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Integrating the value of natural capital into private and public investment: the role of information

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Key findings and recommendations

Definitions and scope

1. This paper reviews how information, broadly defined, can underpin and facilitate investment in living natural capital. Here, this is taken to mean a *stock* of biodiversity (from which *flows* ecological services of benefit to people).
2. Maintaining the stock is a pre-requisite for maintaining the flows. A focus on stocks also recognizes nature's many, poorly-accounted values, including option and existence values, beyond those immediately evidenced through goods and services. Future generations may also derive different benefits from, and accord different values to, natural capital than we do now.
3. The technical sections of the paper deal with definitions, the information base, metrics to assess natural capital, biodiversity asset characteristics to facilitate investment, and tools for upstream project design.
4. Both public and private investment are examined, but the main focus is private investment in biodiversity markets. Such markets are generally based on spatial differences in opportunity cost. This is where information may have the most crucial role in supporting or, if inadequate, constraining investment.

Information base

5. The use of natural capital in Government and corporate accounting is growing. However, the focus remains mainly on abiotic natural capital, or on ecosystem services. Measures for biodiversity stocks need further development. For policy consistency and to minimise duplication of effort, this should build on and reinforce existing measures related to the Aichi Biodiversity Targets agreed under the

Convention on Biological Diversity (CBD). A number of the Targets are directly relevant to investment in natural capital.

6. National Biodiversity Strategies and Action Plans, revised to reflect the Aichi Targets, are effectively plans for maintaining and improving the natural capital base. NBSAPS can form a framework for policies that enable investment in natural capital, and for determining investment priorities.
7. Globally, information on key variables (species richness, abundance and distribution, and habitat area and condition) remains patchy and incomplete, though global datasets are rapidly improving, with important contributions from citizen science. The set of knowledge products mobilised by IUCN provide essential information, but need further development and consolidation. Modelling the extent of suitable habitat for individual species is likely to prove particularly useful, and such maps would ideally be made available through the IUCN Red List of Threatened Species.
8. Effective, integrated information systems for natural capital are crucial and need urgent development or strengthening. There are good models for such hubs (e.g. in Brazil, Mexico, South Africa, ASEAN and the European Union) that other countries and regions could draw on. Detailed, spatially-explicit national conservation plans have been derived from this information in a few countries (e.g. South Africa). Such plans provide an excellent basis for directing public and private investment in biodiversity.
9. As part of and alongside such processes, there is need to develop better national capacity for biodiversity survey, mapping and monitoring. Resources for this could be found by assigning a proportion of payments for transactions in natural capital markets to capacity development.

Metrics – general considerations

10. The particular characteristics and local uniqueness of biodiversity make it challenging to develop fully fungible natural capital metrics. This means that there will always be an element of barter (exchanging different kinds of goods) in markets for living natural capital.
11. Metrics do not have to be technically perfect, however: they succeed if they effectively support the achievement of policy objectives. Additional rules for exchanges may be needed to avoid unintended negative consequences. Metrics may have a directing effect on markets, so do need to be carefully chosen.
12. Equivalence in natural capital exchanges has dimensions of type, space and time. Equivalency of type relies on the measures used to assess biodiversity (e.g. area of habitat) and how these are combined into a metric that can represent key biodiversity attributes.
13. Spatial equivalency has aspects concerning (i) connectivity and fragmentation and (ii) the local nature of biodiversity (and the ecosystem services it supports). Spatial equivalency is often a practical issue for management of business risk, where biodiversity elements are localised or there is strong local dependence on specific ecosystem services.
14. Exchanges for potential, rather than actual, natural capital raise issues of equivalency in time, concerning increased risks, foregone benefits and lost growth in value. Where these risks are deemed unacceptable, natural capital banks may need to operate only with ready assets.
15. There are clear trade-offs between the complexity and completeness of metrics and the effective functioning of markets. The appropriate balance point will depend on policy objectives.

Financial compensation

16. The policy goal of a natural capital market may be to implement a high-level conservation plan that has already been designed and agreed. In this case, money is the appropriate metric. In-lieu fees may also be appropriate for offsetting cumulative impacts of low significance, where transaction costs might otherwise be disproportionately high. The level of compensation should in principle be based on the cost of securing a natural capital gain at least equivalent to the loss incurred. There is need for further research into general cost-benefit models that assess movement towards or away from overall conservation goals, including understanding the information requirements for these.

'Extent x condition' metrics – towards best practice

17. 'Extent x condition' metrics, which typically combine measures of habitat area and quality, are already widely used. They hold the most promise for further development as relatively simple metrics that can support and facilitate natural capital markets. Criticisms of such metrics can be addressed, with appropriate ecological knowledge, choice of additional measures and exchange rules. This approach should be further explored and adapted for use to support natural capital markets in a range of different circumstances. In many cases, there will be need to invest further in the information base to make such metrics viable.
18. For public investments (where policy should be aligned with CBD commitments and the NBSAP), an ecoregion-based metric combining area of broad habitat types with a simple classification of habitat quality may be a straightforward and effective approach for tracking stocks of natural capital.
19. Further research is also needed on applying generalised models for biodiversity metrics, including issues of net present value and discounting over time, and on metrics and the information base for marine natural capital.

Biodiversity asset characteristics

20. The last decade has seen substantial increase in policies that facilitate natural capital trades (among both Governments and financial institutions) and in private sector investments, along with the emergence of policy forums, investment brokers and market-focused clearing houses.
21. Markets in natural capital are clearly growing, but information on them is limited. Their overall scale is hard to estimate and appears far smaller than their full potential, even where particular markets are well established.
22. A substantial market also exists for land or water to be secured in private protected areas, though information on the extent of such areas remains very incomplete.
23. Well-established natural capital markets appear to share several common features, including strong regulatory underpinning (even if implementation and oversight have not always been satisfactory), social contexts where market-like instruments for conservation are generally accepted, relatively straightforward, simple metrics for natural capital value, access to good baseline biodiversity data and access to excellent research and assessment capacity.

24. Regulatory and political environments are clearly key – investors want stability of policy, and transparency of costs and processes. A crucial support to this is sound information systems and the capacity to map, assess, monitor, store and present data nationally or by region.
25. Improved monitoring of outcomes – via collation, analysis and communication of implementation data for the biodiversity projects on which trades are based – is essential to provide confidence to investors, policymakers, the public and other stakeholders.
26. Land tenure and property rights will be fundamental factors determining the viability of biodiversity markets, implying that the scope for such markets will vary greatly around the world. In many places, information about land tenure, property rights and legal regimes is as yet very inadequate and often not spatially explicit.
27. Key issues around information and asset characteristics – including the information base, metrics and monitoring, additionality, permanence, leakage and market mechanisms, have been extensively explored and debated for markets in carbon (both voluntary and regulated, especially those focused on reduced emissions from deforestation and forest degradation, REDD). There are important differences between biodiversity and carbon, but markets in natural capital could valuably draw on the lessons learned in carbon markets. Carbon and biodiversity markets also have substantial potential overlap (e.g. through REDD+).

