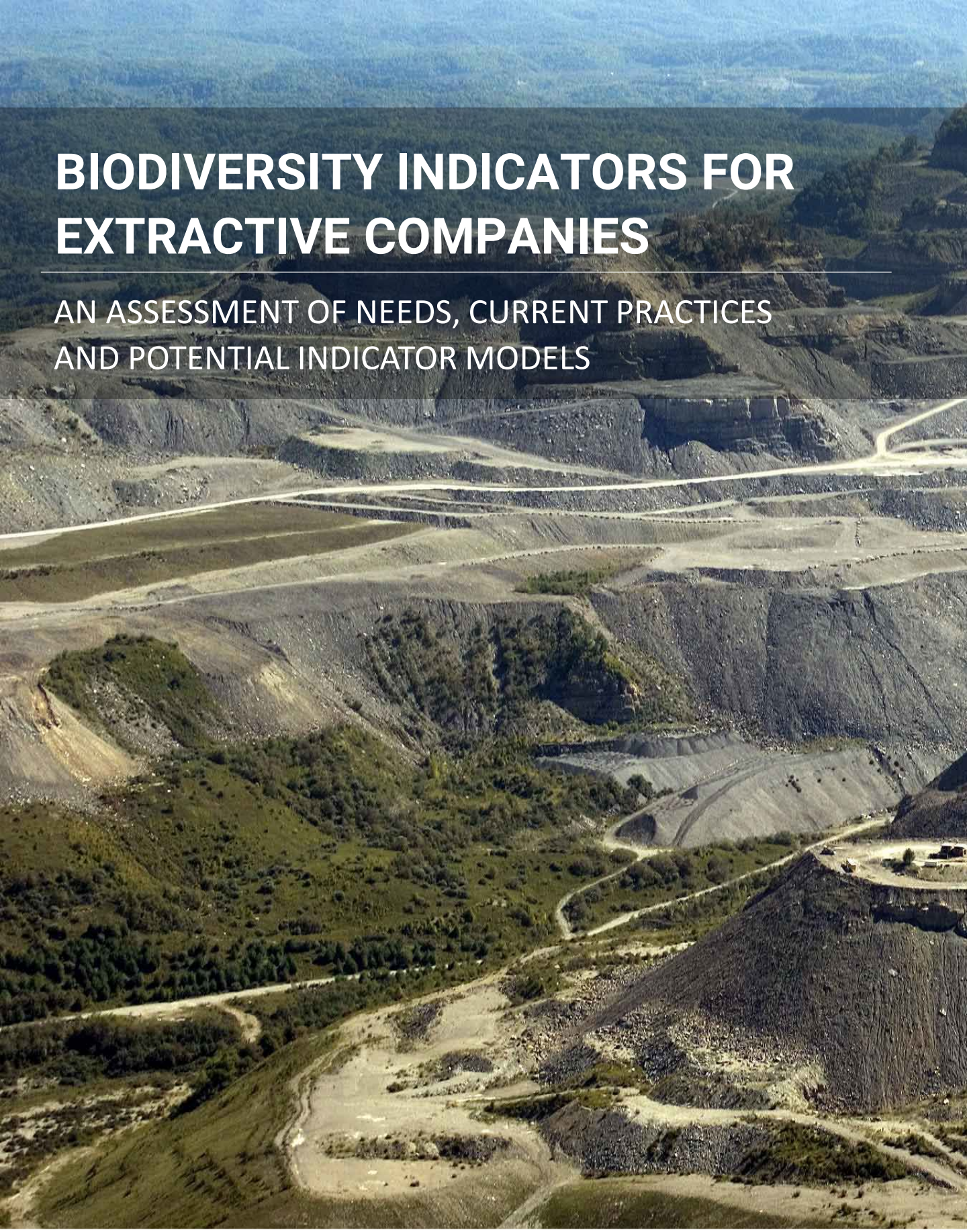
BIODIVERSITY INDICATORS FOR EXTRACTIVE COMPANIES

AN ASSESSMENT OF NEEDS, CURRENT PRACTICES AND POTENTIAL INDICATOR MODELS



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ABOUT UNEP-WCMC

Website: www.unep-wcmc.org

The UN Environment World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of UN Environment, the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 35 years, combining scientific research with practical policy advice.

ABOUT PROTEUS

Proteus is a unique, voluntary collaboration between UNEP-WCMC and 12 large, forward-thinking businesses to support the provision of biodiversity information. Based on the conviction that good decisions are based on good information, Proteus invests to improve the quality of biodiversity data for the benefit of biodiversity decision makers worldwide.

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EXECUTIVE SUMMARY

Biodiversity indicators are an essential tool for understanding and managing changes in biodiversity. Efforts by the private sector to develop biodiversity indicators have often focussed on measuring biodiversity management actions rather than measuring on the ground changes in the status of, and pressures on, biodiversity. This is largely due to methodological and data challenges.

This document is a report on activities conducted during an initial scoping study to understand how progress might be made within the extractive sector in creating effective indicators to establish corporate biodiversity performance. It summarises the results of an analysis of the needs, drivers and current practice relating to biodiversity indicators within the extractives sector.

The initial research was carried out between March and June 2017, in collaboration with Stuart Anstee & Associates. It is based on interviews with eleven companies and a desk review of existing and emerging guidance and approaches. Subsequently, on June 28th 2017, approximately 50 representatives from industry and other interested organisations met in Cambridge, UK, to explore the findings of the scoping study as part of the annual meeting of the Proteus Partnership.

KEY FINDINGS

- **Drivers for indicator development vary, both between and within companies:** at the site level, local regulations are the primary driver, at corporate level drivers are more varied (investor pressure, compliance against internal policies and standards, communication with internal stakeholders).
- **Differences in needs between site and corporate levels** may make it challenging to define a single indicator that suit both needs.
- **Existing biodiversity related reporting frameworks, guidance and indicators are not meeting the needs of the companies** engaged in this research.
- **All companies highlighted the importance of being able to aggregate site-level indicators to corporate level** in order to strengthen monitoring and reporting on biodiversity. Indicators must also be cost-effective, easy to produce/communicate, sensitive to change and credible.
- **Significant monitoring activities are underway at site level, but aggregation of data and indicators up to corporate level is minimal.** Corporate reporting focuses on implementation rather than impact. Use of tailored site-specific monitoring approaches makes securing a corporate level view on biodiversity impacts and contributions challenging.
- **Existing approaches in other sectors may have potential for adaptation to meet extractive companies' needs** and offer possible models for indicator development that merit further exploration.

MODELS FOR INDICATOR DEVELOPMENT IDENTIFIED FOR FURTHER EXPLORATION

Four indicator models were identified for further evaluation:

- a 'core suite' of biodiversity indicators to act as a minimum standard for each site;
- a decision tree to help users determine which indicators from a set should be used at different sites;
- a single composite indicator that brings together various measures of biodiversity to give an overall picture; and
- a framework which allows sites to score the importance of site-specific pressures on or state of biodiversity in a simple and comparable way.

The value of each model was discussed at the Annual Proteus Partnership Meeting, where it was decided that:

1) The key need was for a corporate level indicator that allowed an aggregated measure of impact and performance; and

1) The most appropriate models to further explore for use at corporate level were the single composite indicator and framework model.

1. INTRODUCTION

A number of attempts have been made to design and deliver private sector focused biodiversity indicators e.g. the Energy and Biodiversity Initiative (EBI 2003), the Global Reporting Initiative indicators on biodiversity (GRI 2016), the 2005 review conducted by Earthwatch and Rio Tinto (Tucker 2005), the 2012 International Council on Mining and Metals (ICMM) analysis of member's biodiversity performance (Globalbalance & TBC 2013) and IPIECA's[1] sustainability reporting guidance (IPIECA & IOGP 2015). However, these initiatives have largely focussed on measuring and reporting on actions taken, rather than performance (impact) on the ground.

A desire to better understand and communicate the impacts of company activities on the environment is prompting increased interest in private sector biodiversity indicators. This scoping study aims to understand the drivers for biodiversity indicators and the specific requirements of Proteus members and the extractives sector more broadly. This was the first phase in a multi-phase project that aims to develop indicators for measurement, monitoring and management of biodiversity impacts in the extractive sectors. It is not an exhaustive review of the strengths and weaknesses of the indicator approaches assessed and UNEP-WCMC provides no endorsement of any of the indicator methodologies referenced.

Box 1. Key definitions

Indicator: "A quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect changes connected to an intervention, or to help assess the performance of a development actor"(OECD/DAC 2002). It may be a simple measure or metric e.g. a count of species or individuals in a population, or a compound index, which brings together a number of metrics into an easily understandable trend. Indicators are primarily communication tools, used to convey information about an issue of concern; one given measure or metric may be used for a variety of different indicators, depending on the interpretation of the indicator and the question that it is answering.

