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Realising nature's value in UK business

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This report is compliant with the JNCC Evidence Quality Assurance Policy http://jncc.defra.gov.uk/default.aspx?page=6675 . Selected members of the LWEC Ecosystem Task Force provided comments on the project specification and a draft of the report was peer reviewed by two independent experts and the JNCC project team.

Executive summary

This report explores how UK businesses consider the value of natural capital in their decision-making. In particular, it documents the findings of an investigation into the motivations of business with regards to natural capital, including relevant factors such as their ways of working, institutional barriers encountered, informational and data needs and opportunities for realising nature's value and the sustainable use of natural capital.

The study was based on interviews with 14 businesses across three sectors (agriculture, forestry and fisheries; electricity supply; and wholesale and retail) as well as a review of the literature on business and natural capital. The research revealed that although awareness of natural capital was high, action on natural capital was often limited to 'eco-efficiency' measures (e.g. energy and water saving). While some of the interviewed businesses were in the early stages of implementing natural capital valuation on a project or site level, there appeared to be no adoption of a systematic and holistic approach to evaluating natural capital dependencies and impacts across business operations and very limited monetary valuation of natural capital dependencies and impacts. Moreover, there was a significant level of scepticism amongst interviewees as to the benefits to business, as well as the robustness, of approaches involving the monetary valuation of natural capital.

The findings suggest that it is still 'early days' with respect to embedding systematic natural capital accounting approaches in UK business operations. What then are the opportunities to support UK businesses in realising nature's value to their operations? Key recommendations in light of the study findings include:

- Make information (particularly in-depth case studies) and tools for understanding and embedding natural capital considerations in businesses more easily accessible by creating a central web resource.

- Develop a more collaborative and coordinated approach, drawing together the range of expert bodies, research groups and Government agencies (and their online resources) with an interest in this agenda.

- Clearly demonstrate the business case for action on natural capital for businesses (large and small) in different sectors, and particularly for monetary valuation of natural capital dependencies and impacts.

- Focus early efforts to engage businesses in the natural capital agenda where the business case for action is strongest and clearest. These 'easier wins' will tend to involve a focus on the site and project level, working with businesses that have significant direct dependencies and/or impacts on natural capital (e.g. through extensive land ownership and/or management). A knowledge exchange strategy should be developed to determine how best to engage these sectors and businesses.

- Formulate a proposal to include links to natural capital and NCA in the revised ISO14001 standard. This standard is currently being revised, hence there is an important opportunity to integrate natural capital within existing business management processes already in use.

- Natural capital knowledge providers should consider working with the International Integrated Reporting Council to develop guidance for businesses on how NCA can be integrated with, and enhance, Integrated Reporting.

Contents

1. Introduction

This report explores how UK businesses consider the value of natural capital in their decision-making. In particular, it documents the findings of an investigation into the motivations of business with regards to natural capital, including relevant factors such as their ways of working, institutional barriers encountered, informational and data needs and opportunities for realising nature's value and the sustainable use of natural capital.

1.1 Business increasing awareness of natural capital

"Natural capital will become as prominent a business concern in the 21st Century as the provision of adequate financial capital was in the 20th Century" (Chartered Institute of Management Accountants, 2013).

Natural Capital *ˈnatʃ(ə)r(ə)l/ ˈkapɪt(ə)l/*
noun
Stock of natural resources, including water, soils, forests and seas

Capital is most often thought of as the wealth or assets of an individual, company or nation. The Natural Capital Committee defines natural capital as *"…our 'stock' of waters, land, air, species, minerals and oceans… Natural capital underpins all other types of capital – financial, manufactured, human and social - and is the foundation on which our economy, society and prosperity is built."*[1] Financial and manufactured capital have traditionally been used to measure success and inform business decisions, however, natural capital provides multiple benefits to business and, as such, the need to reflect natural capital in corporate decision-making is the subject of increasing discussion. Businesses are often buffered against changes in the availability and condition of natural capital by factors including technology and the capacity to substitute suppliers within a supply chain. However, as competition for natural capital increases, natural capital and the flow of ecosystem services[2] that it provides must be maintained for businesses (and the wider economy) to continue functioning in the longer-term.

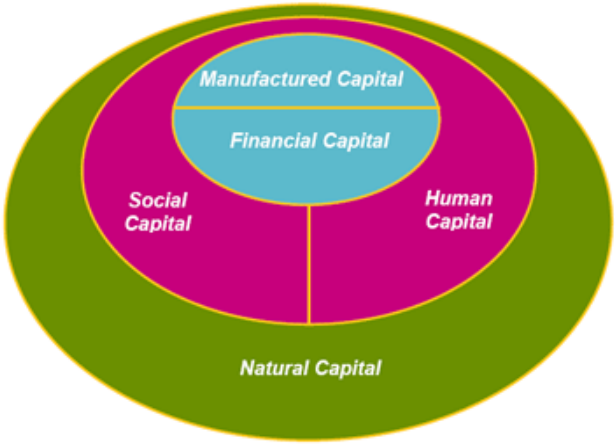


Figure 1: The five capitals[3]

[1] https://www.naturalcapitalcommittee.org/natural-capital.html
[2] These include the provision of food, water, timber and fibre; the regulation of climate and the management of flood risk; opportunities for recreation, tourism and cultural development; and underlying functions such as soil formation and nutrient cycling.
[3] Forum for the Future, https://www.forumforthefuture.org/project/five-capitals/overview

Nationally and globally we are witnessing significant and ongoing depletion of natural capital (UK National Ecosystem Assessment 2011a). In the UK, the private sector owns and manages the majority of natural capital; for example over two thirds of land in England is privately owned (Natural Capital Committee, 2015). Therefore better management of natural capital on the part of businesses is critical if efforts to enhance natural capital and the provision of associated ecosystem services are to be successful. Several of the top global risks identified by business leaders in a report by the World Economic Forum (2015) are natural capital risks (e.g. biodiversity loss and ecosystem collapse, water and food crises, climate change) – see Figure 2. Diminishing stocks of natural capital therefore present a significant risk to what is sometimes termed 'business continuity' (i.e. ensuring that an organisation's critical business functions can continue to operate) as well as to wider economic growth and prosperity.

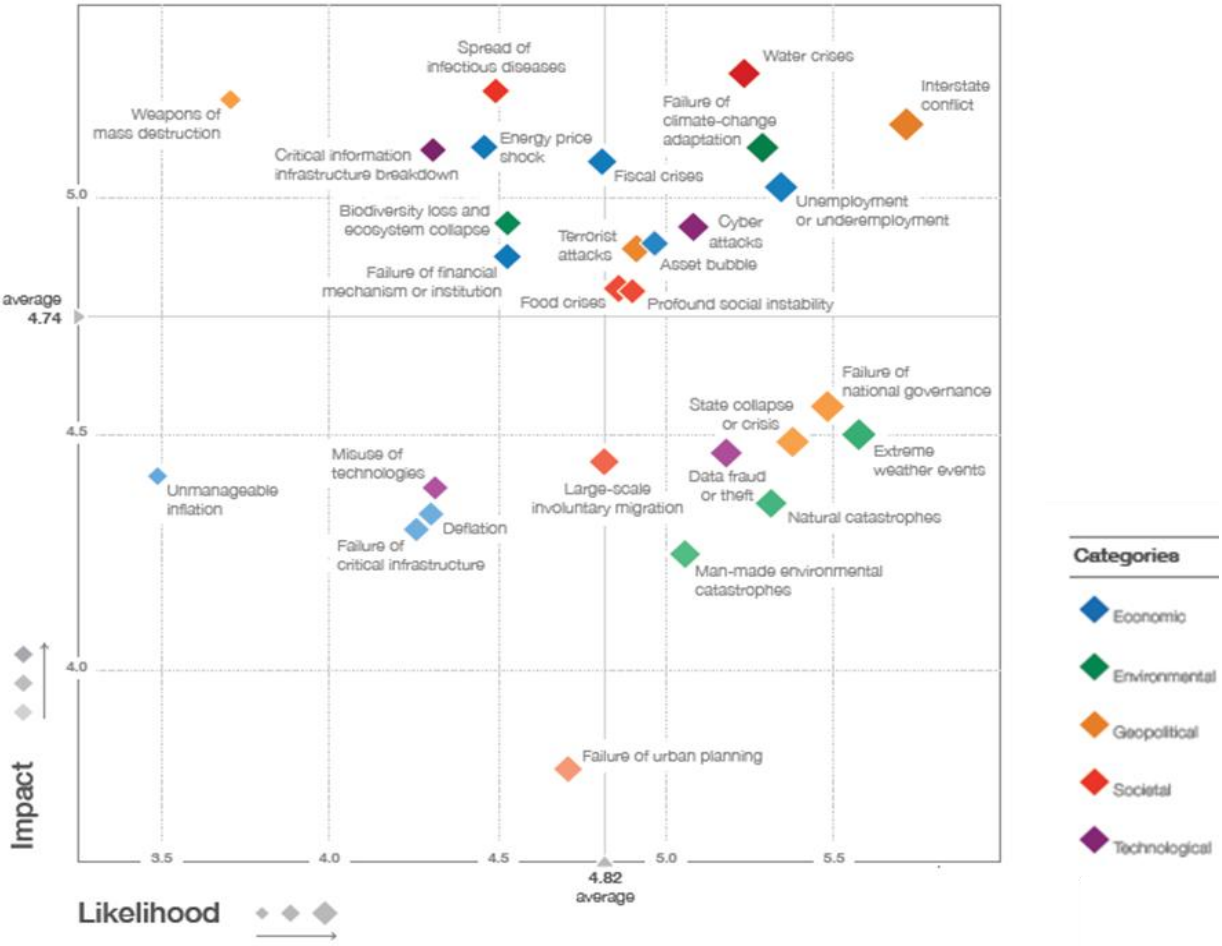


Figure 2: The Global Risks Landscape 2015 (World Economic Forum, 2015)

1.2 Natural capital in corporate decision-making

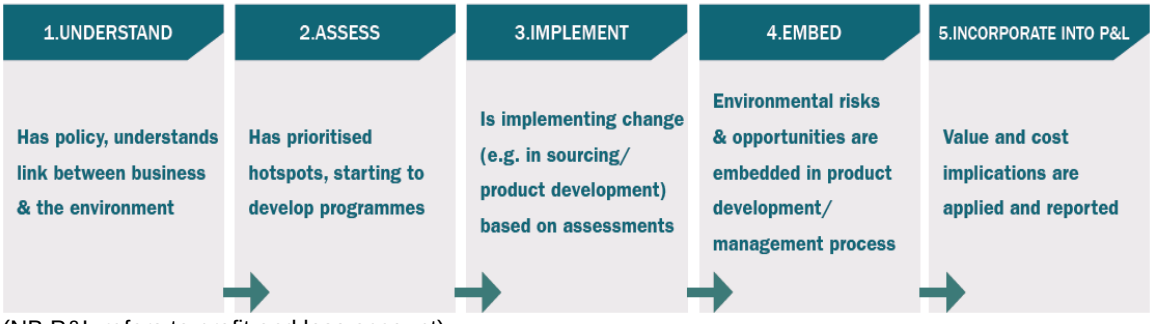
By understanding and accounting for the benefits of natural capital in corporate decision-making, businesses can maintain and enhance business-critical natural capital whilst mitigating risk and building resilience, identifying new market and investment opportunities, making cost savings and enhancing reputation and brand position. This will only become more important as resource prices increase and governments protect nature through regulations and/or market-based mechanisms that better reflect the 'true' price of goods and services that were once 'economically invisible'[4]. Companies that stay ahead of regulation and lead in this area could not only realise cost savings, but also enhance their reputation. In contrast, those that fall behind may suffer increasing costs and exposure to risks that may result in loss of market share or decline in profitability.

There is some debate around how dependencies and impacts on natural capital should be valued – quantitatively (in monetary or non-monetary terms) or qualitatively – and the consequences of different stakeholders adopting different approaches (Kenner, 2014). The Natural Capital Coalition (NCC) argues that 'economic invisibility' has been a major cause of environmental degradation as this damage has not historically been reflected or adequately priced in business models. The NCC (2014) therefore argued that:

"*by including monetary values, impacts and dependencies are translated into monetary risks and opportunities which are key to engaging business decision makers"*.

This study defines Natural Capital Accounting (NCA) as the practice of considering dependencies and impacts on natural capital as part of corporate decision-making processes. This broad and inclusive definition allows for the consideration of both qualitative and quantitative approaches and the analysis of businesses at a range of different stages in their natural capital 'journeys'. When viewed in this way, the practice of NCA can range from an organisation understanding its dependencies and impacts on the environment; to embedding natural capital considerations into business decisions; and ultimately to incorporating natural capital values into financial statements (see Figure 3).

Figure 3: The stages in an organisation's natural capital journey



(NB P&L refers to profit and loss account)

Mainstreaming environmental sustainability practices within UK business is, based on some indicators, continuing to make progress. For example, certificates for Environmental Management System standard ISO 14001 topped 300,000 for the first time in 2013[5] (IEMA,

[4] Pavan Sukhdev, special adviser to the United Nations environment programme's green economy initiative, coined the term "the economic invisibility of nature".
[5] Although this growth may be at least partly down to growth in the number of businesses.

2015). However, other indicators are not so positive; for example GreenBiz Group's State of Green Business Report 2015 (GreenBiz, 2015) indicated that publicly traded companies' progress in tackling greenhouse gas and emissions, air pollutants, water use and solid-waste production has levelled off or is even declining (quantities of GHG emissions, solid-waste generation and water use had all increased from 2009 levels).

Within this context, there remain significant barriers to understanding and accounting for natural capital values in business. Whilst this project examines the motivations and successful ways of working with regard to valuing and accounting for natural capital within UK businesses, it also investigates the barriers to taking this approach. Potential barriers include:

- lack of a harmonised valuing and accounting framework;
- lack of access to appropriate data;
- complex and inconsistent language;
- a possible tendency for businesses to focus on the short term;
- a lack of incentives for valuing and accounting for natural capital;
- the actual versus perceived level of natural capital dependency;
- the (perceived) cost or effort of determining natural capital dependencies;
- the complexity of distinguishing between natural capital values that are directly realisable versus indirectly realisable or non-realisable to business[6].

1.3 Project objectives

The Living With Environmental Change Ecosystem Task Force (ETF) is driving action on natural capital, guided by its *Roadmap for Realising Nature's Value* (LWEC, 2014). The Roadmap includes consideration of how to develop understanding of the information and tools needed to realise nature's value and identifies the need to improve data, synthesise knowledge and identify research priorities.

This project seeks to inform the actions being developed and taken forward in these areas. The outcomes of the project will be used to inform **effective engagement between knowledge providers and businesses**, and to **identify important knowledge needs** that will better enable UK businesses to take natural capital into consideration and thereby develop more environmentally sustainable business practices.

The objectives of this project are summarised in Figure 4 overleaf.

[6] I.e. values that accrue to businesses versus values that accrue to a wider spectrum of stakeholders.

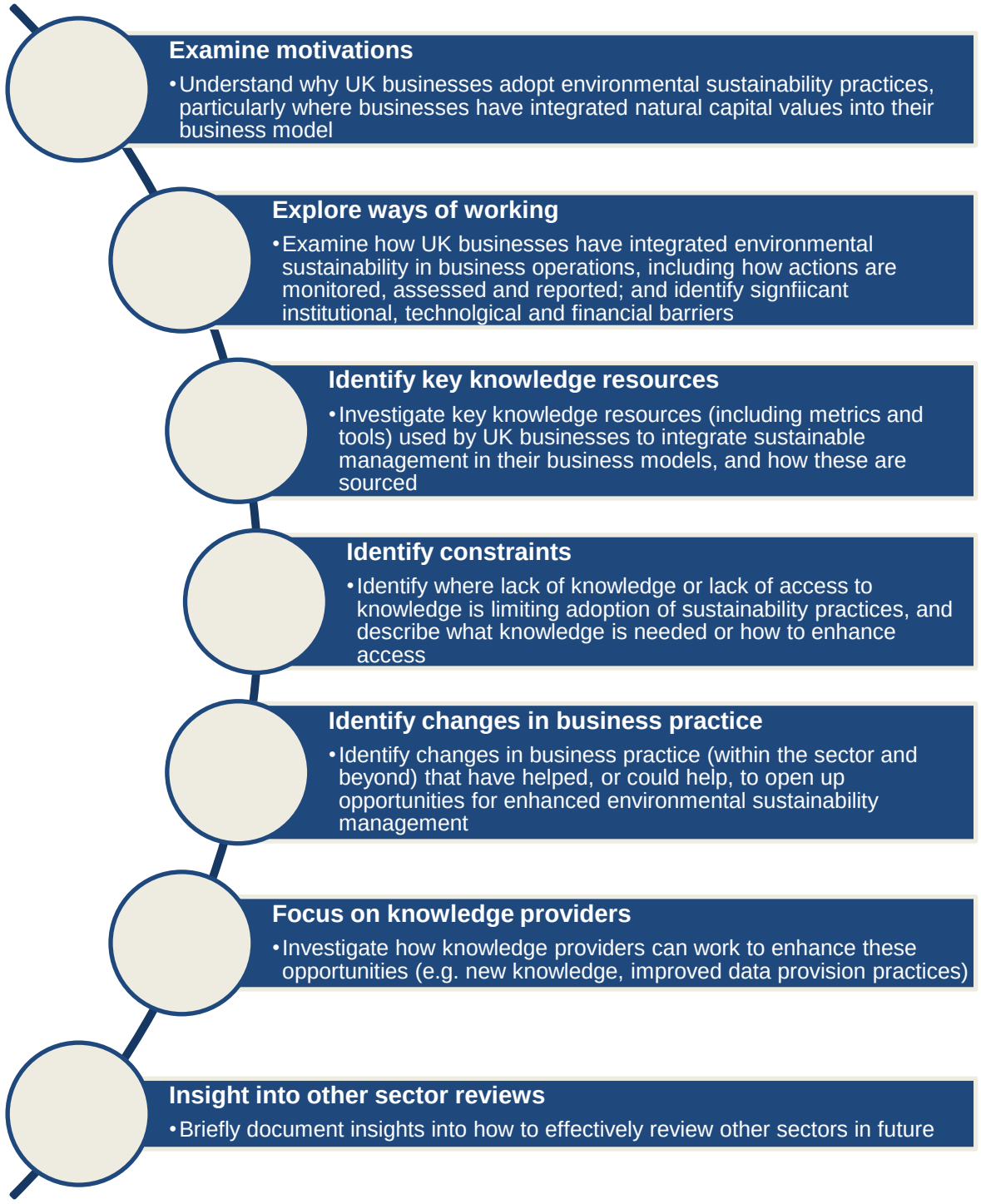


Figure 4: Project objectives

2. Method

To deliver the project objectives we employed the methodology shown in Figure 5. The key elements of the methodology were a literature review, targeted interviews with selected businesses, analysis and synthesis of findings and quality assurance. Further details of the method are provided below.

Figure 5: Method diagram

2.1 Development of interviewee list and interview questions

In conjunction with JNCC, three sectors were selected from which businesses would be contacted to conduct interviews. Business sectors were defined using the UK Standard Industrial Classification of Economic Activities 2007. The selection of business sectors was informed by an understanding of recent investigations of the way in which natural capital is considered in business decision-making (e.g. AECOM, 2015; Cranston *et al*, 2015; Bonner *et al*, 2012), including the sectors that these studies focused on. The three business sectors selected following discussion at the project inception meeting were:

1. agriculture, forestry and fisheries;
2. electricity supply; and
3. wholesale and retail.

A provisional list of businesses to contact for interview was then developed by the project team in consultation with JNCC. The provisional list was developed by focusing on:

1. businesses within the selected sectors;
2. businesses for which project team members had a professional contact in the field of environment/sustainability; and;
3. businesses that operate predominantly in the UK.

The study sought to target those businesses within the three target sectors that were considered to be 'early adopters' and 'nearly adopters' of natural capital; and to engage businesses of a range of sizes and geographies.

Alongside the provisional list of businesses the project team developed and finalised an **interview survey template** in consultation with JNCC. The project team also developed a **project brief** and a '**maturity matrix'** that were sent to interviewees prior to telephone interviews. All three documents can be found in the appendices.

2.2 Literature reviews

Two in-depth literature reviews were conducted concurrently. One of the literature reviews focussed on natural capital dependencies and impacts, and awareness and action in each of the three selected sectors. This involved an evaluation of all relevant research publications focused on the three sectors. Additionally, the findings from a report recently completed by AECOM for Defra on prospective beneficiaries that might be interested in participating in Payments for Ecosystem Services schemes (AECOM, 2015) were analysed and used to inform the literature review as both projects had similar objectives. This Defra study had focused on businesses in the chemical, beverage and food manufacturing sectors. The literature review was conducted to ensure the project team was aware of the latest research and action on natural capital in each sector to enable interviewers to prepare for their business interviews and to inform the discussion section in this report.

To aid the contextualisation of the research findings, we also drew on other studies with a similar focus to this one that were completed in recent years, including Cranston *et al* (2015) and Bonner *et al* (2012)[7], as well as numerous wider sources on the consideration of natural capital in business. These are highlighted in the Discussion section.

The second literature review focussed on the provisional list of businesses within the three sectors with the aim of providing basic information on each company including:

- its size in terms of number of employees and annual turnover;
- its type of operations and its approach to environmental management;
- an overview of its dependencies on natural capital;
- an understanding of the organisations natural capital awareness and current action; and
- a list of potential contacts within the business who could be interviewed (generally contacts were senior sustainability or corporate social responsibility professionals).

Information was sourced by completing an online search and a review of relevant corporate documents for each business on the provisional list. This literature review informed the targeting of interviews and enabled interviewers to prepare thoroughly and use limited time to best effect. A summary of the characteristics of the 14 businesses interviewed is provided in Table 1 below. The summary is at a relatively high level as the identities of the businesses are confidential.[8]

[7] Note that these studies had a global scope rather than focusing only on UK businesses. Cranston et al (2015) concentrated on the growing and production stages of supply chains (the content appears to be based on secondary data and engagement with businesses through the Natural Capital Leaders Platform); Bonner et al (2012) surveyed businesses across the utilities, construction, forestry and food sectors.

[8] A commitment was made to protect the identities of the individuals and businesses interviewed for this study.

Table 1. Summary of the characteristics of the 14 businesses interviewed

Business number	Sector	Approximate annual UK turnover (£)	Approximate number of UK employees	Geography of UK operations
1	Agriculture, forestry and fishing	Unknown	2	Throughout the UK
2	Agriculture, forestry and fishing	30 million	110	Cornwall
3	Agriculture, forestry and fishing	20 million	220	Yorkshire
4	Agriculture, forestry and fishing	230 million	1,500	Somerset
5	Agriculture, forestry and fishing	125 million	450	Scotland
6	Electricity supply	15,000 million	24,000	Throughout the UK
7	Electricity supply	30,000 million	20,000	Throughout the UK
8	Electricity supply	4,000 million	13,000	Throughout the UK
9	Electricity supply	70 million	400	Throughout the UK
10	Electricity supply	28 million	130	Throughout the UK
11	Wholesale and retail	6,500 million	55,000	Throughout the UK
12	Wholesale and retail	20,000 million	170,000	Throughout the UK
13	Wholesale and retail	276 million	5,500	Throughout the UK
14	Wholesale and retail	9,000 million	90,000	Throughout the UK

Both literature reviews enabled greater understanding of the shortlisted sectors and businesses, including which were likely to be 'early adopters' or 'nearly adopters' of natural capital-related business practices.

2.3 Interviews scheduled and conducted with businesses

Following completion of both literature reviews, the project team began contacting potential interviewees from the provisional list. Initial contact was made by sending an introductory email that contained information on the aims of the research and purpose of the interview **(project brief and maturity matrix; see appendices)** as well as a proposed time period in which interviews could be conducted and the anticipated duration of the interview. Follow-up calls with potential interviewees were made where responses were not forthcoming.

Once all the businesses on the provisional list had been contacted, project team members drew up a back-up list of businesses in consultation with JNCC given the need to secure additional interviews[9]. This list was developed in consultation with JNCC and based on shared knowledge of other businesses within the target sectors that were considered likely to be 'early adopters' or 'nearly adopters' of natural capital. Businesses were then contacted via the same process as outlined above to ensure that a reasonable number of interviews were secured across the three sectors.

Semi-structured interviews were conducted by telephone or through face-to-face meetings using the **interview survey template (see appendices)**. With the consent of interviewees, interviews were recorded and answers were also typed out as the interviews were carried out. This dual approach had the advantage of allowing 'live' production of a transcript, thus saving time, as well as the ability to double check after the event if/where any key points or quotations were missed. In instances where permission was not given for interviewees to be recorded only the 'live' production method was utilised.

Overall, 14 business interviews were conducted with five business interviews conducted in the agriculture, forestry and fisheries sector, a further five in the electricity supply sector and four in the wholesale and retail sector.

The 'live' transcript of each interview was reviewed in line with the actual recording of the interview. Amendments to the 'live' transcript were then made including additional key points and quotations. The revised transcripts were sent back to the business contacts for review. Upon receiving any amendments suggested by the business interviewees, the transcripts were revised for a final time to reflect these suggestions and, once complete, any recordings of the interview were then destroyed.

2.4 Interviews analysis

The 14 business interviews generated a significant amount of qualitative data. Once all transcripts were completed and had passed through the review process they underwent thematic analysis. This was completed using a framework approach to categorise evidence into key emergent themes. Taking into account the project objectives (as highlighted below; see p.5 for the full wording of the objectives) and the literature review, the analysis of the written interview transcripts was structured around the following analytical themes:

1. **Awareness and understanding** of natural capital and natural capital accounting;
2. **Motivations and drivers** for natural capital-related practices (objective 1);
3. **Ways of working and** /integration of natural capital into business operations (objective 2);

[9] It was not possible to contact relevant representatives of some businesses on the provisional list. Other businesses declined to take part, due to a range of reasons such as lack if time or a corporate policy ruling out participation in research projects.

4. **Key knowledge resources** (including metrics, data and tools) **and lack thereof** (objectives 3 and 4); and
5. **Changes in business practice** that can assist the embedding of natural capital ideas (objective 5).

Objectives 6 (focus on knowledge providers) and 7 (insight into other sector reviews) are addressed in the discussion section based on a consideration of the research findings.

Analysis of interview findings by theme was based on a review of the entire interview transcript for relevant material, rather than only the answer provided to a specific question. This approach was used because some respondents provided more information in response to some questions than others, and often this information was relevant to more than one theme. It should be noted that due to time constraints it was often not possible to ask follow-up 'off script' questions to explore answers in greater depth. This is acknowledged as a limitation of the study. It should also be borne in mind that the small sample size means the range of views gathered may not reflect the possible range of views, thus the findings should be treated as indicative rather than generalisable.

The interview findings are written up separately for each of the three sectors in the Results section. More detailed responses from the various businesses in each sector are provided in Appendix 3.

2.5 Quality assurance

To ensure the quality of this report, the main project output, an internal technical review of the draft report was undertaken by the Project Director. Amendments were then completed prior to the report's release to JNCC.

The draft report was also forwarded to two expert peer reviewers. The peer review process was managed by the Project Manager in consultation with JNCC and involved two external specialists, Pat Laughlin, CEO of the UK Business Council for Sustainable Development, and Pat Snowdon, Head of Economics and Climate Change at the Forestry Commission. The external specialists were identified and selected on the basis of their knowledge and understanding of businesses' interest and engagement with the natural capital agenda.

The peer review process was informed by guidance on peer review contained in JNCC's Evidence Quality Assurance documents[10]. A standard review form was developed to allow peer reviewers to provide structured feedback. All suggested changes identified by the peer reviewers were compiled and shared with JNCC. A teleconference was then held with JNCC to discuss all of the feedback and agree how this should be addressed in compiling the final project outputs.

[10] Available online at: http://jncc.defra.gov.uk/default.aspx?page=6675

3. Results

3.1 Literature review findings

3.1.1 Literature review on the three selected sectors

The three target sectors for this study were agriculture, forestry and fishing; electricity supply; and wholesale and retail. This section of the report presents the findings of a review of the literature on natural capital dependencies, awareness and action in each of these sectors.

Agriculture, forestry and fishing

Overview of sector

The agriculture, forestry and fisheries sector employed approximately 46,000 people in the UK in 2012, across 11,293 enterprises (Office for National Statistics, 2014a). These organisations had an annual turnover of £3,591 million and contributed £1,404 million to gross value added at basic prices (aGVA) to the UK economy. This represents less than 0.1% of total UK GVA in 2012 (£1452,264 million; Office for National Statistics, 2014b). Seventy percent of land in the UK is used for agriculture (17 million hectares; Defra *et al*, 2012) and 2.8 million hectares is covered by woodland (Parliamentary Office of Science and Technology, 2007).

Dependencies and impacts on natural capital and ecosystem services

The productive, primary industries of agriculture, forestry and fishing are heavily reliant on both the provisioning services that deliver them the raw outputs that are then taken up by wider sectors or directly consumed (e.g. crops, timber, wood fuel, seafood), plus the wider ecosystem services that support this productivity. For example, agricultural productivity is heavily dependent on a wide variety of species and ecosystem services, including soil micro-organisms, pollinators and pest predators, the genetic diversity of crops and livestock, freshwater supplies, and climate regulation (The Economics of Ecoystems & Biodiversity, TEEB, 2012). The forestry industry is dependent on numerous ecosystem services, including freshwater supply, climate stability and nutrient cycling; and the fishing industry depends on the supply of habitat that supports the growth and reproduction of fish stocks (Natural Value Initiative, 2008; Scottish Association for Marine Science, 2011). All three sectors are also indirectly dependent on natural capital and ecosystem services for energy and fuel.

The ecosystem services supporting primary production can in many cases be said to be in decline in the UK (Natural Capital Committee, 2015). Factors behind such declines include not only wider trends such as global climate change, but also the direct impact of drives by these productive industries to increase provisioning services. For example, in its chapter on Enclosed Farmland (one of eight broad habitat types), the UK National Ecosystem Assessment (NEA) notes that whilst wheat, milk, and meat yields have increased and the area of land under cultivation has risen since the Second World War, this growth in provision has 'not been without costs to other services' (e.g. pressure placed on regulating services, through local and exported pollution) and, as such, this increase may have 'reduced the capacity of agricultural systems to function sustainably in the long term' (UK National Ecosystem Assessment, 2011b). Such trade-offs between short term productivity and wider ecosystem service provision can also be seen in the UK's marine environment where the sustainability of food provision from marine habitats is threatened by factors such as the overexploitation of fisheries and damage to the seafloor (UK National Ecosystem Assessment, 2011c).

The UK NEA (2011d) suggests that forestry practices in the twentieth century led to the neglect of multiple products and services in favour of the simplification of practices in order to maximise timber production. However the Forestry Commission (2011) indicate that the wider benefits of woodlands such as amenity (particularly recreation and landscape) were recognised from as early as the 1970s and highlight the development of the concept of multiple-purpose forestry in the 1980s and the amendment of the Forestry Act 1967 by the Wildlife and Countryside (Amendment) Act 1985, which formalised the concept of balance between the environment and forestry as a duty for the Forestry Commissioners. Clearly the creation of woodlands can have positive impacts on a range of ecosystem services if designed and managed effectively (e.g. climate regulation, water supply regulation, water treatment, flood risk reduction, cultural services; CJC Consulting Ltd, 2014; Adas-Eftec, 2014).

Awareness and action focused on natural capital and ecosystem services

Many businesses in the agriculture, forestry and fishing sector are aware of natural capital dependencies and impacts and some are taking action, as outlined below. However it is important to state at the outset that **it was not possible to identify any examples of UK businesses in this sector currently taking a systematic approach to the monetary valuation of natural capital; moreover few appear to be explicitly using the language of natural capital**. This reflects a general lack of such valuation by businesses in general (e.g. Mead, 2014; Bonner *et al*, 2012), as explored further in the Discussion section.

The direct risk that ecosystem service declines pose to productive operations is an important driver for action on natural capital in the agriculture, forestry and fishing sector, particularly given the need to maintain or increase production in these industries in light of rising demand from growing and more affluent UK and global populations (BBSRC, 2015). Awareness of these risks is increasing. For example, in the UK agricultural sector there is an increasing focus on 'sustainable intensification'[11] given the operational risks posed by ecosystem decline (e.g. pollinator declines or reductions in the water available for irrigation (BBSRC, 2014; University of Leeds, 2015). This is reflected in the response of the National Farmers' Union to the Government's 2014 National Pollinator Strategy, which was 'supportive' given the 'importance of pollinators to our food supply' (NFU, 2014). The commercial fishing sector is also finding its operations at risk as a result of declining stocks; in 2012, only 36 per cent of the assessed fish stocks around the UK (5 of the 14 stocks) were at full reproductive capacity and were being harvested sustainably (Defra, 2014; Ecosystem Market Task Force, 2013a). In response, organisations such as the Sustainable Seafood Coalition have been established, the membership of which includes the majority of UK retailers and seafood businesses within the seafood industry, as well as businesses from the foodservice sector (e.g. restaurants) (Sustainable Seafood Coalition, 2015). The trend in UK fisheries is now towards greater sustainability, with a progressive increase during the 2000s in the percentage of fish stocks harvested sustainably and having full reproductive capacity (JNCC, 2014).

Another important driver is the reputational risk associated with any loss in natural capital and ecosystem services, particularly given pressure from environmental campaign groups (e.g. Greenpeace campaigns on sustainable seafood; Greenpeace UK, 2012), supported by increasing public concern over the environmental and social trade-offs being made during the production of crops, wood products, and seafood (e.g. research into seafood buying behaviour around the world has shown that consumers are increasingly looking for fish

[11] Defined as sustainably increasing the production of food (or other agricultural products), combined with improved resource use efficiency and better environmental (and social and economic) outcomes (including animal welfare; BBSRC, 2014).

products from a sustainable sources, with 79% of people in Europe considering the environmental impacts of seafood to be an important factor in their purchasing decisions; Sainsbury's, 2012; Marine Stewardship Council, 2014; Greenpeace, 2006). Such concerns and campaigns have led to the emergence of certification standards that can secure a share of ethical markets for businesses that adhere to particular standards. For example, the UK Forestry Standard (UKFS; Forestry Commission, 2011), developed by the Forestry Commission, was revised in 2011 to include explicit requirements for sustainable forest management[12]. By meeting the Requirements of the UKFS, forest and woodland owners, managers and practitioners can demonstrate that forestry operations and activities are both legal and sustainable. The Forest Stewardship Council (FSC), established by professional forestry interests and major retailers such as IKEA and B&Q, also promotes sustainable forest management, whilst the Marine Stewardship Council (MSC) (ISEAL Alliance, 2015a) and Soil Association (ISEAL Alliance, 2015b) drive sustainable production in the fishing and agricultural sectors, respectively.

Regulatory and compliance risks can also support action, for example through Government policy (including regulation, agri-environment schemes, and procurement policies) or investor concerns (Fauna & Flora International & UNEP, 2009). For example, in 2000 the UK Government announced a procurement policy on timber and timber products, including a requirement to use legal and sustainable sources of such products (NBS, 2010) (UK Government, 2013). Five years on, a Chatham House report found that this policy had resulted in "substantial knock-on effect on to the private sector, with the resulting development of new and revision of existing, environmental codes of conduct and timber procurement policies" (Chatham House, 2005).