Upstream planning tools and methodologies

28. Upstream tools for natural capital management are important, so that governments and developers can use information in an appropriate and timely manner. They are needed both to support regulation and for voluntary initiatives.
29. There are many existing and emerging methodologies that can be helpful for upstream project planning, pointing to where (and which) natural capital investments may be needed.
30. There are also several relevant tools that support application of methodologies. The Integrated Biodiversity Assessment Tool (IBAT) is increasingly widely used. However, no tool has all the features and information desirable to support natural capital investment.
31. An improved tool would combine presentation of the existing IBAT datasets with an up-to-date, accurate global land-cover map, indication of land ownership/tenure, and improved models of species ranges (extent of suitable habitat).
32. Integration of overlapping tools and methodologies should be encouraged, to avoid the confusing plethora of tools that currently exists for ecosystem services.

1 Scope of this paper

1.1 Natural capital

What is 'natural capital'? There are varied definitions. For example, 'natural capital' has been associated primarily with ecosystem services (Kareiva et al. 2011), with ecosystems (Dasgupta 2010) or with biodiversity (TEEB 2010). Dickie & Cryle (2013) view 'natural capital' as nature in a range of productive configurations with other kinds of capital, giving rise to benefits to people.

For policy purposes, and to underpin metrics for investment, it may be most helpful to view natural capital as a stock (rather than the flow of ecosystem services it provides). This is the approach taken by, among others, the Natural Capital Committee[1] (NCC), an independent body set up by the United Kingdom Government to advise on the sustainable use of England's natural capital. The NCC defines natural capital as "the elements of nature that directly and indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions" (NCC 2014). This approach includes biotic and abiotic elements, not just biodiversity, which may be considered separately or be interacting (as they would be in an ecosystem).

All elements of Natural Capital pose challenges to integrate into investment and accounting, but these challenges are greatest for the biotic elements. These living elements, or biodiversity, are the focus of this paper - non-biotic natural capital is not addressed here.

For biodiversity, there are clear policy advantages to a focus on natural capital stocks, rather than flows. The stocks are fundamental: if these are not looked after, then flows will be degraded. This approach also recognizes that nature has many values that are poorly accounted, beyond those immediately evidenced through goods and services, including option and existence values. Importantly, future generations may also derive different benefits from, and accord different values to, natural capital than we do now.

In terms of accounting, there is a further distinction between inclusion of natural capital in national or corporate accounting – a measure of economic activity – and in measures of inclusive wealth, or assets (Mayer 2013). In the first case, natural capital is represented as a correction to the net value of production, income and consumption – effectively a depreciation that takes into account the non-market natural resources consumed to generate that economic activity. In the second case, the aim is to assess stocks of natural capital and how these are changing over time. Only this second aspect, treating natural capital as an asset, is treated in this paper.

1.2 Rationale and routes for private and public investments

Private investments in natural capital – by investors or corporates – may be for a number of reasons. They may seek, for example:

- to secure (including restoring or creating) ecosystem services and thus reduce future business risk relating to access to key resources;
- for income generation, via, for example, payments for ecosystem services (assuming an appropriate regulatory environment), ecotourism or sustainable wildlife use;

[1] www.naturalcapitalcommittee.org/

- to secure nature for conservation (e.g. through private reserves established by philanthropists, NGOs or other private landowners);
- to secure habitats or species populations as investments in biodiversity banking, so as to meet market demands for compensation commitments under regulatory or voluntary schemes.

Public investments may likewise be to meet a variety of (often overlapping) policy objectives, for instance to maintain or build natural capital stocks against national targets, to meet international commitments for conserving and managing biodiversity, or to maintain ecosystem services and climate resilience. The movement of funds to finance public natural capital investments has been termed 'ecological fiscal transfer' (Vatn et al. 2011). Such transfer might be national to local, or international to national. For example, Article 20 of the Convention on Biological Diversity commits developed countries to provide 'new and additional financial resources' to help developing countries meet the incremental costs of implementing the Convention – and one mechanism for such fiscal transfers has been the Global Environment Facility.

While touching on public investment, and on the range of different routes for private investments, the main focus of this paper is on private investment in natural capital markets. This focus is for practical reasons: this is the strand of natural capital investment that appears most promising for immediate scaling-up, and where information can probably play the most crucial role in facilitating (or, where inadequate, constraining) market development.

This paper does not deal directly with payments for ecosystem services, tradeable development rights, subsidies, agri-environment schemes or the many related financial mechanisms that may relate to natural capital investment (see eftec et al. 2012 for an overview). Several of the issues dealt with in this paper – the information base, metrics and monitoring, asset characteristics (e.g. additionality and permanence) and market mechanisms, have been extensively explored, discussed and debated for markets in carbon (including reduced emissions from deforestation and forest degradation, REDD). Reviewing these debates and processes is beyond the scope of this paper. However, it is clear that carbon and biodiversity markets have substantial potential overlap, e.g. through so-called REDD+[2], where natural capital (forest) is secured to maintain a key ecosystem service (carbon storage and sequestration), with likely co-benefits for biodiversity as well.

It also appears that the experiences and lessons learned from carbon markets have not been widely understood and referenced in discussions of biodiversity markets, nor incorporated into market design and operation. While there are many important differences between biodiversity and carbon, markets in natural capital could draw more extensively on the methodologies and lessons learned in carbon markets, both voluntary and regulatory.

[2] "Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks." UN-REDD Programme: www.un-redd.org/aboutredd/tabid/102614/default.aspx

2 The information base, measures and metrics

2.1 Overview

At least 24 countries now include at least one measure of natural capital in national accounting (WAVES 2012), though these focus, as yet, more on abiotic than biotic features. In 2012, the UN Statistical Commission approved the System of Environmental and Economic Accounts3 as an international statistical standard alongside the System of National Accounts (SNA), underpinning the national accounting of natural capital. Again, the SEEA as yet includes only a few, broad measures for stocks of living natural capital, such as forests. These measures are a step in the right direction but, until further extended and developed, are likely to have limited policy impact for increased investment in living natural capital – biodiversity. The UK Natural Capital Committee, mentioned above, is taking a policy-led approach to develop a broader set of measures. This guidance may prove to be a useful model for adaptation elsewhere.

The private sector has also begun to develop measures for incorporating natural capital into accounting, though with the focus so far mainly on ecosystem services (e.g. GRI 2011). This was a focus of discussion at the World Forum on Natural Capital in 2013. At the individual corporate level, Kering's Environmental Profit and Loss account[4] is a notable and innovative attempt to understand natural capital gains and losses along the entire supply chain, converting these into monetary values for comparability. However, biodiversity features only indirectly in the methodology (via land-use, where the emphasis remains on ecosystem services).

The Aichi Biodiversity Targets[5] agreed in 2010 represent commitments from nearly all the world's Governments (all countries Party to the Convention on Biological Diversity (CBD)). Several targets are directly relevant to investment in natural capital. These include Target 5 on loss of habitats, Target 6 on areas under sustainable management, Target 10 on vulnerable ecosystems, Target 11 on coverage of Protected Areas and Target 12 on preventing extinctions.

National roadmaps for achieving the Aichi Targets have been, or are being, developed, via updated National Biodiversity Strategies and Action Plans (NBSAPs). In effect, these are plans for how to maintain or improve the natural capital base for each country, even if that aim is not stated explicitly.