There are two main types of indicators:

1. **Impact indicators:** sometimes known as 'performance' or 'outcome' indicators. These provide information on actual impacts of actions taken to address biodiversity or drivers of change. They help to answer the question, 'how are our activities affecting biodiversity?' (Bubb et al. 2014).
2. **Implementation indicators:** sometimes known as 'process' or 'output' indicators, these are used to monitor the completion of actions that enable conservation to be achieved: e.g. whether a Biodiversity Action Plan has been developed and implemented or not (but not to track the actual impacts on biodiversity of the Biodiversity Action Plan). They help to answer the question, 'did we do what we said we would, when we said we would?' (Bubb et al. 2014).

1 IPIECA is the global oil and gas industry association for environmental and social issues

Structured interviews were conducted with 11 extractives companies to identify key drivers, uses and needs for biodiversity indicators, and the current status of indicator development within the sector (see section two). A desk-based review was undertaken of existing and emerging indicators and indicator initiatives, screening them against the user needs identified through interviews (see section three).

This document brings together the results of the scoping study with feedback from the annual Proteus meeting, in order to identify models for biodiversity indicator development, worthy of further exploration.

2. DRIVERS AND STATUS OF BIODIVERSITY MONITORING IN THE EXTRACTIVE SECTOR

This section summarises the results of structured interviews with 11 companies and additional feedback from the Proteus meeting.

2.1 DRIVERS FOR MONITORING AND REPORTING ON BIODIVERSITY

A range of drivers for monitoring biodiversity were identified (see figure one). At the site level, local regulations are the primary driver, whereas, at the corporate level, drivers are more varied.

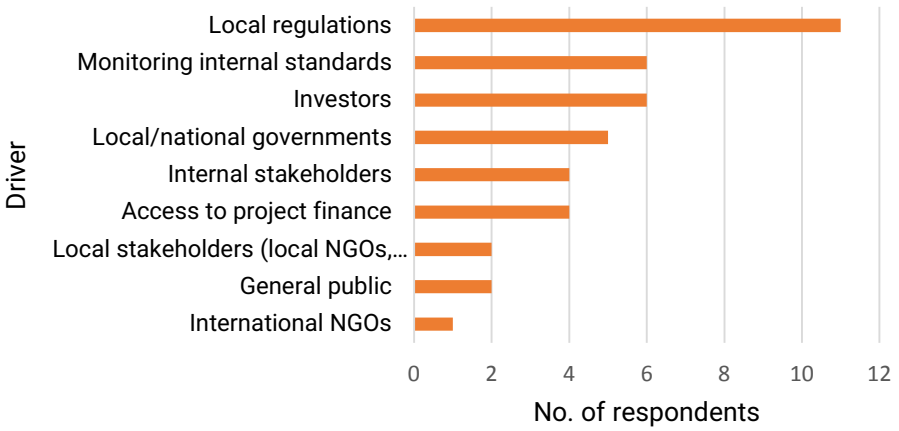


Figure 1: Drivers for monitoring and reporting on biodiversity as reported by interview respondents

- All interviewees cited regulations, predominantly local or national, as a driver for biodiversity monitoring, with three saying this was the primary driver. As a result monitoring is largely site-specific, preventing comparison across sites or meaningful aggregation up to business unit or corporate level and limiting the opportunities for corporate level oversight and reporting on biodiversity.
- Investor interest was identified as a key driver for biodiversity monitoring and reporting. However, it was noted that interest and information required varied greatly across different investor groups. For some interviewees, investors were considered to be a minor driver. It was felt that biodiversity might become of increasing interest to investors in the future; equally, better indicators would help investors understand and thus take an interest in biodiversity.
- Monitoring compliance against internal policies and standards, communication with internal stakeholders such as corporate management, sustainability teams and business units and communications with local and national governments were all considered important drivers. Pressure from international Non-Governmental Organisations (NGOs) was not considered a significant driver.

- Proteus meeting participants confirmed the identified drivers were in line with their practices but queried the relatively low priority placed on project finance and local stakeholders. Company size, project funding strategies and location were identified as additional factors influencing the drivers for indicators.
- Participants also highlighted that impact indicators at a landscape level are likely to be common between sectors (oil, gas and mining), but assessment and scale of footprint will be different between industries. Investor interest in the issue will drive alignment between different sectors as they seek a means to compare performance within and between sectors.

2.2 PRIMARY USES OF INDICATORS

The identification of risk within the companies' portfolio of operations and business decision-making, at local and corporate levels, were cited by most of the companies interviewed as the primary use of indicators.

Other uses cited include:

- Monitoring compliance against internal standards.
- Managing reputational risk through effective communication with the general public.
- Engagement with local communities (noting that information requirements of communities may not always relate to issues impacted by the company).
- Demonstration to government partners of ability to operate near sensitive sites.
- Internal reporting and external reporting (such as compliance or sustainability reporting).

2.3 CURRENT PRACTICE

EXTERNAL REPORTING SCHEMES

The Global Reporting Initiative (GRI) was the external reporting scheme most often referred to by interviewees with seven respondents indicating that they report against the GRI standards. Other reporting requirements, indicators or guidance referred to included:

- The oil and gas industry guidance on voluntary sustainability reporting (produced by IPIECA, the American Petroleum Institute, or API, and the International Association of Oil & Gas Producers, or IOGP).
- The Dow Jones Sustainability Indices, which include specific questions on biodiversity.
- The Sustainable Development Goals (SDGs), which were identified as an evolving influence on five companies. Ten of the 14 reviewed sustainability reports made at least brief references to the SDGs, although without details of the importance of biodiversity underpinning these.

A number of issues were noted with the GRI standards, namely:

- There was not enough guidance given on the spatial scale of data required or specific data needed (two respondents).
- The indicators requested were not relevant or useful for business needs, yet required a lot of work to produce (four respondents).

Table one shows the results of an analysis of 14 companies, including those interviewed for this report and other Proteus members, and their reporting against biodiversity-relevant GRI indicators. The nature of information reported is variable and largely qualitative in nature. This, combined with the lack of broad uptake of the GRI biodiversity indicators suggests that they are not adequately meeting the needs of the extractive sector.

Table 1: Analysis of 14 companies' sustainability reports and websites to identify information disclosed on biodiversity against the GRI

Disclosure requirement	None	Partial	Full	Examples of reporting
304-1 – Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	43%	50%	7%	• Details of sites in/adjacent to protected areas or areas of high biodiversity value (e.g. % of sites, number or name of sites). • No detail on the attribute leading the sites to be protected or classified as high biodiversity value or management interventions.
304-2 – Significant impacts of activities, products, and services on biodiversity	7%	93%	0%	• References made to pollution, construction/use of plants, mines or infrastructure, habitat conversion, extent of areas affected. • No reference made to invasive species introduction, reduction in species or changes in ecological processes, species affected, duration or irreversibility of impacts.
304-3 – Habitats protected or restored	64%	36%	0%	• Extent of area that had been restored. • Extent set aside/ protected for conservation. • Reference to conservation partners.
304-4 – IUCN Red List species and national conservation list species with habitats in areas affected by operations	86%	0%	14%	• Numbers of species in each IUCN category with habitats in areas affected by operations.

SITE-LEVEL BIODIVERSITY MONITORING

- All companies interviewed monitor biodiversity at the site level to varying levels of detail, with a suite of site-specific indicators used to monitor changes in biodiversity and assess implementation of biodiversity action plans (BAPs). Proxy measures, such as land-cover/land-use change, are used alongside direct indicators of biodiversity. All companies produced implementation/process indicators.
- Indicators used at different sites varied greatly, depending on local needs and regulations; this variation was generally acknowledged to hinder corporate-level understanding and communication of changes in biodiversity.
- The focus was largely on state rather than pressures, although both the state of biodiversity (e.g. species populations) and pressures on biodiversity (e.g. habitat clearance) are monitored.
- Quantification of losses and gains for species or habitat features was less common, with only two companies taking this route (although two additional companies expressed an interest in doing so).
- Monitoring and reporting was primarily undertaken for owned and operated sites, although companies may try to influence monitoring at joint ventures to ensure corporate standards are met.

REPORTING AT BUSINESS UNIT AND COMPANY LEVELS

- Reporting on impacts and associated management is largely qualitative in nature, process-focused (e.g. reporting on the development of sites' Biodiversity Action Plans, or BAPs, at the company level, rather than reflecting species or habitat monitoring that forms part of the individual BAPs) and draws on examples or case studies. It is not used for quantifying corporate-wide impact and contribution to biodiversity conservation.
- There was a clear demand from respondents to be able to aggregate biodiversity indicators from individual operations up to the corporate or business unit level, primarily to allow a better understanding of group risk and overall performance in biodiversity management.

DATA USE

- A mixture of scales and types of data are used, depending on data availability (e.g. if a good local, regional and or national biodiversity database already exists) and its intended use (e.g. high-level strategic decisions about a site versus local management decisions).
- Technological advances may present an opportunity to overcome and address some of the existing gaps and challenges in data collection. All companies make use of technology, notably remote sensing, with five also using drones, particularly for marine data. A number of respondents expressed an interest in exploring the opportunities offered by environmental DNA (eDNA[2]) technologies for cost-effective monitoring.

[2] eDNA can be defined as: "genetic material obtained directly from environmental samples (soil, sediment, water, etc.) without any obvious signs of biological source material" (Thomson, P. & Willerslev, E. 2015)

DATA USE continued

- Economic/valuation approaches to biodiversity are not currently being used, although five respondents expressed an interest in doing so. One highlighted concerns about the risks in such data fuelling decisions with negative impacts for biodiversity.