In light of such drivers, the agriculture, forestry and fishing sectors are increasingly considering and taking action on natural capital and ecosystem services. For example, in response to growing the consumer and retailer demand over the past two decades, there has been an overall increase in organic food production in the UK (despite recent contractions; Soil Association, 2014). In addition, the Farming Futures initiative sets out a series of case studies detailing the steps taken by some farms to address issues such as sustainable irrigation, soil management, biodiversity conservation, and climate change adaptation; although it is unclear how widespread such practices are (Farming Futures, 2015). Drivers for such action included the sustainable use of finite resources, such as soil, and adaption to climate change. Action is also being taken through the Linking Environment and Farming (LEAF) programme, which includes demonstration farms, an assurance system, and management tools (LEAF, 2014). In the forestry sector, there has also been an increase in certified timber production, with 87% of UK harvested softwood timber in 2009 certified sustainable, whilst in terms of sustainable seafood there has been an increase in the range of products certified sustainable by the MSC and growth in the market for these products (Woodland Trust, 2011; The Guardian, 2012a; Marine Stewardship Council, 2013). However, it appears there are constraints facing the growth of such standards (e.g. restrictive price premiums(Soil Association, 2014)) and it is unclear to what extent voluntary action is being taken in the UK outside of certification and agri-environment schemes to address the risks to production resulting from ecosystem decline (i.e. operational risks).

[12] Covering biodiversity, climate change, historic environment, landscape, people, soil and water.

Electricity supply

Overview of sector

The electricity, gas, steam and air conditioning supply sector employed on average 121,000 people in the 1,828 enterprises across the UK in 2012 (Office for National Statistics, 2014a). These organisations' annual revenue equated to £105,473 million and contributed approximately 1.7% (£24,464 million) to the total UK GVA in 2012 (Office for National Statistics, 2014b).

Dependencies and impacts on natural capital and ecosystem services

The generation and distribution of electricity can be roughly broken down into four components: generation, transmission, local area distribution and end supply. The production of power can require suitable natural resources for generation purposes, including biomass generated through forestry and agriculture, fossil fuels (coal, gas, and oil), uranium and plutonium, and water resources supporting hydropower (Ecosystem Market Task Force, 2012). In addition to those resources directly enabling the generation of energy, the sector also relies on wider ecosystem inputs, such as the provision of water for cooling, the protection of fixed assets from flood risk, and the capacity of ecosystems to absorb pollutants (Ecosystem Market Task Force, 2012).

The key impacts of the electricity sector on natural capital and ecosystem services relate to the pollution generated by the sector's operations (including greenhouse gases), the use of water supplies, and the potential impact of infrastructure on cultural services (e.g. electricity pylons blighting a 'wild' landscape). Energy generation options have differing ecosystem impacts and reliances. For instance, coal powered generation contributes far more to air pollution and greenhouse gas emissions than nuclear power, but does not have the challenges associated with managing radioactive risk (including nuclear waste). The creation of generation and transmission infrastructure and the management of these facilities can also have an impact on ecosystem service provision, e.g. the land take associated with solar farms (Planning Resource, 2014). Recent growth in renewable energy has the potential to bring about particular impacts on ecosystem services, including on cultural services (e.g. wind turbines), marine habitats and biodiversity (e.g. tidal and hydropower) and provisioning services (for example downstream loss of agricultural or forestry land due to hydropower development) (Ecosystem Market Task Force, 2012).

Awareness and action focused on natural capital and ecosystem services

As in the agriculture, forestry and fishing sector (see above), **there was no evidence of any businesses taking a systematic approach to the monetary valuation of natural capital across their operations.** There was, however, an example in the literature of an electricity sector organisation valuing natural capital in specific projects on a site by site basis. This is summarised in the box below.

Incorporating natural capital in decision making using an accounting tool

National Grid is using a natural capital valuation tool to support decision making on future estate management and investment strategies, and to identify opportunities for new value creation (Accounting for Sustainability, 2014). The tool translates natural capital values into monetary terms by estimating the value of twelve benefits provided by natural capital including flood control, air quality and recreation using over 50 published valuation techniques and values widely used within the environmental economics community. It provides monetary values for a current 'as is' baseline and for a range of site management and development scenarios, comparing current value and future values and costs.

The tool has been applied on a site-by-site basis to quantify natural capital stocks, assess the value of the ecosystem services provided and identify related risks and opportunities. The approach has been successfully piloted in investment decision making; two projects comprising over 100 hectares of land surrounding the business' operational assets are now being managed with local partner organisations to deliver a range of services. Use of the tool enables decisions to be made that optimise change in value to National Grid and local stakeholders, reduce costs and build long term growth in shared natural capital values that generate tangible social, environmental and economic returns.

A key driver for action focused on natural capital and ecosystem services in the UK electricity sector is the impacts on the environment detailed above – i.e. concerns regarding carbon emissions, resource supply, waste management and operational hazards (e.g. the safety of nuclear power). Increased Government and civil society focus on tackling carbon emissions is leading to large scale changes (primarily driven by regulatory requirements[13]) in the technologies and fuels employed by the sector, which in 2012 accounted for 27% of UK emissions covered by carbon budgets (Committee on Climate Change, 2013). Driven by the UK's target to source 15% of its energy from renewable sources by 2020 (DECC, 2011)[14], the use of renewables such as onshore and offshore wind has been rapidly scaled up in the energy sector; the UK generated 1.8% of its energy (or 5.6% of electricity) from renewables in 2007, whilst in the second quarter of 2013, the UK generated more than 4% of overall energy supply (or 15.5% of its electricity) from renewable energy (The Carbon Brief, 2013; The Guardian, 2015). Demand for biomass is expected to grow given the UK's renewable energy targets, although the majority of this demand will be met through international supply chains, with the scattered distribution of smaller UK woodlands better suited to supporting decentralised small and medium scale biomass installations (DECC, 2014; Ecosystem Market Task Force, 2013b).

Another driver towards action amongst energy companies is the potential to enhance natural capital and ecosystem services to deliver increased protection to fixed assets. The UK Climate Change Risk Assessment identifies considerable risks and uncertainties associated with meeting the climate adaptation needs of the UK, including in terms of infrastructure (Defra, 2012). As such, climate adaptation may be a future focus of the electricity sector. For instance, whilst not an electricity generating company, Shell has used a green infrastructure based approach to address flood risk at its Stanlow Oil Refinery. This facility is located on

[13] There are two components to the carbon trading industry: voluntary and regulatory. Although the voluntary side of the market is developing, the key concern for electricity generation is the regulatory requirements facing producers. (Source: EMTF, 2012)

[14] NB. The overall energy target includes transport and heating, as well as electricity generation. For the UK to meet its EU goals, electricity generation from renewable sources is likely to have to increase to above 30% by 2020.

the flood plain and is at risk from both fluvial and tidal flooding. To address this Shell worked with Cheshire Wildlife Trust to restore the ability of the Gowy Meadows nature reserve to operate as flood storage through a Payment for Ecosystem Services (PES) scheme (Smith *et al*, 2013). Internationally, a PES approach has also been used by the Electric Power Company of Quito, Ecuador to support watershed protection programmes that contribute to continued hydropower generation (Ecosystem Market Task Force, 2012).

A green infrastructure approach also been taken up by other large industrial companies, such as Dow Chemicals. Work in this area has included the use of constructed wetlands to treat waste water and manage storm water, reforestation to tackle air pollution, and artificial oyster reefs to control erosion (Dow, Swiss Re, Shell, Unilever, and the Nature Conservancy, 2013). Given the similarities between the impacts and issues associated with these industries and the power sector, there may be scope for similar green infrastructure initiatives in the UK electricity sector. Such action could involve the enhancement of the estates operated by energy companies, as demonstrated by the case of National Grid in the UK, who are currently working with AECOM to develop a framework and procedures focused on the natural capital and ecosystem services that could be secured from their property portfolio (URS, 2014). This action has been driven by company values, implementation of environmental management systems, the financial case for action, and the reputational gains to be made through delivering environmental and social benefits.

Wholesale and retail

Overview of sector

The wholesale and retail trade, repair of motor vehicles and motorcycles sector employed on average 4,737,000 people across 357,578 organisation throughout the UK in 2012 (Office for National Statistics, 2014a). These organisations' annual revenue equated to £1,371,568 million and contributed approximately 9.9% (£144,077 million) to the total UK GVA in 2012 (Office for National Statistics, 2014b).

Dependencies and impacts on natural capital and ecosystem services

Whilst the wholesale and retail sector, like all others, relies fundamentally on the provisioning services of natural capital as well as human capital, its direct ecosystem dependencies are often obscured due to the distancing effect of its supply chains which separate businesses from the primary production of raw materials. The impacts of the wholesale and retail sector on natural capital and ecosystem services therefore tend to be indirect beyond the land take involved in the construction of stores, associated facilities and logistics, and the water and energy required to run these operations and facilities (Ecosystem Market Task Force, 2012). However, some retailers have more obvious links to the natural capital that supports them, such as those supplying wood products or materials and food retailers.

Awareness and action focused on natural capital and ecosystem services

Impacts on natural capital and ecosystem services through supply chains have traditionally been seen as a form of reputational risk for businesses operating in the wholesale and retail trade (KMPG, UNEP FI, FFI, 2011). NGO campaigns on specific product ranges are particularly important in this respect (World Economic Forum, 2010). For example, the reputational risk associated with clear cutting of tropical rain forest for conversion to palm oil or soya plantations is identified as a key concern in the food retail sector (Business & Biodiversity, 2011). A clear example of the power of this driver can be seen in the case of Greenpeace, who sought to increase the sustainability of the seafood industry by placing pressure on the major retailers of these products. The NGO reported that after one year

most of the UK's major retailers had engaged in the process of ensuring that all the seafood they sell comes from sustainable sources, including removing from sale some of the more destructively fished species and commitments to phase out fish that are acquired through environmentally damaging practices, such as beam-trawling (Greenpeace, 2006).

Moving beyond such reactive action to prevent damage to business reputation, the World Economic Forum note that retailers can take advantage of rapid growth in demand for certified sustainable agricultural products to enhance the value of their brands and differentiate their products with consumers (World Economic Forum, 2010). Demand for labelled goods (e.g. 'green' brands, certified products, and eco labels) is seen as an important driver for retailers, but a shortage of particular 'sustainable' commodities (e.g. timber) and the cost of traceability and verification is seen as a concern by some (Fauna & Flora International & UNEP, 2009; DG ENV, 2010). Some value driven retailers have also sought to be proactive in their approach to sustainability in order to stay ahead of increasingly complex consumer demands (GHD, 2007). For instance, Marks & Spencer's 'Plan A' sustainability programme seeks to be 'half a step' ahead of its customers, rather than responding reactively (The Guardian, 2012b). The drivers for this action by Marks & Spencer have included costs savings (mainly from improved resource efficiency), improved brand perceptions, and, according to the company, the 'moral imperative of action' (Financial Times, 2012; Marks & Spencer, 2012).

As with the other sectors reviewed, there was **no evidence of any businesses in the retail sector taking a systematic approach to the monetary valuation of natural capital across their operations**. However Marks & Spencer's Plan A Report 2014 (Marks & Spencer, 2014) states that *"By 2015, we will assess a range of different methodologies for translating social and environmental impacts into financial models and publish our conclusions on their suitability for future use by M&S"* (p.23). This is in response to an increase in questions from investors about how social and environmental activities are measured and reported. Marks & Spencer state they are working with Forum for the Future to progress this and are also taking part in the Prince's Accounting for Sustainability (A4S) Project and the Natural Capital Coalition.

Another example of proactive action by a retailer is implementation of a Product Sustainability Assessment (PSA) tool by Boots UK, originally introduced in 2011 (The Guardian, 2014b; Verdantix, 2014). This tool covers 24 criteria including impact on biodiversity and provenance of raw materials. Work with the Defra's Central Science Laboratory to assess its raw materials use highlighted the impact of chemical ingredients on water and land-based ecosystems and enabled them to eliminate risky ingredients. Boots also worked with Kew Royal Botanic Gardens to develop processes to best source plant extracts while conserving biodiversity. This led to a reformulation of their *Botanics* skincare range using sustainable plant extracts; all raw materials in this range are now 100% traceable. These changes are anticipated to boost the integrity of the *Botanics* brand.

Unlike reputation and brand, the potential for direct cost savings has generally been a less prominent driver in terms of actions focused on natural capital and ecosystem services. Retailer concern over environmental impacts is most obvious in terms of carbon, whilst water is rising up the agenda for many (mainly focused on direct use rather than water used through the supply chain; Forum for the Future, 2009). In both of these cases the direct cost savings are clear, although there are also regulatory, reputational and operational benefits associated with such actions. In contrast, actions to address natural capital and ecosystem service related risks can lead to benefits which accrue to suppliers or other parties, so somewhat reducing the case for action (AECOM, 2015). In addition, the ability of retailers to switch suppliers can insulate them from ecosystem-related risk, so further undermining the business case for action (The Cambridge Natural Capital Programme, 2011).

Despite the focus of most retailers on protecting 'intangible' assets such as brand value and reputation through their action on natural capital and ecosystem services, there are suggestions that this is changing. Instead attention has been shifting to wider risks, including the prospects of increasing regulation, access to finance (given more stringent lender demands), and security of supply (KPMG, 2011; Marks & Spencer, 2012). Forum for the Future in their Retail Horizons report note that many key natural resources are becoming scarcer and more expensive, whilst increased global interconnectedness means that shocks can quickly ripple through supply chains, resulting in price spikes and volatility (Forum for the Future, 2014). Food retail in particular is highlighted as being 'hugely vulnerable to climatic changes' (Forum for the Future, 2009). In response to such concerns some retailers have begun to take action, including Asda's review of the risks posed to its global fresh produce supply chain by climate change and Kingfisher's 'net positive' approach to sustainability[15], which includes aspirations to create more forest than it uses and, as an interim step, to have 100% responsible sourcing of timber and paper in all operations by 2020 (Asda, 2014; The Guardian, 2014; Kingfisher, 2013)[16]. Asda and Kingfisher are also members of the Natural Capital Leaders Platform, which focuses on developing means to value, measure and manage impacts on natural capital (Cambridge Institute for Sustainability Leadership, 2015).

3.1.2 Wider business findings

In 2013, AECOM was commissioned by Defra to explore how wider participation in Payment for Ecosystem Service (PES) schemes in England might be encouraged (AECOM, 2015). This research focused primarily on business sectors with particular dependencies on natural capital and ecosystem services and its findings are highly relevant to objectives of this study.

A broad business sector analysis was undertaken before the study focused in on three sectors deemed to have high potential for PES uptake. These were:

- **Food manufacturing** – The food manufacturing sector is considered to be amongst those most dependent on ecosystem services (Fauna & Flora International & UNEP, 2009). PricewaterhouseCoopers (PwC) has highlighted that the value at stake from ecosystem degradation in agricultural supply chains is enormous and managing these risks across the supply chain will become an increasingly important motivator for business (Ecosystem Market Task Force, 2013a).

  Beverage manufacturing – The beverage industry has numerous dependencies and impacts on natural capital and ecosystem services at multiple stages in its operations (Beverage Industry Environmental Roundtable, 2012). Agricultural inputs are a key connection between the sector and ecosystem services, whilst fresh water is another critical input. The beverage sector is a major user of water resources in England (Beverage Industry Environmental Roundtable, 2012; Defra, 2007).

[15] While net positive strategies can be powerful in motivating business action, achieving such a goal is clearly challenging and some dispute if it is technically or politically feasible (e.g. Walker et al, 2009).
[16] Although the concept of natural capital is not appear to be an explicit core part of either Asda's review of supply chain risks or Kingfisher's 'net positive' approach.

- **Chemical and paper manufacturing**– A number of those UK SIC sectors classified as 'Manufacturing' are disproportionate users of water (Office for National Statistics, 2009; WRAP, 2011). The manufacture of chemicals and chemical products is the most significant sector in terms of the volume of water directly abstracted, whilst the manufacture of paper and paper products is another heavy user of abstracted water in England (WRAP, 2011).

In order to assess the PES potential of these sectors, a total of 24 interviews were undertaken with representatives from across the three sectors, along with focused literature reviews. These primary and secondary research activities explored issues very closely aligned with the themes that are the focus of this study. Table 2 sets out key findings against each of the JNCC research themes.

Table 2. Insights drawn from the Potential PES Beneficiaries research

JNCC Research Theme	Findings of the Potential PES Beneficiaries research
1. **Awareness / understanding** of natural capital and natural capital accounting	**'Proximity' to the underlying ecosystem can influence business perceptions** Observations from all of the interviews undertaken with beverage sector representatives suggested that, even where ecosystem dependencies were just 'one step removed' from business operations (e.g. procuring water from a piped service provider rather than directly abstracting from a waterbody), there was not a perceived connection or incentive to better steward the natural capital providing the services, rather a desire to reduce use primarily for financial reasons. There seemed to be more direct awareness of ecosystem dependencies amongst organisations that own the means of primary production that they rely on, with this potentially stemming from the relative ease by which the connection with the environment could be conceptualised (given fewer 'intermediate' steps) and the high probability that the benefits of any investment would accrue back to the business (e.g. would not be subject to competitors 'free-riding' on benefits generated by the investment). Conversely, supply chains appeared to disconnect businesses from those ecosystems that are remote from the site of production, where little influence is felt to be had beyond the switching of suppliers on the basis of cost. The ability to easily switch suppliers through supply chains also often appears to limit the degree to which a manufacturer is dependent on the outputs of a particular area (e.g. an agricultural region), so reducing their motivation to act. In the food manufacturing sector, supply chain were also felt to distance businesses from their dependencies and impacts on natural capital; although it was noted by one interviewee that larger companies were expected to have a greater awareness of the environmental impacts associated with their supply chain than smaller manufacturers within the sector. **Awareness can be limited to particular focus areas (particularly carbon)** Interviews with representatives from the food manufacturing sector revealed a general awareness of the sector's dependencies on natural capital and ecosystem services due to the reliance of food manufacturing on provisioning services. However, awareness about specific dependencies was comparatively low, including those dependencies that might be critical to business performance, such as water availability. An exception to this was awareness of the importance of climate regulation, given various drivers to reduce carbon footprints (e.g. cost and legislation). There was limited interest in other ecosystem services (although one interviewee had an interest in pollination services). Even when prompted, there was limited awareness or interest in supporting or cultural services beyond CSR projects focused on biodiversity[17]. In the chemical and paper manufacturing sectors there was also a strong focus on energy (due primarily to cost, with usage seen as a proxy for carbon footprint). Water was also a focus of these sectors, but to a lesser extent given lower costs.
2. **Motivations / drivers** for natural capital-	**Importance of cost-driven onsite action**

[17] For example, associated with tree planting and meadow creation projects at operational sites

JNCC Research Theme	Findings of the Potential PES Beneficiaries research
related practices	Across the beverage, food, chemical and paper manufacturing sectors it was clear that cost savings are the primary driver of action relating to natural capital and ecosystem services, particularly those that can be achieved through greater efficiencies in energy use, and to a lesser extent water use. The beverage manufacturing sector interviewees indicated that low levels of consumer demand for enhanced sustainability makes cost a particular issue, even amongst companies driven by ethical values. Interviewees in the food manufacturing sector meanwhile noted the relative simplicity of securing savings through onsite action on energy (where there are often significant savings to be made) and water (where there are fewer, but still notable savings); industry targets focused on onsite impacts (e.g. the Chemical Industries Association target for a 20% reduction in water usage per tonne of production); and the ease with which suppliers could be switched (so reducing the degree to which offsite risks are felt) as being driving forces behind such onsite efficiency drives. **Operational risk** The majority of evidence on the operational risks facing the beverage, food, chemical and paper manufacturing sectors were highlighted in the literature rather than interviews, perhaps indicating that in reality these threats may not always be a strong driver of action. In terms of the literature, the food manufacturing sector is considered to be particularly sensitive to extreme weather events, which have the potential to disrupt supplies of critical agricultural inputs (Environment Agency, 2013), whilst the beverage sector is also highly reliant on agricultural supplies (Beverage Industry Environmental Roundtable, 2012). Water scarcity may also be an increasing issue in some regions given growing population pressure and the effects of climate change. An examination of ecosystem service dependencies reveals that a number of those UK SIC sectors classified as 'Manufacturing' are disproportionate users of water (WRAP, 2011). In 2011, a report examining the challenges and opportunities facing EU chemical and related industries to 2050 found that limited access to water sources of sufficient quantity was a challenge, as was a decrease in the availability of high quality water for industrial applications (ChemWater, 2011). Finally, the protection of fixed assets (e.g. manufacturing facilities) was highlighted as a further area of operational risk. Some examples of action could be found in the literature, such as the Gowy Meadows[18] PES scheme. However, interviews with food manufacturers suggested they typically viewed upstream solutions to flooding as the responsibility of Government and/or water companies, and felt they would not normally be able to make the business case for investing in schemes to reduce flood risk offsite (i.e. they felt 'buffered' from the need to take action on certain ecosystem service dependencies; this was also found to be the case with regard to the quality and consistency of water supply which was viewed as the responsibility of water companies).

[18] The Gowy Meadows site has a history of overgrazing and being heavily managed for drainage, and was no longer functioning as a flood plain for the River Gowy. An Environment Agency (EA) study highlighted the extra flood storage capacity that restoration of the site could provide. The Stanlow Oil Refinery is situated nearby on the flood plain and is at risk from both fluvial and tidal flooding. Following the EA study, a funding partnership was established between the landowners (then Shell UK now Essar Energy), the EA and Natural England to invest in the restoration of the site to lowland grazing marsh under the management of Cheshire Wildlife Trust (Smith et al, 2013).

JNCC Research Theme	Findings of the Potential PES Beneficiaries research
	Reputational and access to ethical markets Access to growing markets for ethical goods is a potential driver of action amongst businesses (TEEB, 2010). The literature indicates that protecting brand reputation is already a strong driver for the adoption of sustainable business practices (e.g. Union for Ethical BioTrade, 2014), and in the food sector this has given rise to a proliferation of eco-labelling schemes and ethical food products (KPMG, 2011). This was borne out in the food manufacturing sector interviews, where the majority of examples of companies investing in more sustainable practices in their supply chains were driven by CSR. The literature provided further evidence of the influence of ethical markets, with the sustainability of timber regarded as being key to the paper industry's reputation given public perceptions around the link between deforestation and paper (CPI, 2013). Public perceptions such as those surrounding paper have led to increased retailer demands. For instance, The Co-operative Group has been recognised by WWF for changing its supply chain for forest goods by demonstrating that at least 95% of its paper-based products are certified by the Forest Stewardship Council (FSC) and/or made from recycled materials (Ecosystem Market Task Force, 2013a). The role of NGOs in supporting or undermining the reputation of companies was highlighted in the beverage sector interviews, with NGOs considered a significant influence on business when they are sending a consistent message through campaigning, which is in turn affecting buying choices by consumers. However, this campaigning was seen as tending to concentrate on single issues, and so may drive environmental action only in specific circumstances. The importance of maintaining a good ethical reputation was also demonstrated in interviews with chemical and paper manufacturing sectors, with all interviewees stating that they have a CSR department focused on collating information on all the elements of environmental health and safety for reporting to customers. Both of the chemical and paper trade bodies interviewed suggested that environmental dependencies that do not feature on company risk registers could feature in CSR reports. **Public policy and legislation** Interviews with the food and beverage manufacturing sectors revealed that Government pressure to act on environmental dependencies and impacts was typically perceived to be lower than pressure from corporate customers, but more pervasive than pressure from NGOs and third sector organisations (given the often single issue nature of much NGO campaigning). Government policies and regulation were also not seen as always pulling together by some in the food manufacturing sector, whilst in the beverage manufacturing sector an absence of regulatory drivers towards action on natural capital and ecosystem services was perceived; or where legislation was in place it was seen as being weaker than leading business practices. However, the beverage interviewees noted in some cases that there was some desire to keep ahead of emerging Government legislation.

JNCC Research Theme	Findings of the Potential PES Beneficiaries research
3. **Ways of working / integration** of natural capital into business operations	**Integrating supply chain dependencies and impacts** The literature suggests that some business in the food and beverage manufacturing sectors are starting to take greater account of their supply chain dependencies and impacts. For instance, the literature indicates that some leading beverage manufacturers (e.g. DIAGEO, Nestle, and Heineken) have specified that they will only purchase from sustainable supply chains in five years' time, with an objective often being a reduction in a product's overall 'footprint'. Interviews with representatives from the food manufacturing sector also highlighted high expectations in terms of sustainable production in supply chains, particularly decreasing energy and water use per unit of production. One company interviewed was actively building capacity for more sustainable supply chain practices and the larger companies who were interviewed were monitoring performance in their supply chains (e.g. water and energy use). However, whilst the majority of interviewees in the beverage manufacturing sector spoke of their long supply chains, a need to focus on costs, the complex and globalised nature of supply chains, the presence of numerous substitutable suppliers, and difficulties in realising a return on investments focused on often distant suppliers were all seen as barriers to supply chain action. In light of such barriers, companies who own their means of primary production appeared more driven to apply greater environmental stewardship (e.g. a beverage manufacturer who also owned their orchards). Shorter supply chains were also found to facilitate easier integration of natural capital and ecosystem services. For example, the literature highlighted the First Milk nutrient runoff[19] case study and the reliance of some food manufacturers on local produce (e.g. Products with European Protected Designation of Origin (PDO) status[20]). A food manufacturing sector interviewee noted that local supply chains may be more important in future for security of supply, given increasing global uncertainties.
4. **Key knowledge resources** (including metrics and tools) and lack of	**Role of trade associations and cross-sector initiatives** The literature review undertaken as part of this study highlighted the role trade bodies have in driving action. For instance, the Food and Drink Federation (FDF) has an environmental ambition statement focused on five target areas (Food and Drink Federation, 2014). The beverage sector also has several trade associations which have adopted various targets, including a reduction in water use of 20% by 2020 (WRAP, 2010), whilst the chemical industry body Cefic has produced a report for its members on biodiversity and ecosystem services (Cefic, 2013). Cross-sector initiatives may also have a role in supporting action, with a range of beverage companies found to be members of the Sustainable Agriculture Initiative Platform, a major food and drink industry initiative supporting the development of sustainable agriculture worldwide through the involvement of

[19] First Milk are working with Natural Resources Wales to pay farmers to reduce nutrient run-off on their farms to offset effluent discharge from their Haverfordwest creamery. Without this, the company would not have been able to obtain the necessary permits to authorise discharge into the River Cleddau. One of the key reasons this was possible was the short supply chain between the creamery and farmers, as First Milk is a farmer owned business. (National Assembly for Wales, 2014).) Available at: http://www.assemblywales.org/en/bus-home/committees/sustainable-land-management/Pages/case-study-10.aspx)

[20] PDO requires that foodstuffs are 'produced, processed and prepared in a given geographical area'. 'Protection of origin' is based on EU Regulation No 1151/2012 (2012) although legislation was first introduced in 1992.

JNCC Research Theme	Findings of the Potential PES Beneficiaries research
	food chain stakeholders (Sustainable Agriculture Initiative Platform 2015). Whilst companies may be individually limited in the action they can bring about (e.g. on supply chain impacts), such organisations and platforms may provide a means of bringing together coalitions of actors and a route for disseminating information. **Mapping and analysis of risks and opportunities** Interviewees in the chemical manufacturing sector noted that their sector's risk assessments were not as systematic or in depth as they could be. It was suggested that companies could go further by mapping risks associated with interrelated materials, so developing an understanding of the 'supply web', and therefore developing a greater understanding of where action might be appropriate. Meanwhile, another representative from this sector suggested promoting the uptake of accounting for natural and social capital as a means of encouraging a more holistic and long term view of business. The need for a comprehensive approach when considering the opportunities and risks associated with action on ecosystem dependencies and impacts was also highlighted in a white paper on green infrastructure co-authored by Dow Chemicals (Dow *et al*, 2013). In this paper the company called on organisations to employ more comprehensive economic and environmental footprint analyses in order to more accurately compare green versus grey infrastructure options, including assessment of the potential co-benefits of green infrastructure solutions.
5. **Changes in business practice** that can assist embedding of natural capital ideas	**Making the business case** During interviews with food manufacturing representatives concern was expressed that although schemes focused on the wider environment (such as PES) may be seen as beneficial by sustainability teams within companies, it would be necessary to convince board members that such projects could enhance profits before significant investment could be justified. Several interviewees in this sector saw schemes focused on the wider environment as competing against projects to improve onsite energy and water efficiency. Onsite actions are linked to explicit cost savings (which can be directly realised, without the complexity and free-rider problems associated with improving the sustainability of extended supply chains, where substitution might be possible); industry targets (e.g. reductions in water use per tonne of product); and the focus of major customers on these efficiencies (i.e. their interest in the carbon and water footprints of products). Manufacturing efficiencies were seen as a means of remaining competitive, with further action on the natural environment considered likely only if they could clearly support such competitiveness. Without this clear business case, wider environmental action was seen as being likely only to be supported on a small scale as part of CSR portfolios.

3.2 Interview findings

This section provides a concise summary of the key finding from the interviews with representatives of businesses in the three target sectors. Findings are presented by sector and then by research theme. The research themes are closely related to the project objectives stated in section 1.3.

Readers wanting further details should refer to Appendix 3 which presents full details of the information ascertained in the interviews with businesses.

3.2.1 Agriculture, forestry and fisheries sector findings

Awareness of natural capital and NCA

The majority of businesses interviewed in this sector (four out of five) had a reasonable understanding of 'natural capital' with one respondent referring to ecosystem services explicitly: *"the store of physical assets that the earth has from which ecosystem services derive".*

All described a broad understanding of the idea of natural capital accounting in terms of considering business impacts on the natural environment and how they can sustain natural capital e.g. "*I suppose as I look at farming we try to keep environmental balance in credit… we farm profitably and on the other hand we are trying to get the environmental balance right, in terms of caring for the countryside, enhancing the environmental features on our farms".* Some respondents also mentioned the quantitative valuation of such impacts as part of NCA. Given that businesses in this sector have the most direct links to natural capital and that we targeted 'early adopters' and 'nearly adopters' it is perhaps unsurprising that respondents showed a high awareness of these concepts.

Terms that respondents said they use within their businesses to describe the dependencies and influence of business on nature varied depending upon the specific issue and audience in question. For example, discussions around planting of a new woodland would focus on the range of 'benefits' provided in addition to carbon reduction, such as "*water quality, flood relief, more habitats, more wildlife… [and] the social benefits: public access, recreation and education opportunities. I suppose I am talking to them about the provision of ecosystem services but tend not to use that term*". The farmers, including fish farmers, used terms like 'sustainability', 'stewardship' and 'environmental management' (at least one business was accredited to ISO 14001, the international environmental management system standard; see Appendix 4 for further details of this tool). The farmers also talked about specific 'good farming practices' such as crop rotation and 'integrated farm management'.

Perceptions of dependencies and impacts on natural capital varied across the five businesses interviewed. **Businesses that are directly engaged in primary production (of trees, dairy products, crops and fish) recognised their direct dependencies on elements of natural capital** such as soil quality, water quality and quantity and fish stocks (and in some cases the potential disruption of natural capital and ecosystem services by climate change); as well as fossil fuels. This is to be expected given that they are working within the natural environment. One business was a large landowner whose land assets are all let to others, therefore the owner felt the business' dependency on natural capital was less direct. However this landowner recognised that this distancing "*can be dangerous because if you are not exposed to the short term ups and downs you can get complacent and detached to what is actually going on*."

Four of the five businesses recognised their natural capital dependencies as **posing risks to their businesses**.

One business identified **positive impacts on natural capital** such as carbon sequestration (through tree planting) and maintenance of high quality soils (through use of sustainable farming practices such as application of pig manure to fields and crop rotation).

The agricultural and forestry businesses (one an organic farmer) identified **negative impacts on natural capital** such wastewater flows, nutrient runoff, and indirect impacts from energy and fuel use as well as more distant impacts along the supply chain. The fishery business identified direct impacts such as increased carbon loading of the sea bed in close proximity to the farms (with adverse impacts on biodiversity) and the need to minimise fish escapes; and indirect impacts from consumption of fossil fuels in business operations and down the supply chain.

Natural capital-related business practices, drivers and challenges

Respondents were asked to self-assess their businesses against AECOM's natural capital maturity matrix (see Figure 6 below). **Perceptions of the stage that businesses had arrived at on their natural capital 'journey' varied significantly** with two organisations judging themselves at level 1 (understand), one at level 3 (implement), one at level 3 or 4 (implementing or embedding change) and one at level 4 or 5 (embedding or incorporating into reporting).

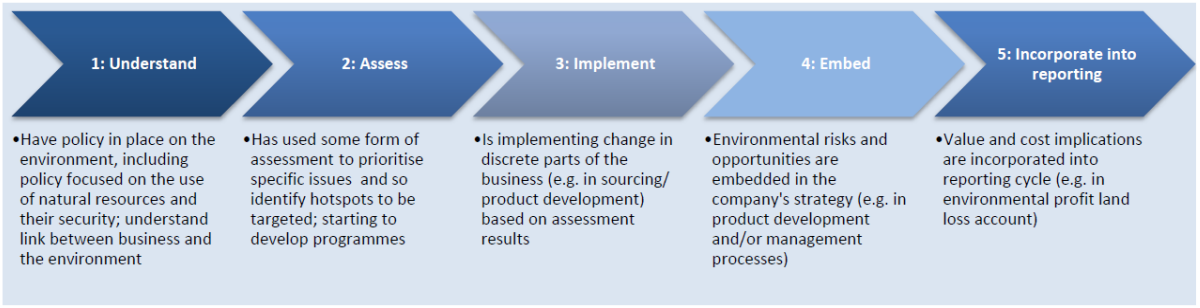


Figure 6: Natural capital maturity matrix.

The table overleaf summarises the stage on the maturity matrix along with a summary of reasons given and adopted natural capital-related practices. Please note that these are self-ascribed ratings and given the potential for different interpretations of the maturity matrix levels they should be treated with a degree of caution. For example, three businesses have rated themselves at levels 3 to 5: these businesses demonstrate an understanding of natural capital, have assessed some key natural capital dependencies or impacts (e.g. water supply, fossil fuels) and are taking action to manage these (e.g. increasing resource use efficiency) and in some cases embed these considerations in management systems. However, it appears that none of the businesses has undertaken a systematic assessment of their natural capital dependencies and impacts using a structured methodology, such as the World Resources Institute's Corporate Ecosystems Services Review (Hanson *et al*, 2012)[21] and none are including comprehensive quantitative natural capital valuations (monetary or non-monetary) in reporting.

[21] http://www.wri.org/publication/corporate-ecosystem-services-review

Table 3. Maturity matrix ratings and commentary on practices

Business	Maturity matrix rating and commentary
1 (forestry)	**Level 3-4:** They have planted nearly 4 million trees on over 900,000 acres. They do a risk assessment of every project (as part of the Woodland Carbon Code) and the carbon calculations are adjusted according to the risk perceived. They describe the wider benefits/ecosystem services of the woodlands they create to potential buyers of carbon credits, e.g. water quality and sustainable flood management benefits; public access, educational and community benefits; and local economic benefits (where the wood has a production element).
2 (large land owner)	**Level 1:** They have lots of stories and good practice they can write about (e.g. carbon reduction projects, renewable energy generation, sustainable buildings) but they lack a 'bigger plan' or framework. They are currently adopting integrated reporting which is focused on strategic objectives across financial, social and environmental aspects. When land is re-let managers will 'walk the farm' and in a subjective way inspect the land but the findings are not aggregated. They have piloted farm carbon footprint audits. Land managers are working with a water company to help improve water quality and retention of water by managing peat bogs. On farmland they are also doing research with a university on the impacts of the way fields are ploughed and planted (including use of filter strips) on water runoff, soil erosion and downstream flooding. In terms of capital investment they have a set return-on-investment 'hurdle' but they are considering how this can be lowered in some circumstances, through a formal process, to take account of societal and environmental benefits.
3 (arable/ dairy)	**Level 1:** Adopted range of on-farm natural capital-related practices including: tree planting and hedge planting, beetle banks, grass margins and buffer strips around all the water courses, wild bird margins at suitable locations to feed and to provide food and shelter for the birds, sites producing pollen and nectar for pollinating insects. Wider practices include staff training, capital investment, and internal corporate reporting on sustainability at board meetings.
4 (dairy)	**Level 3:** Accredited to ISO14001 and have key performance indicators (KPIs) for a variety of environmental impacts including fuel use; natural gas use; emissions to air, land and groundwater (they also have to comply with relevant environmental permitting regulations). Other onsite natural capital practices include: efficient water use and reducing the volumes of treated waste water discharged; managing and monitoring environmental impacts (e.g. nutrient rich runoff) on sensitive areas; and tree and hedgerow planting.
5 (fishery)	**Level 4-5:** Assessment of impacts on natural capital is partly inbuilt into the business through SEPA's (Scottish Environmental Protection Agency) licensing process. The business has to get licenses for all sites and that includes an assessment of potential impacts on the seabed. In addition, an Environmental Impact Assessment (EIA) is completed for all sites during the development process. Their strategic planning includes an environmental focus because they want to have *"long term bioavailability of our sites, which means we need to be environmentally neutral".* Improving resource efficiency is a key focus of employee training and performance-related pay. They are embedding environmental considerations and beginning to incorporate these into reporting (e.g. they report on energy use but also on containment of fish/fish escapes and impacts on habitats where they are operating).