A set of global indicators has been developed for the Aichi Biodiversity Targets (BIP 2013), and CBD Parties are encouraged to adopt or adapt these for use at national level. Again, these form at least a starting point for indicators of natural capital. Information to calculate these indicators is being collected by a range of organizations, though not every indicator is covered in every country. Policies and frameworks to promote investment in natural capital should ideally build on and synergise with these existing frameworks and measures, to maximize benefits and minimize duplication of effort and systems.

National and global datasets on biodiversity (covering species, sites and habitats) continue to develop rapidly, especially through the contribution of citizen science as well as the digitisation of museum and

[3] http://unstats.un.org/unsd/envAccounting/seea.asp

[4] www.kering.com/en/sustainability/environmental-pl

[5] www.cbd.int/sp/targets

herbaria specimens (GBIF 2012). However, the depth and coverage of these datasets is patchy and uneven, especially for aquatic species and for the developing world.

What are the features of biotic natural capital (or biodiversity) that need assessment? NCC (2014) characterize the biotic components of natural capital stocks as species and ecological communities (or 'habitats'). For species, the appropriate measures are richness, abundance and distribution, and for habitats area and condition. Measures and metrics for natural capital will be discussed further below. However, taking these species and habitat measures as the fundamental building blocks, it is relevant to ask: what is the current knowledge base, and how does this relate to the minimum necessary to support natural capital investment mechanisms?

2.2 Species

Our knowledge of living species is patchy both geographically and taxonomically. Generally speaking, the most biodiversity-rich parts of the world are the least well-known (e.g. Collen et al. 2008). Globally, species richness and (for individual species) some measure of abundance and distribution are reasonably well documented for vertebrates, especially in terrestrial habitats (including inland waters). Such information for invertebrates, plants, fungi, microbes is far less comprehensive; there are also large gaps in our knowledge of marine species, especially non-vertebrates. In the absence of such information, using vertebrates as proxies for species-level biodiversity as a whole is a practical way forward, but the potential limitations of this approach (what important components of biodiversity may be left out) are as yet poorly understood.

The conservation status of over 75,000 of the world's 1.9 million known species has been assessed via the IUCN Red List of Threatened Species (one of a set of Knowledge Products mobilized by IUCN: IUCN 2012), with range maps available for over half (c. 43,000) of these (Pimm et al. 2014). Individual records from museum specimens and observations are listed and mapped via the Global Biodiversity Information Facility, GBIF, now including over 420 million individual records from 1.45 million species (GBIF 2. The reliability of these data (in terms of accuracy of identification and location) is variable, though GBIF is working to improve flags for data quality.

Citizen science – the collection of valuable data by non-professionals – is growing fast and is making a tremendous contribution to biodiversity baselines. Bird observers are now making a remarkable contribution to the GBIF database is now being provided by observation records of birds, through a number of web-based systems that support capture of birdwatchers' sightings: notably e-Bird (Kelling et al. 2012), which now has captured more than 100 million records.

Although much remains to be learned about biodiversity in the oceans, the Census of Marine Life has made great progress in mapping marine species including 6.5 million records of fish. These and other records are managed in the Ocean Biogeographic Information System (www.iobis.com) with 38 million records of 115,000 species.

UNEP-WCMC's Global Ocean Viewer (data.unep-wcmc.org/datasets) displays a large number of marine datasets, providing spatial information on key habitats and mapping the species richness of over 11,500 species in 13 major species groups ranging from zooplankton to marine mammals (11,567 species in total).

A large proportion of the world's living species remain unknown, especially among invertebrate animal groups, with estimates that upwards of 3 million, possibly many more, are still undescribed (Pimm et al. 2014).

2.3 Habitats

A number of global land-cover maps exist, based largely on remote sensing. These include GlobCover[6] (for 2005 and 2009; Arino et al. 2012) using data from the European Space Agency, and maps based on MODIS data from NASA satellites, now being generated annually[7] (Friedl et al. 2010). Recent efforts to improve resolution (to 30-m) and land-cover classification accuracy using Landsat data are promising (Gong et al. 2014), but as yet preliminary.

Landcover maps are most successful at representing large areas of homogeneous land cover, such as evergreen forest. They are much less good at mapping heterogeneous habitats, with mixed trees, shrub and herbaceous land covers being among the most confused classes (Herold et al. 2008, Sterling & Ducharne 2008). Different maps use different land classification systems, and there are large discrepancies between maps too.

While overall accuracy rates (land cover classification assessed against points sampled in the field) are reasonably high (in the range of 68-78%), a closer look at particular parts of the world shows that accuracy is often much less satisfactory (less than 50%) with poor correspondence between different maps (Herold et al. 2008; Tchuente, Roujean & de Jong 2011). The GeoWIki project[8] is using volunteer input to improve map accuracy, assisted by high-resolution images available in GoogleEarth[9].

These land-cover maps can provide a means of assessing stocks of natural capital and their changes at the level of very broad habitat types. However, they remain relatively coarse-grained and not able to support finer-scale habitat classification nor, in most cases, assessment of habitat quality.

2.4 New directions

A promising new approach is to combine land-cover maps and other geographical information (such as altitude and rainfall) with species locality data in order to model extent of suitable habitat for individual species. This can help in refining species' range maps from broad polygons drawn around the limits of the range to more accurate representations of where the species is likely actually to occur. It can also highlight areas outside the known range where suitable conditions appear to exist, and where the possible presence of the species should be investigated. While such refined range maps have many uses, they do not show species abundance (either relative or absolute). No comprehensive set of such maps exists as yet. Work to develop them is well advanced for mammals, amphibians and birds, via the Universities of Rome and Milan and BirdLife International respectively, but issues of interpretation, consistency and relationship to existing maps need to be resolved before 'extent of suitable habitat' maps are made more widely available.

The IUCN Red List is one of a set of Knowledge Products mobilised by IUCN, several of which have potential application to support investment in Natural Capital (IUCN 2012). The counterpart of the Red List for species is the Red List of Ecosystems. However, the methods for identifying ecosystems under threat are still to be finalised, and a list of threatened ecosystems is some time, perhaps a decade, away.

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[6] http://due.esrin.esa.int/globcover/

[7] https://lpdaac.usgs.gov/products/modis_products_table/mcd12q1

[8] http://www.geo-wiki.org/

[9] https://www.google.com/earth/

While Red List maps show the possible presence of a species, another Knowledge Product mobilised by IUCN – the IUCN Standard for identification of areas of global significance for biodiversity ('key biodiversity areas'- KBAs) identifies the most important sites for particular species and ecosystems, based on vulnerability (threat as assessed by the IUCN Red List) and irreplaceability (e.g. the presence of species with small ranges, outstanding examples of intact ecosystems or species assemblages, large congregations.) As the most important areas for biodiversity conservation, KBAs are appropriate (though not exclusive) targets for investments in natural capital (e.g. TBC 2013a).

