VALUING NATURE PROGRAMME

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TOWARDS A NATURAL ASSETS RESEARCH AND INNOVATION AGENDA IN SUPPORT OF UK BUSINESS AND POLICY

Focusing on the Infrastructure, land management and insurance/financial services sectors

Authors: Guy Duke
Business Champion, Valuing Nature Programme Coordination Team

Peter Young
Chair, Valuing Nature Programme Business Interest Group

Charlie Stratford
Business Development Manager, Centre for Ecology & Hydrology

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Contents

This paper presents an analysis and outlines options for delivery of cross-sector research and innovation needs, based on outcomes of three High-level Sector Round Tables convened with the infrastructure sector (June 2018), the land management sector (November 2018) and the insurance/financial services sector (January 2019).

This paper provides a synthesis of the findings of these Round Tables. Further details can be found in the separate **Round Table reports** (https://valuing-nature.net/business-round-tables)

- Duke, G. and Young, P. (eds) (2018) *Valuing and Measuring Natural Assets for Infrastructure*. UK Research and Innovation High-level Sector Round Tables – Round Table 1, 26 June 2018. Valuing Nature Programme, CEH, Wallingford.
- Duke, G. and Young, P. (eds) (2019) *Valuing and Measuring Natural Assets for Land Management*. UK Research and Innovation High-level Sector Round Tables – Round Table 2, 21 November 2018. Valuing Nature Programme, CEH, Wallingford.
- Duke, G. and Young, P. (eds) (2019) *Valuing and Measuring Natural Assets for the Insurance/Financial Services Sector*. UK Research and Innovation High-level Sector Round Tables – Round Table 3, 17 January 2019. Valuing Nature Programme, CEH, Wallingford.

The following papers, prepared for each Round Table, are also available online:

- **RT1-01, RT2-01, RT3-01: Background Papers.** These papers outline the objectives, the expected output and longer-term outcomes of each Round Table. They also provide brief context for each Round Table, including an overview of the relevance of, and drivers for, measuring and valuing nature for the sector of interest, some examples of current activity, and direction of travel.
- **RT1-02, RT2-02, RT3-02: Overview of relevant UKRI funding instruments/ programmes for research and innovation.** These papers outline why the Research Councils engage with business, policy-makers and wider society, why NERC is investing in these Round Tables, and provide an overview of existing mechanisms to support academic-policy-business collaboration.
- **RT3-01, RT3-02, RT3-03: Relevant Research and Knowledge Exchange.** These papers provide an overview and specific relevant examples of (predominantly NERC-funded) research and innovation output relating to measuring and valuing natural assets with potential relevance for the sector of interest.

Executive summary

1. Issues around 'natural assets'[1] – including their measurement and valuation – are increasingly of interest to business, policy-makers and society. Numerous reports, notably the recent IPBES Global Assessment Report on Biodiversity and Ecosystem Services, highlight the severity of the decline in natural assets and the need for *'transformative change – a fundamental system-wide reorganization across technological, economic and social factors, including paradigms, goals and values.'*

2. Governments are increasingly addressing natural assets in policy, regulation and related initiatives. At international level, relevant developments include the Sustainable Development Goals, the Paris Agreement on Climate Change, the study on The Economics of Ecosystems and Biodiversity, and increasing attention to the concepts of natural capital and ecosystem services in national accounts and in financial disclosure requirements. At UK level, since the Natural Environment White Paper of 2011, key contributions include the Ecosystem Markets Task Force, the Natural Capital Committee, the Industrial and Clean Growth Strategies, the 25 Year Environment Plan and proposed new Environmental Land Management Schemes. In 2019 to date, the Green Finance Strategy, the draft Environment Bill, the 2050 net zero target for greenhouse gas emissions and the Dasgupta Review on the Economics of Biodiversity keep up the pace. Policy and legislation at the level of the devolved administrations has shown a similar trajectory.

3. As primary funders of the £7M Valuing Nature Programme[2], a five year interdisciplinary research programme (2014–20), the Natural Environment Research Council (NERC) is investigating how valuing nature research can be translated into business and policy decision-making to help deliver urgently needed protection and restoration of natural assets, and what role UK Research and Innovation (UKRI) might have in supporting this.