Key drivers for action on natural capital identified by the five businesses were:

- the principles/requirements of the business's executive board or owner;
- reputation/brand e.g. *"ultimately we want to be seen as being a sustainable company and want to be sure that everyone is aware of it"*;
- the requirements and preferences of customers, including the larger retailers they supply;
- ISO14001 requirements;
- cost efficiency (resource efficiency is a win-win for financial and environmental performance); and
- regulatory requirements, e.g. SEPA set standards for sea water fish farms.

Valuation of natural capital

None of the businesses interviewed were undertaking comprehensive valuation of natural capital using quantitative techniques, though some assess discrete dependencies or impacts, either qualitatively or quantitatively e.g. on water use, soil, flood risk and carbon sequestration. Most are open to considering doing more systematic valuation in the future but an appropriate tool and/or a driver is needed.

One respondent was cautious about the value of quantifying natural capital in monetary terms, believing that given the challenges of quantification *"…a more qualitative approach may be more immediately useful and relevant to different disciplines."* Another respondent was aware of attempts to put numbers on natural capital but felt that this approach tended to be unwieldy and overly expensive. The fishery stated they "*put a huge weight*" on the quality of the water but they have not sought to put a monetary value on this or other dependencies.

Key challenges to comprehensive valuation of natural capital using quantitative techniques identified by the business included:

- lack of an appropriate tool/ matrix (cost effective, proportionate, practical) to test out;
- no one is asking for it/ requiring it/ paying for it; and
- uncertainty as to the benefit it would provide e.g. *"We do enough figures as it is, without trying to create more, which doesn't really achieve a lot… there needs to be a benefit to do it, if because we do that we get some grant or something or we tick some box, then yes."*

Ways of working that have facilitated integration of natural capital

Two businesses indicated that as natural capital considerations are integral to their operations they had been embedded from the start. However, two specific 'ways of working' that have enabled businesses in this sector to successfully integrate environmental sustainability in business operations were highlighted; **ISO14001 and Linking Environment and Farming (LEAF)** membership and annual review (further details of these tools are provided in Appendix 4).

In terms of monitoring, assessment and reporting, three businesses were monitoring carbon emissions, with one business reporting internally on a range of environmental KPIs through ISO14001, an internationally accepted standard that outlines how to put an effective environmental management system in place. Targets and progress are now discussed at board level in this business, something that is anticipated to become a requirement when ISO14001 is revised later this year.

Another agricultural business is a member of LEAF, an organisation that works with farmers, consumers and the industry to promote sustainable food and farming (LEAF, 2015), and completes the annual LEAF audit/review. This process involves reviewing progress on integrated farm management and generating action plans, policies and review dates to evaluate and map out improvements over time as well as highlighting areas to focus on in the future. The review process covers economic performance, environmental quality and social health. They also have an Environmental Steering Group (ESG) where they sit down with managers from all parts of the business to review what they are doing and where they can make improvements.

Barriers or constraints to further integrating natural capital into business operations highlighted by business included:

- the availability of appropriate tools/metrics that can measure hard-to-capture ecosystem services;
- the intellectual and practical challenge of understanding one's natural capital baseline and establishing KPIs;
- cost;
- perceived limits to what more can be done, e.g. *"On a lot of our existing farms, we are not going to be doing anymore because we are doing everything we can"*;
- the rate of technological advance, e.g. the fishery business would like to implement biological controls to reduce environmental impacts and costs but these approaches are still under development;
- regulatory restrictions, e.g. as new technologies become available, regulators need time to catch up and develop a position on what approaches are acceptable.

Businesses are seeking to overcome these barriers through engagement with peers, expert bodies (e.g. International Integrated Reporting Council, LEAF), consultants, natural capital projects and programmes (e.g. the Prince of Wales' Accounting for Sustainability Project) and by exploring the potential of new technologies to open up new management opportunities. As an example of the latter, one business expressed interest in the future use of unmanned aerial vehicles for monitoring issues that cannot be easily analysed from ground level, such as mapping weeds and disease hotspots, and thereby enabling a quicker and more targeted response and less use of environmentally harmful control measures, such as pesticides.

Knowledge resources / lack of knowledge resources

The table overleaf summarises the knowledge resources (including metrics and tools) used by the businesses to successfully integrate sustainable management in their business models. External sources of knowledge highlighted by respondents, such as expert bodies and natural capital projects and programmes, are listed separately above.

Table 4. Knowledge resources

Business	Knowledge resources (including metrics and tools)
1 (forestry)	Implements the **Woodland Carbon Code** (Forestry Commission 2015), the voluntary standard for UK woodland creation projects which account for the CO_2 they sequester. Independent certification to this standard provides assurance and clarity about the carbon savings of sustainably managed woodlands. The business uses **two Forestry Commission-derived two tools**: **Ecological Site Classification** software (from Forestry Research) to understand which tree species are best suited to any given site, how well they will grow on that site and how susceptible they are to climate change; a **set of look-up tables**, also derived by Forest Research, from which they can predict the tonnage of CO_2 that will be sequestered over a given area over a certain period by a certain mix of trees. These tables are being developed to improve their fitness for purpose.
2 (large land owner)	Uses the **CALLM (Carbon Accounting for Land Managers tool) tool** (CLA, 2015), developed by the Country Land & Business Association (CLA) for farming operations to assess their farm carbon footprint. The calculator measures emissions of carbon dioxide, methane and nitrous oxide from land-management businesses (including emissions from energy and fuel use, livestock, cultivation and land use change and the application of fertilisers) and any carbon which is stored in soil and trees (CLA, 2015). The respondent emphasised its 'pragmatic approach' (e.g. much more time- and cost-effective than undertaking soil sampling). With regard to construction of new buildings, they have also done some work assessing the **embedded carbon in different materials** or in the sourcing of different materials.
3 (arable/ dairy)	Refers to the **LEAF annual audit/review** (LEAF, 2015) which involves reviewing progress on integrated farm management (IFM) and generating action plans, policies and review dates to evaluate and map out improvements over time as well as highlighting areas to focus on in the future. The review process covers economic performance, environmental quality and social health. Through implementation of this process and close working with Natural England (NE) and the Environment Agency (EA) they have applied a variety of IFM tools/approaches, combining "the best of traditional farming" with modern precision farming technology. The business also works with the **RSPB and local wildlife organisations** which undertake on-farm ecological monitoring.
4 (dairy)	Works through **ISO14001** monitoring a range of environmental KPIs, including for water use and natural gas, using automatic meter readings and through departmental reporting. Sources key information online e.g. CO_2 reporting metrics and data from the Defra corporate reporting guidance notes; and legislative updates.
5 (fishery)	Works closely with **Scottish Natural Heritage** (SNH, a statutory consultee on some project approval processes) on a relatively regular basis, looking at potential locations for new fish farms and what impacts would arise from sites in those areas. SNH has **significant databases** that they can use to provide the business with information regarding habitats and species that their projects might impact on.

Businesses had a range of views about the extent to which lack of knowledge or lack of access to suitable data, metrics or tools constrains the development of natural capital-related practices. Some respondents identified a need to assist users to locate the relevant knowledge and data from the mass of information available.

The forestry business did not perceive a lack of knowledge or lack of access to suitable data, metrics or tools as a significant constraint. They did highlight the need for a tool (possibly using some form of remote sensing) to cost efficiently verify the growth of new woods[22], however, this tool is now under development (Forestry Commission, pers. comm.).

Respondents from the large land owning and fishery businesses both felt there was no lack of knowledge available but indicated that **finding the relevant knowledge/data was the key challenge.** For example the fishery respondent stated that *"…one of the frustrations that we have at the moment is that it can take a lot of time to know what resource we can access and knowledge of surveys that have been completed in the areas".* They would like to see a tool/GIS data layer that includes the locations of all sensitive habitats that they could overlay on other mapping. However they understand that there are sensitivities around information regarding the location of protected species for obvious reasons.

One respondent was completing the Cambridge Institute for Sustainable Leadership course *"to learn where to go to learn"* about natural capital. He suggested a **centralised one stop place to go** would greatly improve access to reliable information on this specialist area: "*The Defra conversion factors[23] are a sort of bible that everyone uses for reporting. For the areas that it covers it is great. It's just extending this sort of work for natural capitals which would be really useful."*

The arable and dairy business felt that they were better resourced than a lot of organisations and that their emphasis on enrolling people on training courses helped to keep them informed; lack of knowledge was not therefore seen to be a problem. Similarly, the dairy business felt there was no lack of data, although they did highlight problems of **benchmarking performance** against similar businesses because every business does things slightly differently with different associated impacts (cf. TEEB, 2012).

Changes in business practice

Changes in business practice that *have* helped open up new opportunities for enhanced environmental management highlighted by agriculture, forestry and fisheries businesses included the uptake of **Integrated Reporting**, joining **LEAF** and the **introduction of carbon footprinting**.

The key change identified by two businesses that *could* help in future to open up new opportunities for enhanced environmental management was an external change rather than an internal one, namely a need to **create a central source of best practice and case study material** that converts the mass of natural capital research into **understandable and practical outputs** for farmers/land managers to implement. As one respondent emphasised, there is "…*a gulf between academia on the one hand… a lot of good scientific research going on, and then there is us at the sharp end, the actual farmers… I have been critical for a while of finding this middle ground, turning research into a practical interpretation so it can be adopted by the farming community on the ground."*

[22] Under the Woodland Carbon Code this is supposed to be verified after year five and then every 10 years.
[23] These are widely used factors for converting 'activity data' such as distance travelled and litres of fuel used into carbon emissions.

The forestry business emphasised the need for increased publicity of the carbon sequestration and wider benefits of carbon offsetting through UK woodland creation, given that the approach is now well established and is generating multiple natural capital benefits.

3.2.2 Electricity supply sector findings

Awareness of natural capital and NCA

There was a reasonable understanding of the concepts of 'natural capital' and 'natural capital accounting' (NCA) among the respondents interviewed in the electricity supply sector. Four out of five businesses gave broad definitions of natural capital and NCA and the fifth interviewee also demonstrated an understanding of the concepts. Examples of the definitions provided: natural capital is *"the stock of our natural assets, soils, trees, water, etc. the important thing about them is the benefits they provide to us as a business and also our stakeholders and society as a whole".* NCA is *"around attributing a value to these sort of natural assets, so they can be of equal importance to what we would term the more traditional financial capitals, or the human capital, or social capital."*

This high level of understanding may reflect the fact that many of the businesses interviewed in this sector have significant land holdings and routinely consider ecological and wider environmental impacts as part of energy generation activities. The requirement from Ofgem for energy companies to demonstrate how any spending provides value for money may also drive greater uptake of NCA in this sector. A number of the businesses are also involved in wider natural capital initiatives such as the Natural Capital Coalition. The larger organisations are considered more likely to employ full time sustainability specialists and to have the resources to dedicate to such initiatives.

Terms that respondents said they used within their businesses to describe the dependencies and influence of business on nature varied, although many of the businesses focused on project impacts. For example, the electricity distribution business tended to talk about 'impacts' rather than 'dependencies', partly because they were implementing a series of new projects so there was a significant focus on potential impacts and how they might measure and mitigate them. However, increasingly they were also starting to consider the values of natural capital and associated ecosystem services. The two large energy generation companies interviewed used terms like 'natural capital' and 'ecosystem services'. However, one respondent noted that understanding of these terms was limited within the executive team and so they tended to talk more broadly about 'biodiversity'. Of the two smaller energy companies, one used terms such as 'biodiversity' and 'impacts on wider ecosystem services' to describe constraints on developing energy generation; the other talked of 'enhancing nature' through their projects rather than referring to natural capital or NCA.

Perceptions of natural capital dependencies and impacts again varied across the five businesses interviewed. The electricity distribution business considered their direct dependency on natural capital to be "relatively light", relating to ecosystem services such as visual amenity preservation/reduction of visual impact, noise attenuation and flood and water management at specific sites. The two large energy generation companies interviewed saw natural capital dependencies as being significant and "business critical" because floods and storms can threaten their assets and natural capital can reduce the severity of these impacts; or because of the critical need for water for cooling in power stations – identified as a key **risk**. The smaller energy companies highlighted dependencies on wind and solar radiation (biophysical processes rather than ecosystem services) and the water cycle for renewable energy generation.

Four of the businesses talked about the importance of trying to deliver **positive impacts** in terms of **ecological benefits** and/or **community benefits** through site development and management, including by taking sites out of intensive grazing or intensive agricultural production. One mentioned the importance of such efforts in securing a **social license to operate** from local communities in which they are operating for long periods. This was viewed as important because if they are seen as "not welcome" it can have a major impact on project delivery and costs. Managing sites for biodiversity can also avoid nuisance uses of sites, create educational opportunities for schools, improve amenity and help to retain and attract staff. It often involves working with wider stakeholders, for example, Wildlife Trusts.

One of the larger energy companies also identified a **commercial opportunity** in such ecological management and accounting. They anticipated that these habitats could be used in future to offset project biodiversity impacts or sell credits to the market for others to use. Another of the businesses saw a natural capital-related commercial opportunity related to anaerobic digestion. They were exploring the scope to introduce grass leys into arable systems to provide feedstock (to generate biogas for the grid via anaerobic digestion); additional benefits could include enhanced ecological value of the land (particularly if it is taken out of intensive arable production) and the control of black-grass, a pernicious weed that can significantly reduce crop yields. One of the priority recommendations of the final report of the Ecosystems Market Task Force (2013a) was greater use of on-farm anaerobic digestion.

Negative impacts on natural capital referred to by the electricity supply sector respondents included:

- impacts from **construction activities** such as building new power transmission or energy transmission infrastructure, although mitigation measures would be put in place as an outcome of the Environmental Impact Assessment process (and associated ecological surveys);
- supply chain impacts for example from **extractive industries**; and
- **significant CO_2 emissions** from energy generation (with indirect impacts on natural capital as a result of climate change).

Natural capital-related business practices, drivers and challenges

Respondents were asked to self-assess their businesses against the natural capital maturity matrix (see Figure 5 above). **Perceptions of the stage that businesses had arrived at on their natural capital 'journey' varied significantly** with organisations at levels 2-4 (assess through to embed), levels 3-4 (implement to embed) , level 4 (embed) and level 5 (reporting) (one respondent did not provide a rating).

The table below summarises the stage on the maturity matrix along with a summary of reasons given and adopted natural capital-related practices. Please note that these are self-ascribed ratings and given the potential for different interpretations of the maturity matrix levels they should be treated with a degree of caution. In this case, two businesses are using tools that explicitly value natural capital, and are using the economic language of natural capital (e.g. referring to assets and flows). Others are taking a range of environmental actions, many of which are related (directly or indirectly) to natural capital (e.g. around onsite biodiversity enhancement, sustainable sourcing of materials/products, carbon emissions reduction), but are not necessarily using natural capital terminology.

Table 5. Maturity matrix ratings and commentary on practices

Business	Maturity matrix rating and commentary
6 (energy distribution)	**Level 2-4:** They understand the issues and are applying the terminology around natural capital and ecosystem services (e.g. assets, stock and flows). They are starting to use a natural capital and ecosystem services tool, developed with AECOM to assess and value impacts and opportunities. They are implementing change in discrete parts of the business and they are working on embedding it, but they are not yet reporting (limited to some narrative description). They are "*on a journey to embed sustainability and that includes using more sustainable information in our decision making".* In terms of their supply chain, they are exploring how they could change some suppliers to drive more local benefit but they do not yet understand natural capital risk down their supply chain.
7 (large energy)	**Level 3-4 (project scale)/ 2-3 (wider group):** They have been working with PwC using their **Total Impact Measurement and Management (TIMM)** methodology to understand natural capital and to assess at a project level how they could manage impacts; given limited time and resource the focus was on material aspects. They are now moving into implementation and looking at how they can embed a 'business as usual' process for generation as well as network assets. In terms of natural capital being embedded in core business processes, capital expenditure (CAPEX) was where they started and where their A4S Leadership Network activity has focused. Employee assessment is against six core values, one of which is sustainability (e.g. encourages car sharing). Environmental information is becoming increasingly embedded in financial reports. Their work on the supply chain is mainly focused on increasing opportunities for local companies to bid for contracts, which also has environmental benefits i.e. reduced travel. Soon they will be looking at procurement.
8 (large energy)	**Level 4:** They know their landholdings and their ecological value, they understand their environmental impacts on their sites; they have identified opportunities and risks and put strategies in place to manage these. They are working to restore habitat on old coal sites and to enhance biodiversity around their power stations under the Wildlife Trust's Biodiversity Benchmark scheme; they are also developing biodiversity action plans for non-operational sites. They undertake water footprinting and have a programme targeting water efficiency improvements (the primary focus is process water). They have a corporate Biomass Standard which specifies how they procure biomass for their power stations. This includes the need to ensure they are saving carbon through the whole lifecycle, and protecting the environment (e.g. avoiding sourcing of biomass from land classified as having high biodiversity value, or from suppliers with poor waste water management). They have signed up to the UN Global Compact and are looking at the environmental risk/impact of products and using the findings to determine how much assurance is required. All suppliers are required to complete a supplier risk assessment which includes sustainability aspects. There is a risk assessment process for projects, which includes a template to record risks or benefits to biodiversity and, where appropriate, identify how these should be managed/ mitigated. They partner with Wildlife Trusts and others where appropriate. They also have a schools project developing children's interest in science.
9 (small energy)	**No rating provided:** They are focused on renewable energy. They use the Eco-Management and Audit Scheme (EMAS). They are exploring natural capital-related commercial opportunities that are environmentally beneficial e.g. anaerobic digestion. They have a strong focus on the ecological enhancement of their sites. *"natural capital is taken into account as part of formal business and as part of the annual report. The whole point of [the] organisation is to produce energy without emitting carbon"*. The focus is on renewable energy generation but they are also developing a large scale network of charge points for electric cars.

10 (small energy)	**Level 4-5:** They are focused on renewable energy. They believe the overall impact of their projects is positive because of the carbon savings generated from their projects (100% renewable energy) and also the biodiversity enhancements they implement (they work with the owners of energy generation sites to develop and implement biodiversity action plans tailored to each site to enhance habitats e.g. planting wildflower meadows). They also acknowledge wider impacts such as: consumption of energy and resources related to the operation of their office (mitigated through measures such as specifying sustainably sourced and recycled products, cycle to work scheme, renewable energy) and supply chain impacts in terms of the solar panels and wind turbine products ("*but the carbon payback for those is fairly short term, I think within a year*") including extraction of the raw resources. Their procurement process takes into account environmental and natural capital issues (e.g. in assessing suppliers their environmental credentials are scrutinised and sustainable sourcing of materials must be undertaken wherever possible). They also referred to wider environmental practices such as employee engagement on environmental behaviours. In terms of developing energy generation projects, they prioritise poorer quality and brownfield sites in the site selection process in attempt to minimise negative environmental impacts.

Key drivers for action on natural capital identified by the five businesses were:

- values of business leaders/employees (i.e. a desire to minimise negative environmental impacts and maximise positive impacts of business operations based on ethics/values);
- customer expectations – "*It's very important especially for B2B [business to business] customers to have a company that shares their sustainability goals"*;
- social licence to operate and trust in the way environmental impacts are managed;
- getting infrastructure development done and done cost effectively;
- drive efficiency; and
- regulatory requirements e.g. for climate change mitigation/adaptation plans; Ofgem requirements.

Valuation of natural capital

Three of the five electricity supply businesses interviewed were trialling approaches for quantitative valuation of natural capital. The energy distribution business is using a natural capital and ecosystem services tool on a project-by-project basis but not in their overarching business model. The respondent felt that **putting natural capital into monetary terms is useful in terms of engaging internal and external stakeholders**: *"it translates an idea, which is often intangible… into terminology like stocks, benefits and flows which resonate with different communities within the business so that has been very important in terms of engaging internal stakeholders… But using the tools to monetise also helps us to show that we only see half the benefit… and that there is a lot of benefit for stakeholders as well and that valuation be it monetary or otherwise has been a really important tool in engaging external stakeholders."* It is also helping them to start *"…**reflecting the value of the environment in our decision making** for site restorations, site change or investment in infrastructure"*.

The respondents from the two large energy companies both agreed that putting a value on natural capital is **important to getting it recognised in corporate decision making** e.g. "*unless you put a value on something it doesn't hit the balance sheet and therefore the bean counters who control how things are done will not consider it".* Both companies are exploring natural capital quantification. For example, one has worked with consultants to look at valuing natural capital on land for a transmission line project at a "very high level" using values from

The Economics of Ecosystems and Biodiversity (TEEB)[24]. However, the land take turned out to be quite small, thus the estimated value of ecosystem services was also relatively low: *"the materiality of that on a £550 million project, it's not there, but our stakeholders want to understand that, they saw these [natural capital and ecosystem service impacts] as concerns… and therefore that was a criterion for a* ***materiality assessment****".* The respondent noted that these can be quite *"generic assessments but previously we did no assessment so we see that as a positive step".* Working with SEPA, they have also been developing an 'optioneering' tool for application at the very start of the project identification *process "when you have the ability to assess as many criteria as possible… [and you can] bring in that sort of ecosystem valuation or assessment."*

The two smaller energy generation businesses were not currently quantitatively valuing natural capital but both respondents said they could see benefits of doing so. One of them highlighted that their existing qualitative approach is quite effective; for example if they go to the board and say they want to spend a £100,000 on biodiversity enhancements at a specific site and set out the reasons why, including the benefits to the community and the business (e.g. amenity and reputational benefits) they are often successful: *" I don't think our board of directors are quite as hard to persuade to do these things as most because it's a small company, it's very dynamic and is a very passionate company. So I think that the need for it hasn't been there yet but… it will get to a point where it might be needed for getting sign off on things."* This observation highlights the influence of the **corporate culture and decision making context** on the need for quantitative valuation.

Ways of working that have facilitated integration of natural capital

Working with specific tools was the most widely reported driver of the integration of natural capital considerations into business operations. Further details of the tools highlighted by respondents and the extent to which they explicitly address natural capital are provided in Appendix 4.

The energy distribution business suggested that the **use of a natural capital valuation tool had helped them to increase their understanding of the "*intrinsic value of the environment*** *around our assets and using this understanding around values to drive a sharper focus of that within our business".* As a result they are investing in ways to **engage with stakeholders** to **understand what is important in the environment** and are starting to **change the way that they develop long term site management practices.** This is also leading to **more partnerships** such as engagement with Wildlife Trusts to help manage natural capital assets for joint benefit. The site management plans include baseline information and KPIs to facilitate monitoring progress.

One of the large energy companies is trying to do a cost-benefit analysis of projects that **encapsulates the wider economic, social and environmental aspects** in the process. This is a *"fundamental change to the way we've done business...* ***it is an engagement tool; it's probably not for ultimate decision making*** *just now because it's still a little bit of a dark art [i.e. approaches to valuation of social and environmental benefits are still under development] but it's certainly getting our feet at the table in the discussions now, which previously it didn't."*

Other businesses mentioned the use of other tools such as land management plans, ecological monitoring and adoption of Eco-Management and Audit Scheme (EMAS; see detail in Appendix 4), all driven by the need to monitor and report on progress.

[24] http://www.teebweb.org

Barriers or constraints to further integrating natural capital into business operations highlighted by business included:

- cost (this seems to primarily relate to the costs, and wider resource implications, of assessing and valuing impacts and dependencies on natural capital);
- natural capital reporting is still in its infancy/ intellectual challenge;
- lack of examples/case studies;
- lack of appropriate tools – *"We have been discussing this for years, since at least 2002, over a decade later we're not much further forward… You can finesse until the cows come home, at some point need to try it in the real world and then all the problems drop out, then you can tweak it and get it to work"*;
- lack of standardised approach/ lack of certainty – "*there is huge uncertainty around what those valuations will be, how they will work in principle. Will it be something relatively easy to use and stable or will it fluctuate all over the place like the EU ETS [Emissions Trading Scheme] that plummeted in value. What we require is certainty regarding that price signal and it doesn't exist at the moment. So until that is much clearer it's unlikely that many organisations will start caring for ecosystem services or natural capital"*;
- lack of steer from Government - there is a need for clarity about *"what the Government would like us to do, can it incentivize or can it start helping with more guidance around this idea of costs and values… can it help to promote that more long term thinking"*; and
- with respect to land restoration: pressures from surrounding land owners, practical constraints on what can be delivered (e.g. if a site is surrounded by intensively farmed land)[25], cultural attachments to landscapes as they are (even if they provide limited ecosystem services).

Businesses are seeking to understand more about how they can integrate natural capital in their decision making through engagement with expert bodies (e.g. Natural Capital Committee, Natural Capital Coalition, UN Global Compact, Wildlife Trusts), consultants, projects and programmes (e.g. the Prince's Accounting for Sustainability Project, NERC Valuing Natural Capital project), land owners and Government. This involves either direct engagement in these initiatives or use of outputs from these initiatives.

Knowledge resources / lack of knowledge resources

The table below summarises the knowledge resources (including metrics and tools) used by the interviewed businesses to successfully integrate sustainable management in their business models. External sources of knowledge highlighted by respondents, such as expert bodies and natural capital projects/programmes are listed separately above.

[25] The respondent suggested a need for a *"joint biodiversity enhancements"* mechanism where fair and reasonable off site enhancements could be delivered that maximized ecological outcomes.

Table 6. Knowledge resources

Business	Knowledge resources (including metrics and tools)
6 (energy distribution)	Uses their **natural capital and ecosystem services tool**, developed with AECOM and using values based on over 50 published environmental economic studies, which helps them to understand and value their impacts but also to identify opportunities to realise enhancements. The respondent also mentioned **planning guidance called EM5EN-5** about planning for electricity transmission infrastructure *"which talks about softening of environmental impacts and we think that is a great opportunity for us to understand how we can bring natural capital and ecosystem services to bear around some of our major projects".*
7 (large energy)	They have been working with PwC using their **Total Impact Measurement and Management (TIMM)** methodology to understand natural capital and to assess options at a project level; given limited time and resource this has focused on material aspects. They seek to use a lot of **information that is already collated** such as environmental impact assessments, measured project specific data (e.g. on CO_2, mileage) and secondary data (e.g. IPPC, Defra models and conversion factors for CO_2 and GHGs). However sometimes this KPI data does not meet their needs so they are looking at how to refine the approach and how best to report. They are also experimenting with cost-benefit analysis of projects that **encapsulates the wider economic, social and environmental aspects** in the process.
8 (large energy)	Uses the **Biodiversity Benchmark** (The Wildlife Trusts, 2015), a Wildlife Trust independent verification/award scheme that requires good ecological management on site and improvement of habitats. They are currently reviewing this to see if people are aware of it and if it is "*creating value for business".* They also have a corporate **Biomass Standard** which specifies how they procure biomass for their power stations. This includes the need to ensure they are saving carbon through the whole lifecycle, protecting human rights and the environment (e.g. in terms of water, ecology and invasive species). They carry out **water footprinting** for their power stations and CEFAS fish surveys looking at species and volumes entrained. They make use of a **range of existing data sources**: MAGIC[26], Natural England, survey work on land, National Biodiversity Network recorder database (National Biodiversity Network, 2015), Google Earth for aerial photos, etc. They are also **developing a new approach based on 'key indicator species'** – the aim is to be able to survey large parcels of land and understand biodiversity status very quickly without huge survey costs.
9 (small energy)	Uses all the **datasets from the statutory agencies** and nature conservation bodies. They also have **very extensive GIS capabilities** in-house. They do the full suites of **ecological surveys** of all new sites using in-house staff plus contractors. They also do **life cycle assessment** of wind farms and 'carbon balance' calculations for anaerobic digestion (AD) plants (i.e. calculate emissions from AD plant and emissions absorbed during growth of feedstock).
10 (small energy)	They have drawn on somewhat limited **research on the biodiversity effects and enhancements around solar farms** to demonstrate what can be done.

[26] Defra's MAGIC website provided authoritative geographic information about the natural environment from across government.

Businesses had a range of views about the extent to which lack of knowledge or lack of access to suitable data, metrics or tools constrains the development of natural capital-related practices.

Two businesses felt there was generally no lack of knowledge or data and that the constraints were more around having the skills and resource to make the most of the available knowledge and data and the business culture: *"this is a little bit about the philosophy of some organisations that we don't wait for things or for perfection; we actually get on and try stuff… rather than waiting for Government to say this is the way to do it or this is what you need to think about".*

Specific knowledge requirements that were identified included**:**

- **a lack of detailed worked examples where you get "to see under the bonnet" and people willing to discuss them openly**: "*it's about having people willing to actually talk in detail around these projects and be willing to share the sort of deep down honest feedback, what worked, what didn't work and if it did work how did they work round it"*;
- **a lack of accurate data on bats** across the UK (this was mentioned by one respondent in relation to assessing the environmental impacts of projects, however due to time constraints, it was not possible to explore this in further detail); and
- **a lack of data on biodiversity enhancements and other environmental gains around solar farms** (this data was sought to support the case for recognising wider environmental benefits of solar farms beyond carbon reduction).

One respondent identified a **need for a central resource** where detailed examples are collated in a consistent format: "*I think it's probably the most fundamental thing because there are loads of really really good examples out there but people are just not sharing."*

Changes in business practice

The businesses that were interviewed struggled to identify changes in business practice (e.g. move to environmental profit and loss (EP&L) or 'triple bottom line' reporting) that have helped, or could help, to open up opportunities for enhanced environmental sustainability management. The energy distribution business respondent did pick up on the mention of EP&L and noted that Puma's work was useful in terms of persuading people to talk about these issues; he suggested examples and case studies can be powerful means for building up a community of interest and encouraging the adoption of similar approaches. Most other respondents cited issues and tools that had already been referred to and which did not strictly constitute changes in business practice. One respondent mentioned that, in the wider sector, 'carbon balance' methods and the realisation of the value of peat bogs for carbon storage is something that the industry has taken account of more recently. The energy distribution company also mentioned how the use of a natural capital valuation tool had helped them to increase their understanding of the intrinsic value of the environment around their infrastructure assets and how they had used this new understanding of natural capital values (including greater appreciation of the value of these sites to wider society) to drive changes in business practices such as collaborating with wider stakeholders in new approaches to the management of some of their sites.

3.2.3 Wholesale and retail sector findings

Awareness of natural capital and NCA

Respondents from all four retail businesses interviewed demonstrated a reasonable understanding of the concept of 'natural capital'. Understanding of 'natural capital accounting' appeared to be more limited with only one business defining this term, although other respondents demonstrated through their answers to subsequent questions that they did understand some of the key NCA issues and challenges. One respondent expressed strong reservations about NCA: "*Being brutally honest a concept which I'm not sure has progressed very far".*

The lack of a comprehensive understanding of NCA was perhaps not surprising given that these businesses' most significant interactions with the natural environment are often through their supply chains - which may be long and complex - and thus they are more distant from many natural capital impacts (relative to businesses in the agricultural sector for example).

The retail businesses tended to talk more broadly about sustainability rather than natural capital.
The interviewed businesses tended to talk about "sustainability", "corporate responsibility" or "*stewardship of natural resources".* The department store, which did use the term 'natural capital', was the exception.

Perceptions of natural capital dependencies and impacts again varied across the four businesses interviewed although, as would be expected for the retail sector, these tended to focus on supply chain impacts.

The pharmaceutical retailer identified dependence on **mineral resources** as a potentially large **risk** ("*It takes millions of years to make minerals*") and has started to mitigate this risk by partnering with relevant organisations to grow sustainable ingredients from plants for its future products. The respondent stated that valuing natural capital is important as it is this knowledge that enables the business to develop *"products and services which are going to be appropriate for that future"* and therefore this information is critical for making better, more informed decisions. The key impact on natural capital highlighted was the **inappropriate disposal** of consumer products (despite labelling).

The supermarket recognised its "total dependence" on natural capital: "*In a fresh food business it is difficult to do fresh food without fresh water and soil*". The business identified key natural capital-related risks as: **extremes of water availability** (drought and floods) impacting its supply chain in the short term; and **soil quality and genetic variation** in the medium and long terms, respectively. In terms of natural capital impacts, they considered these in terms of three categories: **estate operation** (e.g. impact of building new stores), **supply chain** (e.g. they had just started work on the impacts of cotton cultivation) and **customers** (raising awareness about the impacts of customers' choices on the environment).

The gardening retailer highlighted their heavy dependence on **plants and wood** (in the form of furniture) as these formed the basis for key products. As such, the organisation has a **'sourcing with care' policy** embedded into its Corporate Responsibility (CR) strategy, which seeks to mitigate its dependencies and impacts on natural capital (e.g. through a focus on local sourcing, FSC-certification of wood products and sustainable certification of fish, sausages and coffee sold in their cafes). The business is also focused on **peat** as "*in terms of **reputation** it's a potential risk*"; they promote peat-free compost and are waiting to see if Government will enforce peat elimination by 2020. They also highlighted positive natural capital impacts due to the fact they were selling plants that will capture carbon as they grow.

The respondent from the department store recognised that their dependency on natural capital was relatively significant in their supply chain and listed specific examples of **timber, cotton**, and *"overall a huge amount of raw materials"*. The need for sustainable sourcing of such materials was recognised. The business also owns and operates its own farm which requires management of its natural capital to produce goods sustainably. They viewed natural capital as a **long term risk** and are starting to assess it more accurately as part of their sustainability strategy. The impact of the construction of new stores on natural capital and emissions from operating stores was also highlighted. Such negative impacts are mitigated through implementation of a sustainability strategy which includes targets to reduce a range of impacts (e.g. CO_2 emissions, waste arisings) and working with suppliers to reduce the impacts of their operations (e.g. a project seeking to reduce the impacts of pig production). Potential positive impacts on natural capital were also highlighted, for example an initiative to plant 100 trees on one of their sites, the benefits of which in terms of air quality regulation were valued.

Natural capital-related business practices, drivers and challenges

Respondents were asked to self-assess their businesses against the natural capital maturity matrix (see Figure 5 above). **Perceptions of the stage that each business had arrived at on their natural capital 'journey' varied widely with organisations at level 1 (understand), level 3 (implement), levels 4-5 (embed to reporting) and level 5 (reporting).**

The table below summarises the stage on the maturity matrix along with a summary of reasons given and adopted natural capital-related practices. Again it is important to recognise that these are self-ascribed ratings and given the potential for different interpretations of the maturity matrix levels they should be treated with a degree of caution. For example, the two businesses rating themselves at levels 4 or 5 are implementing a range of commendable environmental sustainability actions but it appears that neither had undertaken a systematic assessment of all business natural capital dependencies and impacts, or included comprehensive quantitative natural capital valuations (monetary or non-monetary) in reporting.