2.5 National biodiversity information systems

Despite the importance of biodiversity information for numerous purposes, effective national or regional biodiversity information systems remain relatively few in number. Typically, biodiversity data sets relevant to natural capital investment remain scattered and fragmented, even when previous survey and research have been extensive (as in the countries that constituted the former Soviet Union). Not surprisingly, developed countries have generally been able to invest more in their biodiversity information infrastructure both nationally and regionally (e.g. the European Topic Centre on Biodiversity). However, some biodiversity-rich developing nations now have impressive national or regional information hubs, among the most notable being CONABIO (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad Mexico), SANBI (South African National Biodiversity Institute), SiBBr (Sistema de Informação sobre a Biodiversidade Brasileira) and the ASEAN Centre for Biodiversity. Detailed, spatially-explicit national or provincial conservation plans have been derived from this information in a few countries, such as South Africa. Such plans provide an excellent basis for directing public and private investment in biodiversity (DEA&DP 2011), Ezemvelo KZN Wildlife 2013), Macfarlane et al. 2014). These institutions and approaches are models for other countries and regions: there is an urgent need to develop information management systems and capacity for biodiversity mapping and monitoring.

3 Natural capital metrics and baselines

3.1 General considerations of equivalency

One significant challenge to integrating natural capital considerations into private and public investment is the absence of a straightforward, universally applicable metric that also captures the key elements of biodiversity. The aim is to achieve equivalence – to have fungible metrics that can facilitate exchange of the same types and amounts of biodiversity. Equivalence has aspects of type, space and time (Salzman & Ruhl 2000) – all of which need careful consideration. In practice, however, given the particular characteristics and local uniqueness of biodiversity, equivalence can never be fully achieved, so there is a greater or lesser element of barter (exchanging different kinds of goods) in biodiversity markets (Salzman & Ruhl 2000; Walker et al. 2009).

3.2 Equivalency of type

Literature on biodiversity markets often refers to 'currencies', but this is potentially confusing – economists tend to view only money as 'currency'. Here the term 'measure' is used to describe a parameter used to assess biodiversity (e.g. area of habitat, number of individuals of a species, vegetation height, canopy cover), the term 'method' to describe the way in which those measures are actually determined in the field, while 'metric' describes the unit used to evaluate losses of, and gains in, biotic natural capital. Metrics may be combined together (aggregated) or kept separate (disaggregated) as components of a set.

Designing metrics is challenging as biodiversity is complex, multi-faceted and tied to a local spatial scale. The term 'biodiversity' is also often poorly understood. Any measure of biodiversity will thus inherently be an imperfect representation of, and an imprecise surrogate for, all variation in all components of a particular area (Salzman & Ruhl 2000; Walker et al. 2009; Pawliczek & Sullivan 2011)

3.3 Spatial equivalency

Spatial equivalency has at least two dimensions. First, concerning measures of connectivity and fragmentation – for example, it would be inappropriate to exchange a large site, well linked to other habitat patches, for a scattering of small, dispersed fragments. Habitat banking (eftec 2012) can rather provide a way for habitat fragments to be exchanged for parts of larger, contiguous areas. Second, because of the local nature of biodiversity (and ecosystem services) proximity is often a consideration in exchange rules – distant sites, with the same general habitat, may not be eligible for exchange. In particular, spatial equivalency can be a major practical issue for management of business risk, especially where biodiversity elements are very localised or there is strong local dependence on specific ecosystem services. This may work against desired policy outcomes – for instance, when the aim is to encourage 'trading up', or help fulfil a larger conservation plan, proximity per se may not be a helpful criterion. Less obviously, this can also be true when the key species of interest are migratory. In this case, exchanges may be best targeted at the most vulnerable stages in a species' life history (Bull et al. 2013).

3.4 Temporal equivalency

The final dimension of equivalency is time. Where an exchange is for potential, rather than actual, natural capital – a wetland that is yet to be created, or a forest that is only half-grown – accounting issues are raised concerning increased risks (what if the promised resource never materializes?), foregone benefits and lost growth in value (or 'interest' on natural capital. This requires the value of the exchange site to be discounted (in whatever metric is being used). Overton et al. (2012) discuss the use of discount functions and, more generally, calculation of net present values for exchanges that take into account losses and gains in value, payback times and discount rates.

The risks and foregone opportunities arising when natural capital exchanges involve delays may often be deemed unacceptable, given the potential consequences for rare or sensitive biodiversity (Bekessy et al. 2010), including a heightened risk of extinction (Evans et al. 2013). In such circumstances, natural capital banks may only be able to operate with ready assets – i.e. mature habitat that is ready to exchange. This will generally require a legal and policy framework that facilitates natural capital markets ('no net loss' type trades), if ready biodiversity assets for loss-gain exchange are to become established at scale.

3.5 Trade-offs and other issues in metric design

From a policy perspective, the choice of measures and metrics is important, as they will drive markets in a particular direction. It is important that this is the same direction as the policy is aimed! Specific difficulties in developing metrics that can function as the basis for natural capital investment have been widely explored (Salzman & Ruhl 2000, Godden & Vernon 2003, Walker et al. 2006, Drechsler & Watzold 2009, Wissel & Watzold 2010, Drechsler & Hartig 2011, Overton et al. 2012, Cole 2013).

Many of these discussions focus on perceived imperfections of specific metrics. It is important to note that metrics do NOT have to be technically perfect – they need to be good enough to support a particular policy aim effectively. They also need to avoid unintended negative consequences – for instance, by creating perverse incentives - that might undermine those policy aims. Approaches to calculating metrics and 'exchange rules' for how they are applied should be developed with this in mind.

In practice, no single metric can effectively capture all components of biodiversity. For climate change, tonnes of carbon dioxide equivalents is not a perfect metric, but it succeeds in capturing the essential elements and is widely accepted and used. There is unfortunately no equivalent for biodiversity.

In terms of investment, there is good empirical evidence that a few, simple metrics (e.g. area of habitat) make it relatively easy and inexpensive for markets to function. However, because of the complex nature of biodiversity, this is at the real risk of compromising natural capital values, e.g. through the loss of vulnerable or irreplaceable biodiversity elements. On the other hand, complex or multiple metrics and exchange rules[10] may reduce that risk, but can be expensive and time-consuming to assess. They also lead to 'thin' markets that are heavily constrained and may cease to operate effectively (Salzman & Ruhl 2000; Fennessy et al. 2007; Wissel & Watzold 2010; Quétier & Lavorel 2011). The 'right' balance point to choose will depend on the policy objectives of the market.

Some other considerations are important in choosing measures to underpin metrics. Is it clear what they are measuring (Norton 2009)? Can they be standardised for consistent replication (Quétier & Lavorel 2011)? And, are they credible – appropriately representing at least the key variables of concern, both for biodiversity and, importantly, people (Sherren et al. 2012)?

3.6 Financial compensation

Where the policy goal is to implement a high-level conservation plan that has already been designed and agreed, a simple metric may be effective – money. The idea is that financial compensation required for loss of natural capital (from development projects) is channeled towards the highest-priority investments in the conservation plan ('trading up', in the language of biodiversity offsets). This approach appears to side-step the challenge of equivalency, but still faces the real practical difficulty of deciding on the level of

[10] 'Exchange rules' are mechanisms that constrain how exchanges of natural capital actually happen, to promote desired policy outcomes and prevent perverse ones. For example, sites where habitats are yet to be restored might not be eligible for consideration as a biodiversity offset; sites holding highly threatened or irreplaceable species might not be exchangeable.

compensation. In principle, this should be based on the cost of securing a natural capital gain (via investment in priorities of the conservation plan) at least equivalent to the loss incurred.