2.4 CHALLENGES IN DEVELOPING AND MONITORING INDICATORS

Challenges companies face with the current application of biodiversity indicators, monitoring techniques and data production include:

- **Scope and boundaries:** Understanding the cause/effect relationship and linking changes in state of biodiversity to the company's activities, and identifying and accounting for externalities.
- **Methodological challenges in measuring state of biodiversity[3]:** How to monitor habitat quality rather than quantity; how to identify key priorities to monitor; how to understand if a decline in a particular species is affecting the functioning of the ecosystem.
- **Methodological challenges in monitoring management responses:** Comparing impacts and improvements across different initiatives, e.g. where like-for-like offsets are not practical, how to compare the impact of the activity with the positive results from the offset?
- **Challenges around aggregation:** Ensuring consistent methodologies that would allow primary data to be aggregated to corporate level to give an overall view of performance.
- **Sensitivity of data to change over appropriate timelines:** Ensuring that ecological data can be collected to identify change/impact in the timescales required to inform (often-rapid) project development.
- **Data cost:** The direct and associated cost of data collection (including technology required), which leads to less frequent collection and thus prevents trend identification.
- **Quality and accessibility of data:** Access to and availability of recent and robust data at an appropriate scale can be challenging. Data quality and resolution differ across the world.

[3] A state indicator expresses an actual resource condition, often based on direct field measurement (Adapted from OECD Glossary of Statistical Terms, https://stats.oecd.org/glossary/detail.asp?ID=2539)

2.5 KEY REQUIREMENTS FOR BIODIVERSITY INDICATORS

Interview results and discussions at the Proteus Meeting identified the following features of a biodiversity indicator that is fit for purpose for the extractives sector, such an indicator should:

- Have minimal cost implications;
- Be easy to produce and communicate for a non-specialist e.g., data collection is straightforward;
- Enable site-by-site performance comparisons and aggregation to company level;
- Be sensitive to change in the issue of concern;
- Be reliable and scientifically robust;
- Allow the separation of the company's impact from that of others in the area;
- Be applicable in a wide range of environments and contexts;
- Respond to well-defined objectives;
- Be repeatable; and
- Be fit for purpose and shareable across the sector via IPIECA, ICMM, etc.

3. EXISTING FRAMEWORKS AND METHODOLOGIES FOR BIODIVERSITY MONITORING AND MANAGEMENT

This section presents the results of a review of existing and emerging guidance, approaches and methodologies for monitoring biodiversity in the private sector and more broadly. While none could be used 'off the shelf' to meet all the needs identified by companies, a number provided potentially useful models for future indicator development.

3.1 Review Methodology

We reviewed sector-specific guidance documents, peer-reviewed and grey literature, and global/regional conservation and policy monitoring frameworks against a set of evaluation criteria drawn from industry interviews and established criteria for good indicators (see table teo). A survey of members of the Biodiversity Indicators Partnership and Global Business and Biodiversity Platforms were used to identify emerging initiatives. We worked with Cambridge Institute for Sustainability Leadership (CISL) to ensure our approach was complementary to theirs.

Table 2: Criteria for evaluation of existing indicator methodologies against user needs

Criteria	Description
1.Business relevant	Indicator can be used directly for company's business decisions at multiple levels.
2.Spatial extent	The ability to use an indicator at site level and aggregate it up to business unit or corporate level.
3.Sensitivity to change	Indicator responds to change in the issue of interest with minimal lag, enabling monitoring over time.
4.Data availability /accessibility	Extent to which data is available and inexpensive/ feasible to access.
5.Scientifically valid*	Accepted theory of relationship between the indicator and its purpose, with agreement that change in the indicator indicates change in the issue of concern.
6.Communication	Ease of understanding of indicator to non-technical people.
7.Production	Data collection, analysis and calculation is straightforward and non-specialists can use the indicator.
8. Policy relevance*	Links to SDG/Aichi Targets.

It is important to note that this high-level review of indicators and methodologies was based on accessible information, without consultation with the indicator providers and without a detailed review of the overall robustness of the methodology. This would be a key next step to fully understand if the indicator could be applied in the extractive sector context. Equally, further scientific review would be required to ascertain the rigour and validity of indicators, particularly those still under development. For more information on the documents reviewed and any specific indicators prescribed or suggested, see Annex two.

3.2 Mining and oil and gas sector guidance

- None of the twelve extractives sector-focused guidance documents, approaches and methodologies that were reviewed meets all the needs of the extractives industry, as identified during the interviews, nor do they provide a clear model for indicator development.
- Some detailed a process (e.g. steps in how to manage for and/or monitor biodiversity), whereas others provided a framework for monitoring (e.g. key headings or topics, or a framework of specific indicators to report against).
- Only the GRI provides a suite of indicators for companies to report on across all sites; however, these focus predominantly on identifying where the company is active in potentially important sites for biodiversity, and likely significant impacts, but do not quantify changes in biodiversity across sites or provide a measure of effectiveness of management interventions. The Energy and Biodiversity Initiative, Biodiversity Indicators for Monitoring Impacts and Conservation Actions (EBI n.d.), and Cross-Sector Biodiversity Initiative (CSBI) Good Practices for the Collection of Biodiversity Baseline Data (Gullison et al. 2015) gave suggestions for indicators that might be used, but specified that these were just given as examples, rather than as a comprehensive framework.

3.3 Existing and emerging guidance from other sectors

- A number of indicator initiatives are currently being (or have been) developed within other sectors, which may have value for the extractive sector. These ranged from composite indicators that provide a simple overview of biodiversity at site level, to a single indicator, to a core suite of basic indicators (for example as developed for gypsum quarries in Pitz et. al 2016); such models would respond to different interviewees' requests, and allow basic standardised impact monitoring across sites and thus aggregation to corporate level.
- All five of the composite indicator methodologies reviewed had traits our interviews had identified as important, such as comparison across sites and aggregation to corporate level, sensitivity to change. The indicators reviewed were mostly sensitive to change, designed to be updated at least annually, but the underlying data were often complex to obtain - several needed a mixture of primary data and existing (e.g. modelled) data.
- Scientific validity was difficult to assess due to the emerging nature of most methodologies or the lack of uptake and availability of case studies thus far, but is likely to improve as indicators are tested.

- Linkages to global targets and policies were not clear. All indicators were only indirectly relevant to the SDGs or Aichi Targets, requiring further interpretation.
- All indicators would require some technical capacity to produce, although the indicators proposed by CISL, for example, were particularly simple to understand for non-technical users.

Overall, the review suggested that a single composite indicator could be a useful model for future indicator development, and that the methodologies proposed by CISL and IUCN's Biodiversity Indicator and Reporting System[4] had potential (with sector-specific adaptations, and further scientific review) to meet the needs and requirements identified by the companies during the interviews. More information on these two methodologies is provided in Table 3 below.

Table 3: Overview of composite biodiversity indicators considered potentially applicable to the extractives sector

Indicator	Overview of methodology	Users & uptake	Data required
Healthy Ecosystem Metric – Cambridge Institute for Sustainability Leadership (CISL)	A composite metric that encapsulates a company's impacts on a given ecosystem. Ecosystem impact is defined as the total land area of a company's operations and supply chains multiplied by its impact on biodiversity. Impacts are defined as changes in quantity or quality of biodiversity. Final metric provides a weighted land area that is adjusted for impact (reported in hectare equivalents).	Users: Companies with impact on land Uptake: Developing	Land area: ha required for company's operations & supply chain. Land use type: different land uses required for production of raw materials used by the company and the intensity of their management Sourcing locations to assess the impact on the quality of a particular habitat. Measure of biodiversity quality (forest cover, ecoregions).
Biodiversity Indicator and Reporting System (BIRS) – IUCN	Assessment of overall suitability of landholdings for biodiversity. Provides companies with information on how they are impacting ecosystems and habitats. Calculate biodiversity condition at all sites annually. Create a Site Biodiversity Condition Class for each assessed site. Once site-level Condition Classes have been measured they are aggregated to create regional/national and global indices.	Users: Cement & aggregates Uptake: in use	Types of habitat on site. Extent of each habitat type (i.e. quantity). Ecological condition of each habitat (i.e. quality), taking into account threats and measures to enhance habitats Ecological importance of habitats to develop a Habitat Context Factor.

4 https://portals.iucn.org/library/sites/library/files/documents/2014-055.pdf

3.4 Existing and emerging guidance from outside the private sector

There are multiple indicator frameworks in use by governments and conservation organisations at the global, regional and national scales. Review of these frameworks showed three to be of greatest potential utility: the Convention on Biological Diversity framework, the Essential Biodiversity Variables (EBVs)[5] approach and the Important Bird Area (IBA) monitoring approach.