Table 7. Maturity matrix ratings and commentary on practices

Business	Maturity matrix rating and commentary
11 (pharmaceutical retail)	**Level 5:** They have adopted several natural capital-related practices across the business including a "*move from mineral to plant based ingredients"* and "*also moving into renewable packaging."* The respondent stated that "*Natural capital related practices are embedded across all these business processes".* The finance department had started using non-financial information, including both social and environmental data, over recent years to better understand the financial information and manage the business better, in essence integrated reporting.
12 (supermarket)	**Level 1:** They have established approaches to and metrics for carbon and water. The business has also started some work with LEAF on supporting biodiversity on farms and has also just started work on cotton cultivation impacts. They also considered natural capital impacts in developing news stores and raised the awareness of customers about impacts on the environment. However, overall the business did not believe that it was in a particularly strong position to manage its impacts or dependencies on the natural environment as the correct metrics are not currently in place. They only currently have a partial understanding of natural capital and *"given we don't understand natural capital I would be a bit loathe to incorporate it*".
13 (gardening retail)	**Level 4-5:** The organisation has a 'sourcing with care' policy embedded into its CR strategy, which mitigates its dependencies and impacts on natural capital. The CR task force (senior manager level group who make things happen on the ground in all the garden centres) input at board level. The respondent emphasised that *"everything starts at the top, the CEO, reporting into board*". They have a network of environment and charity champions to cover all centres, and who train other staff – for example, on reducing utility usage, increasing recycling, etc. They look at where the risks are and where the 'up sides' are, such as cost savings from environmental action, environmental sourcing in the supply chain and the charitable work which creates reputational benefits and is good for customers (this is across marketing, buying, supply chain management).
14 (department store)	**Level 3:** They view natural capital as a long term risk and are starting to assess it more accurately as part of their sustainability strategy. The organisation has adopted several natural capital-related practices across the business including tree planting (ecosystem service benefits were valued) and improved pig production projects. They are also working with cotton farmers to promote environmental best practice in cotton production. The organisation stated that sustainability practices are embedded into strategic planning, capital investments, management information systems, performance evaluation and corporate reporting. However, natural-capital related practices are not always specifically embedded in these processes. Overall they considered their company to be at level 3 (implement) on the maturity matrix *"with some work in Embed and Incorporating into Reporting taking place in parts of the business".*

With respect to the above table, the supermarket respondent expressed scepticism that others would have progressed far along the natural capital journey mapped out on the maturity matrix: "***I don't think anyone out there can really understand natural capital and its business impacts****… I just don't think we are in a position to be able to manage it… we haven't got the right metrics, we are not sure what all this means, we are not sure about these dependencies… all of this has to be completed before I can embed this into this organisation... even at an academic level it's not understood and there are lots of people trying to explore concepts around it and until that has come back round to being something we can get a hold*

of and dumbed down to our level I just don't believe people can make the honest claim that they are improving along that matrix."

Clearly the maturity matrix rankings need to be treated with a degree of caution as they are self-ascribed. Unfortunately given the time and resources available for this research we were not able to cross check the maturity matrix ratings provided by respondents against other sources.

Key drivers for action on natural capital identified by the five businesses were:

- saving money;
- protecting and enhancing reputation;
- operational risk mitigation (e.g. risk of supply shortages or price increases); and
- addressing regulation.

Valuation of natural capital

Three of the four businesses interviewed in this sector expressed reservations about quantifying dependencies in monetary terms. **Nevertheless, two of the four retail businesses interviewed are trialling quantitative valuation of natural capital but this work is at an early stage. One other is considering the value of natural capital in qualitative terms but only in small parts of the business.**

The pharmaceutical retailer highlighted the importance of quantitative valuation of natural capital: "*We can only get people to understand the scale of the problem if we can turn it into some sort of monetary value* ". The business has started the journey of considering the value of natural capital by linking qualitative CSR data with quantitative financial data. This has been driven by recognition of the "*difference between price and value*" for key resources. For example the organisation considers that the value of water is 17 times that of the price the organisation actually pays for it. The organisation will use this work to inform future decision making.

The department store had also started to consider quantification of natural capital value but only in a small number of specific projects such as the "100 trees" project which calculated the value of tree planting in terms of improved air quality. The business was hesitant about quantifying natural resources in monetary terms given the lack of understanding of natural capital and business impacts, the challenges in generating the numbers and the uncertain value the business would derive from doing this. However the respondent suggested in the long term it could be an important tool. *"In terms of non-monetary values… cultural and landscape it is very minor. It is quite tricky for us as once you start talking about landscape impacts [as] we don't work on a landscape scale..."*

The supermarket had started considering the value of natural capital in discrete parts of its business, for example they assessed the sustainability of wild fish sold in their stores *"to a very high level".* The respondent was sceptical about the ability to accurately understand and quantify natural capital-business links at present.

The gardening retailer respondent believed that it is more important to have the general principles of valuing natural capital in place rather than monetary values as any numbers would be based on many questionable assumptions.

Ways of working that have facilitated integration of natural capital

Two businesses highlighted organisational structures as critical to integrating considerations into business operations whilst one mentioned completion of an organisation wide materiality assessment.

The pharmaceutical retailer and the gardening retailer both highlighted having a high level CSR/CR committee or task force that inputs at board level as an important way of working to integrate natural capital considerations into business operations. The gardening retailer emphasised that *"everything starts at the top, the CEO, reporting into board"*; this leads to a strategy, then an action plan and then implementation/embedding: *"It's easy writing strategies… making it happen and embedding is difficult."*

The department store conducted an in-depth **materiality assessment** across the entire organisation which was used to prioritise areas for action: "*Unsurprisingly operational emissions from our estate were high; deforestation linked to our timber products was also another material issue*". All material issues have now been incorporated into the business' strategy and they are now strengthening stakeholder engagement on these material issues and reviewing and updating existing KPI's and targets.

The supermarket had yet to make any significant progress in developing ways of working to integrate natural capital considerations into their business operations. The organisation was hoping to address this in future and was considering applying some form of natural capital criteria when initiating new product development.

Barriers or constraints to further integrating natural capital into business operations highlighted by business included:

- overcomplicating the issue - *"…the biggest issue is that people who engage in this agenda like to make it more complicated than it needs to be… There is a bit of a disconnect between Corporate Responsibility people like me and people with technical know-how"*;
- lack of a standardised approach or consistent framework for measurement – "*If 20 companies are trying to work out the value of water we may get 20 different answers and as a result the numbers start to lose credibility"*;
- lack of understanding of natural capital - *"Until we understand we can't know what other technological, financial, etc. barriers there are… how much is a little black fly worth, how many do you need, how you manage the value of soil, how do you incorporate improvements to soil organic matter versus ease of weed control?"*;
- cost and resource implications of measuring and valuing natural capital impacts in multiple products and supply chains - *"It is very difficult to measure or to put a value on natural capital especially in terms of our supply chain and this process would need massive resource and would be extremely complex to complete given the constantly changing nature of our supply chain"*; and
- maintaining a corporate focus on natural capital - in the face of competing priorities *"…it continually takes effort to keep it on the agenda… How do you make it integral to the business so it doesn't become just another thing, a nice thing to have?"*

Three of the four businesses referred to seeking to overcome these barriers through engagement with external experts. The pharmaceutical retailer had links with "*lots of clever people*", including academics who "*understand a certain theory but lack the real practical examples to make what they are investigating come alive. If we are able to work with them on some of our issues we can use their technical knowledge to come up with the answers*". The supermarket identified the **Cambridge Institute of Sustainable Leadership** as their key knowledge resource whilst the department store mentioned taking part in conversations with

the **Natural Capital Coalition** and supporting their work, as well as internal collaboration on natural capital across several divisions.

Knowledge resources / lack of knowledge resources

The table below summarises the knowledge resources (including metrics and tools) used by the interviewed businesses to successfully integrate sustainable management in their business models. External sources of knowledge highlighted by respondents, such as expert bodies and natural capital projects and programmes, are listed separately above.

Table 8. Knowledge resources

Business	Knowledge resources (including metrics and tools)
11 (pharma-ceutical retail)	Internal social and environmental data collected for CSR purposes. Emphasised external knowledge resources (see section above).
12 (super-market)	They have established approaches to and metrics for carbon and water. Emphasised external knowledge resources (see section above)
13 (gardening retail)	They collect data on key environmental KPIs including energy and water use in their garden centers and sales data on sustainable products such as peat free compost and FSC-certified furniture. They also scrutinise information from suppliers, including environmental data, when looking at sourcing options.
14 (department store)	Sustainability is embedded in management information systems; they have completed an in-depth sustainability materiality assessment across the whole organisation. Emphasised external knowledge resources (see section above).

The retail business respondents had a range of views about the extent to which lack of knowledge or lack of access to suitable data, metrics or tools constrains the development of natural capital-related practices. Two identified knowledge constraints whilst two were less concerned about knowledge gaps.

The pharmaceutical retailer indicated that there will always be debate about the values placed on different aspects of natural capital. However, they do *not* see this lack of consensus on precise values as a particular constraint: *"…we go with a realistic approach and scenario as to what is happening in the world and a realistic valuation/cost to put on things… Looking to the future, whether water is 15x or 17x undervalued is not the point; the* ***point is that we are underpaying by a long, long way****. Understanding this makes us say OK, if we were charged the right amount what would we do as a business? How do we use less water?"*

The supermarket respondent believed a **lack of knowledge about natural capital practices is a heavy constraint.** *"I think it's more important to take it a layer down and be able to look at it from a business perspective rather than a higher level policy."* Providing new knowledge tools and data and/or use specific networks to disseminate knowledge more effectively are a good idea *"but what impact would that have, they* ***need to know what they are disseminating and how appropriate and applicable it is****…The parallel on carbon is quite interesting. If you think about carbon we all started running around talking about food miles, then it needed to become carbon footprint, and then people went offsetting, and then went that's not appropriate either.* ***A level of caution is needed*** *and it is much more complex dealing with natural capital unless I'm missing a trick."*

The gardening retailer had **reasonable data on operational sustainability** issues such as water consumption but said that they **did not go as far as full natural capital quantification** and reporting (therefore data constraints are less of an issue).

The department store indicated a need for **more supply chain information** and better sharing of this information across supply chains. In longer supply chains challenges of accessing the relevant data were highlighted, meaning it is difficult to target improvements. The respondent also highlighted the critical need *for "having **industry recognised metrics** for natural capital"*; and highlighted the potential utility of the **US i-tree model** (i-Tree, 2015)[27] which can be used to quantify in monetary terms the ecosystem service benefits provided by trees. Knowledge providers could help by introducing a UK equivalent of this tool.

Changes in business practice

The businesses that were interviewed struggled to identify any changes in business practice (e.g. move to EP&L or 'triple bottom line' reporting) that *had* helped open up opportunities for enhanced environmental sustainability management. The exception was the pharmaceutical retailer which indicated a key factor was having private equity investors who invested for a number of years, allowing them to gain a better understanding of the business and enabling improved decisions.

In terms of what changes *could* help open up opportunities for enhanced environmental sustainability management, the department store respondent addressed this most directly, indicating that ***"Integrated Reporting, the IIRC [International Integrated Reporting Council] framework, could be really important going forward** but it very much depends on how many organisations do it and how widespread it becomes."* Further details of Integrated Reported are provided in the Discussion section and in Appendix 4. The respondent suggested that **knowledge providers could help by** creating **industry wide metrics for natural capital** that could work across different industry sectors; and strengthening the **business case** for accounting for natural capital.

[27] For UK application of the itree model see: http://www.torbay.gov.uk/itree

4. Discussion

This section of the report compares and contrasts findings across the three sectors targeted in this study: agriculture, forestry and fisheries (AFF); electricity supply; and wholesale and retail. It also integrates relevant insights and findings from the wider literature. The discussion is structured in terms of the key research themes which in turn are linked to the project objectives (as explained further in section 2.5):

1. **Awareness / understanding** of natural capital and natural capital accounting;
2. **Motivations/drivers** for natural capital-related practices (objective 1);
3. **Ways of working**/integration of natural capital into business operations (objective 2);
4. **Key knowledge resources** (including metrics and tools) **and lack thereof** (objectives 3 and 4); and
5. **Changes in business practice** that can assist with embedding of natural capital ideas (objective 5).

This section also seeks to address objective 6 (focus on knowledge providers) and objective 7 (insight into other sector reviews). Suggestions for actions on the part of knowledge providers to support businesses to realise the value of nature are made throughout this section with key recommendations summarised in the Conclusions and Recommendations section. Insights for other sector reviews are provided in sub-section 4.6.

It is important to highlight that given the limited number of interviews carried out for this study (14 interviews in all) the findings should be treated as indicative only and cannot be considered to be representative of business views across these sectors.

4.1 Awareness and understanding of natural capital and NCA

This study identified a relatively **high level of understanding of the concepts of natural capital and natural capital accounting** across the three sectors. This is perhaps unsurprising given that to some extent the sample was self-selecting, i.e. we sought out 'early adopters' and 'nearly adopters' and people who did not understand the term natural capital (which was used in the project brief circulated to potential interviewees) may have declined to take part in the research. While other studies have indicated increasing recognition amongst businesses of their dependencies and impacts on natural capital, the level of understanding of these concepts across the sectors as a whole may be more limited.

With the exception of the larger energy companies and the department store, other respondents indicated that, within their businesses, they would **not tend to talk about natural capital and NCA**. Instead they will tend to use terms such as 'sustainability' and 'stewardship' (AFF and retail); 'environmental management' and 'good farming practices' (AFF); and biodiversity (electricity supply). This **may indicate the lack of a systematic and holistic approach to natural capital**, for example based on using an ecosystem services framework to inform a comprehensive assessment of natural capital dependencies and impacts (e.g. see Corporate Ecosystem Services Review, Hanson *et al*, 2014).

Perceptions of natural capital dependencies and impacts varied significantly both within sectors and across sectors. In terms of dependencies, businesses mostly talked about natural capital stocks (e.g. water) and the provisioning services that flow from natural capital (e.g. timber, fish), with more limited reference to regulating services (e.g. climate and water regulation), supporting services (e.g. primary production) and cultural services (e.g. aesthetic values; cf. TEEB, 2012). The dependencies identified by interviewees broadly reflected those identified for the target sectors in the literature review.

Businesses that are directly engaged in primary production (of trees, dairy products, crops and fish) recognised their direct dependencies on various elements of natural capital and most saw these as key risks to their businesses (cf. BBSRC, 2014). This is to be expected given that they are working close to the natural environment. The large energy companies saw natural capital dependencies as being significant and "business critical" because floods and storms can threaten their assets and natural capital can reduce the severity of these impacts; or because of the critical need for water for cooling in power stations. The retail businesses tended to focus on supply chain issues such as access to sustainably sourced raw materials. Intra-sector variability in responses is likely to be a function of different business contexts (e.g. different aims, operating environments, assets, corporate cultures etc.) as well as different levels of awareness amongst respondents.

Overall there was limited identification of natural capital dependencies as significant business risks, underlined by the fact that natural capital-related risk was not often identified as a key driver for action (see below). This reflects the finding from the Prospective PES Beneficiaries research (AECOM, 2015) that the majority of evidence on the operational risks facing the beverage, food, chemical and paper manufacturing sectors was in the literature rather than gleaned through interviews, which was interpreted as indicating that, in reality, these threats may not always be a strong driver of action. It is not clear if these businesses' perceptions are accurate or if they are inaccurate and based on a lack of awareness of the risks posed by natural capital dependencies. It may be the case that some businesses believe that managing some of these risks is the responsibility of others and therefore they are 'buffered' from these risks and no action on their part is strictly required (cf. AECOM, 2015). Or these views could be based on a perception that the ecosystem services on which a business is dependent have cost effective substitutes and thus the risk associated with the dependency and the associated need to invest in natural capital is reduced (Hanson *et al*, 2012).

When asked about impacts on natural capital, most businesses identified **negative impacts**. Responses again varied significantly both within and between sectors. Businesses generally seemed to be aware of their impacts, with most information provided on direct impacts (e.g. from the AFF sector which is closest to natural capital, or from the construction and operation of business properties) and less information provided on supply chain impacts, probably because the latter are more difficult to understand (particularly where a business has multiple supply chains; cf. AECOM, 2015).

Four of the five electricity companies also highlighted **positive impacts on natural capital** in terms of ecological benefits and/or community benefits delivered through the development and management of sites. One mentioned the importance of such efforts in securing a social license to operate from local communities where they are operating for long periods. In contrast, positive benefits were mentioned by few in the other two sectors.

Two of the energy companies also referred to emerging **commercial opportunities** related to the ecological management of their sites (no other businesses mentioned such opportunities). One was around using their existing sites to offset project biodiversity impacts or sell credits to the market for others to use. The other had identified an opportunity to introduce grass leys into arable systems to provide feedstock for anaerobic digesters supplying biogas to the grid as well as wider ecological benefits. Such opportunities for revenue growth receive limited coverage in the natural capital business literature (an exception is Mead, 2014, who investigated the use of corporate ecosystem valuation tools in large companies and found very limited use, but greatest use amongst those able to capitalise on emerging markets), yet they are likely to be of significant interest for all businesses with substantial landholdings. **Promoting examples of such projects might be powerful means of driving business engagement in the natural capital agenda.**

4.2 Natural capital-related business practices, drivers and challenges

Businesses in the AFF sector have natural capital-related practices at the heart of their businesses by definition, e.g. the primary production of crops, trees and fish. Besides detailed natural capital management practices, other business practices highlighted by these respondents included the adoption of **Integrated Reporting** (also highlighted by one of the retailers), accreditation to **ISO14001** (an internationally accepted voluntary standard that sets out how to establish an effective environmental management system; see Appendix 4 for further details) and use of EIA for new projects. Further details of both of these tools including the extent to which they explicitly deal with natural capital are provided in Appendix 4.

Integrated Reporting and natural capital

The International Integrated Reporting (IR) Framework was released by the International Integrated Reporting Council (2013) in December 2013. IR is a process founded on integrated thinking that results in a periodic integrated report by an organisation about value creation over time and related communications regarding aspects of value creation. The aims of IR that are of relevance to valuing nature in UK business include a focus on reporting that communicates the full range of factors that materially affect the ability of an organisation to create value over time; creating enhanced accountability and stewardship of the broad base of capitals, explicitly including natural capital; and supporting integrated thinking, decision-making and actions that focus on the creation of value over the short, medium and long term.

The level of uptake of IR by UK businesses is currently unclear but includes large businesses such as Marks & Spencer and the Crown Estate. **If there is widespread uptake of IR then it may be useful to develop specific guidance for businesses on how NCA can be integrated with and enhance IR.**

Businesses in the electricity supply sector have a strong focus on impact assessment as part of developing new energy infrastructure and also on managing supply chain impacts. One also emphasised use of an Eco-Management and Audit Scheme. Two of the businesses are experimenting with natural capital valuation tools at a project level.

Retail organisations, like some AFF sector and electricity supply organisations, appeared to be largely focusing their sustainability work around "eco-efficiency" measures (Dyllick and Hockerts, 2002; e.g. monitoring and targeting improvements in CO_2 emissions, water consumption, waste), all of which have direct or indirect impacts on natural capital, rather than applying an ecosystem service framework (i.e. provisioning, supporting, regulatory and cultural services) and considering impacts of options on natural capital stocks and ecosystem service flows in a **systematic way**[28]. This finding mirrors the wider literature; for example Cranston *et al* (2015) noted that business action on natural capital-related issues has tended to focus on water usage and carbon emissions, neglecting other elements of natural capital such as biodiversity, soil and their interdependencies that are essential to the production of raw materials through the supply chain. This may also reflect issues around the complexity of addressing natural capital through extended/multiple supply chains and the presence of

[28] The underlying rationale for the valuation of ecosystem services is to capture the full range of environmental impacts more systematically and comprehensively and, in doing so, better highlight the value of services provided by the natural environment for human welfare.

numerous substitutable suppliers, meaning businesses have limited dependency on individual suppliers and thus limited incentives to invest in supply chain sustainability (AECOM, 2015). Some large retailers are considering natural capital impacts along their supply chains, but this is often focused on primary production overseas rather than in the UK.[29] For example Asda's sourcing arm has reforested large areas with native trees and created connections between 600 hectares of forest. These interventions have supported the survival of forest dwelling animals (e.g. a variety of monkey, deer and bird species), improving the business's local reputation. They have also secured the health of the ecosystems on which their plantations and farms depend (Cranston *et al*, 2015).

The established business focus on measuring environmental inputs (e.g. water, energy, materials) and outputs (e.g. pollutant emissions and solid waste) in environmental performance management[30] is also highlighted by TEEB (2012)[31]. TEEB suggest that the measurement of impacts on natural capital and changes to natural capital (and the ecosystem services that flow from it) is more difficult, especially as it may require attention to wider ecological linkages that extend far beyond a company's operational boundaries or direct control. However they point out that businesses can use conventional environmental indicators of incoming resource flows and outgoing pollution and waste as proxies for natural capital impacts, dependencies and/or responses. For example a measure of the volume and toxicity of wastewater discharged could represent a broad indicator of impacts on biodiversity in the receiving water body.

Perceptions of the stage that businesses had arrived at on their natural capital 'journey' varied significantly both within and between sectors. AFF and retail sector businesses rated themselves from level 1 (lowest) to level 5 (highest) and electricity companies rated themselves from levels 2-4 (lowest) to levels 4-5 (highest). These findings seem to indicate that there is no consistent difference between sectors in how businesses perceive that they account for their dependencies and impacts on 'natural capital' in their business operations and decision-making. Similarly there does not appear to be any clear pattern (bearing in mind the small sample size) between size of organisation and degree of progress on embedding natural capital considerations.

As noted previously, these maturity matrix rankings need to be treated with a degree of caution as they are self-ascribed and it was not possible to undertake any independent verification. It is also important to note that the definitions of the maturity matrix levels are broad and inclusive, for example level 2 requires the business to have used 'some form of assessment to prioritise specific [environmental] issues and so identify hotspots to be targeted'. Use of narrower definitions, for example requiring the business to have conducted a **systematic assessment of dependencies and impacts** using the ecosystem service framework, may have changed the self-assessments substantially and helped to more precisely identify which businesses are taking a systematic and holistic approach to natural capital rather than a more traditional eco-efficiency and sustainable sourcing approach with natural capital-related elements.

[29] The may be because the risks to reputation or operations are perceived to be greatest in the developing world, due to a greater need to secure a social licence to operate (in areas with high levels of poverty and inequality), international concerns about loss of biodiversity rich areas in the developing world, and/or the greater negative impacts of climate change anticipated in the developing world (IPCC, 2014).
[30] For example ISO14001 tackles inputs and outputs of an activity that have 'significant' environmental impacts.
[31] They indicate two broad categories of environmental indicators for businesses: process based (extent to which companies have environmental processes and management systems in place; sometimes criticized because they do not measure outcomes) and results based (e.g. volume of water extracted, number of organic product lines).

The use of the following **natural capital accounting hierarchy** may also be useful in differentiating the extent to which businesses have embedded natural capital thinking in their corporate processes:

1. Business is focused on **eco-efficiency measures** and input and output targets (these may act as proxies for natural capital impacts, dependencies and/or responses)

2. Business makes explicit use of **quantitative assessment and valuation** of natural capital condition, ecosystem services provision and trends (using monetary and/or non-monetary metrics[32]) **on a project/site level**

3. Implementation of **systematic approach to quantifying natural capital dependencies and impacts** and the condition and trends of business critical natural capital **on a corporate/group level** (using monetary and/or non-monetary metrics)

Progression from level 1 to level 3 indicates an increasingly sophisticated and embedded approach to considering natural capital implications for business operations. There may be potential to develop this as a tool for business engagement that can be used to help explain the difference between widely adopted eco-efficiency approaches and more explicitly natural capital-based approaches.

Drivers for adopting natural capital-related practices highlighted by businesses in the three target sectors are summarised in the table below.

Table 9. Drivers for adopting natural capital-related practices by sector

Drivers	**Sectors identifying this driver**		
	Agricultural, forestry and fisheries	Electricity supply	Wholesale and retail
Reputation/ brand/ social licence to operate	X	X	X
Cost efficiency/ saving money	X	X	X
Regulatory requirements	X	X	X
Principles/ values of the business leaders/owners	X	X	
Requirements/ preferences/ expectations of customers	X	X	
Operational risk mitigation (e.g. risk of supply shortages)			X
ISO14001 requirements	X		

The drivers that are common to all three sectors are:

- Reputation/ brand/ social licence to operate;
- Cost efficiency/ saving money; and
- Regulatory requirements.

These drivers, and indeed all of the drivers highlighted in the table above (with the possible exception of the last one), are consistent with the natural capital-related drivers and risks (the

[32] Given different businesses will have differing requirements for monetary or non-monetary approaches no assumption is made here that a monetary approach is somehow more advanced.

'flip side' of drivers) highlighted in the wider business natural capital literature (e.g. AECOM, 2015; Cranston *et al*, 2015; Natural Capital Coalition, 2014; Bonner *et al*, 2012).

4.2.1 Valuation of natural capital

Three of the five electricity supply businesses interviewed (the three larger organisations interviewed) and two the four retail businesses interviewed were **implementing approaches to quantitative valuation of natural capital on some projects.** A key reason identified for doing this was to get natural capital considerations recognised in corporate decision making through translating environmental considerations into financial language.

One of the smaller energy companies stated that their existing qualitative approach to natural capital projects was quite effective: "*I don't think our board of directors are quite as hard to persuade to do these things as most because it's a small company, it's very dynamic and is a very passionate company. So I think that the need for it hasn't been there yet".* This finding is an important one that highlights the influence of the **corporate culture and decision making context** on the need for quantitative valuation. Smaller businesses, particularly businesses that are not publicly listed, have different management and reporting approaches and likely have a different decision making culture. Thus there may be less of a need to translate proposals for environmental enhancement into the financial language of natural capital in order to secure buy-in from the board/financial department.

In contrast to the above finding, none of the AFF businesses interviewed were undertaking comprehensive valuation of natural capital using quantitative techniques, though some qualitatively or quantitatively assessed discrete environmental inputs and outputs (e.g. water consumption, carbon emissions; waste). Respondents from this sector were **cautious about the value of quantifying natural capital in monetary terms**, highlighting the challenges associated with quantification, the costs of quantifying impacts, the lack of an appropriate tool that is cost effective, proportionate, practical) and uncertainty around the benefits of quantification for the businesses. Three of the four businesses interviewed in the retail sector shared the AFF respondents' **reservations about quantifying dependencies** in monetary terms, mentioning the lack of understanding of natural capital and business impacts, the challenges in generating the numbers and the uncertain benefit the business would derive from doing so.

Others have acknowledged some of these challenges and concerns, including the inherent complexities in quantifying natural capital, concerns that some values are incommensurable (i.e. they cannot be measured in the same units) and concerns that adding economic uncertainty to ecological uncertainty (e.g. unknown tipping points) exacerbates risks (Natural Capital Coalition, 2014; Sukhdev *et al*, 2014; Bonner *et al*, 2012). Significant use of benefits transfer, a process in which economic values generated in one context are applied to another for which values are required, is seen as key to the practical use of environmental values in decision making. However the values may not be applicable (e.g. socio-economic characteristics of the population and/or the physical context of the locality may be very different) and therefore adjustments are often needed. Ultimately the rationale behind the final figures used may be complex and open to question. If proponents of quantitative valuation of natural capital are to win over sceptics it is important that they are transparent about these complexities and explain their approaches clearly.

In summary these findings suggest that **many businesses still need to be convinced of the business case for natural capital valuation (particularly monetary valuation) and that, to date, they have not been able to access valuation tools that they feel are appropriate and cost effective** for their businesses. This may change in the future if leading companies demonstrate the benefits of taking such an approach and clearly communicate the

approaches used and the lessons learned; or if Government introduces incentives to strengthen the business case.

This finding reflects research results from the wider literature about the lack of uptake of quantitative approaches to natural capital valuation. For example:

- Mead (2014) investigated the use of corporate ecosystem valuation (CEV) tools in 11 multinational companies and found that use of CEV is still "very limited" in large firms, apparently because "Most firms are still trying to establish how to apply this to realise benefits". Greatest use was amongst those able to capitalise on emerging markets. She also found that monetisation was not considered influential for decision-making for two thirds of the companies interviewed.
- TEEB (2012) noted that there are few examples of companies that have published a financial valuation of natural capital risks and opportunities, although many more have identified ecological systems that merit attention as part of their corporate strategy.

The wider literature also supports the view that the lack of progress in valuing nature in businesses reflects the lack of a strong, evidence-based company-level business case that links natural capital considerations to the operational concerns of businesses (Cranston *et al*, 2015; Natural Capital Committee, 2015; Bonner *et al*, 2012; TEEB, 2012). As Cranston *et al* (2015) stated: *"…**the robust commercial logic for business to substantially address environmental degradation and secure natural capital remains under-developed**. A comprehensive body of evidence that connects environmental enhancement to business gains and links strategic investment in natural capital to positive business returns is required to shift mainstream business practice."*

The limited uptake of natural capital valuation[33] perhaps also reflects wider research findings revealing a lack of progress in corporate sustainability reporting. For example, a study by Canadian investment advisory firm Corporate Knights Capital indicated that 97% (4,481 out of 4,609) of the largest companies listed on the world's stock exchanges are failing to provide data on the full set of so-called 'first-generation' sustainability indicators including energy, greenhouse gas emissions (GHGs), waste and water (The Guardian, 2014). Given such trends, new regulations may ultimately be required to ensure that natural capital accounting is widely embedded in UK business practice.

[33] Notable exceptions in the UK are water companies such as South West Water that have made significant progress with valuing natural capital and the ecosystem services that flow from it are (Smith et al, 2013). These companies are realising the commercial benefits of investing in upstream land management (via payments for ecosystem services schemes) rather than hard infrastructure.

Corporate natural capital accounts

An example of a systematic quantitative monetary approach to business-wide NCA is the 'balance sheet' format for 'corporate natural capital accounts' recently developed for the Natural Capital Committee (Eftec, RSPB and PwC, 2015). This process involves documenting natural capital assets (distinguishing between renewable and non-renewable), the costs (liabilities) of maintaining those assets, and changes in asset values and liabilities. The balance sheet approach is underpinned by supporting schedules and accounts including a 'natural capital asset register' (of all the natural capital assets and their condition that fall within the boundaries of a business over time), a schedule of natural capital maintenance costs, a physical flow account of the expected flow of goods and services from the natural capital (that benefit both the business and wider society) and a 'monetary account' (that records separately the private and external value of physical flow of goods and services).

In the context of the discussion above it is noteworthy that three of the four 'pilot organisations' that tested the framework have a wider role than purely commercial businesses: the National Trust is a conservation charity; The Crown Estate is required by statute to take a long-term view of value creation; and United Utilities acts under statutory requirements than can be interpreted as implying the organisation has a stewardship role with respect to the water environment. Thus approaches that value the wider benefits to society of natural capital (as well as the private benefits) have value to them, whereas the value of such information to more narrowly commercial businesses is likely to be more limited. Moreover the fourth organisation (Lafarge Tarmac) is perhaps in a relatively unique position given its role in restoring sites, after extraction activities have been completed, to locations of value for nature and recreation. This means that it has a *strong commercial incentive* to promote the wider environmental gains that its projects deliver to society (which can be substantial). Use of the framework provides a new means for Lafarge to do this, and thus to support its *core business operations*.

Given the questions raised about the benefits of monetising natural capital impacts and dependencies, it is important to reiterate that **qualitative analysis can be sufficient for identifying priority risks and opportunities**; and that non-monetary data can be linked with financial information (e.g. on the capital and maintenance costs of different measures) to inform decisions. Indeed this may be a less risky approach. The risk to business' reputations of adopting quantitative natural capital accounting is not often recognised by its proponents. This risk is double edged. Financial officers (CFOs) perceive a risk of undermining the credibility of annual reports, and overcomplicating such reports, by including judgement-based natural capital-related data with potentially large error margins (Bonner *et al*, 2012). And there is also a potential risk that public 'queasiness' about putting monetary values on nature, and the uses to which such numbers might be put, (i.e. the commodification of nature) may have negative impacts for corporate image and reputation. For example, one electricity supply business respondent stated that *"…headlines about 'license to trash' around the biodiversity offsetting proposals were a concern for companies because they don't want to be perceived to be using it as a tool to trash the environment".*

There appears to be a need to clearly explain the **pros and cons of different systematic approaches to qualitative and quantitative valuation of natural capital** to businesses, including the limits and uncertainties associated with benefit transfer methods and how this influences their use for different business applications. The Natural Capital Coalition's (2014) proposal to show how to use valuation in different applications with real or anonymous worked examples as part of the Natural Capital Protocol is an important initiative in this context and should be supported by others interested in promoting business action on natural capital. The potential risks to businesses of applying certain approaches inappropriately also need to be highlighted.

4.3 Ways of working that have facilitated integration of natural capital

AFF businesses highlighted monitoring of carbon emissions, including one that reports internally on a range of environmental KPIs through ISO14001, an internationally accepted standard that outlines how to put an effective environmental management system in place. Targets and progress are now discussed at board level within this business (something that is anticipated to become a requirement when ISO14001 is revised later this year), thus supporting integration of natural capital considerations into business operations.

Given that many businesses focus their environmental efforts primarily on eco-efficiency measures, partly because they generate clear cost savings, uptake of ISO14001 (already well recognised worldwide) may continue to increase in future. It is therefore relevant to note that the standard is currently being revised and that the new version will include an expanded expectation *"to commit to proactive initiatives to protect the environment from harm and degradation, consistent with the context of the organisation"* (ISO, 2015) with 'protect the environment' defined to include, amongst other things 'sustainable resource use' and 'protection of biodiversity and ecosystems'. Thus **there appears to be an important opportunity to make links between the revised ISO14001 and NCA to encourage increased integration of natural capital considerations in business operations**.

In the electricity supply sector, companies mentioned the use of a **natural capital valuation tool and a new approach to cost benefit analysis of projects** that encapsulates wider economic, social and environmental aspects. Use of both tools is helping the businesses to understand wider natural capital values and to engage with stakeholders in new ways. In the case of the energy distribution business, this has led to more partnerships such as engagement with Wildlife Trusts to help manage natural capital assets (e.g. biodiversity rich sites) to deliver wide benefits to society. This finding seems to support Cranston *et al*'s (2015) assertion that *"[t]ackling natural capital challenges requires collaboration between all stakeholders within a landscape to explicitly consider natural capital interdependencies and devise solutions based on the best available science".*

References to materiality assessment by a business in the energy sector and a business in the retail sector were particularly noteworthy. The department store respondent said that the business had conducted an in-depth sustainability **materiality assessment** across the entire organisation which was used to prioritise areas for action. Material issues[34] identified included operational emissions from the estate and deforestation linked to timber products. The respondent indicated that all material issues had now been incorporated into the business's strategy and that they were now strengthening stakeholder engagement on these material issues and reviewing and updating existing KPI's and targets. The energy company respondent mentioned that a materiality assessment for a transmission line project had included valuation of the ecosystem services provided by the land in question because "…*our stakeholders want to understand that, they saw these [natural capital impacts] as concerns… and therefore that was a criterion for a materiality assessment".*

The materiality of natural capital issues has been explored by Bonner *et al* (2012). They observed that key stakeholders still largely judge corporate performance based on measures of financial materiality and that many environmental issues such as natural capital are rarely

[34] Material issues are issues that could influence the users of financial accounts, such as shareholders, investors and lenders (e.g. Bonner et al, 2012). The materiality of an issue is judged based on the basis of its financial impact and probability of occurrence.

considered to be material by companies, due to problems of economic quantification and low economic values. As a consequence, natural capital-related issues are rarely included in corporate financial reporting. Thus the examples of materiality assessments incorporating natural capital identified through this study are significant and would be worthy of further exploration and potentially promotion as an example of good practice. Promotion of such examples alongside clear guidance or standards for robustly valuing natural capital might help to change judgements of the materiality of natural capital-related issues in the future, particularly if natural capital continues to be degraded resulting in more direct and significant financial impacts on companies.

The **barriers or constraints to further integrating natural capital into business operations** highlighted by businesses in the three target sectors are summarised in the table below[35].