This brings one around again to the starting point, of developing appropriate metrics for accounting gains and losses in natural capital – which here may not even be like-for-like. In practice, in-lieu fees have necessarily been set by blunter and more arbitrary means. The general models discussed above (Overton et al. 2012, Maron et al. 2013) should clearly be applicable here, and this area is **recommended** as a priority for further research – one aim being to understand the minimum data requirements to set realistic and meaningful compensation levels.

More generally, financial compensation, or in-lieu fees (e.g. Wilkinson 2009) has been seen as a potentially appropriate solution to offsetting cumulative impacts of low significance, where the transaction costs of assessing natural capital losses and gains case-by-case might be disproportionately high (eftec et al. 2012). However, if the policy goal is for no net loss, or indeed measurable gains, of natural capital, experience suggests this approach can be risky. This is for reasons of practical implementation, rather than any conceptual flaw: financial resources may not always find their way to funding truly additional actions for conservation (BenDor & Riggsbee 2011).

3.7 'Extent x condition' measures – towards best practice

For the biotic dimensions of natural capital, metrics could focus on species or on habitat, and there are examples of both approaches in current use.

For practical reasons, habitat-based metrics are the best-established and most widely used (Treweek et al. 2010). Some longer-established biodiversity offsetting programs are still simplistically based on area alone (Fox & Nino-Murcia 2005; Quétier & Lavorel 2011). This has obvious disadvantages, in that the habitat's quality is not taken into account. More often, metrics combine a measure of the area of the habitat in question and its quality ('extent x condition' metrics - e.g. 'habitat hectares' or 'quality hectares': Parkes et al. 2003; Temple et al. 2012)

Quality is generally measured by combining metrics that ecological knowledge suggests are important for supporting the characteristic species community of the habitat, or particular target species of concern (e.g. canopy height, canopy cover, understorey height, density of tree holes, density of large trees). Sometimes a single proxy measure has been used (eg canopy cover in Tsitongambarika, Temple et al. 2012) Condition may be based entirely on habitat structural characteristics (e.g. Temple et al. 2012), or may include species composition or abundance of indicator species (e.g. Normander et al. 2012).

Criticisms of 'extent x condition' have come from a number of different directions. Responding to these criticisms can point the way to emergent best practice.

3.7.1 Measuring habitat condition

Criticism: **'Habitat condition is difficult to measure.'** Measures of condition metrics are generally set against a benchmark of minimally-disturbed habitat (as pristine as is available). However, it is often hard to know which metrics to use, and how these should be combined (what weightings should be used, and whether combination should be additive, or multiplicative, or both).

Further research into how to measure 'quality' is needed, for example by investigating the habitat features that correlate with the presence of particular species or communities of concern. However, many such habitat features may themselves be inter-correlated and it is important to recognize a diminishing function of effort and complexity vs value as more and more metrics are added.

Best practice is likely to consist of a small set of simple metrics as the basis, with scope for some supplementary metrics that deal with particular specialized features (for instance, tree holes) that are known to be important for certain species (Burrows et al. 2011). Ways of combining metrics into a metric, and exchange rules, need to be carefully designed to avoid perverse outcomes – where overall scores mask the absence of some crucial habitat feature, or where (for instance) intact, species-rich forest could be exchanged for a larger but heavily degraded area.

3.7.2 Benchmarking in dynamic environments

Criticism: **'Benchmarks do not work well in dynamic environments.'** Where good quality habitat is a consequence of repeated disturbance or where ecological change is the norm, selecting the right benchmarks can be problematic – there may not be an appropriate 'intact' or equilibrium stage. McCarthy et al. (2004) argue that disturbance should be factored into the metrics used in such cases – with scores 'contingent on the current and desired distribution of time since disturbance within an area'. This is not an easy metric to define or assess, and it is possible that the use of additional metrics for key species of concern (whose presence relates to habitat 'quality') might be a more straightforward approach (see below).

3.7.3 Choosing condition measures

Criticism: **'Choice of condition measures can strongly affect results.'** Virah-Sawmy et al. (2014) note that there may be a number of different plausible metrics of habitat quality, but which give widely varying answers for the hectares of pristine forest regarded as equivalent. One way to handle this would be to assess a range of separate quality metrics and, taking a precautionary approach, settle on that which gives the highest value for equivalent 'quality hectares' (Quétier & Lavorel 2011). Preferably such metrics would be selected via research before a natural capital investment framework is formalized – again pointing to the need for underpinning research to provide a sound ecological understanding of the habitat(s) involved, and their biodiversity, which can feed into metric design.

3.7.4 Accounting for conservation significance

Criticism: '**Condition measures do not account for conservation significance.'** The presence of threatened or range-restricted species or communities, and their viability requirements, are not necessarily captured (indeed may often not be) by simple habitat condition measures (Maron et al. 2010, Virah-Sawmy 2014). However, this does not mean that extent x condition metrics are only appropriate for habitats with relatively modest biodiversity values (Gibbons and Lindenmayer, 2007), but rather that additional metrics are needed to account for particular species or communities of concern.

An example of a practical metric for species is 'units of global distribution' (UD) (Temple et al., 2012), one unit being equivalent to 1% of the total global population of the species (or 1% of its global distribution as a proxy, if adequate population data are unavailable). This measure highlights relative importance in a global context. For example, loss or gain of 1 ha of a species' distribution is much more significant if that species is globally restricted than if it is widespread.

The extent to which disaggregated (separate) species metrics are used should depend on circumstances – the extent to which important species or ecosystem attributes are not captured by ‘extent x condition’ metrics, and the policy aims for which the metric is designed. For example, IFC’s Performance Standard 6 for Critical Habitat requires no net loss (or a net gain) for the key biodiversity elements identified, which may include a number of individual species triggering the CH designation. Calculations of net changes in each species (offset gains less residual impacts) are therefore needed. Such investments tend to require intensive, bespoke – and therefore expensive - approaches. For a generalized natural capital ‘bank’ it may be more practical to select a small suite of indicator species that can act as proxies for the full set of species/communities of interest.

Suitable exchange rules and thresholds may also need to be applied – as in the ”irreplaceability and vulnerability” filters now applied to land clearing applications in Victoria, Australia, such that clearing (and hence offsetting) cannot occur in areas deemed of high conservation value (Gibbons et al., 2009, Virah-Swamy et al. 2014).

3.7.5 Area effects

Criticism: **‘Biodiversity does not scale straightforwardly with area’**. In larger sites, there is a greater chance that relatively unusual micro-habitats and their associated species will be present, as well as species that need large home ranges, so species richness rises (sometimes called ‘beta diversity’). Species number within a region thus does not rise linearly with area but according to a logarithmic function (it takes ever greater increases in area to bring about a unit increase in species richness). On a very large scale, biogeographic turnover also begins to occur (‘gamma diversity’), again resulting in greater species richness overall.

This has been seen as undermining the conceptual basis of ‘extent x condition’ metrics, in that they may result in unequal trades of biodiversity loss and gain. However, this problem is more imaginary than real. The metric makes no assumptions about simple proportionality of species richness with area, and as areas being exchanged are likely to be fairly similar in extent (probably not differing by even an order of magnitude), the effects of the logarithmic species-area relationship will not be marked.