4. This paper builds on, synthesises and analyses findings from three high-level business Round Tables with three key sectors – the infrastructure sector (INF), the land management sector (LM) and the insurance/financial services sector (IF) – relating to measuring and valuing natural assets. The Round Tables were convened between July 2018 and February 2019. They considered current activity and trends related to measuring and valuing natural assets, drivers for this activity, barriers/challenges to measuring and valuing natural assets in the sectors, and key research and innovation (R&I) needs. The full report addresses the issues summarised below.

[1] The term 'natural assets' is taken here to incorporate the concepts of natural capital (stocks), ecosystem services (flows) and biodiversity.

[2] https://nerc.ukri.org/research/funded/programmes/valuingnature/

5. **CURRENT ACTIVITY** across the 3 sectors[3] includes work on: biodiversity assessment, accounting and biodiversity 'no net loss'/'net gain' (INF); natural capital assessment and accounting (INF, LM); generating datasets, information management (INF, LM); developing indicators and metrics (LM); developing tools (INF, LM); modelling natural assets (INF, LM, IF); developing standards (INF, IF), implementing green infrastructure/nature-based solutions (INF, LM, IF); dis-investment (IF); developing financial instruments (IF); developing markets for natural assets (INF, LM, IF); quality assurance and certification (LM); and capacity-building (LM).

6. **KEY DRIVERS.** For INF and LM, **sector specific policy and legislation** have been key drivers for the consideration of natural assets. These drivers have been boosted by the increasing **cross-sector drive** in UK environmental, industrial and agricultural policy to address natural assets, including through the Natural Environment White Paper, 25 Year Environment Plan, Industrial Strategy, Green Growth Strategy, forthcoming Environment Bill (including mandatory 'net gain') and post-Brexit agricultural policy. For IF, developments such as the Sustainable Development Goals, Paris Agreement, EU and UK climate targets, Task Force of Climate-related Financial Disclosures and the EU Sustainable Finance Initiative are important drivers. The increasing global and national cross-sector policy emphasis on natural assets is generating an increasing amount of common ground across sectors.

7. **KEY BARRIERS AND CHALLENGES** across the 3 sectors include: **knowledge gaps** (INF, LM); **data issues** including availability, quality, granularity (INF, LM, IF), monitoring costs (LM, IF) and data relating to complex supply chains (LM); issues around **approaches, methods, tools, metrics, standards** (INF, LM, IF) including a plethora of approaches, methods and tools, absence of standards, applying methods across differing scales, measuring and valuing biodiversity; **regulatory constraints** to uptake of the measurement and valuation of natural assets, including absence of mandatory net gain (INF), inflexible regulations on water quality (water utilities) and safety (transport and energy companies), conflicting multiple regulatory frameworks relating to the same natural assets (LM); **challenges around investing in natural assets** including securing a return on investment, issues relating to multiple asset holders and ecosystem services beneficiaries, absence of suitable brokers, and disconnect between natural asset values and land prices (LM), absence of suitable markets, and challenges in demonstrating materiality of biodiversity and natural capital in investment (IF); issues related to **knowledge generation and exchange, awareness and training** including securing corporate buy-in for the consideration of natural assets in business decision-making (INF), a broader communications and awareness challenge both within corporations and with external stakeholders including multiple landowners and beneficiaries at catchment scale (LM), limited R&I funding for co-creation of knowledge (academia-business), limited relevant training and a shortage of skills across the project pipeline (IF).

3 Sectors mentioning the issue are noted in parenthesis – the fact that a sector did not mention an issue does not necessarily mean the issue is not present for the sector.

8. **R&I NEEDS.** A general R&I need across the three sectors is for **R&I in relation to natural assets to be better focused on business and policy needs.** This requires suitably-framed R&I funding instruments, increased investment in the co-creation of R&I relating to natural assets, appropriate partnership between business and academia in R&I proposals; appropriate representation of business and academia on proposal evaluation panels; and co-direction by business with academia of funded R&I programmes/projects, so outputs meet business needs and are framed through a business lens. There is also a need to better **broker interaction across academia, business and policy** in this complex, multi-disciplinary, multi-sector space.