Table 10. Barriers and constraints to further integrating natural capital into business operations

Barriers/constraints	**Sectors identifying this barrier/constraint**		
	Agricultural, forestry and fisheries	Electricity supply	Wholesale and retail
Intellectual challenge of understanding your natural capital baseline/ over-complication of issue	X	X	X
Cost	X	X	X
Lack of appropriate tools that can measure hard-to-measure ecosystem services	X	X	
Lack of access to examples and case studies	X	X	
Lack of standardised approach		X	X
Lack of steer from Government[36]		X	

Many of these barriers have been highlighted in the wider literature on natural capital and business (e.g. Natural Capital Coalition, 2014). For example, Bonner *et al* (2012) and TEEB (2012) highlighted the **lack of straightforward and internationally accepted metrics** for natural capital issues, making them more difficult to report, manage and monitor consistently; as well as the inherent challenges in evaluating the risks and opportunities associated with natural capital. Badger (no date) highlight a **need to use natural capital and ecosystem services language "sparingly and appropriately"** (i.e. not overcomplicating matters by introducing lots of technical terminology where it is not required and using clear, consistent definitions) to help businesses to better understand what their environment does for them, and which parts of the environment are important and where.

Businesses are seeking to overcome these barriers through engagement with a range of expert bodies and projects or programmes, as highlighted in the results chapter. For example

[35] Niche barriers or constraints have not been included.
[36] Though another business noted people should not be waiting for Government, they should be getting on with experimenting with what tools work for them.

the Prince's Accounting for Sustainability Project was mentioned by businesses in both the AFF and electricity sectors. However a more direct and pragmatic approach may be required in some of these exchanges. As Cranston *et al* (2015) stated, **there is a need, where necessary, for business to challenge existing metrics and communicate what they need and want of measurement tools**. Indeed it is not sufficient for business to simply say that there is a lack of appropriate tools; direct engagement and collaboration with expert bodies is required to ensure that the "gulf" between academia and practitioners is bridged and progress is made in developing and piloting practical tools. As one respondent noted, "*We have been discussing this for years, since at least 2002, over a decade later we're not much further forward… You can finesse until the cows come home, at some point need to try it in the real world and then all the problems drop out, then you can tweak it and get it to work".*

4.4 Knowledge resources / lack of knowledge

Businesses across the three sectors highlighted a variety of metrics and tools that they currently use to integrate sustainable management into their business models. For the AFF sector the tools tended to be sector and sub-sector specific tools e.g. the Woodland Carbon Code and the LEAF annual audit/review. **None of the businesses were using tools for systematic quantitative valuation of natural capital across their businesses as a whole.** However, some electricity companies were in the early stages of implementing quantitative natural capital valuation tools at a project level and two retail businesses were also trialling such approaches.

Businesses had a range of views about the extent to which lack of knowledge or lack of access to suitable data, metrics (physical or financial) or tools constrains the development of natural capital-related practices. Some businesses in all three sectors did not see lack of knowledge as a key constraint. The specific knowledge requirements that were identified by businesses in each sector are highlighted in the table below.

Table 11. Knowledge requirements

Knowledge requirements	Sectors identifying this knowledge requirement		
	Agricultural, forestry and fisheries	Electricity supply	Wholesale and retail
Improved access to detailed worked examples/ case studies e.g. by creating a central resource	X	X	
Industry wide metrics for natural capital[37]		X	X
Greater understanding of natural capital complexities and natural capital-business links[38]			X
Lack of supply chain data			X
A stronger business case for NCA[39]			X
A tool to efficiently verify the growth of new woods[40]	X		
Introduce UK equivalent of US itree model[41]		X	
Lack of accurate data on bats across the UK		X	
Lack of research on biodiversity enhancements/environmental gains around solar farms		X	

The proposed **Natural Capital Protocol**, an ambitious project to develop a harmonised framework for understanding and valuing dependencies and impacts on natural capital in business decision making being led by the Natural Capital Coalition, will - if realised - help to address some of these higher level knowledge needs e.g. industry-wide metrics and a clearer business case. The Natural Capital Protocol is under development and is expected to be completed in December 2015.

Similarly the Living With Environmental Change (LWEC) proposal to develop a **UK sourcebook for realising nature's value** that includes information on evidence, and access to models and tools that could meet the needs of different groups at different scales could address the need for a centralised information resource (LWEC, 2014). However this could end up competing with the Natural Capital Protocol website.

The Natural Capital Committee has also recently developed a 'balance sheet' format for 'corporate natural capital accounts' which could be a valuable framework for businesses (Eftec, RSPB and PwC, 2015; see box above). However, it is unclear how this process will relate to the proposed Natural Capital Protocol.

[37] TEEB (2012) highlight the lack of consistent metrics as an important barrier to comprehensive corporate disclosure on natural capital.
[38] It is a fact that the relationship between cause and effect for many complex ecosystem services, and the existence of tipping points, is not well understood (e.g. Sukhdev et al, 2014; UK National Ecosystem Assessment, 2011a)).
[39] The Natural Capital Committee (2015) has highlighted the lack of incentives to drive business engagement in the natural capital agenda and Bonner et al (2012) and TEEB (2012) have noted that for many a clearly quantified business case for action, management, monitoring and disclosure on natural capital is lacking.
[40] This is understood to be under development (Forestry Commission, pers. comm.).
[41] This is a tool used to quantify in monetary terms the ecosystem service benefits provided by trees; see https://www.itreetools.org/ For UK application of the itree model see: http://www.torbay.gov.uk/itree

A list of initiatives/programmes referred to by respondents is provided in the table below, including the number of businesses that referred to each initiative.

Table 12. Selected natural capital initiatives referred to by respondents

Initiative name	Brief description	Number of businesses involved in or using outputs from initiative
Natural Capital Coalition http://www.naturalcapitalcoalition.org	The Natural Capital Coalition is a global, multi stakeholder open source platform for supporting the development of standardised methods for natural and social capital valuation and reporting in business.	2
Prince's Accounting for Sustainability project and leadership network http://www.accountingforsustainability.org	Accounting for Sustainability (A4S) was set up by HRH The Prince of Wales in 2004. A4S works with the accounting and finance community to support a fundamental shift towards resilient business models and a sustainable economy.	2
Cambridge Institute of Sustainability Leadership http://www.cisl.cam.ac.uk	CISL is an institution within the University of Cambridge. It seeks to challenge, inform and support leaders from business and policy to deliver change towards sustainability.	2
Natural Capital Committee https://www.naturalcapitalcommittee.org	The Natural Capital Committee was established in 2012 to provide expert, independent advice to Government on the state of England's natural capital. The Committee brings together expertise and experience in ecology and environmental science, economics and business.	1
The Economics of Ecosystems & Biodiversity http://www.teebweb.org	TEEB is a global initiative focused on drawing attention to the economic benefits of biodiversity including the growing cost of biodiversity loss and ecosystem degradation. TEEB presents an approach that can help decision-makers recognise, demonstrate and capture the values of ecosystem services & biodiversity.	1
UN Global Compact https://www.unglobalcompact.org	The UN Global Compact is a strategic policy initiative that assists the private sector in the management of increasingly complex risks and opportunities in the environmental, social and governance realms, seeking to embed markets and societies with universal principles and values for the benefit of all.	1

One respondent noted that: *"There is so much going on in this environment that we just don't know what we should be pursuing and we are paralyzed with choice…"* Clearly **there is a need to coordinate efforts across initiatives and between knowledge providers to avoid a damaging proliferation of tools which could otherwise further undermine business engagement.**

Although interview respondents had mixed views about the need for **improved access to data** at present, some of the tools that businesses are using could make use of data supplied by JNCC on biodiversity (e.g. ISO14001, LEAF Sustainable Farming Review, Integrated Reporting; see Appendix 4 for further details). If there is increasing uptake of the natural capital agenda by UK businesses in future then this is likely to generate an increase in **demand for JNCC data** to feed directly into natural capital accounts/ registers. In anticipation of this, it is recommended that JNCC consider reviewing its data sources and developing a portal that highlights datasets and tools that are likely to be of particular value to these businesses. For example, the National Biodiversity Network (NBN) species records from across the UK will be a valuable resource for businesses to draw on (one interviewee already uses this resource). The Biodiversity Action Reporting System (BARS), which provides an online interactive map of practical action in place to benefit important habitats and species, could also become an increasingly important resource for coordinating actions by businesses and wider stakeholders (e.g. farmers, Natural England, Wildlife Trusts) at a local level.

Use of **new technology to cost effectively monitor and manage natural capital** on specific sites was a notable theme emerging from a number of interviews. This included use of remote sensing data captured by satellites or unmanned vehicles ('drones'), and use of increasingly sophisticated sensors on agricultural machinery to support more precise application of inputs. The roll out of such technologies could help to enable more widespread collection of data on natural capital. JNCC may wish to consider developing standard protocols for the recording and sharing of such data, and encouraging the sharing of such data by businesses. This would facilitate the integration of data from these sources into its existing range of data sources and tools, enhancing the quality and coverage of available data.

Few significant data constraints were identified by respondents but given the lack of systematic approaches to NCA within the businesses interviewed this is perhaps unsurprising. Some specific knowledge requirements identified through the research that JNCC may want to consider providing support to address (albeit they may only benefit of subset of stakeholders) included: a tool to cost efficiently verify the growth of new woods[42]; a UK equivalent of US i-Tree model[43]; improved data on bats across the UK; and research on the biodiversity enhancements and wider ecosystem service benefits that are being delivered around solar farms.

4.5 Changes in business practice

Respondents generally struggled to answer the question about changes in business practice that had helped or could help open up new opportunities for enhanced environmental sustainability management, or highlighted tools and practices already mentioned. This finding suggests that in a future sector assessment the wording of this question may need to be reconsidered. It may also reflect the fact that few businesses have progressed very far in terms on embedding NCA. Changes in business practice highlighted by respondents included the uptake of Integrated Reporting (mentioned by businesses in the AFF and retail sectors and discussed above), joining LEAF (AFF sector business); and the introduction of carbon footprinting (AFF sector business) and 'carbon balance' methods (electricity sector), all of which helped to support increased recognition of natural capital impacts and, to a lesser extent, dependencies in decision making (though the language of natural capital was not

[42] Note that this is understood to be already under development (Forestry Commission, pers. comm.).
[43] This is a tool used to quantify in monetary terms the ecosystem service benefits provided by trees; see https://www.itreetools.org/ For UK application of the itree model see: http://www.torbay.gov.uk/itree

always used). Further information on these tools and the extent to which they explicitly address natural capital is provided in Appendix 4.

4.6 Insights into other sector reviews

Based on this review of the three sectors, we suggest the following recommendations for further sector reviews:

- Target sectors where the research team has established contacts – this greatly increases the success rate of setting up interviews, which can otherwise be a time consuming process.

- Consider piloting two different presentations of the maturity matrix, the existing version and new version based on the use of narrower definitions, for example requiring the business to have conducted a systematic assessment of dependencies and impacts using an ecosystem services framework. This might allow more precise identification of which businesses are taking a systematic and holistic approach to natural capital (for example using the ecosystem service framework to consider the overall system in which the impact is occurring), in addition to those that are implementing a more traditional eco-efficiency and sustainable sourcing approach with discrete natural capital-related elements.

- If time and resources allow, conduct interviews with multiple representatives of each business in order to develop richer findings and allow a degree of cross checking of maturity matrix ratings.

- Revisit the wording of the changes in business practice question and consult with businesses to see how this question should best be worded. Consider developing some new questions that allow the research team to better understand the details of corporate approaches to risk assessment and materiality assessment. For example: what approaches to risk assessment are used[44] ? Do you apply the ecosystem service framework or similar as part of your screening of risks or impacts? How are these risks then assessed in terms of materiality? Are the views of external stakeholders (e.g. civil society, Government, investors) considered in the materiality assessment (Bonner *et al*, 2012, suggest that where this happens natural capital-related issues are more likely to be considered material)?

[44] Some of the businesses interviewed referred to use of risk registers, an approach that is widely adopted according to Bonner et al, 2012.

5. Conclusions and recommendations

The UK's natural capital is under pressure (UK National Ecosystem Assessment 2011a). The private sector owns and manages the majority of natural capital in the UK; for example over two thirds of land in England is privately owned (Natural Capital Committee, 2015). Therefore better management of natural capital by businesses is critical. A whole range of policy, legislative and voluntary responses may be required to reverse the degradation of natural capital, including changes in land use planning, new environmental regulation and more eco-labelling and eco-certification. The adoption of NCA by businesses offers one mechanism to facilitate improved management of natural capital by businesses. It also holds out the potential to enable businesses to better manage natural capital-related risks and to secure multiple benefits including enhanced reputation and brand.

This research has explored the extent to which nature's value is currently being realised in UK businesses, with a focus on the agricultural forestry and fisheries, electricity supply and retail sectors. The research revealed that the businesses interviewed were aware of the concepts of natural capital and NCA and were often taking action to manage and mitigate negative impacts on natural capital. However, this was commonly through the implementation of eco-efficiency measures (e.g. *input and output measures* such as water consumption and CO_2 emissions) which can be seen as proxy indicators for dependencies and impacts on natural capital; it often did not involve use of the language of natural capital (assets, flows, etc) or the collection of data on natural capital condition and trends (i.e. natural capital *outcomes*). Some businesses are also actively pursuing commercial revenue generating opportunities related to natural capital management, although again many frame these in terms of biodiversity or environmental management rather than in terms of natural capital.

While some of the interviewed businesses were in the early stages of implementing natural capital valuation on a project or site level, there appeared to be no adoption of a systematic and holistic approach to evaluating natural capital dependencies and impacts across a business; and very limited monetary valuation of natural capital dependencies and impacts. There was also a significant level of scepticism amongst interviewees as to the benefits to business, and the robustness, of approaches involving the monetary valuation of natural capital, particularly given concerns about cost and complexity.

These findings suggest that it is still **'early days' in terms of embedding systematic and explicit natural capital accounting approaches in UK business operations**.

It is important to reiterate that, given the small sample size, these findings should be considered as indicative only and may not fully represent the wider pattern of business practice in these sectors. However, these findings reflect wider findings in the literature regarding the:

- limited uptake of natural capital valuation[45] by business in the UK and globally (e.g. Mead, 2014, Bonner *et al*, 2012[46]),which perhaps reflects a lack of progress in corporate sustainability reporting more generally (e.g. GreenBiz, 2015; The Guardian, 2014a);

[45] Often a narrower definition of NCA is used than here, focusing quantitative and often monetary valuation of natural capital.
[46] Based on a survey of 40 companies they identified only one company using valuation techniques to quantify the value of the ecosystem services associated with its operations, and this was experimental in nature.

- lack of incentives to drive business engagement in the natural capital agenda (Natural Capital Committee, 2015); and

- lack of a strong, evidence-based company-level business case that links natural capital valuation to the operational concerns of businesses (Cranston *et al*, 2015; Natural Capital Committee, 2015; Bonner *et al*, 2012; TEEB, 2012).

What then are the opportunities to support UK businesses in realising nature's value to their operations?

Some key recommendations for knowledge providers are set out below based on the preceding discussion:

1. There is a need to **make information and tools for understanding and embedding natural capital considerations in businesses more easily accessible**. Knowledge providers should work together to create a 'live' central web resource that brings together key guidance and **in-depth, sector-specific practical case studies** in an easy to navigate structure. This should include: clear explanations of the pros and cons of different approaches for undertaking systematic qualitative and quantitative assessments (monetary and non-monetary[47]) of business risks and opportunities arising from dependencies and impacts on natural capital and ecosystem services; and guidance on, and examples of, materiality assessments that include natural capital. It should ideally include separate sections tailored to different business sectors and also to large and small businesses (given the finding that the corporate decision making cultures and processes of small businesses may be very different to larger companies).

2. In developing such a shared resource a more **collaborative and coordinated approach** is required, drawing together the range of expert bodies, research groups and Government agencies (and their online resources) with an interest in natural capital accounting. This will be critical to reducing the proliferation of conceptual frameworks, metrics and tools which could otherwise further undermine business engagement.

3. The **business case** for action on natural capital, and particularly for monetary valuation of natural capital dependencies and impacts, still needs to be clearly demonstrated for businesses in different sectors, large and small. This should include a focus on key drivers of natural capital action highlighted by businesses in this research, such as reputation, brand and cost efficiency. Increased promotion of examples of businesses identifying new opportunities for revenue generation through a natural capital approach might be a useful means of driving greater engagement in the natural capital agenda. The Government could consider introducing incentives to strengthen the business case and encourage early uptake and demonstration of systematic approaches to realising nature's value in UK business. New regulations may ultimately be required to ensure this approach is widely embedded.

4. **Efforts to engage businesses in the natural capital agenda should be initially focused where the business case for action is strongest and clearest.** These 'easier wins' will tend to involve a focus on the site and project level (rather than the

[47] Qualitative and non-monetary approaches should not be neglected in favour of monetary valuation, especially given the need to understand business-natural capital linkages clearly as a first step in NCA and the reservations about the robustness and benefits of monetary valuation of natural capital highlighted in this study.

corporate/group level or along value chains)[48], working with businesses that have significant direct dependencies and/or impacts on natural capital (e.g. the agricultural, forestry and fishery sector; extractive sectors such as mining, oil and gas; and water companies). The best opportunities will be where core business dependencies on natural capital are non-substitutable, are at significant risk of being disrupted and where the natural capital is under the influence or control of the business. There will also be opportunities with businesses that have a wider remit (beyond profit maximisation) that allows a longer term approach and recognition of wider benefits to society (e.g. National Trust, Crown Estate); and organisations that have natural capital enhancement as a core part of the business model (e.g. extractive industries that are required to restore sites after use). A **knowledge exchange strategy** should be developed to determine how best to engage these sectors and businesses (channels, language, etc) and who will be responsible for doing so. Working with trade bodies and existing networks such as LEAF (in the agricultural sector) may be a useful means of bringing together businesses in particular sectors aiding dissemination of information.

5. **ISO 14001** is currently being revised. It is proposed that the new version of the standard will include an expanded expectation *"to commit to proactive initiatives to protect the environment from harm and degradation, consistent with the context of the organisation"* (ISO, 2015). This would appear to be a key opportunity to integrate natural capital within existing business management processes already in use. It is therefore recommended that JNCC and/or organisations promoting natural capital accounting should formulate a proposal, via the BSI, to include more explicit links to natural capital and NCA in the revised standard.

6. There are complementarities between the drive for **Integrated Reporting** (IR; being led by the International Integrated Reporting Council, IIRC) and the natural capital agenda, including a focus on reporting of stewardship of the full range of capitals, including natural capital. The level of uptake of IR by UK businesses is currently unclear but includes large businesses such as Marks & Spencer and the Crown Estate. If there is significant uptake of IR then natural capital knowledge providers should consider working with the IIRC to develop guidance for businesses on how NCA can be integrated with, and enhance, IR.

[48] Given the costs of undertaking a systematic whole business NCA exercise and the scepticism about the business case among many respondents the initial focus for engaging business should be at the project/site scale as this has lower cost/resource implications and offers the opportunity to deliver tangible benefits more quickly.

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Appendix 1: Glossary and Acronyms

Accounts – Company accounts are a systematic summary in money terms of the activities of a business over a specified period, usually a year. National income and expenditure accounts are surveys of the economic activities of a nation. This include analysis of the production of goods and services, the distribution of incomes and the expenditures of investors, consumers and the Government.

Afforestation – Planting of forests on land that has historically not contained forests.

Asset – A store of value, representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. It is a means of carrying forward value from one accounting period to another.

Benefit – changes in human welfare (or wellbeing) that result from the use or consumption of goods, or from the knowledge that something exists (for example, from knowing that a rare or charismatic species exists even though an individual may never see it). Note that benefits can be both positive and negative (dis-benefits).

Biodiversity (a contraction of biological diversity) – The variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part. Biodiversity includes diversity within species, between species, and between ecosystems.

Capital – A material resource used or available for use in production. Natural capital (see below) underpins the three other main types of capital that is, manufactured capital (for example, machinery and buildings), human capital (for example, knowledge and skills) and social capital (for example, levels of trust and connections amongst people).

Carbon sequestration – The process of increasing the carbon content of a reservoir other than the atmosphere.

Catchment – The land area that drains into a particular watercourse or body of water.

Condition of an ecosystem – The capacity of an ecosystem to yield services, relative to its potential capacity.

Cost-benefit analysis – A technique designed to determine the feasibility of a project or plan by quantifying its costs and benefits.

Degradation of an ecosystem service – For provisioning services, decreased production of the service through changes in area over which the services is provided, or decreased production per unit area. For regulating and supporting services, a reduction in the benefits obtained from the service, either through a change in the service or through human pressures on the service exceeding its limits. For cultural services, a change in the ecosystem features that decreases the cultural benefits provided by the ecosystem.

Degradation of ecosystems – A persistent reduction in the capacity to provide ecosystem services.

Ecosystem – A dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit.

Ecosystem services – Are the outcomes from ecosystems that directly lead to good(s) that are valued by people.

Ecological community – An assemblage or association of populations of two or more different species occupying the same geographical area.

Fishery – A particular kind of fishing activity, for example, a trawl fishery, or a particular species targeted, for example, a cod fishery or salmon fishery.

Goods – something used or consumed by humans, such as food, timber or clean water that delivers benefits or is of 'value'. Often goods are produced through the input of different forms of capital e.g. food may require inputs of both natural (soils, water or species to pollinate and control other pests) and manufactured capital (fertilisers, farm machinery or processing).

Green infrastructure – a strategically planned and delivered network comprising the broadest range of high quality green spaces and other environmental features. It is a multifunctional resource delivering those ecological services and quality of life benefits required by the communities it serves (based on Natural England, 2009).

Habitat – Is an ecological or environmental area that is inhabited by a particular animal or plant species. "Broad Habitats" are used to classify different ecosystems for reporting.

Landscape – An area of land that contains a mosaic of ecosystems, including human-dominated ecosystems. The term cultural landscape is often used when referring to landscapes containing significant human populations or in which there has been significant human influence on the land.

Market failure – The inability of a market to capture the correct values of ecosystem services.

Materiality – In financial reporting and auditing, an item (usually economic in nature) is material if its omission or misstatement could influence the users of the financial accounts, with 'users' frequently defined as shareholders, investors and lenders.

Metrics – the means through which changes in assets, goods and benefits can be measured.

Natural Asset – a distinctive component of natural capital as determined by the functions it performs, e.g. soils, freshwater, species. Ten individual natural assets have been identified and listed in the report, though in practice, they combine to deliver goods and benefits.

Natural capital – Capital is most often thought of as the wealth or assets of an individual, company or nation. Natural capital is one of the five types of capital relied on by businesses: financial, manufactured, natural, human and social capital. Natural capital is an economic characterisation of the limited stock of natural resources, including water, soils, forests and seas. The so-called 'ecosystem services' that flow from natural capital provide multiple benefits to business (e.g. provision of food, management of flood risk).

Natural capital accounts – ways of organising information on changes in natural capital to conform with the principles and framework set out in the national accounts.

Natural capital accounting – refers to the process of reflecting natural capital in corporate decision-making. It is defined broadly here to include both qualitative and quantitative approaches to valuing natural capital impacts and dependencies.

Nutrient cycling – The processes by which elements are extracted from their mineral, aquatic, or atmospheric sources or recycled from their organic forms, converting them to the ionic form in which biotic uptake occurs and ultimately returning them to the atmosphere, water, or soil.

Nutrients – The approximately 20 chemical elements known to be essential for the growth of living organisms, including nitrogen, sulphur, phosphorus, and carbon.

Policy-maker – A person with power to influence or determine policies and practices at an international, national, regional, or local level.

Pollination – A process in the sexual phase of reproduction in some plants caused by the transportation of pollen. In the context of ecosystem services, pollination generally refers to animal assisted pollination, such as that done by bees, rather than wind pollination.

Provisioning services – The products obtained from ecosystems, including, for example, genetic resources, food and fibre, and fresh water.

Public good – A good or service in which the benefit received by any one party does not diminish the availability of the benefits to others, and where access to the good cannot be restricted.

Renewable – Natural or man-made resources that are replenishable at least as fast as they are consumed or used up. Natural resources such as fresh water or timber may become non-renewable if used up at a faster rate than they are replenished by natural processes.

Risk-register – Used to identify, quantify and value the risks and uncertainties relating to a proposal or activity, a risk register is a tool commonly used in project planning and organisational risk assessments.

Safe limit – a target used in management to avoid crossing a point at which the condition of a particular component of natural capital changes dramatically (see threshold).

Species – An interbreeding group of organisms that is reproductively isolated from all other organisms, although there are many partial exceptions to this rule in particular taxa. Operationally, the term species is a generally agreed fundamental taxonomic unit, based on morphological or genetic similarity, that once described and accepted is associated with a unique scientific name.

Sustainable use (of a natural capital) – Human use of a natural capital so that it may yield a continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

Threshold – A point or level at which new properties emerge in an ecological, economic, or other system, invalidating predictions based on mathematical relationships that apply at lower levels. For example, species diversity of a landscape may decline steadily with increasing habitat degradation to a certain point, then fall sharply after a critical threshold of degradation is reached. Human behaviour, especially at group levels, sometimes exhibits threshold effects. Thresholds at which irreversible changes occur are especially of concern to decision-makers.

Valuation – The process of expressing a value for a particular good or service in a certain context (for example, of decision-making) usually in terms of something that can be counted, often money, but also through methods and measures from other disciplines (sociology, ecology, and so on). See also Value.

Value – The contribution of an action or object to user specified goals, objectives, or conditions. (Compare Valuation).

Wellbeing – The degree of happiness, health and prosperity of an individual or society.

List of acronyms

Term	Definition
A4S	Accounting for Sustainability
AD	Anaerobic Digestion
AFF	Agriculture, Forestry and Fisheries
B2B	Business to Business
CALLM	Carbon Accounting for Land Managers tool
CAPEX	Capital Expenditure
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CO_2	Carbon Dioxide
CR	Corporate Responsibility
CSR	Corporate Social Responsibility
DIA	Daily Interpretive Analysis'
EA	Environment Agency
EIA	Environmental Impact Assessment
EMAS	Eco-Management and Audit Scheme
EP&L	Environmental Profit & Loss
ESG	Environmental Steering Group
ESS	Ecosystem Services
ETF	Ecosystem Task Force
EU ETS	European Union Emissions Trading System
FSC	Forest Stewardship Council
GHG	Greenhouse Gas
IFM	Integrated Farm Management
IPPC	Integrated Pollution Prevention and Control
JNCC	Joint Nature Conservation Committee
KPI	Key Performance Indicator
LEAF	Linking Environment And Farming
LWEC	Living With Environmental Change
MSC	Marine Stewardship Council
NC	Natural Capital
NCA	Natural Capital Accounting
NCC	Natural Capital Coalition
NE	Natural England
NERC	Natural Environment Research Council
NGO	Non-Governmental Organisation
PES	Payment for Ecosystem Services
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
TIMM	Total Impact Measurement and Management methodology
UKNEA	UK National Ecosystem Assessment
UN	United Nations

Appendix 2: Survey Template, project brief and maturity matrix

Survey Template

Name of interviewer: Date of interview:

Name and position of interviewee: Organisation:

1. Preliminaries	Hello, my name is [XX] [and I'm calling from AECOM]. Can I speak to [XX] please? I'm conducting research on behalf of the Joint Nature Conservation Committee that is investigating business dependencies and influence on nature and how these are considered in particular sectors. I believe we spoke a little while back about this? Would you still be willing to take part in this short interview? If Yes – OK great, just to reiterate - the interview will take approximately half an hour. Any information provided in the interview will be treated anonymously, and will not be attributed to either you personally or your company. The findings will however be attributed to a specific economic sector, along with findings from other businesses in your sector. With your permission I will put you on speaker phone and record this interview so that I can ensure I pick up all your points accurately. Once we have written up the interview we will delete the recording and send the write up to you so that you can correct any factual errors. Is that OK? Do you have any questions before we begin? Have you had a chance to look at the maturity matrix? Great we will be exploring this later in the interview.

2. Awareness / understanding of natural capital and natural capital accounting	What do the terms 'natural capital' and 'natural capital accounting' mean to you?	*If interviewee has a reasonable level of understanding:* How relevant[49] do you consider these concepts to be? *If interviewee has limited understanding of these terms provide brief explanation:* 'Natural capital' is one of the five types of capital relied on by businesses: financial, manufactured, natural, human and social capital. Natural capital is the stock of natural resources, including water, soils, forests and seas. The so-called 'ecosystem services' that flow from natural capital provide multiple benefits to business (e.g. provision of food, management of flood risk). 'Natural capital accounting' refers to the process of reflecting natural capital in corporate decision-making.
	Response:	
	What terms do you use within your business, if any, to describe the dependencies and influence of business on nature?	Prompt: Biodiversity, ecosystem services, natural value, environmental profit and loss (EP&L)
	Response:	

[49] Nidumolu (2013) highlights the 'relevance barrier' as a key early barrier to integration of natural capital considerations.

	How dependent do you consider your business to be on natural capital, such as water, soils or forests, or the benefits that flow from these (e.g. provision of food and clean water)?	Prompt: Please explain how.	
		If some dependencies identified, to what extent do you think your business's dependencies on natural resources represent a risk, or a potential risk, to your business?	Prompt: e.g. operational risks such as increased scarcity or cost of inputs, reduced output or productivity, disruption to business operations; or risks to reputation due to having negative influence on the environment.
		How useful do you feel it is to quantify in monetary terms the dependencies on, and influence of, your business on natural resources?	
		Do you in any way seek to establish the non-monetary value of natural resources?	Prompt: For example, seeking to capture the amenity value of an enhancement to the local environment
	Response:		
	Are you aware of any impacts (positive or negative) that your business activities (including through supply chains and consumers/customers) have on the natural environment?	Prompt: Please explain what these impacts are?	
		If some positive effects are identified, is your business taking any action to enhance or promote these?	
		If some negative effects identified, is your business taking any action to mitigate these?	Prompt: Please explain how.
	Response:		

3. Motivations	Please can you briefly describe any natural capital-related practices that you have adopted in your business, or are currently adopting?	Prompt: refer back to the **Natural Capital Maturity Matrix** and explore the stage they are at and what is being undertaken	
	Response:		
	Which core business processes are these sustainability practices explicitly embedded in?	Prompt: (e.g. strategic planning, capital investment decision-making, supply chain management, management information systems, performance evaluation, corporate reporting, employee engagement[50])	
	Assuming they named some NC practices: What were the drivers for adopting these practices?	Prompt: Most important drivers? (e.g. risk mitigation, addressing regulations, improving reputation, reducing costs, growing revenue)	
	Response:		
	Have you considered the value of natural capital, using quantitative or qualitative techniques, in your business model in any way? (Yes / no)	*If so,* please explain how?	
		What were the drivers for doing this? *If not*, do you think your business might do this in future?	Prompt: Most important drivers?
	Response:		

[50] Corporate EcoForum, 2012. Valuing Natural Capital: The New Business Imperative. http://www.corporateecoforum.com/valuingnaturalcapital/offline/download.pdf

4. Ways of working	Can you describe any specific ways of working that have facilitated, or are in the process of facilitating, integration of natural capital considerations into your business operations?	Prompt: E.g. internal changes in specific business processes or strategies, supply chain management, stakeholder engagement, policy-maker engagement	
	Response:		
	How are natural capital-related actions monitored, assessed and reported?	What indicators and targets are used? Are you going beyond meeting regulatory requirements in some areas?	
	Response:		
	What barriers or constraints are there to integrating natural capital your business operations?	Prompt: Technological, financial, organisational, knowledge / data	NB. If a lack of knowledge (including metrics and tools) / lack of access to knowledge is identified as a constraint here, jump to Question 6 in order to explore this further.
	Response:		
	Assuming they named some barriers: Have you had any success in overcoming these barriers, or do you know of other organisations who have managed to overcome these barriers?	*If so,* please explain how?	
	Response:		

5. Key knowledge resources (inc. metrics and tools)	What knowledge resources, for example specific data, metrics and/or tools, has your organisation used to successfully integrate natural capital in your business model?		
	How were these knowledge resources sourced?	Prompt: Databases, sourcebooks, knowledge exchange mechanisms/networks such as WBCSD, Natural Capital Leaders Platform, Natural Capital Coalition, etc?	
	Response:		
6. Lack of knowledge (including metrics and tools) / lack of access to knowledge	To what extent is a lack of knowledge or lack of access to suitable data, metrics or tools constraining development of natural capital-related practices in your business?	If so, please explain what knowledge your business lacks or how access to suitable metrics and tools could be improved? Does your business have appropriately qualified staff who are able to select and make use of relevant sustainable business tools?	
	Response:		
7. Changes in business practice	Can you identify any changes in business practice (e.g. move to EP&L or 'triple bottom line' reporting) either within your business sector or beyond, that have helped, or could help, to open up opportunities for enhanced environmental sustainability management?	If so please explain	
		If so, what could knowledge providers do to enhance these opportunities?	Prompt: For example, provide new knowledge in specific areas, develop new tools, or better data, and/or use specific networks to disseminate knowledge more effectively
	Response:		
8. Thank you and next steps	Checks: • Send a copy of transcript to interview to check for any factual errors • Any documentation re Natural Capital approach .		

Realising nature's value in UK businesses: motivations and constraints

AECOM's Strategic Sustainability and Climate Change team has been commissioned by the **Joint Nature Conservation Committee (JNCC)** to explore the motivations, ways of working, institutional barriers, informational needs and opportunities for realising nature's value and the sustainable use of nature and the natural environment by UK businesses.

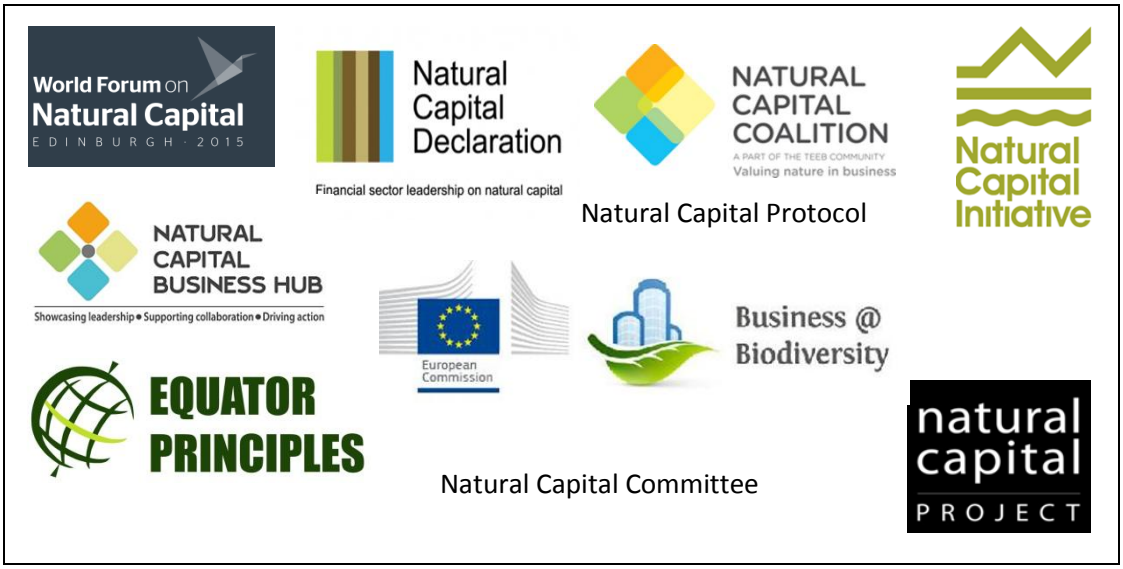
Governments and business alike are beginning to recognise the critical importance of natural capital to economic and business productivity. For businesses to be viable in the long term, the ecosystems and resources on which they depend must be maintained. However, a number of recent assessments (at global, national and local scales) have indicated that many ecosystems are severely degraded and in a state of long-term decline.

