state, or the response?

Why do you want to measure? Clarify what is the main reason for the development of the biodiversity indicators, e.g., site-level assessment of the effectiveness of mitigation measures on biodiversity, landscape-level or commodity-level assessment of biodiversity dependencies and impacts, through to a corporate-level holistic overview of how a company is doing with regards to its commitments to biodiversity.

Who do you want to communicate the results to? Define up front the target audience as this will influence the format of the output, e.g. site level operations managers, investors, regulatory bodies, stakeholders, and the general public.

By working through the initial steps of the process to clarify the decision context, a good foundation is set to explore and set out the management actions (step 3) that can be implemented to help influence biodiversity and help achieve management objectives (see Smith et al (2018)) for comprehensive analysis on business actions for biodiversity). Following this, practitioners can assess whether indicator(s) exist already that will help meet the specific business application, context, and objectives, or whether new indicators will need to be developed (step 4). What is particularly important at this stage is ensuring that the underlying biodiversity data that is used in the indicator(s) matches the spatial scale and temporal frequency of the assessment and reporting (as specified in step 1).

For indicator(s) to be useful in a business application, they will need to take into consideration an understanding of the natural system, and an idea of how the system will respond to management (i.e., the indicator will provide a signal that can be attributed to a business). Once indicator(s) have been selected, the final steps of the process must be worked through, which include monitoring, assessment and reporting (step 5), with flexibility built into the processes to adapt and refine monitoring and management through time (step 6).

The outlined process should come as no surprise to most people, as it resembles many logical frameworks or processes developed to guide robust and transparent decision-making. However, behind these steps sit a range of approaches (e.g., tools, modelling approaches, etc) from conservation science that can help businesses progress through each step, which are outlined in Box 2. What these approaches, along with the overarching process, support is the development of robust and relevant biodiversity indicators for different business applications. This will help ensure that biodiversity indicators will be both responsive[1] to, and meaningful[2] for, the business application.

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1 A responsive indicator is sensitive to and respond predictably to business activities, by providing direct and unambiguous signals of change, e.g.: the temporal scale of indicator data matches the temporal scale of the business need (e.g., annual evaluation & reporting will require data for a biodiversity indicator that is collected/updated <12 months); and, the spatial scale of indicator data matches the spatial scale of the business need (e.g., site-level evaluation & reporting will require data for a biodiversity indicator that can differentiate between site level activities, therefore should be collected at the site-level).

2 A meaningful indicator measures important component(s) of biodiversity, or addresses priority biodiversity issues (as identified in the decision context and through setting management objectives). The indicator and its reporting format are meaningful to the target audience (e.g., business decision-makers, shareholders, investors or the general public).

Box 2. Examples of approaches from conservation science to support practitioners work through the process of developing indicators

Methods to develop ecosystem understanding and select indicators

Using conceptual models to help explore local and landscape scale ecosystems, how management actions could influence the system, and determine what indicators could help detect important changes in the system (e.g., Bal et al, 2018; de Bie et al 2013).

Using qualitative loop models to work with stakeholders, explore ecosystems, and develop fit-for-purpose indicators for monitoring (e.g., Vugteveen et al 2015).

Approaches to develop scalable Indicators (i.e., indicators are consistent from site to corporate level)

Selecting a 'core set of indicators' across the country-level Vital Signs monitoring program in the USA, that support both site level monitoring and management, and a national scale assessment of biodiversity information in a standardised format (e.g., National Park Service, 2012).

Using two sets of monitoring for International Bird Areas (IBAs) in Kenya to construct site and national indictors, where broad-scale monitoring involves remote sensing of pressures across all IBAs, and detailed on-ground monitoring is undertaken for species, threats and actions at selected IBAs (e.g., Nature Kenya. 2016).

Using Essential Biodiversity Variables, which include core indicators for biodiversity (from genes to species to ecosystems) that are consistent across countries and sectors and are designed to be used by multiple stakeholders (e.g., Pereira et al, 2013).

Approaches to aggregate indicators (i.e., indicators can be combined to provide a high-level summary)

Using approaches to develop composite indicators for national scales, which could be adapted for corporate application (e.g., the Ocean Health Index, Local Biodiversity Intactness Index, and the Biome Health Metric); noting a review by Burgass et al (2017) and colleagues that outlines how composite indicators can hide uncertainties, and mask important changes, and how these can be addressed during composite indicator construction.

Developing condition assessments for indicators (e.g., the Joint Nature Conservation Committee (JNCC) Common Standards Monitoring; JNCC (2016)), where baselines and targets to define favourable to unfavourable condition of species and habitats. This supports standardised assessments across species / ecosystems at site to national scales.

Approaches to develop monitoring, evaluation & reporting systems

Undertaking Protected Areas Management Effectiveness Evaluation, which includes the evaluation of full management cycle – from inputs, to outputs, and outcomes, and the measurement of State – Pressure – Response indicators (e.g., Hockings et al. 2006).

Developing indicators, and evaluating these against selection criteria that relate to the power and accuracy of indicators to detect important changes, before selecting indicator and developing the final monitoring programme (e.g., French Marine Protected Areas approach to develop indicators; Beliaeff and Pelletier (2011)).

The "report card" format used in the Conservation Measures Partnership Open Standards (CMP, 2013) and in the Vital Signs Monitoring programme (National Park Service, 2012), to present monitoring results in graphical formats for non-scientific audiences.

Approaches to develop an information management system

The UNEP- WCMC Guidance on Information Systems (UNEP-WCMC, 2016) promotes shared understanding of how a whole information system is needed to produce & process biodiversity information over time for user needs, and activities and roles required.

4. A way forward

The spectrum outlined in Table 1 demonstrates the breadth of decision contexts where biodiversity indicators are relevant to businesses, and is designed to be used as a resource for businesses seeking to clarify the business application where biodiversity indicator(s) are required.

The process introduced in this paper offers a contribution to the current dialogue on biodiversity indicators for business. It is designed to help businesses seeking to integrate biodiversity into their business know where to start, by asking the right questions upfront and to seek out existing indicators that could help measure and track their biodiversity performance. It can be used alongside the full spectrum of business applications, to help clarify the decision context (step 1) where biodiversity indicators are required.

Moving forward the intention is to use this process, and translate supporting conservation science approaches, to tackle the most challenging business application for biodiversity indicators – the aggregation of site, product and raw material biodiversity performance to a corporate-level biodiversity assessment used for both internal decision-making and external disclosure of non-financial performance (e.g., to meet corporate reporting requirements and to report against the Sustainable Development Goals).

The IUCN and the University of Oxford are also seeking, with businesses and conservation practitioners, to further develop and test this process for indicator development across a variety of business applications. The aim of this next phase of work is to test the process with many business case studies, and translate a range of useful methods that have been compiled from the scientific community that supports the entire process of indicator development. The outcome of a next phase of work will be a selection of business case studies highlighting a range of business applications for biodiversity indicators across different sectors, and illustrating the general process to help businesses seeking to measure and track their biodiversity performance.

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