- The Convention on Biological Diversity (CBD) and Sustainable Development Goal frameworks are not directly transferable to corporate indicators and monitoring. However, the indicators they use may have value. The global frameworks under the CBD and SDGs contain a very broad range of indicators for its goals and targets, many of which are not directly relevant or useful for companies. Some are only applicable at the global scale or do not provide useful information at smaller scales, whereas others can be applied at national or local scales.
- The Essential Biodiversity Variables approach could inform the development of a model around a core suite of indicators. This approach suggests a framework of core variables (e.g. species ranges & populations, species traits, ecosystem extent & structure) for monitoring at various scales, from which a comprehensive and scaleable picture of biodiversity status can be obtained. Several EBVs have potential for use by the private sector, while others are less appropriate. EBVs around ecosystem structure and diversity are likely to be particularly useful.
- The IBA Monitoring Approach could provide a simple and applicable model for extractives companies, being designed for use at site level in any context, to permit a comparable overview of pressures on and status of biodiversity (see Box two below). Unlike the other frameworks reviewed, this does not prescribe indicators but rather sets out an approach to score state and pressures at a given site in a way that is then comparable across sites and can be aggregated upwards.

Annex two presents the most relevant of these frameworks with a brief summary of each.

5 The 22 Essential Biodiversity Variables (EBVs) have been identified by the Group on Earth Observations Biodiversity Observation Network (GEO-BON) as a suite of basic “measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity”.

Box 2. Monitoring Important Bird Areas – BirdLife International[4]

Overview of methodology: Monitoring framework that provides Managers of Important Bird Areas (IBAs) with a standardised scoring system to record the condition of (i.e. "State") and threats (i.e. "Pressures") to IBAs, as well as the conservation actions that have been implemented in response to those threats (i.e. "Response").

Target user(s): IBA site managers supported by local communities and authorities.

Data required:
- Pressure: this includes information on the timing, scope, and severity of threats to biodiversity in the IBA.
- State: this measures the condition of IBAs (i.e. how much the IBA contributes to the maintenance of the most endangered species found within the IBA).
- Response: this includes information on the extent to which conservation actions cover the IBA, existence and quality of a management plan, and implementation of conservation measures.

Extent of use/uptake: Not widely used beyond the BirdLife International Partnership.

Twenty-two individual global indicators from the CBD indicator framework (which includes all biodiversity-relevant SDG indicators) and 18 of the Essential Biodiversity Variables, that were considered most applicable to the extractives sector were reviewed against the criteria on page nine.

- While the global indicator suites as a whole do not provide an appropriate framework for corporate use, some individual indicators could serve as a useful basis for corporate indicators. Some indicators could be directly disaggregated to any scale required, allowing indicators to be produced at minimal cost or effort to companies, while, for others, the methodology or underlying data could be used by companies.
- No existing global indicator scored perfectly against all criteria for direct use by companies. However, there are a number of potentially useful methodologies or underlying datasets that could be explored for their application at site level in conjunction with indicator providers, depending on the needs of the company. A number of existing global indicators offer access to near real-time high-resolution data, while several are based on new modelled data products such as the PREDICTS database (Newbold et al. 2012; www.predicts.org.uk), which may offer a cost-effective alternative for biodiversity data.

All models will require refinement and testing in consultation with companies.

Box 3. Three examples of global indicators and their potential use

Of the existing and operational global-scale indicators reviewed, a number scored highly and are worthy of further consideration. Three are discussed below:

- The **Wildlife Picture Index (WPI)** uses camera trap data to quantitatively measure changes in species variation over time. It can also be used for other presence/absence data, such as information collected using sound sensors. The data is collected from 17 protected areas in tropical forests, which are aggregated to provide the global index. As such, direct disaggregation of the indicator is possible but is only likely to be of use for sites in protected areas; the data itself may not be appropriate for use by companies, but the methodology has potential for use at the site level and for aggregation.
- **Trends in tree cover** is based on a data layer produced by Hansen *et al.* (2013). This high-resolution (30m) global remotely sensed dataset tracks trends in forest cover in near real time. This globally consistent and locally relevant indicator has the potential to be directly disaggregated by companies to site level, or there is also potential to use the underlying imagery data.
- The **Local Biodiversity Intactness Index** is based on a purpose-built global database of local biodiversity surveys combined with high-resolution global land-use data. The index provides estimates of human impacts on the intactness of local biodiversity worldwide, and how this may change over time. The indicator can be reported annually at a one kilometer resolution, giving great potential for site-level use. Further discussions with the indicator provider would be required to fully explore the ways in which the indicator and its data can be used, but in its current form there are clearly opportunities for direct disaggregation by companies.

The results of the review are included in Annexes three and four and more details on three indicators that showed most potential for use by companies are in Box three above.

4. MODELS FOR APPLICATION BY THE EXTRACTIVES SECTOR

A number of different models that could be explored for corporate indicator development in a potential follow on phase of this work. This section outlines those models and subsequent feedback from the Proteus Annual Meeting participants.

4.1 Different models for indicator development

Three models were suggested during interviews:

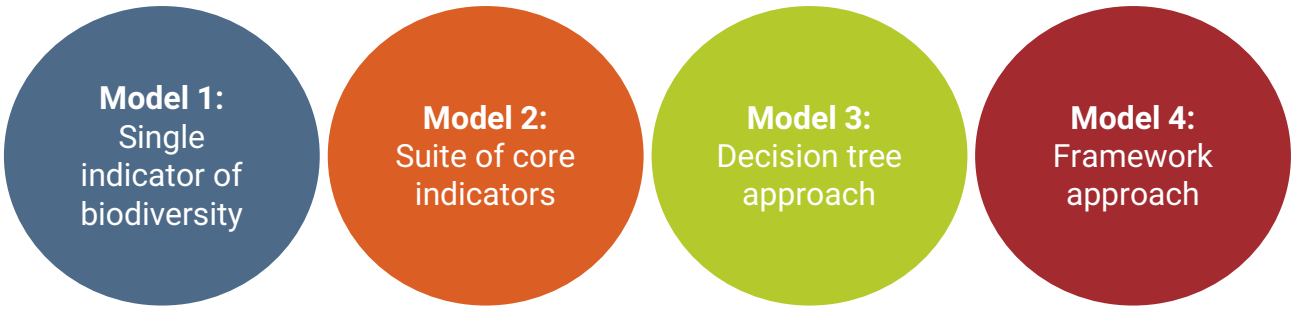
- **Model 1: Single indicator of biodiversity:** Single overarching biodiversity indicator, bringing together a number of 'core' elements into a single index.
- **Model 2: Suite of core indicators for measurement at all sites:** Identification of a small suite of core indicators to cover fundamental concerns common across all sites. These would serve as a 'minimum standard' – sites would identify additional indicators according to their needs.
- **Model 3: Decision tree approach:** Decision tree or similar (e.g. with thresholds/criteria) to help companies select 'core' indicators that are appropriate for different sites and contexts. This would therefore result in a more comprehensive suite of indicators, with some overlap across sites to allow aggregation and comparison where appropriate.

A fourth model was identified through desk research:

- **Model 4: Framework approach:** Provide guidance for indicator identification and then comparably assessing changes in state of the site using the state-pressure-response framework, pressure on a site or site level actions taken. Scores can be assigned to facilitate management decision making.

Although none of the identified approaches and methodologies could be used directly, there is significant existing material that could be further explored and built upon.

Figure 1: Four potential models for biodiversity indicators



Participants at the June 2017 Proteus Annual Members' meeting discussed the four models and reviewed each model's suitability for mining, oil and gas companies. Participants noted the various merits of all four models but felt that:

- No single model was currently ready for use.
- A single indicator would be of significant value, but participants also acknowledged the associated challenges, including the potentially limited ability to show a comprehensive picture.
- Some of the models are compatible and will feed into the others (e.g. the decision model could lead to a framework model, which could in turn lead to a single or suite of indicators).
- The core suite of indicators approach is less appropriate for an aggregated measure of performance than the other models.
- As none of the models have been tested as an aggregated corporate indicator, it was felt that further investigation was warranted before they could be used.

The section below gives a more detailed review of the participant's response to the individual models. Table 4 outlines an overview of the models and provides a summary of their strengths and limitations.

MODEL 1: SINGLE INDICATOR OF BIODIVERSITY

Participants agreed that a single aggregated indicator would be very valuable and answer an existing need. It would need to cover both risk and performance in order to reduce pressures and improve management. However, there is as yet no consensus with regards to the methodology that could achieve this. A range of methodologies exist of varying robustness / scientific credibility (outlined in table four). Participants acknowledged that this model could be limited in its ability to provide a comprehensive picture of performance, but still expressed a desire to develop a single indicator.

MODEL 2: SUITE OF CORE INDICATORS FOR MEASUREMENT AT ALL SITES

Participants highlighted that a key advantage of this approach is that it could be applied at all locations using a standardized methodology, allowing for easy aggregation. However, it was also noted that any set of variables or indicators would be industry-specific and therefore non-transferable.

The applicability of EBVs as a core suite of indicators was discussed, with participants noting that while EBVs are a good way to measure the state of biodiversity, businesses seek to measure their impact on biodiversity. Furthermore they are broad elements of biodiversity rather than indicators themselves and further work to define a supporting methodology is required. As such, EBVs do not work as an indicator in their current form. It was suggested that the concepts and thinking underlying the EBVs could be developed and adapted to identify a set of variables adapted to industry needs.