As a result, there is a growing case for understanding the dependencies business has on natural capital and the nature and significance of risks and opportunities associated with this relationship. Policymakers and businesses increasingly recognise the importance of valuing and managing natural capital and many businesses have already begun to account for their impacts on natural capital through their operations, products and services.

"Natural capital will become as prominent a business concern in the 21st Century as the provision of adequate financial capital was in the 20th Century"[51]

Discussions on how to consider natural capital in business and wider societal decision-making are gaining momentum as reflected in the growing array of natural capital-related initiatives – see Box 1.

Box 1: Natural capital-related initiatives



This project seeks to inform the actions being developed and taken in these areas. The outcomes of the project will be used to inform effective engagement between knowledge providers and businesses, and to identify important knowledge needs that will enable UK businesses to take natural capital value into consideration and thereby develop more environmentally sustainable business practices.

We are interviewing businesses for this project over the next three weeks. Please contact doug.mcnab@aecom.com if you would like to contribute to this research.

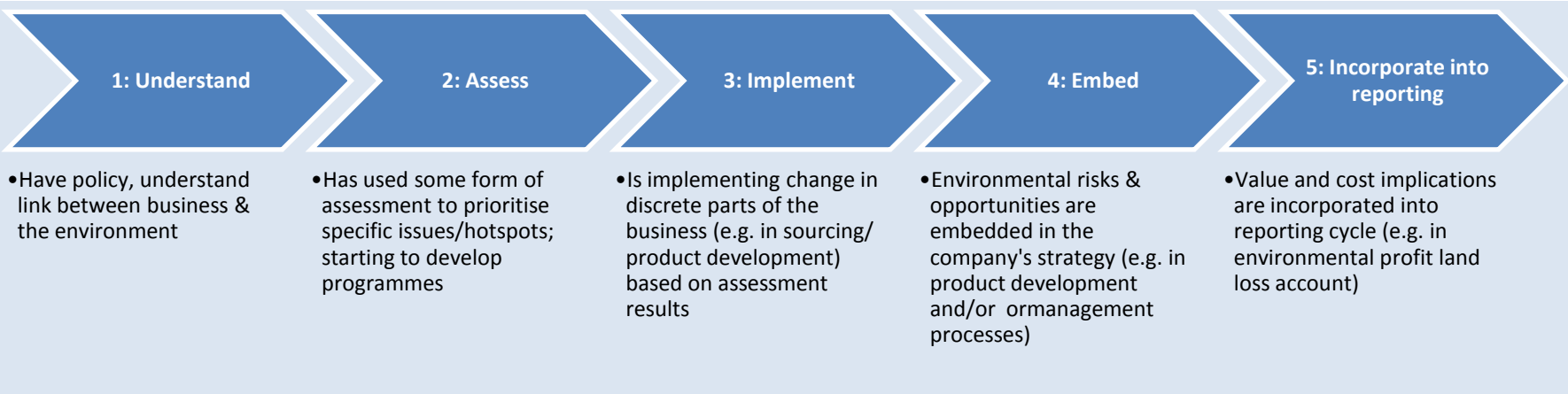
[51] Chartered Institute of Management Accountants, 2013. Accounting for natural capital: the elephant in the boardroom.

AECOM Natural Capital 'Maturity Matrix'

Different business sectors and organisations are at various stages in accounting for their impacts and dependencies on 'natural capital' in their business operations and decision-making. For example, some organisations are aware of their impacts on the environment and have developed sustainability policies that address these; others have assessed the significance of their impacts and dependencies and may be starting to change business practices to mitigate impacts and risks, while yet others have gone as far as incorporating the natural capital values and costs into their financial reports.

Ahead of our scheduled interview we would be grateful if you could consider the below and send a brief email to doug.mcnab@aecom.com identifying at what stage you consider your organisation is at. This will enable us to better tailor the interview questions to your business's circumstances and ensure we make the best of the time available.

Figure 1: Natural capital maturity matrix



Appendix 3: Full write up of interview findings by sector

A full write up of the interview findings is provided below by sector and research theme.

Agriculture, forestry and fisheries

Theme 1: Awareness / understanding of natural capital and natural capital accounting

What do the terms 'natural capital' and 'natural capital accounting' mean to you?
What terms do you use within your business, if any, to describe the dependencies and influence of business on nature?

There was a reasonable understanding of the concepts of 'natural capital' and natural capital accounting' (NCA) among the respondents interviewed in the agriculture, forestry and fisheries sector.

Four out of five businesses interviewed in this sector had a reasonable understanding of 'natural capital' with one respondent referring to ecosystem services explicitly: *"the store of physical assets that the earth has from which ecosystem services derive".* The other business admitted that prior to reading the project brief they were not familiar with the concept. All described a broad understanding of NCA in terms of considering business impacts on the natural environment and how they can sustain natural capital e.g. "*I suppose as I look at farming we try to keep environmental balance in credit… we farm profitably and on the other hand we are trying to get the environmental balance right, in terms of caring for the countryside, enhancing the environmental features on our farms".* Some respondents also mentioned quantitative valuation of such impacts as part of NCA.

Terms that respondents said they use within their businesses to describe the dependencies and influence of business on nature vary depending upon the specific issue and audience in question. For example discussions around planting of a new wood would focus on the range of 'benefits' provided in addition to carbon reduction, such as "*water quality, flood relief, more habitats, more wildlife… [and] the social benefits: public access, recreation and education opportunities. I suppose I am talking to them about the provision of ecosystem services but tend not to use that term*". The farmers, including fish farmers, use terms like 'sustainability', 'stewardship' and 'environmental management' (at least one business was accredited to ISO 14001). The farmers also talk about specific 'good farming practices' such as crop rotation and 'integrated farm management'.

How dependent do you consider your business to be on natural capital?

Are you aware of any impacts (positive or negative) that your business activities (including through supply chains and consumers/customers) have on the natural environment?

The forestry/carbon mitigation business (business 1) recognised that their product is a 'natural resource', new woodland (they have planted nearly 4 million trees on over 900,000

acres), therefore the business is directly dependent on natural capital that may be "directly at risk of climate change and really adverse weather events". They believe that due to the nature of their business they do not have any negative impacts on NC but do have multiple environmental benefits, including most importantly for the business, carbon sequestration. They generally do not ask a land owner/manager who want to plant a wood to redesign it to maximise the benefits provided: "that's really not our business"; they simply check the credentials and accept it onto the list of projects they offer to buyers.

The business does not quantify impacts or influences on natural capital but is "very keen to improve our ability to do that". They are particularly interested in quantifying wider non-carbon social and environmental benefits of woodland creation. The respondent was aware of various attempts to put a number on these benefits but these have *"tended to be top heavy, unwieldy and* ***overly expensive****… who is going to pay for that? ...The danger is that the cost of measuring and verifying a mix of benefits will exceed the benefits themselves."* Besides cost their **customers are not asking for it**, perhaps because as all their woods are in the UK it would not be difficult for them to check for themselves what is happening.

A large landowner (business 2) noted that as all of their assets are let to other people they are "***not in direct control of what goes on our natural capital****, say our soils".* They have tenancy agreements but a lot of these are quite old. They may include clauses about not reducing the nutrient value of the soil but "they are quite aspirational **and it's hard to prove it either way"**. Therefore *"we have to try to influence rather than control. We don't have the access we might want to measure impacts and that sort of thing".* **The business's dependency on natural capital is 'averaged out':** *"If the values of the natural capital were depleted then the rental value of our land would fall. But in any one or two years the response of the land doesn't affect us particularly, whereas for the farmer of the land it does: good or bad weather or good or bad rainfall affects their harvest and their profits, whereas our profitability is much more about the medium and long term*". However despite this greater level of separation between natural capital and the business, they recognise that this "***can be dangerous because if you are not exposed to the short term ups and downs you can get complacent and detached to what is actually going on*****."**

Business 2 maintains a risk register, which includes some NC-related risks, and identifies high risks that need to be actively managed. The business seeks to manage NC risks through working with farmers and land managers. For example they undertake carbon audits and some qualitative valuation of natural capital: *"When the land is re-let those managers will 'walk the farm' and in a subjective way they inspect the land, the soil, the hedgerows, what is in good condition, what is in poor condition and that is a very expert but subjective but it is never aggregated across the whole patch."* They are also signing up to the **International Integrated Reporting Framework for Integrated Reporting** and have wider business strategies to manage risk and reduce environmental impacts (e.g. building a wider cross-sector property portfolio that is no longer focused mainly on agricultural land; investing in renewable energy projects including biomass and biomethane).

The business 2 respondent was cautious about the value of quantifying natural capital in monetary terms: *"****I think if you can it's great as it allows for a very easy triple bottom line accounting to be done… [****for example using a shadow price of carbon in projects, but] I think* ***there is a danger that accountants or consultants can get hooks on that utopian vision and because it becomes so difficult you don't try anything, whereas a more qualitative approach may be more immediately useful and relevant to different disciplines."***

Business 3, an arable farmer and dairy products producer, highlighted their dependencies on "healthy soils in a good structure", water and sunlight to grows crops. While they do a lot of work around biodiversity enhancement (e.g. woodland, hedges, grass margins, beetle banks, wild bird mixes, etc) this is to some extent 'secondary'. Many of the crops are used to feed livestock, particularly pigs, and the organic manure they produce is recycled onto the fields to nourish the soil. They see this as a highly sustainable model that recycles waste, minimizing associated negative impacts whilst sustaining the soil, the business-critical natural capital.

Business 4 (dairy business) also highlights a dependency on water, in this case groundwater, which they extract via boreholes to use in their production processes. This is recognised as a key business risk and they have a contingency plan in place for if they are not able to extract groundwater (involving reverting to mains water supply at significant additional cost). They also have impacts in terms of discharging treated wastewaters locally to local waterways. They are accredited to **ISO14001** and have KPIs for a variety of environmental impacts including fuel use; natural gas use; emissions to air, land and groundwater (they also have to comply with relevant environmental permitting regulations). They are working to reduce impacts on natural capital by increasing the efficiency of water use (though they are an expanding business so they are looking to abstract more through new boreholes; this requires detailed technical work to prove that there is sufficient water available) and reducing the volumes of treated waste water discharged back into the system. One key manufacturing/farm site is on the edge of a SSSI so they have to carefully manage and monitor environmental impacts (e.g. nutrient rich runoff). They also highlight reliance on natural capital for fuel in the form of natural gas and oil and efforts to reduce waste generation.

Neither business 3 or 4 systematically quantify NC impacts in monetary terms currently, though business 4 suggests they could easily quantify consumption of resources including natural resources (e.g. water, natural gas) and report on it. In future business 4 plan's to do life cycle assessment of their dairy products to understand the full environmental impacts along the supply chain (which extends beyond the UK for some products).

Business 5 grows fish in open water and is therefore critically dependent on **clean fresh water** as well as access to **food sources for the fish**. **There is "a very real risk of scarcity" of food sources for the fish because the wild caught fish populations used for feed (MSC certified 'where we can') fluctuate and there are competing markets for this fish and the grain content. An alternative route that would reduce this risk/dependency would be to use GMO protein feed rather than wild caught fish but there is no market for this in the UK at the moment. In terms of water quality, they note that a significant change in water quality could be 'catastrophic' for the business (even a small change** in water temperature profile can increase quantities of algae which can have an impact on their operations). Business 5 has not tried to put a monetary value on these dependencies but they are very aware of them and 'put a huge weight' on the quality of the water.

Negative impacts of the fish farms can be monitored and quantified. These include: increased carbon loading of the sea bed in close proximity to the farms with adverse impacts on biodiversity; impacts of use of vaccines on local biodiversity; consumption of fossil fuels in business operations and down the supply chain; waste generation (e.g. packaging); and the need to minimise fish escapes which, if occurring on a large scale, would have a negative impact on wild salmon stocks. The business is looking at ways to minimise energy use, generate renewable energy and reduce materials use and takes "a very thorough approach to containment of fish". The key positive impact of the business is identified as the production of salmon, "a **good quality, healthy food"** that, due to its farmed nature, is much more accessible/affordable to a range of consumers, contributing to people's improved diets.

Theme 2: Motivations/drivers for NC-related practices

Please can you briefly describe any natural capital-related practices that you have adopted in your business, or are currently adopting? Which core business processes are these sustainability practices explicitly embedded in? What were the drivers for adopting these practices?

The interviewed businesses self-assessed themselves against the natural capital maturity matrix. Perceptions of the stage that businesses were at varied significantly with two organisations at level 1 (understand), one at level 3 (implement), one at level 3 or 4 (implementing or embedding change) and one at level 4 or 5 (embedding or incorporating into reporting).

Business 1 (forestry) considered they are at **level 3 (implementing change) or level 4** (environmental risks and opportunities are embedded in the company's strategy) on the maturity matrix because they **do a risk assessment** of every project (as part of the Woodland code) and the carbon calculations are adjusted according to the risk perceived. However they are not really reporting on natural capital (level 5).

Business 2 believes they are at level 1 (understand) on the natural capital maturity matrix but they are training staff (CISL course) and hope to be able to progress soon. They have lots of stories and good practice they can write about (e.g. carbon reduction projects, renewable energy generation, sustainable buildings) but they lack a 'bigger plan' or framework. They are currently adopting **integrated reporting** which is viewed as a 'huge' step and is focusing on strategic objectives across financial, social and environmental aspects. They have piloted farm carbon footprint audits using a tool called **CALLM (Carbon Accounting for Land Managers tool)**[52], which was developed by the Country, Land & Business Association (CLA). In terms of directly managing natural capital the business owns a significant area of high moor which is a huge water catchment area. Land managers are working with South West Water to help improve water quality and retention of water by managing the peat bog. On farmland they are also doing research with a university on the impacts of the way fields are ploughed and planted (including use of filter strips) on water runoff, soil erosion and downstream flooding. In terms of capital investment they have a set return on investment 'hurdle' but they are considering how this can be lowered in some circumstances, through a formal process (e.g. some form of decision-making matrix tool), to take account of **societal and environmental benefits**. Business 2 sees itself as an 'exemplar' and 'convenor' and seeks to engage others, including other large land owners, to explore such approaches. Key drivers for action on natural capital are the principles and passion of the business's executive board, and also many of the staff, with regard to sustainability and integrated reporting.

Business 3 highlights a range of on farm natural capital-related practices including: tree planting and hedge planting, beetle banks, grass margins and buffer strips around all the water courses, wild bird margins at suitable locations to feed and to provide food and shelter for the birds, sites producing pollen and nectar food for the bees and other pollinating insects. Wider practices include staff training; capital investment, internal corporate reporting on sustainability at board meetings.

[52] http://www.calm.cla.org.uk/

Action on natural capital is driven by the ethos of the family who own the company, which is one of looking after the countryside. It is also about reputation – "*the brand is centred around the core ethos of environmental sustainability, people do perceive XX in that way, in preference to competitors products, so we understand the importance of maintaining that advantage".*
Business 3 saw themselves as being at **level 1 (understand)** on the natural capital maturity matrix.

Business 4 also highlights on farm natural capital-related practices including planting hedgerows and trees [see earlier for more details]. As organic farmers they are nurturing natural capital through avoiding the use of fertilisers on soils and practices such as planting clover to fix nitrogen from the air. Important natural capital-related business processes include e**mployee engagement** (part of ISO 14001 is getting buy-in from the work force to reduce our environmental impact); **corporate reporting** of successes; and the **capital investment decision making** process (which is informed by information on the environmental impact of a project , positive and negative, as well as financial data). The main driver for adopting these practices is "because we believe in it", the owner of the business required it and it is the "key ethos of the brand and we want to project that image". Action is also driven by the requirements of customers (the larger retailers that they supply) and of ISO14001.
Business 3 saw themselves as being at **level 3 (implement)** on the natural capital maturity matrix.

Business 5 believes they understand their impacts on natural capital clearly. The assessment of impacts on natural capital is partly inbuilt into the business through the SEPA (Scottish Environmental Protection Agency) licensing process. The business has to get licenses for all sites and that includes an assessment of potential impacts on the seabed. In addition an Environmental Impact Assessment (EIA) will be completed for all sites during the development process. Their strategic planning includes an environmental focus because they want to have "**long term bioavailability of our sites**, which means we need to be **environmentally neutral".** In terms of operational practices they are improving resource use efficiency where they can, for example by being as efficient as possible in terms of feed use. This is a key focus of employee training and performance-related pay: *"we have a ratio called the feed conversion ratio and the ideal would be to get a gram of Salmon from a kilogram of feed… that's out target".* In terms of **capital investment** energy efficiency is a crucial focus. Given that they are embedding environmental considerations and beginning to incorporate it into reporting (e.g. they report on energy use but also on containment of fish/fish escapes and impacts on habitats where they are operating) they rate themselves as being at **level 4 or 5**. The drivers of their NC-related practices are regulation (see above), customer preferences (e.g. supermarket demands for non-GM salmon), cost efficiency (resource efficiency is a win-win for financial and environmental performance) and reputation – "because ultimately we want to be seen as being a sustainable company and want to be sure that everyone is aware of it".

Have you considered the value of natural capital, using quantitative or qualitative techniques?

None of the businesses interviewed were undertaking comprehensive valuation of NC using quantitative techniques, though some qualitatively assess impacts, positive and/or negative e.g. on water use, flood risk, carbon sequestration. Most are open to considering doing more systematic valuation in the future but a driver is needed.

Indeed two businesses query the demand/need for such valuation, as explained below.

Business 1 (forestry) creates natural capital in the form of new woodlands. These can be measured in terms of the area of woodland created, but valuing the NC and ESSs provided requires measuring environmental and social benefits and enumerating them. They have not progressed quantitative NC valuation to date but **they are ready to as soon as "an organisation that can come up with a sensible and workable matrix for us to test out".** They suggest that **the challenge is that their** projects tend to be relatively small with a very narrow financial base so "*w**ho will pay for the monitoring and reporting? Ultimately whoever benefits from it** and that is whoever is reporting it and making claims or statements. If a new customer says "we really want to do this with you but we must be able to report how many people walk in our woods, how many jobs are benefiting and how many fish are being added to the river" we'll rise to the challenge but , as of yet, we don't know how to do it." The respondent emphasises that the* extent and intensity of monitoring must be appropriate to the scale of the project.
It should be noted that business 1 does describe the multiple benefits provided by new woodlands to customers: "*We describe water quality and sustainable flood management issues where they are relevant and where there are public access and educational opportunities and community benefits we spell those out. Where the woods have got a productive element then the contribution to the local economy and jobs we always spell that out. **But we are doing it in, I would say, simple prose rather than numerical form**."*

Business 2 is at an early stage in terms of embedding natural capital into business decision making. They do complete some qualitative valuation of natural capital but not in a systematic way: *"When the land is re-let those managers will 'walk the farm' and in a subjective way they inspect the land, the soil, the hedgerows, what is in good condition, what is in poor condition and that is a very expert but subjective but it is never aggregated across the whole patch. So if you said to me are the natural resources in our ownership in a better or worse condition than they were 20 years I wouldn't be able to answer."*

Like business 1, business 3 also refers to considering valuation and basic high level numbers such as the areas of woodland maintained. They note that they could go and count and measure all of their environment features *"but how do you value a woodland, which is basically there for amenity value, rather than timber production, how do you value a beetle bank?... We do enough figures as it is, without trying to create more, which doesn't really achieve a lot… **there needs to be a benefit to do it,** if because we do that we get some grant or something or we tick some box, then yes."*

The business 5 respondent noted that "***natural capital is discussed but it's never discussed as natural capital, it's discussed on the many specific points across that very broad term*** [e.g. feed options, treatment options, water quality, potential impacts on protected habitats, etc.]."

Theme 3: Ways of working/integration of NC into business operations

Can you describe any specific ways of working that have facilitated, or are in the process of facilitating, integration of natural capital considerations into your business operations?
How are natural capital-related actions monitored, assessed and reported?

Business 1 (forestry) indicated that integrating NC into their operations is "**absolutely implicit in everything we do"** – this is understandable given the focus of the business is on woodland creation and selling the carbon (plus wider) benefits provided to third parties. The respondent observed that if you asked any of their customers about how they address natural capital *"many would be a bit puzzled because I don't think they are actually thinking in those terms yet. They are thinking about carbon reduction and they're aware because we tell them that there will be benefits to people and wildlife".*

Similarly **business 5 (fishery)** indicated that NC considerations are *"**built into the day to day anyway**. So we work in these environments where we are considering what impact there is and what our feed use is at all times."* They are focused on capturing what they are doing (e.g. feed use, biodiversity impacts) so that they can better understand how to improve business operations; given NC is integral to the operations it is considered as a matter of course. This is also a **regulatory requirement** – for example SEPA set standards for sea water fish farms based primarily around biodiversity around the farms so they need to do ongoing assessments, at least every 18 months to two years.

Businesses 2 and 4 both highlighted their work on monitoring, reporting and seeking to reduce annual **carbon emissions**. Business 2 noted that as a large land owner they have never measured or reported on the natural capital activities of our tenants; the respondent acknowledged this does lead to a 'slight disconnect' in that carbon emissions from tenant farmers may be many times greater than the carbon emissions from the land owner's operational activities.

Business 4 also highlighted their work through **ISO14001** (e.g. environmental KPIs, including for water use and natural gas, are measured through automatic meter readings and through departmental reporting) and the fact that they now report at all levels throughout the business including up to site manager and director level, whereas before it might have just been reported at a team leader level, or a department level. So targets and progress towards achieving targets are now discussed at board room level in the business. This is anticipated to become a requirement when ISO14001 is revised later this year, along with an expanded expectation "to commit to proactive initiatives to protect the environment from harm and degradation, consistent with the context of the organisation" (IS14001 website[53]; 'protect the environment' can include, amongst other things 'sustainable resource use' and 'protection of biodiversity and ecosystems').

As a member of Linking Environment and Farming (LEAF), an organisation that works with farmers, consumers and the industry to promote sustainable food and farming[54], **Business 3** completes the **annual LEAF audit/review.** This process involves reviewing progress on

[53] www.iso.org/iso/iso14001_revision
[54] www.leafuk.org

integrated farm management and generates action plans, policies and review dates to evaluate and map out improvements over time as well as highlight areas to focus on in the future. The review process covers economic performance, environmental quality and social health. They also have an **Environmental Steering Group** (ESG) where they sit down with managers from all parts of the business to review what they are doing and where they can make improvements. The business also **works with the RSPB and local wildlife organisations** (e.g. East Yorkshire Butterfly and Moth group, East Yorkshire Bat group) who come and monitor on the farms: "*We've got to know some of these groups really well over the years, and they come back, and it's a win-win, they enjoy doing it and we get the information, which we can then report on internally or when we get visitors."*

What barriers or constraints are there to integrating natural capital your business operations? Have you had any success in overcoming these barriers?

Business 1 (forestry) argues that NC is already integral to the business and thinks that are no barriers at all to further integration – " we will be building in natural capital qualitative metrics as soon as we have suitable tools available to us". However the **availability of appropriate tools** that can measure hard-to-measure ecosystem services (beyond carbon sequestration) is clearly seen as a key constraint.

Business 2 (large land owner) perceives a key barrier as being the intellectual and practical **challenge of understanding your NC baseline and establishing KPIs**. A further constraint is the ability of the business to control what is actually done on their land: "we are operating mainly through influence and persuasion". They are exploring ways to address these barriers through discussions with other large land owners implementing integrated reporting and learning from emerging approaches such as reducing farm rents for tenants who are doing things to reduce their carbon footprint and/or enhance natural capital.

Businesses 3 and 4 both identify **financial issues** as a key barrier: *"if we are profitable, then we can afford to spend part of that profit on caring for the environment… in a tough year, you're not going to have as much to throw at it"* (business 3). There are also **practical limits** to what can be done: *"On a lot of our existing farms, we are not going to be doing anymore because we are doing everything we can, if we start to do anymore then we are actually going to start impinging on the factory floor. But we do have scope on some blocks of land we've taken on… which aren't farmed or haven't been historically farmed as well as we would like, and haven't had much consideration for the environment"* (business 3). Use of **new technology** can help to overcome some of these barriers. For example business 3 already uses 'precision agriculture' techniques such as using nitrogen sensors on fertilizer sprayers to measure nitrogen content of growing crops and apply targeted amounts of pesticides; and is interested in the future use of unmanned aerial vehicles for monitoring issues that cannot be easily seen from ground level. For example mapping weeds and disease hotspots and enabling a quicker and more targeted response and less use of pesticides.

Business 5 (fishery) highlights the **rate of technological advance** as a key barrier to further reducing impacts on natural capital. For example their preference is to use biological controls to reduce environmental impacts and often also costs. However these approaches are still under development and the company continues to investment in their implementation. They do not perceive many barriers within the business, in contrast **regulatory barriers** are seen as significant; for example, with regard to the use of biological controls they are working closely with regulators *"to bring them up to speed with what we'd like to happen, they obviously have to take a more cautious view… they are willing to get to the same solution as us they just want to be confident that the route they are taking is one which is going to give them the sustainable long term view that they are looking for as well."*

Theme 4: Key knowledge resources (including metrics and tools) and lack thereof

What knowledge resources, for example specific data, metrics and/or tools, has your organisation used to successfully integrate natural capital in your business model? How were these knowledge resources sourced?

Business 1 (forestry) implements the **Woodland Carbon Code**, the voluntary standard for UK woodland creation projects which make claims about the CO_2 they sequester. Independent certification to this standard provides assurance and clarity about the carbon savings of these sustainably managed woodlands. The business uses **two Forestry Commission-derived two tools** to inform its work:

- A piece of software called the **Ecological Site Classification**, which is part of a decision support system suite from Forest Research. This enables them to know which tree species are best suited to any given site, how well they will grow on that site and how susceptible they are to climate change i.e. temperature change over a 50 or 80 year cycle.
- A **set of look up tables**, also derived by Forest Research, from which they can predict the tonnage of CO_2 that will be sequestered over a given area over a given period by a certain mix of trees. Using these they can derive the s-curve of carbon gains from any specific project. These tables currently being further developed to improve their fitness for purpose.

Business 2 highlighted one tool, **the Carbon Accounting for Land Managers (CALLM) tool**[55] which was developed by the Country Land & Business Association (CLA) for farming operations to assess their farm carbon footprint. The calculator measures emissions of carbon dioxide, methane and nitrous oxide from a land-management business (including emissions from energy and fuel use, livestock, cultivation and land use change and the application of fertilisers) and any carbon which is stored in soil and trees[56]. The respondent emphasises its 'pragmatic approach' (e.g. much more time and cost effective than doing soil sampling) and stated that they use it with Farm and Wildlife Advisory Group (FWAG) advisors on a number of our farms. With regard to construction of new buildings, they have also done some work assessing the embedded carbon in different materials or in the sourcing of different materials.

Business 3 referred to the **Linking Environment and Farming (LEAF)**[57] **annual audit/review** which involves reviewing progress on integrated farm management (IFM) and generates action plans, policies and review dates to evaluate and map out improvements over time as well as highlight areas to focus on in the future. The review process covers economic performance, environmental quality and social health. Through implementation of this process and close working with Natural England and the Environment Agency (and FWAG until it ceased) they have applied a variety of IFM tools/approaches, combining "the best of traditional farming" with modern precision farming technology. For example "*every time we go through our crops we are scanning them with infrared, we are basically*

[55] http://www.calm.cla.org.uk/
[56] Ibid.
[57] www.leafuk.org

measuring chlorophyll and biomass production out there, we are doing yield mapping, we are doing GPS fertilizer soil sampling to help determine exactly what fertilizer is needed and the optimum requirements for the crops, we certainly don't want to be throwing seed, agrochemical or crop protection products or fertilizers, we don't want to be putting more on them than the crop needs because there is obviously a risk to the environment. Neither do we want to be going short of what we are putting on because we are not going to get the optimum yield from the crop."

Business 4 (see above re ISO14001 approach) sources most information from the Internet. This includes legislative updates and CO_2 reporting metrics and data from the DEFRA corporate reporting guidance notes: *"we try to make sure its .GOV website rather than from anywhere else to make sure it is a reliable source".*

Business 5 works closely with **Scottish Natural Heritage** (SCN, a statutory consultee on some project approval processes) on a relatively regular basis, looking at potential locations for new fish farms and what impacts would arise from sites in those areas. SCN has **significant databases** that they can use to provide them with information regarding habitats and species that their projects might have an impact on.

To what extent is a lack of knowledge or lack of access to suitable data, metrics or tools constraining development of natural capital-related practices in your business?

Businesses had a range of views about the extent to which lack of knowledge or lack of access to suitable data, metrics or tools constrains the development of natural capital-related practices. This included a need to assist users to locate the relevant knowledge and data from the mass of information available.

Business 1 (forestry) does not see a lack of knowledge or lack of access to suitable data, metrics or tools as a significant constraint. Besides the desired improvement to the CO_2 sequestration lookup tables (work is underway) they believe they are 'well served'. One project under development is the ability to most efficiently verify the growth of the new woods they are creating. Under the **Woodland Code** this is supposed to be verified after year 5 and then every 10 years. However, many of the woods are very small and in remote locations so there is a concern about the cost of the verification assessment. They hope that a simple, easy to use, **cost effective remote sensing method will become available,** be it a satellite or a hand-launched drone approach. They have sufficiently qualified staff to use the tools that are relevant.

Business 2 did not see lack of knowledge as a constraint although the respondent did state that *"we are **not sure where to go** as we don't quite have the staff resource to do it."* For this reason the interviewee is completing the Cambridge Institute for Sustainable Leadership course *"to learn where to go to learn"* about natural capital. He suggested a "**centralized one stop place to go"** would greatly improve access to reliable information on this specialist area: "*The Defra conversion factors are a sort of bible that everyone uses for reporting. For the areas that it covers it is great. It's just extending this sort of work for natural capitals which would be really useful. Similarly, on societal benefits, some common metrics would give you more confidence to use them and not be criticized by other people. We all use the same measures for the conversions of a litre of diesel into CO_2 emissions, and we should all use same measures for creating a job."*

Business 3 felt that they were better resourced than a lot of organisations and that their emphasis on sending people away on training courses helped to keep them informed: *"We have very highly qualified and motivated staff."* Thus lack of knowledge was not seen to be a problem.

Business 4 indicated that there is no lack of data but highlighted problems of benchmarking: *"… it is not so easy for us to benchmark against similar businesses, not because businesses like ours are trying to be secretive necessarily, it's difficult to compare like for like because even two yoghurt manufacturers can do things quite differently, we produce a lot of different products whereas the next manufacturer might just be producing one or two…"*

Business 5 highlighted similar concerns to business 2 in terms of **finding the right information**: *"…one of the frustrations that we have at the moment is that it can take a lot of time to know what resource we can access and knowledge of surveys that have been completed in the areas".* They would like to see a tool/GIS data layer that included the locations of all sensitive habitats that they could overlay onto mapping. However they understand that there are sensitivities around information about where protected species are located for obvious reasons. They have sufficiently qualified staff.

Theme 5: Changes in business practice that can assist embedding of NC ideas

Can you identify any changes in business practice (e.g. move to EP&L or 'triple bottom line' reporting) either within your business sector or beyond, that have helped, or could help, to open up opportunities for enhanced environmental sustainability management?

Changes in business practice that *have* helped open up new opportunities for enhanced environmental sustainability management highlighted by agriculture, forestry and fisheries businesses included the uptake of Integrated Reporting and joining LEAF (Linking Environment And Farming).

Key changes that *could* help in future to open up new opportunities for enhanced environmental sustainability management included:

- **increased publicity of the carbon sequestration and wider benefits of carbon offsetting through UK woodland creation**
- **creating a central source of best practice and case study material that converts the mass of natural capital research into understandable and practical outputs for farmers/land managers to implement**

Business 1 (forestry) sees publicity as "the big thing now". They believe that their approach to carbon offsetting through the Woodland Carbon Code is robust, that they have "a sound story to tell" and that "*most now recognize the credibility of what we are doing".* Thus to open up further opportunities they need to *"get the message out to more businesses that are potential investors and to more farmers and land managers to look into the case for woodland planting. And… we need DEFRA, the Forestry Commission and Natural England to create a more flexible grant funding mechanism so that carbon funding can augment grants and enable grant funding to do more."*

Business 2 believes the work of the **Prince of Wales' Accounting for Sustainability Project** and **the International Integrated Reporting Council's**[58] work promoting integrated reporting is hugely beneficial and involves a very sound approach. In terms of what knowledge providers could do, the respondent highlighted the need to make the mass of available research material *"**understandable and practicable as well, so taking the research and converting it into best practice or case studies** where people have done things, so you can follow those examples that are helpful. Too many of the research papers coming out of the international organisations are just impenetrable. You read it and then you think OK what does that mean to me, what I can actually do tomorrow?"* He suggested creating a "**centralized one stop place to go"** would greatly improve access to reliable information on this specialist area.

Business 3 identified one of the biggest changes as being **joining LEAF (Linking Environment And Farming)** many years ago and being able to market some of their produce through LEAF Marque[59], an environmental assurance system recognizing sustainably farmed products. Reflecting the concerns of business 2 the respondent also emphasized *"…**a gulf between academia on the one hand… a lot of good scientific research going on, and then there is us at the sharp end, the actual farmers**… I have been critical for a while of finding this middle ground, **turning research into a practical interpretation so it can be adopted by the farming community on the ground**."*

Business 4 identified the introduction of **carbon footprinting** and CO_2e measurements as a significant change in business practice (albeit this is more about improving general environmental performance that specific natural capital related practices). They are not doing any CSR reporting yet but they are considering instigating this voluntarily.

Business 5 could not identify any specific changes in business practice. Natural capital is integral to their fish farm operations and cost and environmental performance are closely linked (e.g. efforts to maximize feed conversion ratio and reduce medicine usage), therefore there primary impacts are "*fully inbuilt into the way we measure performance on our sites".* Secondary environmental impacts (e.g. related to fuel usage) are not currently costed in financial considerations but these are considered to be much smaller impacts. If they ever felt they had done all they could with the primary impacts then there would be potential to look at the other ones and they would then turn to using relevant knowledge provider resources.

[58] www.theiirc.org/
[59] http://www.leafuk.org/leaf/consumers/theLEAFmarquecons.eb

Electricity supply

Theme 1: Awareness / understanding of natural capital and natural capital accounting

What do the terms 'natural capital' and 'natural capital accounting' mean to you?
What terms do you use within your business, if any, to describe the dependencies and influence of business on nature?

There was a reasonable understanding of the concepts of 'natural capital' and natural capital accounting' (NCA) among the respondents interviewed in the electricity supply sector. Four out of five businesses gave broad definition of NC and NCA and the fifth interview also demonstrated an understanding of the concepts e.g. NC is *"the stock of our natural assets, soils, trees, water, etc. the important thing about them is the benefits they provide to us as a business and also our stakeholders and society as a whole".* NCA is *"around attributing a value to these sort of natural assets, so they can be of equal importance to what we would term the more traditional financial capitals, or the human capital, or social capital."*

The relatively high level of understanding of these concepts is perhaps unsurprising given that to some extent the sample was self-selecting (i.e. we sought out 'early adopters' and 'nearly adopters' and people who did not understand the term might have been more reluctant to be interviewed). Moreover, many of these businesses have significant land holdings and routinely consider ecological and wider environmental impacts as part of developing energy generation projects.

Terms that respondents said they use within their businesses to describe the dependencies and influence of business on nature vary. **Business 6** stated they **tend to talk about impacts rather than dependencies**. This is partly because they are implementing lots of new projects so there is a significant focus on **potential impacts and how we measure and subsequently mitigate** those. However increasingly through the work they are doing they are also starting to talk about the **values** of natural capital and those ecosystem services to the business and to our stakeholders.

Business 7 uses the term 'natural capital' and the six capitals framework as well as terms like 'biodiversity and ecosystem services': *"… we focus mostly on capital, our business is hugely capital intensive and I think that is probably the most effective way to discuss it with senior management, in terms of natural capital."*

Business 8 sometimes uses terms like NC and NCA, but at the moment understanding is limited in the executive team and so they tend to talk more broadly about biodiversity.