3.7.6 Considering landscape spatial structure

Criticism: **‘Extent-condition’ metrics do not take landscape spatial structure into account.’** It is possible for metrics to be refined to include consideration of habitat fragmentation or connectivity. The usefulness of doing so (considering the additional expense and complexity created) depends on context and on policy aims. Natural capital gains are likely to be greatest when small and fragmented habitats are exchanged for sections of consolidated or connected sites (although there may be other reasons, such as local access to ecosystem services, why this is not always an appropriate approach).

This usually requires exchange rules that reference a spatial conservation plan. There may be trade-offs between aiming for spatial equivalency (where the sites exchanged should be close to each other) and aiming to secure part of a larger, well-connected but possibly distant area of habitat. When goods and benefits derived from natural capital flows (ie ecosystem services) are important, spatial equivalency can be an important consideration.

Some actual or proposed metrics include weightings to take into account conservation concerns (Oliver et al. 2005; Fennessy et al. 2007; Treweek et al. 2010) or other expressions of stakeholder preference (Hajkowicz & Collins 2009). These considerations are generally better dealt with via exchange rules. Complex compound metrics created from diverse metrics are hard to understand, raise questions about what weighting is appropriate, and could create undesired results by masking losses of specific biodiversity elements.

3.8 Exchange rules

Exchange rules are not dealt with further here but have been extensively discussed in the context of biodiversity offsets (reference). In addition to the issues mentioned above, they may include considerations of, among others, limits to what can be exchanged or compensated for (Pilgrim et al. 2013), additionality of conservation benefits (including if and how averted loss should be considered) (Maron et al. 2012), permanence, addressing uncertainty and risk (including multipliers), and like-for-like versus 'trading up' exchanges.

3.9 Recommendations for natural capital metrics

'Extent x condition' metrics, supplemented as needed with species metrics and regulated by appropriate exchange rules, appear the most promising way forward for biodiversity markets. Overton et al. (2013) and Maron et al. (2013) both discuss general models for assessing what equates to natural capital loss and gain. These are conceptually robust approaches that involve measures of movement towards or away from clear high-level conservation goals. Such goals are being elaborated via, for example, National Biodiversity Strategies and Action Plans, but comprehensive, high-resolution data on the state of biodiversity, the threats it faces and the responses to these are needed to apply these models practically. Sufficiently in-depth data are unlikely to be available soon in most parts of the world.

Public investments must be driven by policy decisions to maintain or increase stock of natural capital, already in place in effect (for nearly all countries) via commitments under the Convention on Biological Diversity. Such investments should therefore align with and be driven by the Aichi Biodiversity Targets. This implies a need to mainstream National Biodiversity Strategies and Action Plans into wider policy, and to link these closely with regulatory systems for compensation when natural capital is damaged.

For high-level accounting, a focus on tracking stocks and quality of broad habitat types (as proposed by NCC 2014) may be most workable, along with tracking stocks and trends in a few key species of commercial and/or conservation importance. An ecoregion-based metric combining habitat area with a simple classification of habitat quality, as proposed by Jarrett (2012), could be a straightforward and effective approach for tracking stocks of natural capital at national or sub-national level.

4 Biodiversity asset characteristics

There can be no doubt that the profile of – and interest in - national capital investment has greatly increased over the last decade. Policies that enable biodiversity trades have been implemented or are in development in tens of countries worldwide (Madsen et al. 2011, TBC 2013b). Where such markets are well established, as in Australia and the USA (see below), biodiversity banking has attained significant scale and value, and has turned natural capital into a financial asset (Fox & Nino-Murcia 2005). Specific national and international public sector investments in natural capital are also scaling up, though targeted primarily at carbon: for example Norway's International Climate and Forest Initiative[11] (in support of REDD+) or Abu Dhabi's Blue Carbon Demonstration Project[12]). Policy forums for public investment are also emerging, such as The Natural Capital Initiative13 which aims to "embed natural capital thinking in policy and practice based on the best available evidence".

The principles of biodiversity 'no net loss' or 'net positive impact', providing the basis for natural capital investment, have been taken up by numerous companies voluntarily (Rainey et al. 2014) and are integrated into requirements for lending by major financial institutions, including the International Finance Corporation (IFC 2012) and the Equator Principle Financial Institutions (EPFIs). A number of financial institutions have committed to integrate natural capital criteria into financial products and services via the Natural Capital Declaration[14].

Businesses are emerging that promote, broker and design natural capital investments (such as Mission Markets Earth[15] and Althelia Ecosphere[16]) or act as information clearing houses (such as Ecosystem Marketplace[17] and Global Species Banking[18]). Individual companies are also moving to secure and manage natural capital on which their businesses depend. The Natural Capital Business Hub[19] profiles the natural capital efforts of some 40 major companies, while around 16 large companies have signed the Natural Capital Leadership Compact[20] ("a collective call for action to properly value and maintain the earth's natural capital").

Markets in natural capital are clearly growing. However, it has generally been difficult, so far, to collate global implementation data and analyse successes. The overall size of markets also has not been robustly estimated: the most recent available estimate, from 2012, is that they are in the order of $4 billion globally (Parker et al. 2012). In global economic terms (and considering the economic value of natural capital: TEEB 2010) this is not large. With few exceptions, the policy success of such markets has not been assessed.

The longest-established such markets focus on wetlands and threatened species in the USA, and on biodiversity (via habitat) in Australia and on fish habitat in Canada. The success of these schemes in meeting underlying conservation objectives has been varyingly graded. Hunt et al. (2011) cited key deficiencies in the Canadian fish habitat banking programme as inadequate monitoring of compliance and evaluation of effectiveness, inadequate accountability in habitat management agreements, and inadequate measurement of habitat loss and gain. Similar issues have been identified as key challenges in other habitat compensation programes. The overall scale of conservation impact often remains relatively small: for example, in 2011 an estimated 30,300 ha of land in the USA was under conservation easement through endangered species

[11] http://www.regjeringen.no/en/dep/kld/kampanjer/the-governments-climate-and-tree-project.html?id=733947

[12] http://bluecarbonportal.org/?page_id=8489

[13] http://www.naturalcapitalinitiative.org.uk/

[14] http://www.naturalcapitaldeclaration.org/

[15] http://www.mmearth.com/

[16] http://ecospherecapital.com/

[17] www.ecosystemmarketplace.com,

[18] www.speciesbanking.com

[19] http://www.naturalcapitalhub.org/

[20] http://www.cisl.cam.ac.uk/Business-Platforms/Natural-Capital-Leaders-Platform/Natural-Capital-Leadership-Compact.aspx

credit trading (Madsden et al. 2011)[21], compared to a total of c. 50 million ha managed for biodiversity conservation by various agencies (Aycrigg et al. 2013).

These schemes appear to share several features in common:

- Strong regulatory underpinning (even if implementation and oversight has not always been satisfactory)
- Social contexts where market-like instruments for conservation are generally accepted
- Relatively straightforward, simple metrics for natural capital value
- Access to good baseline biodiversity data
- Access to excellent capacity for research and assessment.

The regulatory and political environments are clearly key – investors want stability of policy, transparency of costs and processes. A crucial support to this is sound information systems and the capacity to map, assess, monitor and store and present data nationally.