MODEL 3: DECISION TREE APPROACH

This model was perceived as having great potential due to its flexible approach. The technical challenge is that a decision-tree does not currently exist, and some work is required to ensure a developed tree is workable. It would also require regular updating. This approach would also still be dependent on the development of a core or broad suite of indicators in order to be of value.

Participants drafted a high-level decision tree model, identifying key elements and questions that would guide users through the process:

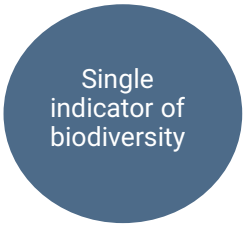
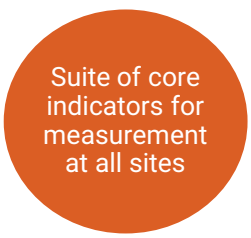
- The model starts with a high-level question aimed at helping users identify their motivations for developing indicators (e.g. for legal compliance, pressure from stakeholders, to understand risks and/or impacts).
- Users then specify what information they need and at what scale (e.g. site or corporate/global).
- The decision tree would help users to identify which biodiversity features to measure, what types of indicators they can measure (i.e. process, outcome, or policy indicators) and what the indicators tell users (i.e. whether they show trends or provide comparisons between different states of biodiversity).
- Finally, the decision tree would give users an idea of the frequency at which monitoring and evaluation would need to be carried out.

MODEL 4: FRAMEWORK APPROACH

Participants felt that the framework approach could work well as a corporate oversight model due to its flexibility, noting that the use of a simple framework for aggregation at the corporate level does not preclude complexity at the site level. The simple framework would have the additional benefit of being communicable. Participants did however outline a number of challenges including agreeing upon change thresholds and arranging site-level trials.

For a successful framework approach, two frameworks are likely need to be needed, as corporate users will need an overall picture of what is going on throughout the company, whereas site-level users will want to identify which specific actions need to be taken. The model would therefore need to be combined with a site-level review or auditing process to verify the approach undertaken and its consistency with the required framework.

Table 4: Overview of potential models for indicator development

Model	Benefits	Limitations
MODEL 1 	• Enable comparison across sites, across business units or across companies, even in different contexts • Potential to support or build on existing initiatives. • *Useful for communicating the main impacts**	• Bringing multiple elements into a single indicator often 'hides' individual trends of interest, and may as such present a misleading picture of progress. • Scientifically complex: would require significant work and consultation, including peer review. • *The methodology must be simple and easy to understand to facilitate uptake across multiple sites and business divisions.* • *The approach needs to be piloted both at corporate and site levels to ensure buy-in.* • *Participants felt that the development of one indicator for Pressure, State, and Response will be technically challenging. There is currently no composite indicator that can summarize these in a single number and existing indicators tend to focus on one aspect.* • *There is a need to consider how a single composite indicator would be placed among or against other indicators used.*
Example	• CISL's Healthy Ecosystem Metric	
Target user	Corporate/business unit level, to get a rapid overview of biodiversity impact and change over time across sites.	
MODEL 2 	• Fully comparable suite of indicators selected that can be aggregated to support company reporting • Applicable at all sites, and forming a minimum standard for site-level monitoring.	• May require selecting the 'lowest common denominator' in order to be applicable to all sites • May be unlikely to be fully comprehensive, so would need to be supplemented with additional site-specific indicators. • Any set of variables or indicators, would be industry-specific and therefore non-transferable.
Example	• Pitz et al. (2016) • Essential Biodiversity Variables	
Target User	Site level to ensure basic monitoring. Corporate level to aggregate site level data to report on corporate impact.	

*Text in italics represents additions from the Proteus Annual Meeting

Model	Benefits	Limitations
MODEL 3 	• Acknowledges and allows for the variability between sites and ensures comprehensive monitoring. • Clear guidance will ensure that the appropriate indicators are selected. • *The decision tree would give users an idea of the frequency at which monitoring and evaluation would need to be carried out.*	• Not all indicators would be used at all sites meaning it would not be comparable in its entirety. • Determining thresholds that would be applicable for all sites/contexts could be complex. • This approach would also still be dependent on the development of a core or broad suite of indicators in order to be of value. • No existing models to draw from

Example	None identified
Target user	Site level to ensure comprehensive monitoring. Corporate level to aggregate site level data to report on corporate impact

Model	Benefits	Limitations
MODEL 4 	• Flexibility allows application at and comparison across very diverse sites. • Easy for non-specialists to apply. • Simple framework could be communicable.	• Relatively subjective and simplistic. • Two frameworks are likely needed (site-level and corporate) • Would need to address cumulative impact attribution • May be problematic to agree on change thresholds • Site level trials would be required

Example	The monitoring framework for Important Bird Areas
Target User	Site level to compare change in biodiversity status and pressures over time Corporate level to get a rapid overview of biodiversity impact and change over time across sites.

4.2 Next Steps

Overall, there is sufficient knowledge and a strong business case to work to develop biodiversity indicators that provide an insight into corporate performance within the Proteus membership. Proteus Annual Meeting participants expressed a desire to test the models through a number of pilot sites using existing data. Such testing would require cross sector collaboration and coordination to enable lessons learned to be extracted and a generally accepted indicator framework to be developed, which is complimentary to government policies and the Sustainable Development Goals (SDGs). It should be designed with multiple users in mind e.g. corporate head office, management, investors.

IPIECA's reporting guidance is being revised in the coming two years; there is an opportunity to use this work to improve the process-based measures set out in that guidance. UNEP-WCMC will be exploring how this work can be taken forward in collaboration with key partners.

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ANNEXES: BIODIVERSITY INDICATORS FOR EXTRACTIVE COMPANIES

These annexes provide the details of the methodology used and assessment of indicators that underpin the report 'Biodiversity Indicators for Extractive Companies'.

ANNEX 1: METHODOLOGY

OBJECTIVES

To understand industry drivers for biodiversity indicators, generate clarity about definitions of biodiversity indicators amongst different stakeholders and undertake in initial assessment of indicator methodologies (phases 1). This is the first phase of an ongoing project that aims to develop in conjunction with a broader range of partners a set of biodiversity indicators that meet the extractive sector's needs for better measurement, monitoring and management of impacts and are designed with a view to enabling cross sector comparison.

PART ONE: TELEPHONE INTERVIEWS WITH COMPANY REPRESENTATIVES

Telephone interviews were conducted with individuals from 11 companies. Each interview lasted approximately one hour and followed a standard set of questions in order to ensure consistent information obtained. The approach for the interviews was closely coordinated with Cambridge Institute for Sustainability Leadership (CISL), which had recently conducted a similar piece of work[7], in order to ensue results could be compared and contrasted, and common themes identified. Each interview focussed first on the drivers for monitoring and measuring biodiversity, before moving on to current practices (including the levels at which monitoring takes place, the types of indicators produced, challenges and key requirements for biodiversity indicators).

PART TWO: DESK-BASED STUDY

The second part of the work involved desk-based research to identify and appraise existing and emerging guidance, methodologies, indicators, frameworks and approaches to monitoring. Sector-specific and general guidance was identified and reviewed to determine if indicators were clearly specified, and, if so, whether they provided quantifiable means of assessing biodiversity impact. A literature review also sought to identify academic and grey literature in which biodiversity-related indicators had been identified for the extractives sector and broader private sector. This was complemented by an online survey that was disseminated to Partners in the Biodiversity Indicators Partnership and a range of Platforms on Business and

7 Di Fonzo, M. & Hime, S., (2017), 'How businesses measure their impacts on nature: A gap analysis', *University of Cambridge Institute for Sustainability Leadership (CISL), Working Paper 01/2017*

Biodiversity. In addition, existing global, regional, national and general conservation monitoring frameworks were reviewed for their potential relevance and usefulness for the private sector. Based on the responses from the interviews, and on a number of established means for assessing indicators (e.g. BIP 2011, Tittensor *et al.* 2014, Chenery *et al.* 2015), eight criteria were identified for assessing the relevance and usefulness of existing biodiversity indicators for use by the extractive sector. For each of these criteria, three categories were identified, which range from the least suitable option ('1') to the ideal option ('3'). For a number of these, particularly the usefulness for business decisions and potentially also spatial extent (which covers the ability to use an indicator at site level and aggregate it up to business unit or corporate level), an indicator that fell into category '1' could be considered as not appropriate for use. For other criteria, such as sensitivity to change or ease of communication, an indicator that fell into category '1' might not be automatically discounted but may require further exploration.

The categories were weighted according to their perceived importance to businesses, with scientific validity and policy relevance weighted as '1' and all other categories weighted as '2'. 'Policy relevance' was considered a non-essential category and therefore weighted accordingly. Equally, while scientific rigour is of course important, it takes years of development, review and refinement for an indicator to be considered unequivocally 'valid', which may be unattainable; as such, scientific validity was weighted as a '1'. From the global indicator frameworks and sector-specific methodologies reviewed, a number of relevant indicators were identified, which were then assessed against the criteria above. Indicators were discounted if they were considered not directly relevant to biodiversity, if they were not appropriate for company use (e.g. counts of countries that have implemented a policy), or if they were not yet operational. Scores were used to give an indication of those which would most likely be worth further exploration for use by companies.