In **business 9** they use terms such as 'biodiversity' and 'impacts on wider ecosystem services' to describe constraints on developing energy generation. Their policy is to put the environment first so if there is a significant environmental impact that cannot be mitigated, they will not go ahead.

Business 10 would not tend to refer to NC and NCA. They would talk about "looking to enhance nature through our projects" and the use of renewable energy as a means of preventing impacts on nature and on the climate.

How dependent do you consider your business to be on natural capital?

Business 6 considered they have **"relatively light" dependency on NC,** relating to ecosystem services such as **visual amenity preservation**/reduction of visual impact, **noise attenuation** and **flood and water control** on their sites. They saw these dependencies as presenting local, site specific risks.
The respondent thought putting natural capital and ecosystem services into monetary terms helps in two ways: *"it **translates an idea**, which is often intangible as in the environment into terminology like stocks, benefits and flows which resonate with different communities within the business so that has been very **important in terms of engaging internal stakeholders,** particularly the planners, the estate managers and so on. But using the tools to monetize also helps us to show that we only see half the benefit or less than half the benefit and that there is a lot of benefit for stakeholders as well and that valuation be it monetary or otherwise has been a really important tool in **engaging external stakeholders**."*
They have been working with AECOM in terms of valuing natural capital and ecosystem services from their sites using a **combination of monetary and non-monetary approaches**; they also use non-monetary values I guess in terms of impact assessments e.g. Environmental Impact Assessments for development projects.

Business 7 views **NC as "business critical"** because approximately 25% of the energy generation assets **depend on wind and water**; and because **floods and storms** threaten these assets and NC can reduce the severity of these impacts. The business has a lot of customers in very remote locations so **not having the infrastructure that can withstand these storms is key business risk;** this is linked to the fact that their **license** to operate as a network owner relates to them providing a reliable network. The environment can also be very disruptive as it can fluctuate power demands and power generation, making providing stability to customers more challenging.
They are exploring quantifying NC in **monetary terms** – *"it's not a case we think that we have quantified exactly, it is very much a **materiality assessment** but **unless they have some kind of value they are just not going to be able to be measured or managed in the same sort of way we would with traditional capitals**… what we have found is that good or bad you can attribute a value to most of these capitals, whether or not that encapsulates all of its value is probably still a question but it is a question we are seeking to answer… we don't want to be putting values on everything but there is an ability to at least monetize the material aspects."*

Business 8 believes they are **"very heavily dependent"** on NC. Use of **water for cooling** is a critical dependency and risk as they cannot operate without it. They also see managing the environment as key part of our business, especially regarding **'license to operate'** from local communities where they are operating for long periods. The aim is to protect but also to enhance the local environment. This is also viewed as a risk because if they cannot develop because they are seen as "not welcome" then it can have a major impact on projects and **increase costs**. The respondent believed quantification in monetary terms could be useful because "*unless you put a value on something it doesn't hit the balance sheet and therefore the bean counters who control how things are done will not consider it".* They **have not fully deployed valuation method yet**. Generally they take action because it is "**good for PR and for getting a development done"**. Managing sites for biodiversity can also **avoid nuisance uses of sites** and create **educational opportunities** for schools. *"All of this seen as key to the business – demonstrating we are sustainable, helping **retain and attract staff**, to engage children to study the right subjects so we get the talent coming through. All of this is hard to put a monetary value on."*

Business 9 (like business 7) identifies their **dependence on biophysical processes to generate energy,** in this case wind and sun. Key NC-related **risks** relate to the **potential impacts of developing energy generation projects** on biodiversity and runoff/drainage. In planning applications they ensure they mitigate all impacts and maximise positives where possible. Developments can have **ecological benefits** where they take upland sites out of intensive grazing pressure or they take sites out of intensive arable production, thereby **creating opportunities to manage them for greater ecological value.**

Business 10 (like business 7 and 9) highlights their heavy dependence on **wind, solar radiation and the water cycle (hydro-electricity)** for generating energy.
They see NC dependences **not as risks but as opportunities**: *"as fossil fuels run out the opportunity for more renewables is going to become bigger and bigger. So for us it's not so much a risk but is an opportunity".*
They believe **quantifying dependencies in monetary terms is very important including at a national scale**: *"From our perspective… being able to quantify and monitor how fossil fuels are running out and the climate is changing, those two factors are how we* ***demonstrate that renewable energy is needed****. For us it is really important to be able to quantify and monitor but not so we can change what we are doing but just to* ***demonstrate what we are doing is the right way to go."***
In terms of non-monetary values of NRs, they like to secure **biodiversity enhancements** as part of energy generation projects; these projects are not for monetary gain.

Are you aware of any impacts (positive or negative) that your business activities (including through supply chains and consumers/customers) have on the natural environment?

Business 6 highlighted NC impacts from their **construction activities** such as building new power transmission or energy transmission infrastructure. They undertake a full Environmental Impact Assessment (including when not legally required) to **understand the impacts and what mitigation can be put in place**. This will include asking fundamental questions about do we need this infrastructure and how could it be located to as far as possible **avoid impacts** to high value or sensitive areas or coming into areas where there are high population densities; as well as carrying out all the required ecological surveys and using that information alongside public consultation to find a solution that minimised negative impacts. There are also impacts through their **supply chain** (e.g. pipes and wires) through **extractive industries** so they are focusing on the 'circular economy' and increasing resource efficiency. In terms of enhancing or promoting positive impacts, examples include:

- a **vegetation management policy** focusing on trees and hedgerows (e.g. replacement of trees as part of infrastructure projects); and
- an emerging '**enhancing ecosystems**' programme that is establishing how they can manage and use the land around their operational and non-operational assets to make sure the visual amenity and value are maintained and that **biodiversity or community benefits are optimised**. This involves working with partners like the Wildlife Trusts and Forestry Commission, using natural capital evaluation tools to develop scenarios (*"using ideas around natural capital does help us enumerate or start to enumerate impacts in different ways")* and putting long term management plans in place which meet the business's needs as well as helping to **deliver the ambition of local stakeholders** like the wildlife trusts.

Business 7 has coal and gas power stations which generate **significant CO_2 emissions** and have supply chain impacts on natural capital (extraction etc.). Mitigation measures being explored include carbon capture and storage projects; projects converting coal power stations to multi-fuel; and investment in renewable energy generation. There are also impacts of infrastructure development, including work on networks to release additional capacity for renewable generation (e.g. wind and hydro) so there is a need to manage and mitigate environmental (as well as economic and social) impacts (including on areas of outstanding natural beauty or national scenic areas), working with stakeholders allows us to develop better practice. They are working on trying to measure these impacts so that they can manage them as effectively as possible. This includes:

- participation of their Chief Financial Officer (CFO) in the **Accounting for Sustainability CFO Leadership Network;**
- supporting the World Forum on Natural Capital in 2013 and engaging with the Natural Capital Coalition; and
- working with PWC on **quantifying natural capital aspects** of their transmission lines

Beyond this wider engagement they are looking at specific future projects because *"**without actual projects and real life experience a lot of it is just lip syncing and green words rather than green actions". "**We are sceptical and reserved where we should put our resource just now. **There is so much going on in this environment that we just don't know what we should be pursuing and paralysed with choice and thus is why I believe we are moving along with our own agenda but we don't know who we should be speaking to, who we should be aligning our projects to..** I think we are pretty similar to a lot of companies that I speak to on this, in terms of people just understanding where they are going, what is the next focus and… what is the sort of return on being involved".*

Business 8 emphasised opportunities to maximise positive impacts. They highlighted their work to restore habitat on old coal sites and to enhance biodiversity around their power stations under the **Biodiversity Benchmark**. This is a **Wildlife Trust** independent verification scheme that requires good ecological management on site and improvement of habitats (many sites already have significant biodiversity value because they have not been under intensive management for a significant period). They anticipate that these habitats could be used to offset project biodiversity impacts or sell to the market for others to use i.e. they see a **commercial opportunity through habitat management and accounting**. They also have the **Biomass Standard** which specifies how they procure biomass for their power stations. This includes the need to ensure they are saving carbon through whole lifecycle, protecting human rights and the environment (e.g. in terms of water, ecology, invasive species). They have also signed up to **UN Global Compact** and are **looking at environmental risk/impact of products and categorizing as high/med/low**; this is used to determine how much assurance is required. All suppliers are required to complete a **supplier risk assessment,** a process which includes sustainability aspects.

Business 9: Development of energy generation projects can have impacts on biodiversity and runoff/drainage. In planning applications they ensure they mitigate all impacts and maximise positives where possible. Developments can have **ecological benefits** where they take upland sites out of intensive grazing pressure or they take sites out of intensive arable production, thereby **creating opportunities to manage them for greater ecological value.**
They are **exploring NC-related opportunities**. For example they are developing a **sustainable gas project** that is seeking to use grass and other feedstock (e.g. maize) to generate gas for the grid via anaerobic digestion. Drivers for this include an **increase in**

grass leys as a consequence of a massive decline in the dairy herd in the West Country; and as a treatment to control black -grass, a pernicious weed that can seriously reduce crop yields through competition for nutrients[60]. Integrating **grass leys** into an arable system could have **multiple environmental benefits** besides the generation of sustainable gas e.g. it is "carbon neutral in two years", it reduces the amount of molluscicides which are heavily used in growing oil seed rape, wheat, barley) that enter the system, and it takes land out of intensive arable production.

Business 10: The development of their renewable energy generation projects, particularly during the construction process, has environmental impacts. They undertake Environmental Impact Assessments for all projects as part of the planning process. However they believe the **overall impact of their projects is positive** because of the carbon savings generated from their projects (100% renewable energy) and also the biodiversity enhancements that they implement (these include creation of wildflower meadows and creating wetland areas around solar arrays and planting hedgerows and trees for landscape and biodiversity benefits): *"there is a **short term negative impact**, whilst we are building our projects and there is a **long term positive impact**… **[and] we give our customers the opportunity to switch to a renewable energy source** and that in itself is kind of a positive thing."* They also acknowledge wider impacts such as: consumption of energy and resources related to the operation of their office (mitigated through measures such as specifying sustainably sourced and recycled products, cycle to work scheme, renewable energy) and **supply chain impacts** in terms of the solar panels and wind turbine products ("*but the carbon payback for those is fairly short term, I think within a year*") including extraction of the raw resources.

Theme 2: Motivations/drivers for NC-related practices

Please can you briefly describe any natural capital-related practices that you have adopted in your business, or are currently adopting? Which core business processes are these sustainability practices explicitly embedded in? What were the drivers for adopting these practices?

Business 6 is beginning to apply the terminology around Natural Capital and Ecosystem Services (e.g. assets, stock and flows). They are finding that this approach *"really lends itself to informed decision making so using those tools allows us to start **reflecting the value of the environment in our decision making** for site restorations, site change or investment in infrastructure*". The sophistication of their understanding of environmental links is growing. In terms of assessing impacts and valuing ecosystem services they have the **Natural Capital and Ecosystem Services tool**, developed with URS/AECOM, which helps them to understand their impacts but also opportunities to realize enhancements. They have used this information, including valuations, in some **capital investment decisions** and in **recruiting new partners** into the management of some of their natural capital assets. However they are on a journey and use of the tool is not yet widespread or integrated. *"In terms of planning we've always had a focus on the environment through planning and it is about introducing the new terminology and new tools into that domain, which is a big driver or will be a big driver for our business over the next 12 months."*

[60] To control this weed requires treatment with several herbicides at the right time of year or taking intensively used arable land out of production and putting in a grass ley for five years.

In terms of the **supply chain** they are exploring how they could change some suppliers to drive more local benefit but they do not yet understand natural capital risk down their supply chain.
The respondent felt there were a range of drivers for adoption of NC-related practices: "*XX has set out on a journey to embed sustainability and that includes **using more sustainable information in our decision making** and I think one of the drivers there is that we do have a **significant footprint** out in the natural environment so understanding a) what that is and b) finding ways to enhance [positive impacts] is… the right thing for a business like ours to being doing, it reflects government ambition… [to develop] bigger, **better more connected spaces for nature that is a great opportunity for our business**. If we get the approach right it **should drive efficiency** and it should help us understand that intrinsic value of the capital we have as well… [It is also about] how we are able to talk about it both now and also how we develop in the future and impacts our license to operate."*

Maturity matrix: rating between Level 2 and 4. They understand the issues; they have a policy and understand the link between business and environment. They are implementing change in discrete parts of the business and they are working on embedding it, but they are not reporting (limited to some narrative description).

Business 7 is also on a NC 'journey'; they have been working with PWC using their **Total Impact Methodology (TIM)** to understand NC and to assess at a project level what they could do with what impacts, focusing on **material aspects** given limited time and resource. They are now moving into implementation and looking at how they can embed a 'business as usual' process for generation as well as network assets. (**Maturity matrix: rating between 3 and 4 at project level, 2 to 3 at wider group level).**
In terms of NC being embedded in *core business processes*, **CAPEX** was where they started and where their A4S Leadership Network activity has focused. **Employee assessment** is against 6 core values, one of which is sustainability (e.g. encourages car sharing, video conferencing, recycling onsite, cycle to work).

Regarding **corporate reporting**, in 2011 they got rid of a separate Sustainability Report and put it all in the financial report – there was a separate environment section but this is changing as they are valuing NC impacts and **"becoming more and more embedded"**. Their work on the **supply chain** is around increasing opportunities for local companies to pitch for the work, which also has environmental benefits due to reduce travel. Soon they will be looking at **procurement** - European legislation imposes limits and what you can and cannot require but they are starting work with suppliers on these issues.

Business 8: [See above answer regarding tools.] Other NC-related practices include developing **biodiversity action plans** for non-operational sites e.g. engaging staff at offices on green areas/planting; water fooprinting and a programme targeting water efficiency improvements (the primary focus is process water as significant savings can be achieved here and it is an important issue when looking to develop in water deprived areas).
Maturity matrix: **stage 4**. They know their landholdings and their ecological value, they understand their environmental impacts on the; they have identified opportunities and risks and got strategies in place to manage these. They are currently reviewing use of the **biodiversity benchmark** to see if that is adding best value for business. They have not tried to undertake formal monetary valuation
Core business processes: They are looking at supply chain for biomass, management of sites, employee engagement work. Other processes: **'biodiversity standard';** risk assessment for all major projects; EIA process for larger projects. There is a **template to record risks or benefits to biodiversity** and where appropriate identify how these should be managed/mitigated. They **partner with Wildlife Trusts** and others where appropriate

e.g. in Lancashire they have a long running partnership managing a reserve there. They also have a schools project developing children's interest in science.
Key drivers for NC-related practices are the **CSR agenda and getting development done and done cost effectively** and **license to operate**. The schools project is also about supporting **future talent**. Work on water footprinting and risk has been driven by mandatory requirements for climate change mitigation/adaptation plans which included water as well as a range of other issues.

Business 9: [Re NC-related projects see also answer above] **No maturity matrix rating provided.**
Core business processes: They use a European management assessment system and have an EMAS champion. *"NC is taken into account as part of formal business and as part of the annual report. The whole point of organisation is to produce energy without emitting carbon"*. The focus is on renewable energy generation but they are also developing a large scale network of charge points for electric cars.
Drivers for NC practices: EMAS is used in strategic planning but is not always a main driver. Finance and minimizing carbon are the main drivers.

Business 10: Maturity matrix: **stage 4-5.**
They look carefully at sustainable sourcing of products like solar panels and our wind turbines; there is a **procurement process** that takes into account environmental and NC issues: *"**there is a policy but I don't think there is a reporting at the moment**… Sustainable sourcing is ranked quite highly in the importance matrix".* They also mention wider environmental practices such as employee engagement on environmental behaviours. In terms of developing energy generation projects, they **prioritise poorer quality and brownfield sites** in the site selection process in order to minimise negative environmental impacts.
*Drivers for NC practices: "We consider ourselves to be quite **eco-friendly people** so one driver is just the type of people that work for [Business 10]".* **High customer expectations** are also an important driver and the respondent emphasised the importance on **communicating what they are doing** (e.g. new energy sites, biodiversity and community gains) in terms of ***"keeping and maintaining customer relationships and meeting their expectations"*** and building *"confidence in you as a developer that you are … not just in it for the money but … for a bigger reason as well."* **Social media** is important for getting the message out.

Have you considered the value of natural capital, using quantitative or qualitative techniques?

Business 6: They are using quantitative values on a project-by-project basis but not in the over-arching business model (see earlier answer regarding Natural Capital and Ecosystem Services tool). They are partnering with organisations **including Prince of Wales' Accounting for Sustainability** (A4S) partnership and using peer groups like that to help to understand how they can start to ***"integrate this more in terms of the actual accounting basis rather than just a project by project bottom up type approach that we are developing now".***

Business 7: They looked at valuing NC on land for a transmission line project at a "very high level" but the land take turned out to be quite small, thus the estimated value of ecosystem services was also relatively low at £200 to £250 a hectare: "**the materiality** of that on a £550 million project, it's not there, but our stakeholders want to understand that, they saw these [NC and ESS impacts] as concerns… and therefore that was a criteria for **a materiality assessment**". The respondent notes that these can be quite *"generic assessments but previously we did no assessment so we see that as a positive step".*

Working with SEPA they have also been developing an **optioneering tool** for application at the very start of the project identification *process "when you have the ability to* ***assess as many criteria as possible… [and you can] bring in that sort of ecosystem valuation or assessment."***

Business 8: They are doing **limited quantitative valuation of NC at this stage:** *"I think it's really useful but as an ecologist I don't like it. But at the same time I know that unless you put a value on something it doesn't hit the balance sheet and therefore the bean counters who control how things are done will not consider it".* Therefore most of what they do is qualitative valuation.

Business 9 has **not yet done quantitative valuation** but *"it is something that is being discussed and looked at"* and they certainly think they might do this in future.

Business 10: They are **not doing quantitative valuation now** but to some extent they are doing **qualitative evaluation** e.g. going to the board and saying they want to spend a £100,000 on biodiversity enhancements at this site and setting out the reasons why, including the benefits to the community and the business (e.g. amenity and reputational benefits): *"I definitely think that there is a benefit for doing it [quantifying NC]… although having said that I don't think* ***our board of directors are quite as hard to persuade to do these things as most because it's a small company****, it's very dynamic and is a very passionate company. So I think that the* ***need for it hasn't been there yet*** *but… it will get to a point where it might be needed for getting sign off on things."*

Theme 3: Ways of working/integration of NC into business operations

Can you describe any specific ways of working that have facilitated, or are in the process of facilitating, integration of natural capital considerations into your business operations?
How are natural capital-related actions monitored, assessed and reported?

Business 6: *"I think we always have but I think what we are doing now is understanding more the actual value, the intrinsic value of the environment around our assets and* ***using this understanding around values [developed through application of a valuation tools] to drive a sharper focus of that within our business"****.* They are investing in ways of **engaging with stakeholders** to **understand what is important in the environment**, what ecosystem services mean most to those people and as a result are starting to **change the way that they develop long term site management practices** (e.g. shift from intensive mowing of grass around sub stations to allowing it to grow and encouraging wild flowers to create biodiversity value and reduce costs). This is also leading to **more partnerships** such as engagement with the wildlife trusts to help manage natural capital assets for **joint benefit**.
In terms of monitoring and reporting they can report numbers generated by the valuation tools and they **can model scenarios**. They are putting that into practice through **Sustainability Action Plans**, multi-year plans for different sites (the aim is for 50 plans in place by 2020) setting out the baseline, what in terms of capital and ecosystem services are important (this will depend on where the site is and who they are working with e.g. joint management of some sites) and how management will seek to enhance or change those values through the duration of the plan. They will monitor against these plans through a series of KPIs.

They have to demonstrate clearly to OFGEM that the **investments they are making are efficient** and are in the interests of customers and/or provider wider benefits.

Business 7: The respondent provided the example of **how they develop projects for sub-sea cables**. This involves trying to **do a cost benefit analysis which encapsulates the wider economic, social and environmental aspects** in the process: *"even if financially it doesn't make sense, it's a wider impact or wider benefit that might be a way to drive these projects."* This is a *"fundamental change to the way we've done business... **it is an engagement tool, it's probably not for ultimate decision making** just now because it's still a little bit of a dark art but it's certainly getting our feet at the table in the discussions now, which previously it didn't."*
The respondent stated NC **reporting was still in its infancy;** they are still focused on measuring and are **taking their time to develop relevant KPIs internally, working with** executive directors who are willing to be patient for results: *"that is a real sort of strategic shift because I am always very sceptical when a lot of people tell me they are going to fix sustainability in a year, two years… **these are difficult things and we need to have time to accept the challenge and to learn from others."*** They are following mandatory requirements rather than going significantly beyond.

Business 8: A key driver of the way they work on NC is **regulation** (e.g. Ofgem sustainability criteria for biomass) and staying "*ahead of the curve*" – this enables them to demonstrate they are being sustainable but also allows them to **secure commercial advantage by preparing early and embedding what is required to ensure that they can secure the product they need**, *"rather than having to buy whatever is left"* (e.g. securing sustainable biomass supplies ahead of the competition). They are also learning through **engagement with policy makers and ESS research/development** e.g. on a NERC project developing tools for NC.
Business 8 completes evaluation and compliance audits and they monitor against **land management plans** to check what is actually delivered. As well as independent auditing for the **Biodiversity Benchmark** to verify good management of landholdings, they also report on **total water footprint** as a function of electricity generation and look at how they can manage impacts on the marine and freshwater environment. They always go beyond the regulatory minimum, *"it is a dangerous game not to".* What drives them is attracting and retaining business: *"if we don't do that our **customers will vote with their feet**. It's very important especially for **B2B customers to have a company that shares their sustainability goals**. We're able to use that as a position to gain new business."*

Business 9: Adoption of **EMAS** was driven by the need to monitor and report annually on performance across environmental indicators e.g. building performance, company travel, CO_2 emissions. They have a **strategic partnership with RSPB** which includes supplying a wind turbine, consider future sites, discussing impacts on wildlife and working jointly on the **'energy futures' project** looking at if the UK could be 100% renewable by 2050 without significantly effecting birds.
They are also talking to the **forestry commission** about opportunities for AD plants on their estate (e.g. using cuttings from site management combined with another feedstock), though it is a significant risk for a small business to trail new technologies.
Monitoring and assessment is through EMAS.

Business 10 did not identify any specific ways of working. As part of their operational solar and wind farms they do **ecological monitoring** (e.g. checking tree growth and wildflower survival) which is written up into an internal report every year that goes onto the project files.

What barriers or constraints are there to integrating natural capital your business operations? Have you had any success in overcoming these barriers?

Business 6: They need to be able to **show their regulator that this is efficient investment and that is driving benefit to their customers:** ***"****I think it is really important that we can establish that natural capital is valued at a local level… making sure that we can deliver local enhancement on and alongside large national scale projects is important."* **Costs** are also a barrier to driving enhancements. There is also a 'cultural' barrier*: "getting over that intangibility of environment, with some people that new language is actually helping them."* The aim is to establish *"a social licence to operate… credibility… trust in terms of the way we manage our impacts*".

Business 7: ***"****I think probably the* ***biggest barrier is examples*** *and…* ***a lot of people do this [they are networking with other utilities and consultants]… a lot of different perspectives*** *that you could take and we are little bit risk averse in terms of going full into one of those just now. So we are very much setting our own agenda, we are looking at what is key to us, but yes barriers are a* ***lack of case studies****…* ***a lot of people are working on things but they are not sharing, they are not collaborating and that is a real shame that there isn't this sort of library of good case studies****."* They are just trying to establish the best ways of share their learning. The focus of the **A4S forum** in the next year is **around embedding what has been collectively done in CAPEX;** this is seen as a key development. They have **upskilled their team** but it is still not enough to understand all the things that are going on.

Business 8: ***"****It is that valuation – there is* ***huge uncertainty around what those valuations will be, how they will work in principle****. Will it be something relatively easy to use and stable or will it fluctuate all over the place like the EU ETS that plummeted in value. What we require is certainty regarding that price signal and it doesn't exist at the moment. So* ***until that is much clearer it's unlikely that many organisations will start caring for ESSs or NC."*** They do not want tools that are 'too academic'; they need an *"appropriate tool that spits the numbers out".* Any offsetting scheme should include safeguards around certain types of habitats that you cannot recreate effectively. Headlines about 'license to trash' around the biodiversity offsetting proposals are a concern because companies do not want to be perceived to be using it as a tool to trash the environment. Offsetting schemes also need to deal with the localism issue – if building a power station and you have some available offsets, you could offset in a remote location but then what about the loss of access/benefits for local people? There is a need to create something locally. *Overcoming barriers:* See answer above, working with NERC etc.

Business 9: [See above re finance pressures – a key barrier.] In terms of land restoration, *"perhaps one nature conservation constraint is a slight* ***obsession with maintaining habitats in sub-climatic conditions****; or should we be letting to evolve back to what it was."* There are also **pressures from surrounding land owners** nearby meaning that *"some of things we would like to do we could not do".* Moreover if a site is in the middle of an intensively farmed area there are **practical constraints** to the enhancement you can deliver. The respondent would like to see a form of *"joint biodiversity enhancements… a* ***fair and reasonable thing for doing enhancements off site*** *with partner organisations, a formal mechanism"* e.g. if a project contributes to a large scale re-wilding project through a formal mechanism then this would have a much bigger impact (especially if pooling funding from all wind projects). **Perceptions of impact on landscape is another constraint –** a landscape that is highly valued for its aesthetic qualities may provide very limited biodiversity or ecosystem services.

Possible to overcome barriers? "It is down to politics, whoever wins the next election."

Business 10: Biodiversity enhancements *"**cost** quite a bit of money and they don't directly bring any money in, so that is a barrier just to get sign off. But generally we do it by talking to people around the benefits of it to our customers".* Another barrier is **persuading land owners** of the benefits of an intervention: *"farmers aren't necessarily always thrilled by the idea of making their farms a wildlife hotspot".* These barriers are overcome through *"…**compromise with our land owners**… the company in general are quite supportive of doing this and are usually happy to sign off for us to spend the money to do it."*

Theme 4: Key knowledge resources (including metrics and tools)/ lack of

What knowledge resources, for example specific data, metrics and/or tools, has your organisation used to successfully integrate natural capital in your business model? How were these knowledge resources sourced?

Business 6 has their **natural capital and ecosystem services valuation tool** that is uses values based on a raft of over 50 published environmental economic studies. They network widely with **Natural Capital Committee, Natural Capital Coalition etc.** to develop knowledge.

Business 7 has tried to use a lot of the information that is already collated such as environmental impact assessments, measured project specific data (e.g. on CO_2, mileage) and secondary data (e.g. IPPC, Defra models and conversion factors for CO_2 and GHGs). However sometimes this KPI data is "not quite the right detail" so they are looking at how to refine the approach and how to report.

Business 8: [Mentioned tools already, see above.] These include the **Biodiversity Benchmark**, working with the Wildlife Trust. They are currently reviewing this, *"if people are not aware of it could be an issue, not creating value for business".* They also carry out **water footprinting** for their power stations; CEFAS fish surveys at certain times of year, looking at species and volumes entrained.
Data sources: MAGIC, Natural England, survey work on land, **National Biodiversity Network recorder database**[61], google earth for aerial photos, etc. They are also **developing a new approach based on 'key indicator species' – the aim is** to be able to survey large parcels of and understand the biodiversity status the land very **quickly without huge survey costs**.

Business 9 uses all the **datasets from the statutory agencies** and nature conservation bodies. They also have **very extensive GIS capabilities** in-house. They do the full suites of **ecological surveys** of all new sites using in-house staff plus contractors: phase 1, NBC, bat, bird, peat, tree surveys. They also do **life cycle assessment** of wind farms and 'carbon balance' calculations for AD plants (i.e. calculate emissions from AD plant and emissions absorbed during growth of feedstock).

Business 10 has drawn on **somewhat limited research on the biodiversity effects and enhancements around solar farms** to demonstrate what can be done.

[61] http://www.nbn.org.uk/

To what extent is a lack of knowledge or lack of access to suitable data, metrics or tools constraining development of natural capital-related practices in your business?

Business 6: "I don't think it is [a constraint] and this is a little bit about the philosophy of some organisations that **we don't wait for things or for perfection; we actually get on and try stuff"**. They are exploring approaches through pilot and demonstration projects to understand what is most relevant for their business, *"rather than waiting for government to say this is the way to do it or this is what you need to think about".*
The respondent noted you can never have enough appropriately qualified staff but they are doing what they can and *"there is good information out there and lots of people we can consult on."*

Business 7 indicates the key gap is **worked examples** to understand how people have done it - *"not just having the one or two page summaries… it's about* ***having people willing to actually talk in detail around these projects and be willing to share the sort of deep down honest feedback, what worked, what didn't work and if it did work how did they work round it****… positive stories is useful but at the same time it doesn't give you as many learning points."*
They are building staff capacity, they do not want to be 'overly reliant' upon consultants but they need support for specific projects as they develop 'organic internal growth'.

Business 8 thinks it is "***the valuation that is missing***" and also they have concerns about the **supply of "sufficiently experienced people to manage biodiversity**" in future: *"What we're seeing from universities is limited knowledge – students do not have wider knowledge e.g. able to manage across a wider range of legislation."*

Business 9 suggests it is not a lack of knowledge, *"we have got reasonable data, [this is] not really a constraint. It is a* ***matter of using them effectively, more about computing power and people time…*** *most of it is about* ***specific sites****."* The respondent did highlight a **lack of accurate data on bats** across the UK as an issue.

Business 10 feels there is **a lack of data [on biodiversity enhancement around solar farms] just purely because it [the solar industry] is a relatively new industry, so it is getting better** – *"We are actually looking at funding some research ourselves that will help over the next few years but yes I definitely think it is a constraint."*
They have appropriately qualified staff to do research for planning applications etc. and they also use external consultants for expert reports; they do share a lot of information about new research.

Theme 5: Changes in business practice that can assist embedding of NC ideas

Can you identify any changes in business practice (e.g. move to EP&L or 'triple bottom line' reporting) either within your business sector or beyond, that have helped, or could help, to open up opportunities for enhanced environmental sustainability management?

Business 6: Examples and case studies are important (e.g. Environmental Profit & Loss) – *"its* ***building up that community*** *and helping organisations internalize it in the right way."*

The Natural Capital Committee's reports and the work of the Natural Capital Coalition is very helpful for *"understanding **protocols without over specifying toolsets."***
*"One thing that is helping us and it is going to be very specific is **planning guidance called EN-5**, which is about planning for electricity transmission infrastructure, which talks about softening of environmental impacts and we think that is a great opportunity **for us to understand how we can bring natural capital and ecosystem services** to bear around some of our major projects."*
There is a need for clarity about *"what the **government would like us to do, can it incentivize or can it start helping with more guidance** around this idea of costs and values… can it help to promote that **more long term thinking… [that is]** going to be able to drive gains in natural capital".*

Business 7: "**EP&L is a very good example but you don't get to see under the bonnet**… which I think has been a big hindrance… I think them being more transparent and saying this is how we did it, this is how we look at this, here is some **materiality aspects** that you could look at… that would have been helpful." There is a need for a ***"central resource,** where these things are collated in a consistent format, I think it's probably the most fundamental thing because there are loads of really really good examples out there but people are just not sharing."*
There is risk attached to investing heavily in NC business processes - *"…**is the focus on sustainability going to remain at a high end or is it going to be something else that businesses now need to focus on and we don't want to be held to ransom on that"**.*

There is a need to better understand local impacts rather than at Scottish level or a UK level. Having staff with broad knowledge/capability across environment, engineering and accountancy is also important.

Business 8 did not identify any specific practices, they are doing qualitative NC work and this is likely to remain the case until appropriate tools are developed for testing: *"It needs to be speeded up. We have been discussing this for years, since* at *least 2002, over a decade later we're not much further forward… You can finesse until the cows come home, at some point **need to try it in the real world** and then all the problems drop out, then you can tweak it and get it to work… otherwise another decade will pass and we'll be at the same stage".*

Business 9 asserts that the idea of **environmental sustainability is *"completely embedded** in the company's ethos – embedded from start, so I'm not sure changes to business practice have done that."* In the wider sector, carbon balance and the carbon storage value of peat bogs is something that the industry has taken account of more recently.

Business 10 thinks that ***"having data that shows the direct benefit** of doing all of these things would be useful but I'm not too sure how that would change things in the business… looking at what has been done and what works well [**examples**] and reporting on that."*
They are also interested in independently demonstrating to government that **renewable developments have wider benefits** than just producing electricity, particularly around biodiversity gains and also allowing grazing to carry on – *"the more evidence there is to back that up that sort of thing the better."*

Retail sector

Theme 1: Awareness / understanding of natural capital and natural capital accounting

What do the terms 'natural capital' and 'natural capital accounting' mean to you?
What terms do you use within your business, if any, to describe the dependencies and influence of business on nature?

Respondents from all 4 retail business demonstrated a reasonable understanding of the concept of 'natural capital'. However understanding of 'natural capital accounting' appeared to be more limited with only one business defining this term.

The pharmaceutical retailer felt the concept of NC was very important: "*Natural capital is absolutely essential, if we've got any long term sustainability/profitability ambitions as a business."*

Business 14 (department store) was the only business to explicitly define NCA in response to the question; this was in terms of "*putting a value on Natural Capital*". Business 12 (supermarket) expressed strong reservations about NCA - "*Being brutally honest a concept which I'm not sure has progressed very far".*

The interviewed businesses tended to talk about **"sustainability", "corporate responsibility"** or "*stewardship of natural resources".* Business 14, who did use the term 'natural capital', was the exception.

How dependent do you consider your business to be on natural capital?

The pharmaceutical retailer (business 11), who is a manufacturer, retailer and wholesaler of goods, highlighted the importance of the **business moving from mineral based to plant based materials** to ensure its "*long term sustainability/profitability ambitions as a business*". The organisation understands that its dependence on non-renewable mineral resources is a potentially large **risk** ("*It takes millions of years to make minerals*") and has started to mitigate this risk by **partnering with relevant organisations to grow sustainable ingredients from plants for its future products**. The respondent stated that valuing natural capital is important as it is this knowledge that enables the business to develop *"products and services which are going to be appropriate for that future"* and therefore this information is critical to make better informed decisions.

Business 12 (supermarket) states that they "… ***are totally dependent upon on natural capital. In a fresh food business it is difficult to do fresh food without fresh water and soil*"** and as such see this as a business critical risk. Specifically the business is concerned about the extremes of water availability (drought and floods) impacting its supply chain in the short term, whilst medium and long term concerns surround soil quality and genetic variation respectively.

Business 13 (gardening retailer) is heavily dependent upon plants and wood (in the form of furniture) as these form key products for the organisation. As such the organisation has a **'sourcing with care' policy** embedded into its Corporate Responsibility (CR) strategy,

which is mitigating its impacts and dependencies on natural capital. Within this policy the organisation is:

- Sourcing products locally, with "*9 out of 10 are from British Isles*" and they "*do not take any that are endangered*";
- Ensuring all furniture sold is FSC certified.
- Ensuring "suppliers' contracts specify not contravening human rights issues, child labour etc.".