In a recent report Credit Suisse et al. (2014) characterise pre-requisites for developing scalable and investable conservation projects and programs in order to establish well-defined, standardized and monetizable conservation benefits, emphasising:

- The role of early stage venture investing
- Professionalization of project management
- Importance of cost-efficient measurement.

The emphasis on keeping measurement to a necessary minimum is significant – as noted above, there is a clear trade-off between complex metrics for better characterizing biodiversity and simple ones that can help promote active markets.

Analysis by Credit Suisse et al. (2014) suggests that sufficient funds are available from private sources to meet conservation needs, and that there is a significant appetite for conservation investments. However, the market does not yet provide simple investment opportunities at the required scale. The report recommends initial focus on investments in natural capital which, in addition to intrinsic value, can provide ecological services (which can then generate income directly – e.g. via ecotourism – or be sold on, where regulatory frameworks permit) and in compensation markets – e.g. habitat banking. (Policy frameworks to support ecosystem service markets are not yet in place in the majority of countries: however, it seems likely, despite concerns about the design of such markets, that this will evolve rapidly (Pattanayak et al. 2010, Kinzig et al. 2011, Muradian et al. 2013)).

A substantial market also exists for private conservation – significant tracts of land (and at least some of water) are secured as private protected areas, including by philanthropic individuals and foundations, and by NGOs. As yet, very incomplete data are available on the extent of these landholdings (Holmes 2013). IUCN's World Commission on Protected Areas has set up a task force[22] to compile more comprehensive information on private protected areas. There has been relatively little attention given to the policy regimes, including tax frameworks, which can encourage investment in private protected areas. There are many forms of positive tax incentives, but they are still not used to their full potential (TEEB 2009, Parker et al. 2012).

[21] Increasing at a rate of c. 1800 ha/year

[22] www.iucn.org/about/work/programmes/gpap_home/gpap_people/gpap_tilcepa/gpap_privatepas/

It is clear that fundamental factors determining the viability of biodiversity markets are land tenure and property rights. Who owns the land (or water), and are they in a legal position to sell it and/or the rights to its natural capital and eco-service flows?

This fundamental factor suggests that scope for biodiversity markets will vary greatly around the world – in some countries it will not be feasible for investors to buy and sell land (or usage rights) in any quantity, either because suitable land is unavailable or because of land tenure arrangement and legal regimes. Basic information about land tenure, property rights, and legal regimes is often difficult to locate at a relevant scale, and not available globally in any standardised form. Improved information base on legal regimes, land tenure arrangements, and maps of land ownership will be key to supporting investment – along with better information and atlases on natural capital status amd carbon/biodiversity co-benefits.

As noted earlier, there has been surprisingly little cross-over in market design and technical framing between markets in carbon storage and sequestration and biodiversity. Carbon markets are noteworthy in part because of the particular potential of REDD+ to provide natural capital co-benefits. While there is substantial uncertainty still regarding the international regime for REDD, there is already a substantial voluntary market in carbon that is not replicated for biodiversity. For both voluntary markets and nascent markets in REDD, there has been extensive work on important technical issues, including specification of baselines, additionality, leakage, permanence and monitoring. These elements are much less well developed, conceptually and in terms of information provision, for biodiversity markets – though there are good examples of how the issues have been tackled, these are case-by-case. There are few if any agreed standards and little readily available information. Monitoring of natural capital assets on the ground (once they have entered a market scheme) has generally been particularly poor, making it more difficult to assess and learn from existing examples. Inadequate monitoring has implications for assuring permanence, which continues to be a problem in practice – often linked to poor implementation, changing legal regimes (for example, recent flux in Brazil's Forest Code), and uncertainties around restoration efforts. This diminishes investor confidence and is likely to put a brake on natural capital markets.

More positively, there is no much experience of how to set up long-term funding mechanisms to maintain natural capital stocks, such as covenants, easements or conservation trust funds (Parker et al. 2012). An information need, however, is to share frameworks and best practice across countries and institutions

Conservation banking in the USA provides an example of a well-established framework. Under a Conservation Banking Agreement (CBA), a bank owner must put the designated property into a permanent conservation easement with oversight by a third party, usually a non-profit or government agency. A CBA must include a science-based management plan for species and habitats, an operation and maintenance plan, as well as provisions for remedial action. These activities must be fully funded by the bank's endowment fund – bank owners are required to provide adequate funding for the perpetual operation of the bank. Federal guidance recommends establishing a non-wasting endowment fund by depositing a fixed amount for every credit sold. Additionally, creation of a bank can require posting performance bonds for bank establishment and a maintenance period.

5 Tools and methodologies for upstream project design

Upstream tools for biodiversity management are important, so that governments and developers can use information in an appropriate and timely manner. They are needed both to support regulation and for voluntary initiatives.

A great variety of tools and methodologies is available. The two categories overlap to an extent – but it is helpful to differentiate methodologies (written guidance that can be followed, step by step, provided the necessary information is available) and tools (software that supports the application of one or more methodologies, by making the necessary information and/or facilitating the step-by-step process).

BSR (2014) provide a comprehensive overview of available tools, for a range of different purposes and points in the development process. The great majority of these, reflecting the emphasis to date, deal with ecological services – the flows, rather than the stocks. For valuation of these flows, the WBCSD Guide to Corporate Ecosystem Valuation (WBCSD 2011) is widely used as guidance.

So many tools and methodologies are now available relating to ecosystem services (over 100 listed by BSR 2013) that users may be somewhat overwhelmed - confused about what ecosystem services are, which tool to use, and how to interpret the results. It would be desirable to avoid a similar proliferation of tools and methods for natural capital stocks.

Tools and methodologies supporting investment in natural capital stocks are primarily framed in terms of assessing and managing biodiversity risk, including the planning and design of biodiversity offsets.

5.1 Methodologies: screening for biodiversity risks

5.1.1 Biodiversity Risk Screening.

An emerging set of data and methods that can be applied at any spatial scale at any time in project development to assess overall biodiversity-related risk. Most usefully applied at a very early stage (e.g. to inform new country-entry risk assessments by financial institutions and companies) and also pre-ESIA (to inform the scope, focus and methods for ESIA, especially baseline surveys).

Several tools exist that bring together relevant biodiversity datasets to support biodiversity risk screening. These include IBAT, BESTCAT and LEFT, discussed below. IBAT integrates three of knowledge products mobilised by IUCN. Other potentially important datasets are not yet incorporated in decision-support tools, such as the marine datasets in UNEP-WCMC's Ocean Data Viewer.

For an example of biodiversity risk screening using IBAT, among other data sources, see TBC (2013c).

5.1.2 Critical Habitat Screening

A refinement of biodiversity risk screening, focused more narrowly on assessing whether a project is likely to be situated in Critical Habitat, in the sense of IFC's Performance Standard 6 (IFC 2012). This is a desk-based screening process using data already available, and as yet without a web-based support tool. There are plans to develop functionality in IBAT to indicate the presence of potential critical habitat more clearly, while indicative global maps of potential critical habitat are in preparation, led by UNEP-WCMC.