LIMITATIONS

- Biodiversity is inherently linked to the wider environment, and, as such, environmental indicators such as water or soil quality are often considered as indicators of biodiversity. For example, a decline in freshwater quality will impact on freshwater biodiversity. However, for the purposes of this review, we limited consideration of indicators and monitoring to biodiversity in the more traditional sense, and omitted broader environmental issues.
- The report does not consist of a scientific critique of the methodologies and approaches, but rather a high-level screening, which was conducted using readily available information and without wider consultation. As such, there may be issues or flaws in the methodologies that were not identified through the review.
- Consultations with organisations involved in the development of the methodology or approach may reveal more potential than was initially identified.

Table 11: Criteria for evaluation of existing indicator methodologies against user needs

Criteria	Weight	Categories
1. Business relevant:	2	1. Indicator not useful or relevant for company 2. Indicator useful for company but requires additional information/indicators 3. Indicator fulfils all data/evidence needs
2. Spatial extent:	2	1. Applicable at site (local) level; aggregation to or use at greater scale not appropriate or very complex OR applicable at national/regional/global level, disaggregation to site level not possible. 2. Applicable at site (local) level, but with ability to aggregate certain aspects of underlying data across multiple sites to scale of interest (business unit, corporate etc.) Or applicable at global level but can be disaggregated to site level 3. Applicable at site (local) level, but able to aggregate indicator across multiple sites to scale of interest (business unit, corporate)
3. Sensitivity to change:	2	1. Monitoring required over long periods to detect change (e.g. >10 years) 2. Monitoring required over medium to long periods to detect change (5-10 years) 3. Monitoring can detect change rapidly (0-5 years)
4. Data availability /accessibility:	2	1. Primary data must be collected at site level but complex and/or expensive to collect 2. Primary data must be collected at the site level but relatively quick and cost effective; or data is available e.g. online but must be purchased/access not straightforward 3. Data readily available and will continue to be available
5. Scientifically valid*:	1	1. Methodology of indicator or use of indicator to assess change in the issue of interest is not appropriate, unknown or untested 2. Methodology of indicator is recognised but some concerns over use/utility 3. Indicator methodology widely accepted – e.g. peer reviewed and widely used
6. Ease of communication	2	1. Only understandable by technical people 2. Needs some explanation for non-technical people 3. Easy to communicate the story that the indicator is telling to non-technical people
7. Ease of production:	2	1. Only producible by technical people 2. Needs some training for non-technical people 3. Easy to produce for non-technical people
8. Relevance to global policy*:	1	1. Not relevant to the Aichi Targets or SDGs 2. Indirectly relevant to the Aichi Targets and/or SDGs (requires some explanation) 3. Directly relevant to the Aichi Targets and/or SDGs (link is evident)

** Considered non-essential criteria, and therefore weighted as '1' in scoring. All six other criteria weighted as '2'.*

ANNEX 2: EXISTING SECTORAL, GLOBAL, REGIONAL AND NATIONAL APPROACHES, FRAMEWORKS AND INDICATORS REVIEWED

This annex summarises the review of sector-specific guidance documents, peer-reviewed and grey literature, and global/regional conservation and policy monitoring frameworks against a set of evaluation criteria drawn from industry interviews and established criteria for good indicators (see Annex 1).

Guidance, Approach or Framework Extractive sector focused	Indicators suggested	Potential for use by companies?
Energy and Biodiversity Initiative: Biodiversity Indicators for Monitoring Impacts and Conservation Actions Process for developing indicators, which consists of 9 actions.	It gives a few example indicators within the guidance, but these are not intended to be used 'off the shelf' or to provide comprehensive monitoring, just as examples. Examples • **Species indicators e.g.** Globally threatened and data deficient species in area • **Habitat indicators e.g.** Operational site overlap with Conservation Priority Areas containing globally threatened or restricted range specie • **Management indicators e.g.** Sites with biodiversity action plans (BAPs) • **Industrial process indicators e.g.** Emission / discharge outputs	**Some potential value but not sufficient** Provides a useful framework but no specific indicators for monitoring
IPIECA, Energy API, IOGP: Oil and gas industry guidance on voluntary sustainability reporting Section E5 on Biodiversity and Ecosystem Services gives a brief overview of the type of information that companies might report on relative to biodiversity and ecosystem services.	No specific indicators given; qualitative descriptions against a number of specific headers such as how BES considerations are incorporated into environmental management systems, adaptive management etc. For example: " Describe how mitigation of dependencies and potential impacts of planned activities, management of associated potential risks and identification of enhancement opportunities related to BES is integrated into the company's HSE management systems."	**Some potential value but not sufficient** • No specific indicators provided • Qualitative rather than quantitative approach
IPIECA BES Fundamentals	The guidance sets out good practice in developing and using indicators at the site and company levels. It also offers some case studies, but does not propose indicators for use.	**Some potential value but not sufficient** - Provides a useful approach and guidance for indicator

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
Sets out a management framework comprised of six interrelated BES management practices		development, but no specific indicators for monitoring
ICMM: Good Practice Guidance for Mining and Biodiversity An overarching guidance document for incorporating biodiversity into planning and management of mining sites.	Contains a short section on developing indicators but no specific indicators suggested.	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring
Towards Sustainable Mining Assessment Protocol Guidance to facilities in completing their evaluation of biodiversity conservation management against TSM indicators	Identifies three corporate performance indicators each with criteria to allow assessment: 1. Corporate biodiversity conservation commitment, accountability and communications 2. Facility-level biodiversity conservation planning and implementation 3. Biodiversity conservation reporting	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring
Initiative for Responsible Mining Assurance: Standard for Responsible Mining Is intended to provide a standard that is applicable to all kinds of industrial mining, including 2 biodiversity-relevant chapters.	Covers all areas of sustainability, and within the section on 'Environmental Responsibility' are two chapters: 'Protected Areas', and 'Biodiversity outside Officially Protected Areas', which contain in total 3 indicators: The number, area and proportion of Highly Protected Areas that are impacted or threatened by mining projects and related activities. The number and area of protected areas per mining project that are impacted or threatened by mining and related activities. The extent and condition of areas identified as containing or likely to contain HCVs 1 – 3 and affected (positively or negatively) by mining and related activities.	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring
Azapagic, A. (2004) Developing a framework for sustainable development indicators for the mining and minerals industry *Journal of Cleaner Production 12 639–662*	Contains 10 principles, each with one or more criteria underneath them, each of which has associated 'indicators'. However, these indicators are actually more a checklist of actions rather than indicators that would guide impact monitoring	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring
General private sector focused		
BBOP Standard on Biodiversity Offsets Aims to help auditors, developers, conservation groups, communities, governments and financial institutions	Provides a set of principles, criteria and indicators as a standard for offsets. 'Principles' are interpreted as the fundamental statements about a desired outcome. 'Criteria' are the conditions that need to be met in order to comply with a Principle. 'Indicators' are the measurable states that allow the	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
that wish to assess biodiversity offsets against the BBOP Principles, Criteria and Indicators.	assessment of whether or not a particular Criterion has been met. Indicators are largely implementation/process focussed and qualitative in nature. Although they do request that, e.g., evidence is provided that conservation gains from offsets are calculated, the indicator does not specify how or that this is done quantitatively.	
Global Reporting Initiative Standards 304: Biodiversity The GRI provides a clear standard for reporting on biodiversity, as well as having a number of sector-specific guidance documents that identify additional reporting that would be required for different sectors.	The standard identifies a number of specific indicators for companies to report on, although these largely identify any activities in sites of particular importance for biodiversity, the nature of potential impacts, and any restoration efforts. They do not focus on quantifying actual impact at or across sites. Example indicators: Position in relation to the protected area (in the area, adjacent to, or containing portions of the protected area) or the high biodiversity value area outside protected areas; Nature of significant direct and indirect impacts on biodiversity Disclosure 304-4 IUCN Red List species and national conservation list species with habitats in areas affected by operations **Oil and gas sector specific indicators, e.g.** Number and percentage of significant operating sites in which biodiversity risk has been assessed and monitored **Mining and minerals sector specific indicators, e.g.** Amount of land (owned or leased, and managed for production activities or extractive use) disturbed or rehabilitated	**Some potential value but not sufficient** - Many companies already reporting at least partially on biodiversity disclosures - Does not quantify impact and therefore help companies better manage biodiversity
CSBI Good Practices for the Collection of Biodiversity Baseline Data Contains 5 steps for developing a biodiversity baseline and guidance on designing a sampling strategy, including determining what metrics to use (surrogates or direct measures). Brief introduction to data collection and analysis for different habitats, species groups and ecosystem services.	There are no indicators 'prescribed' through the guidance, but a number of indicators or indicator subjects are mentioned as variables/issues that may want to be measured. Indicators mentioned in the report include: - Highly threatened or unique habitats - Key Biodiversity Areas - Species with restricted ranges	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
IFC Performance Standard 6 Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.	IFC PS6 does not stipulate specific indicators/monitoring, but provides a number of requirements for which indicators would need to be identified in order to demonstrate that the requirement were being met.	**Some potential value but not sufficient** - Provides a useful framework but no specific indicators for monitoring
Other sector-specific guidance and approaches		
Cement Sustainability Initiative Biodiversity Management Plan Guidance This guidance document provides a step-by-step guide to producing a Biodiversity management Plan, with Stage 6 focussed on "Reviewing, revising and reporting on the BMP"	It notes four biodiversity-related Key Performance Indicators (one of which is a rehabilitation KPI). • Biodiversity KPI 1: Number of active quarries within, containing or adjacent to areas designated for their high biodiversity value (number and coverage), biodiversity value as defined by GRI EN11 • Biodiversity KPI 2: Percentage of quarries with high biodiversity value (according to KPI 1) where biodiversity management plans are actively implemented • Biodiversity KPI 3: Percentage of sites with community engagement plans in place • Rehabilitation KPI: Percentage of active quarries with quarry rehabilitation plans in place. To complement this work, the Guidelines on Quarry Rehabilitation have been published.	**Some potential value but not sufficient** - Not a comprehensive framework - No quantification of actual impact
IUCN: Biodiversity management in the cement and aggregates sector Biodiversity Indicator and Reporting System (BIRS) Developed to help companies in the cement and aggregates sector monitor and evaluate changes to biodiversity on their landholdings, through repeated, consistent assessment and aggregation of the suitability of these landholdings for biodiversity.	Outlines 6 main steps in defining a site's Biodiversity Condition Class, which is calculated based on a number of other indices derived over the course of the process. A site threat score is also reported. These can be aggregated to, e.g. country or company level.	**Potential for use of indicator** • Site based indicator designed to be aggregated to other levels useful for company decision • Methodology has potential to be applied to extractives sector
Pitz, C. *et al.* (2016) Developing biodiversity indicators on a stakeholders'	Defines a suite of core indicators for gypsum quarries, following in depth consultation. Indicators include:	**Potential for use of indicator suite**