Furthermore, the organisation is closely monitoring Government and its focus the **on elimination of peat use by gardeners by 2020.**

Overall the business sees natural capital as a growing risk, with the CR task force and committee reporting CR, including natural capital, to the board. In particular the organisation is focussed on **peat** as "*in terms of **reputation** it's a potential risk*"; they are waiting to see if government will enforce peat elimination by 2020. Additionally it appears that some customers are demanding peat free but this is only in the minority and therefore the organisation is "***waiting for pull from customer or push from government***". Finally the organisation believes it is more important to have the **general principles of valuing natural capital rather than monetary values** as at the moment any numbers will have "*lots of assumptions".*

Business 14, the department store, recognises that their dependency on natural capital is quite high in their supply chain and lists specific examples of "*timber, cotton, and overall a huge amount of raw materials*". The organisation also owns and operates its own farm which requires management of its natural capital to produce goods sustainably. The organistion does view natural capital as a risk, however; it is more long term risk, and the organisation does admit there is now a more concentrated effort as "***We are certainly assessing it more accurately than in the past, we have a sustainability strategy which is starting to consider this***". The organisation is hesitant about the usefulness of valuing natural capital in monetary terms as once this information is created, which they note is a difficult process, how do they as a business derive value from doing this. Although hesitant the organisation has completed a few trial projects to explore this process "for ***example we planted 100 trees on a site and then looked at and derived the value of doing this in terms of air quality improvements"***. The organisation has also started to develop **integrated reporting** are working on a project to reduce the environmental impact of outdoor pig production.

Are you aware of any impacts (positive or negative) that your business activities (including through supply chains and consumers/customers) have on the natural environment?

Business 11 (pharmaceutical retailer) highlighted the impacts of their organisation specifically focussing on the consumer use of their products and in particular the impacts of products being disposed of inappropriately. For instance "***our organisation puts stickers on products saying 'please don't flush' (but they still do). How do we stop that happening***"? This organisation highlighted the need for **collaboration** especially within its supply chain to create more sustainable solutions for its products "*e.g. if we could develop a cotton wool bud that dissolved on contact with sewage*".

Business 12 (supermarket) focused on impacts in three separate categories namely estate operation, supply chain and customers. In terms of its own operations the organisation outlined the potential negative impacts of building new stores on what at times has been "*virgin territory*". In terms of the organisation's supply chain it is engaging with the

Cambridge Institute of Sustainable Leadership to help manage its natural capital impacts and dependencies, in particular they have started a train of work on the natural capital impacts of **cotton cultivation**. *"There is a bit being spoken about food but there is very little being spoken about fibre*". Finally, business 12 feels that they are only at best **raising awareness amongst their customers** of their impacts on the natural environment "… *you can argue we are encouraging them to reduce the temperature of washing but is that really moving the dialogue a lot, probably not. At the moment I don't think this can be anything other than awareness with the customers… I don't think there is a consumer facing message out there yet*".

Business 13 (gardening retailer) talked about **"sourcing with care", "operating correctly"** (e.g. they do not sell patio heaters as these are seen as "unsustainable") and noted that there business, selling plants for people to grow which then capture carbon, is a very sustainable business. They seek to address known risks in the supply chain e.g. fish sold on their cafes is MSC certified, sausages are Red Tractor, the coffee is Fairtrade. Moreover used coffee beans are recycled and made into compost for plants.

Business 14: ***"****There are negative impacts, so for example in our supply chain there is a risk of suppliers not procuring goods or attaining raw materials from* ***sustainable sources****. When we are constructing stores there are impacts on the natural environment and also operating the estate there are emissions to the natural environment, however, there is also scope to improve the biodiversity of areas on these sites, which is a positive impact. For example… the initiative to plant 100 trees was valued and had a demonstrable positive impact on local air quality… In terms of mitigating our impacts we have* ***sustainability targets*** *which can be found in our sustainability report and this focusses on a range of targets to reduce our impact including reducing our absolute* CO_2 *emissions by 15% against our baseline, we have targets for waste, for transport, working with our suppliers so for example the pig production project, we have a farming network where our farmers our able to share good practice including the environmental management of their farms and we have farming risk assessments."*

Theme 2: Motivations/drivers for NC-related practices

Please can you briefly describe any natural capital-related practices that you have adopted in your business, or are currently adopting? Which core business processes are these sustainability practices explicitly embedded in? What were the drivers for adopting these practices?

Business 11 (pharmaceutical retailer) have adopted several NC-related practices across the business including the "*move from mineral to plant based ingredients"* and "*also moving into renewable packaging."* The latter includes asking their suppliers to put items directly into **business 11's** packaging to prevent transit packaging. Critical to these practices has been collaboration: "***Collaboration*** *is an important part of how we operate. If we are the only person to ask a supplier to do this then there is less chance of success, but if everyone asks them to do this, then they are more likely to cooperate"*. Collaboration has to include "*a compelling argument so that* ***people can see that they will save money".*** The respondent stated that "*Natural capital related practices are embedded across all these business processes"*. Within its business there has been an important step in the last 6 or 7 years where the finance department has started using non-financial information, including both social and environmental data, to better understand the financial information, in essence

integrated reporting, in order to manage the business better. As such the business could be considered to be at **level 5 (incorporate into reporting) on the maturity matrix.**

Business 12 (supermarket) has established approaches to and metrics for **carbon and water**. It has also started some work with **LEAF (Linking Environment and Farming) on biodiversity and supporting biodiversity on farms** as part of practical best practice and has just started work on cotton. However, overall the business does not believe it is in a particular strong position to manage its impacts or dependencies on the natural environment at the moment as **the correct metrics are not currently in place,** "*all of this has to be completed before I can embed this into this organisation*". The business stated that it would be just before **level 1 (understand) on the maturity** matrix as it feels its only currently has a partial understanding and *"given we don't understand natural capital I would be a bit loath to incorporate it*".

The respondent was sceptical that others would have progressed far along the NC journey mapped out on the maturity matrix: "***I don't think anyone out there can really understand natural capital and its business impacts****. I know Puma have completed the EP&L but they have got bogged down in what it tells them. I just don't think we are in a position to be able to manage it, I mean* ***we haven't got the right metrics, we are not sure what all this means****, we are not sure about these dependencies, as ever no one will ever know about the expected consequences… all of this has to be completed before I can embed this into this organisation... even at an academic level* ***it's not understood*** *and there are lots of people trying to explore concepts around it and* ***until that has come back round to being something we can get a hold of and dumbed down to our level I just don't believe people can make the honest claim that they are improving along that matrix****".*

Business 13: [See above regarding CR policies] The CR task force (senior manager level group who make things happen on the ground in the garden centres) input at Board level. The respondent emphasizes that *"everything starts at the top, the CEO, reporting into board*". They have a network of environment and charity champions to cover all centres, and who train other staff – reducing utility usage, increasing recycling, etc. They work hard to keep motivating people. The respondent emphasized that a CR strategy is worthless unless it is implemented. *"****It's easy writing strategies… making it happen and embedding is difficult.****"* They look at where the risks are and where the 'up sides' are, such as cost savings from environmental action, environmental sourcing in the supply chain and the charitable work which creates reputational benefits and is good for customers (this is across marketing, buying, supply chain management). **Maturity matrix: rated as level 4-5**.

Business 14 (department store) self-assessed itself as being at **level 3 (implement)** on the maturity matrix *"with some work in* ***Embed*** *and* ***Incorporating into Reporting*** *taking place in parts of the business".* The organisation has adopted several natural capital-related practices across the business including the 100 tree example [see above], the pig production project [see above] and "*working with cotton farmers to promote environmental best practice in cotton production*". The organisation states that sustainability practices are embedded into strategic planning, capital investments, management information systems, performance evaluation and corporate reporting. However, natural-capital related practices are not always specifically embedded in these processes. Finally, in terms of drivers the business believes **cost efficiency, addressing regulations and risk mitigation** are critical to sustainability actions being implemented in the business, however, as of yet growing revenue hasn't been a reason sustainability actions have been implemented. "*Finally,* ***reputation*** *is very important to us as in our organisation there are rules about respecting the environment and therefore we need to ensure we do this as best we can"*.

Have you considered the value of natural capital, using quantitative or qualitative techniques?

The respondent from the pharmaceutical retailer (business 11) noted that "*We can only get people to understand the scale of the problem if we can turn it into some sort of monetary value* ". The business has started the journey of considering the value of natural capital by linking qualitative CSR data with quantitative financial data. This is mainly being driven by the "***difference between price and value***". For instance the organisation considers that the value of water is 17 times that of the price the organisation actually pays for it, "***The full value isn't reflected in price".*** As such the organisation is attempting to protect itself from future increases by understanding the difference in price and value between key raw materials. The organisation states that it "***can only make choices if we have the information and know what the choices are*****".**

The supermarket (Business 12) has only started considering the value of natural capital in **small parts of its business**. For instance "*we do a lot around assessing fish biology because its wild capture… we assess the sustainability of the management practices to a very high level".*

Similarly to business 12, **the department store (business 14)** have started to consider this value but only in specific examples such as the "*100 trees" example, which demonstrated the value that had on the local environment and society in terms of improved air quality"*. The business is **hesitant about quantifying natural resources in monetary terms** given the lack of understanding of NC and business impacts, but suggests in the long term it could be an important tool. *"In terms of non-monetary values… **cultural and landscape** it is very minor. It is quite tricky for us as once you start talking about landscape impacts we don't work on a landscape scale..."*

Finally, the **gardening retailer (business 13)** is not yet considering the value of natural capital either quantitatively or qualitatively**.**

Theme 3: Ways of working/integration of NC into business operations

Can you describe any specific ways of working that have facilitated, or are in the process of facilitating, integration of natural capital considerations into your business operations?

Business 11, the pharmaceutical retailer has a dedicated **CSR committee**, which is *"a properly constituted board committee (similar to an audit committee). I get access to the board 4 times a year for 3 hours and can have conversations with them about these subjects, plus I can build relationships with them."* This is the most important way of working that the organisation has developed to integrate natural capital considerations into its business and its operations.

Currently **business 12, the supermarket,** has yet to make any significant progress in developing ways of working to integrate natural capital considerations into their business operations. The organisation is hoping to change this in the future and is considering in the future "…*when we start **a NPD, New Product Development, one of the initial sifts is are there any sustainability criteria and of those could well be natural capital**…"* additionally "*putting a list together to say these are the pollinators and pollinating species"* and finally "*stop mowing our lawns around our depots and putting in some flower banks there*".

In **business 13, the gardening retailer**, has an a**pproach that filters throughout the organisation**, this starts with "*strategy from top, then the action plan, then making it happen through network, continual communication, keeping motivation of staff on ground level up…. Extends to supply chain through contracting process."* The organisation has several initiatives within its centers and it promotes competition among different centers to support behavior change.

B**usiness 14, the department store,** conduct an in-depth **materiality assessment** across the entire organisation which was used to prioritise areas for action: "*Unsurprisingly operational emissions from our estate were high; deforestation linked to our timber products was also another material issue*". All material issues have now been incorporated into the business' strategy and they are now strengthening stakeholder engagement on these material issues and reviewing and updating existing KPI's and targets.

How are natural capital-related actions monitored, assessed and reported?

Business 11 (pharmaceutical retailer), business 13 (gardening retailer) and business 14 (the department store) all use a range of indicators to measure some aspects of natural capital. For instance **business 11** and **business 14** attempt to use quantitative indicators and targets for natural capital, whilst **business 13** more specifically measures "*peat free sales data (track amount of peat free and data on product composition)*" and" "*FSC certification checks with suppliers".*

However, **business 12 (supermarket)** is currently not monitoring, assessing or reporting natural capital related action, however the organisation stated "***At some point they will be and they will have to be audited as well".*** Going forward given the complexity of natural capital the organisation would like to use iceberg indicators, where there is an overarching indicator with greater information feeding into each iceberg indicator. The organisation gave the following example to demonstrate this point "***if you've got a diverse population of birds on a given area then you can be reasonably sure about the food sources underneath them and that there will be a reasonable flora, fauna, invertebrate population beneath"***.

What barriers or constraints are there to integrating natural capital your business operations? Have you had any success in overcoming these barriers?

Business 11 saw this biggest barrier as **overcomplicating the issue:** *"…the biggest issue is that people who engage in this agenda like to make it more complicated than it needs to be… There is a bit of a disconnect between Corporate Responsibility people like me and people with technical know-how. I think the issue is that you just have to put your case forward – talk about things you see as sensible and realistic."*
"We need a ***consistent framework*** *to define how we are going to measure these things. How are we going to measure a carbon footprint/water intensity? If 20 companies are trying to work out the value of water we may get 20 different answers and as a result the numbers start to lose credibility."*

Businesses 12 and 14 both highlighted **understanding and the related challenge of valuing natural capital** as the key constraint. Business 12: *"Until we understand we can't know what other technological, financial, etc. barriers there are… how much is a little black fly worth, how many do you need, how you manage the value of soil, how do you incorporate improvements to soil organic matter versus ease of weed control?"* Business 14 highlighted

the particular challenges of understanding and valuation where your business deals in **multiple products and supply chains**: *"It is very difficult to measure or to put a value on natural capital especially in terms of our supply chain and this process would need massive resource and would be extremely complex to complete given the constantly changing nature of our supply chain… it is significantly easier where you only have one or a few products that you sell, we stock over 350,000 products just in one part of our business and many of these are not produced by us".*

Business 13 highlighted the **challenge of maintaining a focus on this issue within a business:** in the face of competing priorities *"…it continually takes effort to keep it on the agenda… How do you make it integral to the business so it doesn't become just another thing, a nice thing to have?"*

Theme 4: Key knowledge resources (including metrics and tools) and lack of

What knowledge resources, for example specific data, metrics and/or tools, has your organisation used to successfully integrate natural capital in your business model? How were these knowledge resources sourced?

Business 11, 12 and 14 highlight key external sources of NC-related knowledge. Business 11 said their key knowledge resources were **links with "*lots of clever people*"**, including academics who "*understand a certain theory but lack the real practical examples to make what they are investigating come alive. If we are able to work with them on some of our issues we can use their technical knowledge to come up with the answers*". **Business 12** identified the **Cambridge Institute of Sustainable Leadership** as their key knowledge resource. **Business 14** mentioned taking part in conversations with the **Natural Capital Coalition** and supporting their work, as well as internal collaboration on natural capital across several divisions.

Business 13 collects data on key environmental KPIs including energy and water use in their garden centers and sales data on sustainable products such as peat free compost and FSC-certified furniture. They will also scrutinize **information from suppliers**, including environmental data, when looking at sourcing options.

To what extent is a lack of knowledge or lack of access to suitable data, metrics or tools constraining development of natural capital-related practices in your business?

Business 11 notes that there will always be debate about the values placed on different aspects of NC. However they do not see this as a particular constraint: *"…we go with a realistic approach and scenario as to what is happening in the world and a realistic valuation/cost to put on things… Looking to the future, whether water is 15x or 17x undervalued is not the point; the **point is that we are underpaying by a long, long way**. Understanding this makes us say OK, if we were charged the right amount what would we do as a business? How do we use less water?"*

Business 12 stated a **lack of knowledge about NC practices is a heavy constraint.** *"I think it's more important to take it a layer down and be able to look at it from a business perspective rather than a higher level policy."* Providing new knowledge tools and data and/or use specific networks to disseminate knowledge more effectively are a good idea *"but*

what impact would that have, they ***need to know what they are disseminating and how appropriate and applicable it is****…The parallel on carbon is quite interesting. If you think about carbon we all started running around talking about food miles, then it needed to become carbon footprint, and then people went offsetting, and then went that's not appropriate either.* ***A level of caution is needed*** *and it is much more complex dealing with natural capital unless I'm missing a trick."*

Business 13 felt they had reasonable accuracy in their numbers, giving the example of water use data from Thames Water. They do not go as far as full quantification and reporting. They do not have ecologists or NC specialists in their staff.

Business 14 indicated a need for **more supply chain information** and collaboratively sharing this information and transferring this information across supply chains. In longer supply chains this can become very difficult: *"For example we are trying to work with our timber suppliers to help them reduce their environmental impacts but we find it very hard to get the data and as such it means we cannot help them improve."* The respondent also highlighted the critical need *for "having industry recognized metrics for natural capital"* but also thought it will be difficult to implement across different sectors.

Theme 5: Changes in business practice that can assist embedding of NC ideas

Can you identify any changes in business practice (e.g. move to EP&L or 'triple bottom line' reporting) either within your business sector or beyond, that have helped, or could help, to open up opportunities for enhanced environmental sustainability management?

The businesses interviewed were generally not able to identify changes in business practice that *have* helped open up opportunities for enhanced environmental sustainability management. The exception was **business 11** which indicated a key factor was having Private Equity investors who invested for a number of years, allowing them to gain a better understanding of the business and enabling better decisions.

Business 13 indicated that they do not do 'triple bottom line' reporting, rather they are focused on the CR section in the annual report. *"The drive is from senior management level down to champions, staff on ground. Things that are measured get done. You get the structure in place, you communicate, you measure, you report, it keeps going round… If you do not have senior level buy in it will not get embedded and priority, it will get squeezed".* The respondent suggested that **reputation** is one of the key issues for all board room agendas and that CSR is a key part of that.

In terms of what changes *could* help open up opportunities for enhanced environmental sustainability management business 14 addressed this most directly, indicating that ***Integrated Reporting, the IIRC framework****,* ***could be really important going forward*** *but it very much depends on how many organisations do it and how widespread it becomes."* The respondent suggested that **knowledge providers could help by**:

- creating **industry wide metrics for natural capital** that could work across different industry sectors
- strengthening the **business case** for Accounting for Natural Capital

- helping introduce the **UK equivalent of the US Itree model**[62] which can be used to quantify in monetary terms the ecosystem service benefits provided by trees.

[62] https://www.itreetools.org/ For UK application see: http://www.torbay.gov.uk/itree

Appendix 4: Natural Capital Tools

This appendix contains information on eight tools that businesses referenced using during interviews. The eight tools were:

- ISO 14001;
- Woodland Carbon Code (including Ecological Site Classification Decision Support System (ESC-DSS) and a set of look up tables);
- Annual LEAF audit/ LEAF Sustainable Farming Review;
- CALLM (Carbon Accounting for Land Managers tool) tool;
- Integrated Reporting, the IIRC [International Integrated Reported Council] framework;
- PWC Total Impact Measurement and Management (TIMM) tool;
- Eco-Management and Audit Scheme (EMAS); and
- The Wildlife Trust's Biodiversity Benchmark scheme.

Each tool is considered in turn and information is provided to answer the following questions regarding the tool:

- What it is?
- What does it do?
- Does the tool explicitly reflect natural capital?
- Does JNCC's data inform the tool?
- Is the tool process or results based?

The final question uses the table below to specify whether the tool in question is process based, results based or a combination of the two.

Process based	Results based
Process based tools measure the extent to which companies have in place processes and management systems which, if operating effectively, can drive performance improvements. Examples of this would include the number of sites that have a biodiversity action plan in place, or the extent to which environmental impact assessments incorporate biodiversity and ecosystem services dependencies and impacts. Process-based tools may not provide a clear picture of outcomes if based on 'tick the box' completion of procedures; they may suggest progress even when implementation and actual improvements are minimal.	Result based tools provide a better picture of performance over time and are essential for the valuation of natural capital dependencies and impacts as they tend to be quantitative, e.g. the volume of water abstracted per tonne of production, or the number of organic product lines in a range. However, performance-based indicators are infrequently used and tend to be customised to individual companies, which can create barriers to benchmarking and interpretation by other stakeholders. Currently there is no consensus on corporate indicators for natural capital related performance which may be applied across different sectors and regions.

Source: TEEB, 2012.

1. ISO 14001

- **What it is?**

  ISO 14001 lays out the criteria for an environmental management system (EMS) and business can be certified in accordance with its provisions. It does not state requirements for environmental performance, but maps out a framework that a company or organisation can follow to set up an effective environmental management system and can be used by any organisation regardless of its activity or sector. Using ISO 14001 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved upon.[63] The current version of the standard is ISO14001:2004, however, this is due to be updated and replaced by ISO14001:2015 at the end of 2015.[64]

- **What does it do?**

  An organisation with an effective environmental management system certified to ISO14001:2004 may experience the following benefits:[65]

  - Improvements in overall environmental performance and compliance;
  - Provides a framework for using pollution prevention practices to meet EMS objectives;
  - Promotes increased efficiency, predictability and consistency when managing environmental obligations and helps to identify potential cost savings;
  - Supports more effective targeting of scarce environmental management resources; and
  - Enhances relationship with outside stakeholders.

- **Does the tool explicitly reflect natural capital?**

  The current iteration, ISO14001:2004 does not explicitly mention natural capital or natural capital accounting. The standard is designed so as not to be prescriptive and therefore allows an organisation to determine its most significant environmental aspects and impacts and manage them accordingly. Although, the 2015 revision will bring many changes to the standard and to certifying organisations[66], this again is unlikely to include specific mention of natural capital, natural capital accounting or ecosystem services.

- **Does JNCC's data inform the tool?**

  In terms of certifying an EMS to ISO14001, JNCC's data is likely to be of limited use. Such data may be of value to an organisation as part of managing

[63] http://www.iso.org/iso/home/standards/management-standards/iso14000.htm
[64] http://www.iso.org/iso/iso14001_revision
[65] http://water.epa.gov/polwaste/wastewater/Environmental-Management-System-ISO-14001-Frequently-Asked-Questions.cfm
[66] http://www.iso.org/iso/iso14001_revision

environmental performance but this will depend very much on the organisation and their environmental aspects and impacts.

- **Is the tool process or result based?**

The current iteration, ISO14001:2004, is very much a process based tool and focuses on the creation, implementation and maintenance of an EMS. As such, it does not specify particular environmental improvements as part of ISO14001 certification. However the revised version, ISO14001:2015, is expected to be more focused on results[67] and therefore this tool may become a more results based tool in the future.

2. Woodland Carbon Code (including Ecological Site Classification Decision Support System (ESC-DSS) & a set of look up tables)

- **What it is?**

The Woodland Carbon Code is the voluntary standard for woodland creation projects in the UK which make claims about the carbon dioxide they sequester. Independent certification to this standard provides assurance and clarity over the carbon savings associated with these woodlands[68]. The Ecological Site Classification Decision Support System (ESC-DSS) is a PC-based system to help guide forest managers and planners to select ecologically suited species to sites, instead of selecting a species and trying to modify the site to suit.[69] This is used in conjunction with a set of Carbon and Soil Carbon look-up tables which predict future carbon sequestration from woodlands.[70]

- **What does it do?**

The Code sets out design and management requirements for voluntary UK based projects that aim to sequester carbon through woodland creation.[71]

It accounts for:

- Carbon sequestration and emissions for new woodland creation, within the woodland boundary;
- Woodland created by planting and natural regeneration (where some intervention is necessary to establish woodland);
- Carbon sequestration and emissions under various management regimes from frequent clear felling to minimum intervention woodland; and
- Emissions outside the woodland boundary as a result of the project going ahead.

[67] http://www.iso.org/iso/1n1000_iso_14001_revision_information_note_update_july2014.pdf
[68] http://www.forestry.gov.uk/carboncode
[69] http://www.forestry.gov.uk/esc
[70] http://www.forestry.gov.uk/forestry/infd-8jue9t
[71] http://www.forestry.gov.uk/forestry/infd-8jrm37

It does not account for:

- Additional carbon sequestration due to changes to the management of existing woodland;
- Carbon stored in forest products; and
- The carbon saved when substituting wood products or fuels for other products or fuels with a larger carbon footprint.

ESC-DSS assesses the suitability of a range of tree species and National Vegetation Classification woodland communities. The evaluation is based on the match between key site factors and the ecological requirements of different species and the ecology of woodland communities defined in the National Vegetation Classification.

The Carbon and Soil Carbon look up tables provide a quick and easy way to 'look up' the amount of carbon that is likely to be sequestered in above and below ground tree biomass. Emissions from ongoing woodland management are also included in the Carbon Lookup Table[72].

- **Does the tool explicitly reflect natural capital?**

The Woodland Carbon Code, ESC-DSS or the Carbon and Soil Carbon look up tables do not make any specific mention of natural capital or natural capital accounting although they are fundamentally natural capital-related

- **Does JNCC's data inform the tool?**

Currently there is limited use for JNCC's data in the Woodland Carbon Code and the associated tools that feed into this process, with the possible exception of feeding into the wider description of other 'bundled services' provided alongside carbon sequestration such as ecological enhancement. In the future if the Woodland Carbon Code is expanded to consider other ecosystem services provided by woodland in greater depth then there could be an increased role for such data.

- **Is the tool process or result based?**

The Woodland Carbon Code itself can be considered to be a process based tool as it sets out design and management requirements for voluntary UK based projects aiming to sequester carbon through woodland creation. However, both the ESC-DSS and look-up tables which support the Woodland Carbon Code are more result based tools. Therefore overall this tool can be considered to be both process and results based.

[72] http://www.forestry.gov.uk/forestry/infd-8jue9t

3. Annual LEAF audit/ LEAF Sustainable Farming Review

- **What it is?**

  The LEAF (Linking Environment and Farming) audit was a business and environmental management tool for farms, only available to LEAF members as part of their membership.[73] The LEAF Audit was replaced by the LEAF Sustainable Farming Review as of the 1st December 2014. The LEAF Sustainable Farming Review is a new self-assessment on-line management tool for farmers, which has been designed to help farmers farm more sustainably.[74]

- **What does it do?**

  The LEAF Audit provided a comprehensive health check for a farm including benchmarks and action plans to help focus the business for the year ahead.[75] The updated LEAF Sustainable Farming Review puts more emphasis on farm managers due to the self-assessment nature of the tool. This tool requires farm managers to monitor their own performance, identify strengths and weaknesses and set targets for improvement across the whole farm.[76] The LEAF Sustainable Farming Review focuses on nine sections of Integrated Farm Management (IFM), which include:

  - Organisation and Planning;
  - Soil Management and Fertility;
  - Crop Health and Protection;
  - Pollution Control and By-Product Management;
  - Animal Husbandry;
  - Energy Efficiency;
  - Water Management;
  - Landscape and Nature Conservation; and
  - Community Engagement.

- **Does the tool explicitly reflect natural capital?**

  The LEAF Sustainable Farming Review does not appear to explicitly recognise the terms natural capital and natural capital accounting. However, the "Organisation and Planning" section of the review does consider ecosystem services under the "To actively develop market opportunities for sustainable food" scoring section.[77]

[73] http://www.leafuk.org/leaf/farmers/audit.eb
[74] http://www.leafuk.org/leaf/farmers/lsfr.eb
[75] http://www.leafuk.org/leaf/farmers/audit.eb
[76] http://www.leafuk.org/leaf/farmers/lsfr.eb
[77] http://www.leafuk.org/resources/000/733/200/Sustainability_report.pdf

- **Does JNCC's data inform the tool?**

  There appears to be some scope for JNCC's data to feed into the Sustainable Farming Review, especially regarding objectives on "Landscape and Nature Conservation"[78].

- **Is the tool process or result based?**

  Both the LEAF audit and the subsequent LEAF Sustainable Farming Review can be considered to be process driven tools which provide information on how farm managers can improve the environmental performance of their farms.

4. CALLM (Carbon Accounting for Land Managers tool) tool

- **What it is?**

  CALM, Carbon Accounting for Land Managers, is a business activity-based calculator showing the balance between annual emissions of the key Greenhouse Gases (GHGs) and carbon sequestration associated with the activities of land-based businesses.[79] The web-based tool was designed by the Country Land & Business Association (CLA).[80]

- **What does it do?**

  CALM measures emissions of carbon dioxide, methane and nitrous oxide from a land-management business and any carbon which is stored in soil and trees. The emissions come from:
  - Energy and fuel use;
  - Livestock;
  - Cultivation and land-use change; and
  - Application of nitrogen fertilisers and lime.

  These are balanced against carbon sequestration by soil and trees.[81]

- **Does the tool explicitly reflect natural capital?**

  The CALM tool does not make any specific mention of natural capital or natural capital accounting.

[78] http://www.leafuk.org/resources/000/733/200/Sustainability_report.pdf
[79] http://www.calm.cla.org.uk/
[80] http://www.environmenttools.co.uk/directory/tool/name/cla-calm-calculator-for-land-managers/id/93
[81] http://www.calm.cla.org.uk/

- **Does JNCC's data inform the tool?**

  Currently there is no use for JNCC's data in the CALM tool. However, in the future if the CALM tool is expanded to consider other ecosystem services provided by land-management businesses there could be a role for data provided by the JNCC.

- **Is the tool process or result based?**

  CALM (Carbon Accounting for Land Managers) is a results based tool as it provides a quantitative estimate of annual emissions of the key Greenhouse Gases (GHGs) and carbon sequestration associated with the activities of land-based businesses.[82]

5. Integrated Reporting, the IIRC [International Integrated Reported Council] framework

- **What it is?**

  The International Integrated Reporting (IR) Framework was released by the International Integrated Reporting Council (2013) in December 2013. IR is a process founded on integrated thinking that results in a periodic integrated report by an organisation focused on value creation over time and related communications regarding aspects of value creation.

- **What does it do?**

  IR promotes a more cohesive and efficient approach to corporate reporting and aims to improve the quality of information available to providers of financial capital to enable a more efficient and productive allocation of capital.[83]

- **Does the tool explicitly reflect natural capital?**

  The International Integrated Reporting Framework makes explicit mention of natural capital and states that Integrated Reporting (IR) will enhance accountability and stewardship for the broad base of capitals, which includes natural capital, although it states that organisations do not necessarily have to report along the lines of the capitals.[84] The International Integrated Reporting Framework defines natural capital as the following:

[82] http://www.calm.cla.org.uk/
[83] http://www.theiirc.org/wp-content/uploads/2013/12/13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf
[84] http://www.theiirc.org/wp-content/uploads/2013/12/13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=13-12-08-THE-INTERNATIONAL-IR-FRAMEWORK-2-1.pdf

"All renewable and non-renewable environmental resources and processes that provide goods or services that support the past, current or future prosperity of an organisation. It includes:

- *air, water, land, minerals and forests*
- *biodiversity and eco-system health".*

The aims of IR that are of relevance to valuing nature in UK business include a focus on reporting that communicates the full range of factors that materially affect the ability of an organisation to create value over time; creating enhanced accountability and stewardship of the broad base of capitals, explicitly including natural capital; and supporting integrated thinking, decision-making and actions that focus on the creation of value over the short, medium and long term.

- **Does JNCC's data inform the tool?**

JNCC data may be of value to some organisations implementing Integrated Reported but this will be dependent upon the organisation and how it aims to account for its natural capital dependencies and impacts (both positive and negative).

- **Is the tool process or result based?**

The International Integrated Reporting (IR) Framework is a process based tool that enables organisations to create more holistic corporate reports using the framework as guidance.

6. PwC Total Impact Measurement and Management (TIMM) tool

- **What it is?**

The Total Impact Measurement and Management (TIMM) tool developed by PwC has been designed to enable organisations to understand how their activities contribute to the economy, the environment and society.[85]

- **What does it do?**

The tool enables a more complete assessment of value generation or destruction in both the short and long term, which helps decision makers to consider the net impact of their actions, beyond monetary results.[86] TIMM values the impacts of a business arising in three ways:[87]

[85] http://www.pwc.co.uk/corporate-sustainability/total-impact-measurement-management.jhtml
[86] http://groupedebruges.eu/sites/default/files/publications/downloads/measuring_and_managing_total_impact_-_pwc.pdf
[87] http://www.pwc.co.uk/corporate-sustainability/total-impact-measurement-management.jhtml

- Direct impacts: from a business' own activities;
- Indirect impacts: recognising that a business has responsibility for some of the impacts of organisations in its supply chain such as impacts associated with the creation of goods consumed by the business; and
- Induced impacts: the effects of spending by a business' employees, or suppliers' employees, in the wider economy.

- **Does the tool explicitly reflect natural capital?**

  Although the tool does not explicitly mention natural capital or natural capital accounting it does consider ecosystem services to a certain extent as part of the methodology.[88]

- **Does JNCC's data inform the tool?**

  JNCC data may be of some use and value to this tool in the future, when newer versions are developed. However, given the confidentiality of the datasets that currently feed into the methodology it is difficult to understand how helpful or appropriate the integration of JNCC data is likely to be.

- **Is the tool process or result based?**

  PwC's Total Impact Measurement and Management (TIMM) tool can be considered to be both process and result based. The TIMM tool allows organisations to view their impacts (both positive and negative) on the wider world, which in turn can feed and change the way a business operates and therefore would be considered to be process based. However, the tool also provides tangible results regarding the impacts of the business' activities on the economy, the environment and on society.

7. Eco-Management and Audit Scheme (EMAS)

- **What it is?**

  The Eco-Management and Audit Scheme (EMAS) is a voluntary instrument designed for companies to evaluate, report, and improve their environmental performance.[89] EMAS was initially established by European Regulation 1836/93, which has since been updated twice with Regulation (EC) No 1221/2009 coming into force in January 2010.[90]

[88] http://groupedebruges.eu/sites/default/files/publications/downloads/measuring_and_managing_total_impact_-_pwc.pdf
[89] http://ems.iema.net/emas
[90] http://ems.iema.net/emas

- **What does it do?**

  EMAS aims to recognise and reward those organisations that go beyond minimum legal compliance and continuously improve their environmental performance. Its approach is similar to ISO14001 in that it is a standard that organisations can certify their environmental management systems against, thereby enhancing their credibility and recognition. However, there are some subtle differences between the two standards.[91]

- **Does the tool explicitly reflect natural capital?**

  The EMAS standard does not appear to explicitly recognise the terms natural capital, natural capital accounting or ecosystem services.[92]

- **Does JNCC's data inform the tool?**

  In terms of certifying an environmental management system to EMAS the JNCC's data will be of limited use in this process. However, it may be of value to an organisation as part of managing its environmental performance but this will depend very much on the organisation.

- **Is the tool process or result based?**

  EMAS, similar to ISO14001:2004, is a process based tool that focuses on creating, implementing and maintaining an environmental management system and does not specify certain environmental improvements as part of EMAS certification.

8. The Wildlife Trust's Biodiversity Benchmark scheme

- **What it is?**

  The Wildlife Trust's Biodiversity Benchmark scheme is an award for business to recognise and reward continual biodiversity improvement. The Biodiversity Benchmark provides a framework within which organisations can ensure that their impact on biodiversity is as positive as it possibly can be by providing robust, independent verification of planning and implementation of land management practices.[93] The Biodiversity Benchmark is a nationally recognised standard for commitment to biodiversity and responsible land management.[94]

[91] http://www.emas.de/fileadmin/user_upload/04_ueberemas/PDF-Dateien/Unterschiede_iso_en.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=Unterschiede_iso_en.pdf
[92] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R1221&from=EN
[93] http://www.wildlifetrusts.org/biodiversitybenchmark
[94] http://www.wildlifetrusts.org/how-you-can-help/working-business/biodiversity-benchmark/benefits-and-requirements

- **What does it do?**

  The Biodiversity Benchmark scheme is a standard for assessing and certifying an organisation's systems for achieving continual biodiversity protection and enhancement on its landholdings. The Benchmark can complement existing environmental biodiversity into the systems of an organisation. Alternatively it can operate as a standalone system.[95]

  Certified sites can vary significantly and therefore each site can contribute to the creation of a 'Living Landscape' in a number of ways:[96]

  - Restore: proactive management of existing wildlife rich sites and sites of conservation importance.
  - Recreate: establishment of wildlife habitat on land previously used for other purposes.
  - Reconnect: sites which contribute management systems such as ISO14001 and EMAS by integrating towards a network of habitats, enhancing the permeability of the landscape to wildlife.

- **Does the tool explicitly reflect natural capital?**

  The Wildlife Trust's Biodiversity Benchmark scheme does not appear to explicitly recognise the terms natural capital, natural capital accounting or ecosystem services.[97]

- **Does JNCC's data inform the tool?**

  JNCC's data will be of limited use in terms of the certification process as this is likely to be based on site specific ecological surveys. It may be of value to an organisation as part of managing its biodiversity but this will depend very much on the organisation's aims and the availability of site specific data.

- **Is the tool process or result based?**

  The Wildlife Trust's Biodiversity Benchmark scheme is a process based tool, which acts as a subset of an environmental management system by providing a framework within which organisations can monitor their biodiversity impacts.

[95] http://www.wildlifetrusts.org/biodiversitybenchmark
[96] http://www.wildlifetrusts.org/biodiversitybenchmark
[97] https://www.iema.net/system/files/biodiversity20benchmark20requirements_0.pdf