5.2 Methodologies: scoping the magnitude of project biodiversity risk

5.2.1 Mitigation Hierarchy scoping for No Net Loss feasibility

An emerging methodology used to conduct a high-level impact assessment and application of the mitigation hierarchy, to evaluate whether it is theoretically and technically possible for a development project to achieve No Net Loss of biodiversity. The biodiversity information required for biodiversity risk screening is combined with basic project information such as infrastructure requirements, to estimate major impacts, mitigation potential (via avoidance, minimisation and restoration), residual impacts, and potential offset options. This methodology is increasingly being applied by international financial institutions and oil and gas and mining companies to inform early investment decisions and project biodiversity budgets and schedules, often in combination with the Cross-Sector Biodiversity Initiative Timeline Tool (below).

5.2.2 CSBI Timeline Tool

ICMM, IPIECA and the EPFIs have formed an industry association called the Cross-Sector Biodiversity Initiative. Their first product is the CSBI Timeline Tool[23] which supports better alignment of project development, biodiversity impact management, and financial timelines and milestones. It provides a road-map to help identify critical milestones and inter-dependencies, identifies actions needed to apply the mitigation hierarchy as early as possible, and supports the work of a variety of functions in project planning and execution.

5.3 Methodologies: managing biodiversity risk

5.3.1 CSBI Mitigation Hierarchy Guidance

CSBI is also developing guidance on implementing the steps of the mitigation hierarchy (avoid, minimize, restore, offset), capturing practical and innovative ideas to help companies in the extractive sectors target no net loss or net gain of biodiversity. The guidance will clearly define the mitigation hierarchy steps and their application within the extractive project life cycle, provide practical guidance for determining and demonstrating biodiversity loss or gain as a result of mitigation action or inaction, highlight links to ecosystem services where available and appropriate, offer practical measures for predicting and verifying conservation outcomes over time, document and compare costs and savings resulting from mitigation action or inaction, and provide a variety of adaptable mitigation options for flexible application of the mitigation steps www.csbi.org.uk

[23] www.csbi.org.uk

5.3.2 Environmental and Social Impact Assessment (ESIA)

ESIA is the standard process to assessing and planning mitigation of project environmental impacts. A range of guidance exist at national and international levels, notably that of the International Association of Impact Assessment (IAIA)[24]. Methods are also available for an extended ESIA approach that compares natural capital and ecosystem service values with net present value of the planned project, as required by some Governments.

5.3.3 Critical Habitat Assessment

Projects financed by IFC and the EPFIs require application of this approach – an extension of Critical Habitat risk screening (above) but using field data along with available desktop biodiversity distribution datasets. Published methods are available or in preparation (Stefan et al. 2013; TBC, in prep.).

5.3.4 Biodiversity Action Planning

Biodiversity Action Plans are biodiversity-focused action and management plans for new or existing projects. They set and prioritise targets, actions and monitoring requirements to manage biodiversity. They can be used under any regulatory regime or voluntary approach to biodiversity management. For new projects, they are equivalent to a detailed biodiversity-focused section of the Environmental Management Plan that is the last output of an ESIA.

5.3.5 Biodiversity Offset Design

Biodiversity offsets are potentially closely linked to markets in natural capital, being measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and/or or restored, so as to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk (protecting areas where there is imminent or projected loss of biodiversity). Several sets of guidance exist for design of biodiversity offsets (e.g. ICMM 2005a,b, Kiesecker et al. 2010, BBOP 2012).

5.4 Tools relevant to natural capital stocks

Relevant tools that focus on natural capital stocks – biodiversity – include the Biodiversity and Ecosystem Services Trends and Conditions Assessment Tool (BESTCAT), Biodiversity Risk and Opportunity Assessment (BROA), Integral Biodiversity Assessment System (IBIS), Integrated Biodiversity Assessment Tool (IBAT), Lasting Initiative for Earth (LIFE), Local Ecological Footprint Tool (LEFT), Normative Biodiversity Metric (NBM) and Tools for Assessing Biodiversity in Supply Chains (TABS)

Of these, LIFE is an audit and certification process; IBIS and BROA also focus on on-going operations; TABS is focused on supply-chain assessment, and the NBM is designed to support reporting of changes in natural capital stocks. None of these is especially well suited to upstream planning and design.

However, BESTCAT, IBAT and LEFT have an upstream application and these tools are compared in Table 2.

[24] www.iaia.org/publications-resources/downloadable-publications.aspx

There is, in addition, a range of analytical tools designed for use in systematic conservation planning. These include well-established tools such as Marxan[25], which helps select the best set of sites to meet particular pre-defined goals, and newer programmes such as RobOff[26], a decision-support tool for resource allocation which allows consideration of uncertainty and timing, as well as cost and connectivity.

None of these tools is presently ideal for integrating natural capital considerations into upstream project design – further development is needed. A tool that combined the existing IBAT presentation and datasets with an up-to-date, accurate global land-cover map, indication of land ownership/tenure, and improved models of species ranges (extent of suitable habitat) would be a valuable development.

Table 1: Comparison of natural-capital relevant tools to support upstream project design

Tool	Scope	Developer and website	Notes	Considerations
BEST CAT - Biodiversity and Ecosystem Services Trends and Conditions Assessment Tool	Upstream planning. Web-based tool highlights biodiversity and ecosystem service risk and identifies locations that require risk management	The Nature Conservancy (with Dow Chemicals) http://bestcat.org.s3.amazonaws.com/index.html (Tool is not available for use at time of writing)	Using existing global datasets, provides site-level information on biodiversity sensitivity using six key metrics: habitat protection and intactness, threatened species numbers and percentage, and global and biome-based species richness. Terrestrial.	"All data are developed at a very small scale and should not be used for an individual, local site assessment but rather used compare sites relative to others globally." Because of nature of data, metrics at individual site scale should be interpreted cautiously.
IBAT – Integrated Biodiversity Assessment Tool	Upstream planning. Integrates spatial information on protected areas, key biodiversity areas and threatened species distributions to identify potentially sensitive locations. While main use is for pre-screening, has application throughout the production cycle, including reporting (e.g. for GRI)	A collaboration between BirdLife International, Conservation International, IUCN and the UNEP-World Conservation Monitoring Centre. www.ibatforbusiness.org	Integrates three Knowledge Products mobilised by IUCN, providing the best available site-level data, which is linked through to great depth of additional information in underlying datasets. Global coverage - both marine and terrestrial (marine data less comprehensive).	Key Biodiversity Areas are identified based on known (not inferred or assumed) presence of species of conservation concern - an advantage. Outside protected area/KBA polygons, IBAT provides only information on potential presence of threatened species - a limitation.

[25] www.uq.edu.au/marxan/

[26] cbig.it.helsinki.fi/software/roboff/

Tool	Scope	Developer and website	Notes	Considerations
LEFT - Local Ecological Footprint Tool (sensitivity mapping for biodiversity)	Upstream planning. Preliminary assessment of potential ecological impact of proposed development.	Oxford University and Statoil https://left.zoo.ox.ac.uk:8443/left/login.html	Uses existing global databases and models to provide an ecological score based on five key ecological features (biodiversity, fragmentation, threat, connectivity, and resilience) for any 300 m pixel. Mapped output for each feature and a summed measure of ecological value. Terrestrial.	Comprehensive coverage is potentially an advantage, but there are questions concerning reliability of the underlying datasets at this scale, robustness of measures and interpretation of outputs - many caveats. Global land-cover map dates from 2005 and for some areas may be substantially out of date.

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