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
opinions basis: the gypsum industry Key Performance Indicators framework *Environ Sci Pollut Res (2016) 23:13661–13671*	• Number/abundance of protected and Red list species in the quarry • Abundance of protected/Red list species in the quarry • Number/surface of habitats in the quarry • Numbers of invasive alien species in the quarry • Freshwater quality	- Could forma basis for a core suite of indicators to be defined for companies - Would need further consultation to ensure appropriateness for extractives sector
SPOTT: Indicators The Sustainable Palm Oil Transparency Toolkit assesses 50 of the world's largest palm oil producing companies against over 50 indicators using publicly available information on disclosure of their operations and their commitments to environmental and social best practice.	SPOTT identifies a number of 'indicators' on which companies are assessed and scored, mostly with an implementation focus. Most are yes/no questions, with an implementation/process focus and a focus on disclosure e.g. - Is the company an RSPO member? - What percentage of the company's total estates is RSPO certified? - Has the company publicly disclosed its total planted area? Are SEIA assessments publicly available? Yes/No.	**Limited** - Largely sector-specific yes/no questions - No quantification of impact
Global frameworks and approaches		
Convention on Biological Diversity Framework of over 150 indicators, used by the global biodiversity community. Most are operational, structured around the 20 Aichi Biodiversity Targets.	Example of potentially useful indicators: • Global Ecosystem Restoration Index; • Biodiversity Habitat Index; • Species habitat index; • Red List Index; • Living Planet Index.	**Some individual indicators** • Comprehensive suite of indicators selected primarily due to availability or current development efforts, not purpose-built • Many can be used at the national or local scale, either by direct disaggregation, using underlying data or using the methodology • Individual indicators would need to be selected based on company needs, rather than adopting the whole suite, some are more relevant than others • Some indicators only relevant or useable at the global level

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
		• Some may be useable at the national or site level, but may not be very robust at fine scale • Some are not operational
Sustainable Development Goal Indicators Framework of ~230 indicators corresponding to the 169 SDG targets, under 17 Goals. Many go far beyond biodiversity, with two Goals (14 and 15) focussed on biodiversity and a number of others (e.g. 6, 13) highly relevant.	Example of potentially useful indicators: Red List Index, Forest Cover as a Percentage of Land Area	**Some individual indicators** • Global indicators are mostly aggregated from national level data, which has been or will be made publicly available. Methodologies must be made available and could potentially be used by companies with their own data. • Many of the indicators, particularly those under Goals 14 and 15 related to biodiversity, are still under development and will not be ready for some time. • Only a few focus on biodiversity-related issues.
Essential Biodiversity Variables Defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity	• Taxonomic diversity • Net primary productivity • Nutrient retention	**Some individual variables, or as a possible model for future work** • - Suite of basic measures that could (mostly) relatively easily be applied by companies, and are often derived using remote sensing, reducing the need for costly primary data collection • Certain EBVs would be more relevant than others – some are too detailed • Can be used as the basis for more complex indicators • A monitoring framework based on the EBVs would be scaleable and allow aggregation

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
Regional frameworks and approaches		
Streamlining European Biodiversity Indicators (SEBI) European set of over 26 biodiversity indicators to assess and inform about progress towards European and global targets	• Species of European Interest • Fragmentation of natural and semi-natural areas • Marine Trophic Index of European Seas	**Some individual indicators** • Almost all the indicators are well-developed, have many data points and are produced consistently by countries (often beyond EU28), meaning much data is available • Cover a broad range of topics • Some underlying methodologies may be of interest for companies • Primarily European coverage • Focus on European priorities, e.g. Species/habitats listed on the Birds and Habitats directives, limited relevance for wider use
Managing Natura 2000 Sites Guidance document intended to facilitate the interpretation of Article 6 by competent authorities in Member States.	• No specific indicators are referenced, although provides some guidance on indicators for defining conservation status of a natural habitat or a species, which could be useful for companies in determining (change in) conservation status at sites	**Limited** • Guidance given on determining deterioration of habitats and disturbance of species • Does not provide technical detail for, e.g., monitoring or analysis
National policy frameworks and approaches		
IUCN: Corporate Biodiversity Reporting and Indicators: Situation Analysis & Recommendations Analyses the current French legal context for biodiversity reporting and provides a series of recommendations of types of information for reporting.	Each recommendation contains 'proposals for information or indicators to publish', which detail some types of indicators/information, and give some specific examples. Biodiversity-specific indicators include: • Number of production processes that need to be located near an environment supplying an ecosystem service. • Indicators of habitat destruction, modification, uniformization, fragmentation and the disturbance/destruction of flora and fauna. • Number or percentage of sites in which the ecological richness is progressing	**Some potential value but not sufficient** - Provides a useful framework but indicators are not clearly defined; I is left to the company to determine the indicators.
Conservation frameworks and approaches		

Guidance, Approach or Framework	Indicators suggested	Potential for use by companies?
BirdLife International: Monitoring Important Bird Areas (IBAs): A global framework Provides a simple, standardised approach for assessing (change in) status of and pressures on biodiversity at the site level that is easily comparable.	No specific indicators referenced, but guides user in scoring change in status or threats.	**Possible model for future work** • Intended for use at site level and can be aggregated up to any required level, e.g. country or global – it could equally provide a comparable and standardised approach to assessing biodiversity status and pressures for companies • Relatively simple approach, which could be implemented and understood by non-specialists • The scoring system is relatively simple and could therefore miss subtle changes in biodiversity that are nonetheless important.

ANNEX 3: SELECTED GLOBAL INDICATORS FROM THE CBD AND SDG FRAMEWORKS: REVIEW OF USE FOR COMPANIES

The table below reviews 22 individual global indicators from the CBD indicator framework (which includes all biodiversity-relevant SDG indicators) against the criteria in Annex 1.

Indicator	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Data/Indicator/ Methodology for use?	Total
Ecological footprint Compares human demand on nature against nature supply.	2	2	2/3	2	2	3	1	3	D/I/M	30
Trends in tree cover Based on Hansen et al.'s remotely sensed dataset, shows near real-time trends in tree cover	2	3	3	3	3	3	2	3	D/I	38
Forest area as a percentage of total land area (indicator for SDG target 15.1) Uses nationally reported figures on forest cover produced by FAO	2	1	3	3	3	3	2	3	M/D	34
Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type (indicator for SDG target 15.1) Overlays Key Biodiversity Areas with Protected Areas	2	1	1[8], 3[9]	3	3	3	2	3	D/I/M	32
Wetland extent trends A global and regional dataset showing trends in wetland extent, based on a detailed review published literature	1/2	1	2	1	2/3	3	1	3	I/M	25
Biodiversity Habitat Index Uses biologically-scaled environmental mapping and modelling to estimate impacts of habitat loss, degradation and fragmentation on retention of terrestrial biodiversity globally, from remotely-sensed forest change and land-cover change datasets.	2/3	3	3	2	2	3	1	3	I/M	34
Species Habitat Index Quantifies changes in suitable habitats of single species to provide aggregate estimates of potential population losses and extinction risk increases in a region or worldwide.	2/3	3	3	2	2	3	1	3	I	34

8 KBA data: not regularly updated
9 Protected area data regularly updated and freely available

Indicator	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Data/Indicator/ Methodology for use?	Total
Proportion of fish stocks within biologically sustainable levels (indicator SDG target 14.4) Produced by FAO at global level & gives information on the proportion of overexploited, fully exploited and non-fully exploited fish stocks.	2	1	2/3	1	2/3	3	1/ 2	3	I/M	28
Wild Bird Index Shows average trend in relative abundance of a group of bird species during the breeding season	2	1	3	1	3	3	1	3	I/M	28
Water Quality Index for Biodiversity Based on data compiled from >6000 monitoring stations globally, this indicator looks at change in scores (excellent-good-poor) and infers implications for biodiversity	2	2	2	1/2	2/3	3	2	3	D/I/M	31
Climatic Impact Index for birds Measures divergence between weighted population trends of bird species whose populations are thought to have been favoured/disadvantaged by recent climatic change	1/2	1	1	2	2/3	2	1	3	I	23
Percentage of terrestrial and inland water areas covered by protected areas Looks at the percentage of land area that is protected (e.g. in relation to the global 17% target)	1	2	3	3	3	3	2	3	D/I/M	34
Coverage of protected areas in relation to marine areas (indicator for SDG target 14.5) Percentage of the ocean that is protected (e.g. in relation to the global 10% target)	1	2	3	3	3	3	2	3	D/I/M	34
Protected area coverage of terrestrial and marine ecoregions Assesses how well represented the world's ecoregions are in protected areas.	1	2	3	3	3	3	2	3	D/I/M	34
Red List Index (indicator for SDG target 15.5)* Assesses change in conservation status (endangered, least concern etc.) for species/species groups	2	2	2	2	3	3	2	3	D/I/M	26
Species Protection Index* Measures how much suitable habitat for single species is under protection and estimates the regional or global biodiversity representativeness of terrestrial protected areas.	2	2	3	1/2	2	2	1	3	I/M	28
Protected area management effectiveness Considers the number/proportion of sites that have undergone management effectiveness assessments	1	3	2	2/3	3	2	3	1	I/M	30.5
The Wildlife Picture Index Using camera traps, provides trends in populations of species across sites in the tropics	3	3	2	2/3	3	2	3	2	D/I/M	35.5

Indicator	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Data/Indicator/ Methodology for use?	Total
Living Planet Index* Calculated using time-series data on more than 14,000 populations of over 3,700 vertebrate species from around the globe.	1/2	2	2	3	3	1	3	2	I/M	30
Local Biodiversity Intactness Index Estimates how much of a terrestrial site's original biodiversity remains in the face of human land use and related pressures.	3	3	2	2	3	1/2	3	2/3	I	34.5
Ocean Health Index Assessment framework that comprehensively evaluates marine environments in a way that is standardized yet tailorable to different contexts and spatial scales	1	2/3	3	2/3	3	1/2	3	2	I/M	32
Global Ecosystem Restoration Index Composite index that integrates structural and functional aspects of the ecosystem restoration process, in relation to a baseline for degraded ecosystems.	3	2	1	2	1/2	1	3	2	I/M	27.5

** This indicator can be disaggregated for different species groups according to needs*

ANNEX 4: REVIEW OF THE ESSENTIAL BIODIVERSITY VARIABLES

The table below reviews 18 of the Essential Biodiversity Variables that were considered most applicable to the extractives sector against the criteria in Annex 1.

Description	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Total
Species distribution Presence surveys for groups of species easy to monitor, over an extensive network of sites with geographic representativeness. Potential role for incidental data from any spatial location	2	3	2	1/2	n/a	3	2	2	27
Population abundance Population counts for groups of species easy to monitor and/or important for ecosystem services, over an extensive network of sites with geographic representativeness	2	3	3	1/2	n/a	3	2	2	**29**
Population structure by age/size class Quantity of individuals or biomass of a given demographic class of a given taxon or functional group at a given location	2	3	3	1/2	n/a	3	2	2	29
Phenology Record timing of periodic biological events for selected taxa/phenomena at defined locations. Examples include: timing of breeding, leaf coloration, flowering, migration	1	2	3	2	n/a	2	1/2	2	23
Body mass Body mass (mean and variance) of selected species (e.g. under harvest pressure), at selected sites (e.g. exploitation sites)	1	1	2	1	n/a	2	2	1	19
Natal dispersion distance Record median/frequency distribution of dispersal distances of a sample of selected taxa. In marine species larval lifetime may be a useful surrogate	1	1	1	1	n/a	1	1/2	2	13
Migratory behaviour Record presence /absence / destinations / pathways of migrant selected taxa	2	2	2	1	n/a	2	1/2	2	21
Demographic traits Effective reproductive rate (e.g. by age/size class) & survival rate (e.g. by age/size class) for selected taxa at selected locations	2	2	2	1	n/a	2	1/2	1/2	20

Description	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Total
Physiological traits For instance, measurement of thermal tolerance or metabolic rate. Assess for selected taxa at selected locations expected to be affected by a specific driver	1	2	2	1/2	n/a	1	1/2	2	16
Taxonomic diversity Multi-taxa surveys and metagenomics at selected in situ locations at consistent sampling scales over time. Hyper-spectral remote sensing over large ecosystems	3	3	2	1/2	n/a	3	2	2	29
Species interactions Studies of important interactions or interaction networks in selected communities, such as plant-bird seed dispersal systems	2/3	2/3	2	1	n/a	2	1	2	17
Net primary productivity Global mapping with modelling from remote sensing observations (Fraction of Absorbed Photosynthetically Active Radiation, ocean greenness) and selected in-situ locations (eddy covariance)	2	3	3	2/3	n/a	3	1/2	2	**26**
Secondary productivity Measurement of secondary productivity for selected functional groups, combining in-situ, remote sensing, and models. Example functional groups include: fisheries; livestock; krill; herbivorous birds	1/2	2	3	2	n/a	3	2	2	**27**
Nutrient retention Ratio of nutrient output from the system to nutrient input, measured at selected in situ locations. Can be combined with models and remote sensing to extrapolate regionally	1/2	2	3	1	n/a	2	1	2	**21**
Disturbance regime Type, seasonal timing, intensity and frequency of event-based external disruptions to ecosystem processes and structure. Examples: sea surface temperature and salinity (RS); scatterometry for winds (RS); trawling pressure (in situ); flood regimes (in situ); fire frequency (in situ, RS); cultivation/ harvest (RS); windthrow; pests (in situ)	2	2	3	1/2	n/a	2	1	2	23
Habitat structure Remote sensing measurements of cover (or biomass) by height (or depth) classes globally or regionally, to provide a 3-dimensional description of habitats	3	3	3	3	n/a	3	2	3	37

Description	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid	Communication	Production	Policy relevance	Total
Ecosystem extent and fragmentation Local (aerial photo and in-situ monitoring) to global mapping (satellite observations) of natural/semi-natural forests, wetlands, free running rivers, coral reef live cover, benthos cover, etc.	3	3	2/3	2	n/a	3	1	3	**28**
Ecosystem composition by functional type Functional types can be directly inferred from morphology (in situ) or from remote sensing	3	3	2	3	n/a	3	2	3	35

ANNEX 5: REVIEW OF EXISTING AND EMERGING METHODOLOGIES

This Annex sets out the results of a review of private sector biodiversity indicator initiatives against extractive sector needs set out in Annex 1.

Description	Target user	Business relevance	Spatial extent	Sensitivity to change	Data availability/ accessibility	Scientifically valid*	Communication	Production	Policy Relevance*	Total
Healthy Ecosystem Metric (CISL) Provides a composite metric that encapsulates a company's impacts on a given ecosystem.	Finance & agriculture sector	3	3	2	2	1/2	3	2	2	33.5
Return on Investment index (IUCN): *Site-based measure either of the potential for intervention to achieve reduction in threats (and hence reduction in extinction risk), or of the reduction in threats achieved over time.*	Finance sector - impact investment	3	3	2	2	1/2	2	1/2	2	30.5
Normative Biodiversity Metric (Ecometrica): Assesses quality of the habitat on land owned by an organisation producing a quantitative biodiversity score to track performance over time.	Organisations that own and manage land.	3	3	3	2	1/2	3	2	2	35.5
Global Biodiversity Score (CDC): Identifies the causes of biodiversity erosion by reallocating it to responsible economic activities.	Private sector	2	2/3	1	2	1/2	2	1	2	23.5
Biodiversity Indicator and Reporting System (IUCN): Assesses suitability of land holdings for biodiversity giving site level measure of biodiversity condition. Provides companies with information on how they are impacting ecosystems and habitats.	Cement and aggregates companies	3	3	3	1/2	1/2	2	2	2	31.5
Habitat Hectares (Victorian Department of Natural Resources and Environment (NRE)/Parkes *et al.* 2003): Comparisons between existing vegetation features and those of 'benchmarks' representing the average characteristics of mature stands of native vegetation of the same community type in a 'natural' or 'undisturbed' condition.	Varied sites	2	2/3	2	1	1/2	3	2	2	28.5

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