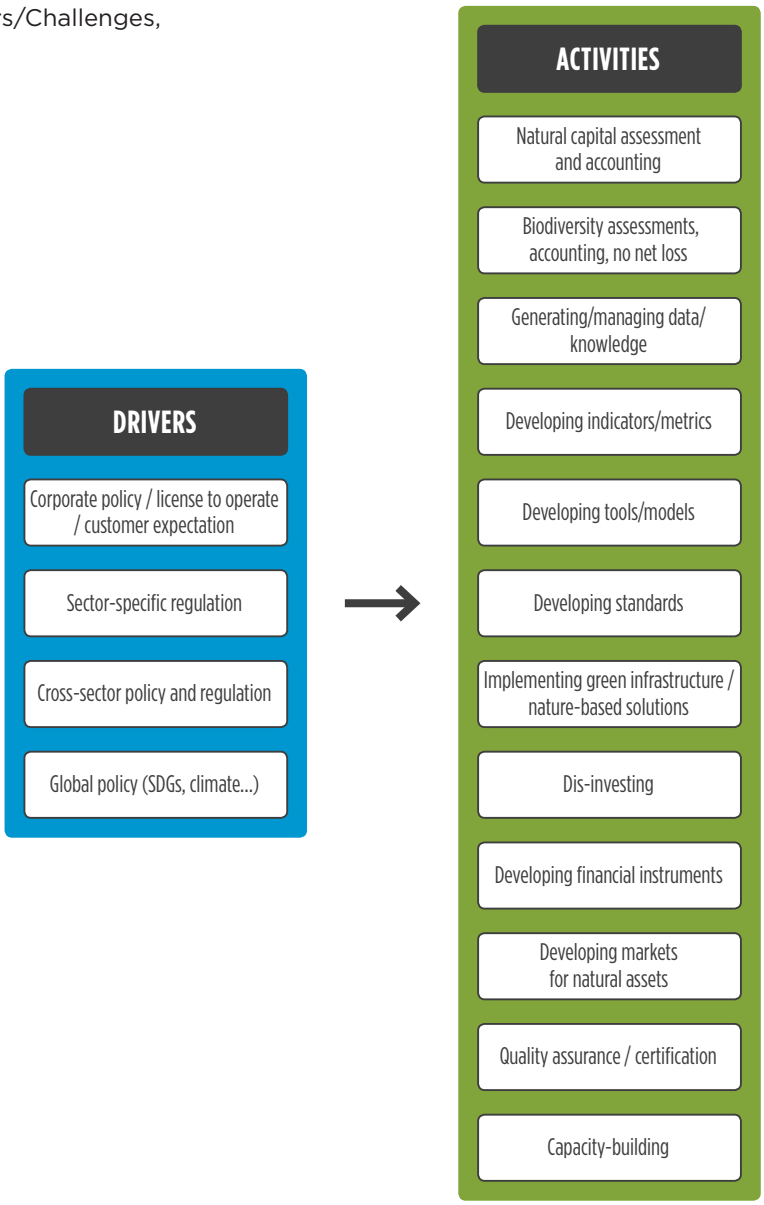
9. More specific R&I needs vary by sector with commonalities and differences detailed in the report. R&I needs include:

   - **basic research on natural assets** to underpin measurement and valuation;
   - **data for business** including: assessing data needs and provision; making existing data accessible and usable; filling key data gaps; data quality assurance and enhanced long-term monitoring including through remote sensing;
   - **frameworks, standards, models, metrics and other tools for business,** including: developing coherent frameworks and standards; consolidating and validating methods, metrics and tools; developing new methods, metrics and tools; and developing natural capital accounting to better define boundaries, address ecological connectivity, etc.;
   - **pilots, demonstration, scaling of new business models and solutions** including: scaling uptake of natural capital thinking by business, piloting and demonstrating at catchment and regional scales; meeting sector specific needs, e.g. relating to natural asset enhancement through the UK National Infrastructure and Construction Pipeline (INF) and trials for post-Brexit agri-environment payments for public goods, developing a natural assets farm advisory service, and building understanding on how to incentivise good land stewardship (LM);
   - **developing natural asset markets, and stimulating investment in business solutions,** including: regulation and policy for markets that value and enhance nature; accelerating investment in natural assets; markets for soil natural assets; linking natural assets to commercial value; leakage effect; ethics and risks of monetising and trading natural assets;
   - **assessing risks and resilience in relation to natural assets,** including: materiality; linking risk with impact assessments; links between physical and transition risks; stranded assets related to natural capital; and understanding how natural assets deliver business resilience to climate change;
   - **knowledge exchange, training and capacity-building** including: for academics/professionals in relation to measuring and valuing natural assets for business; knowledge exchange (including research output, practical application experience, developing a knowledge hub); and raising awareness and understanding (e.g. common language on natural assets for making business cases, and raising public awareness and shaping public opinion on the importance of natural assets).

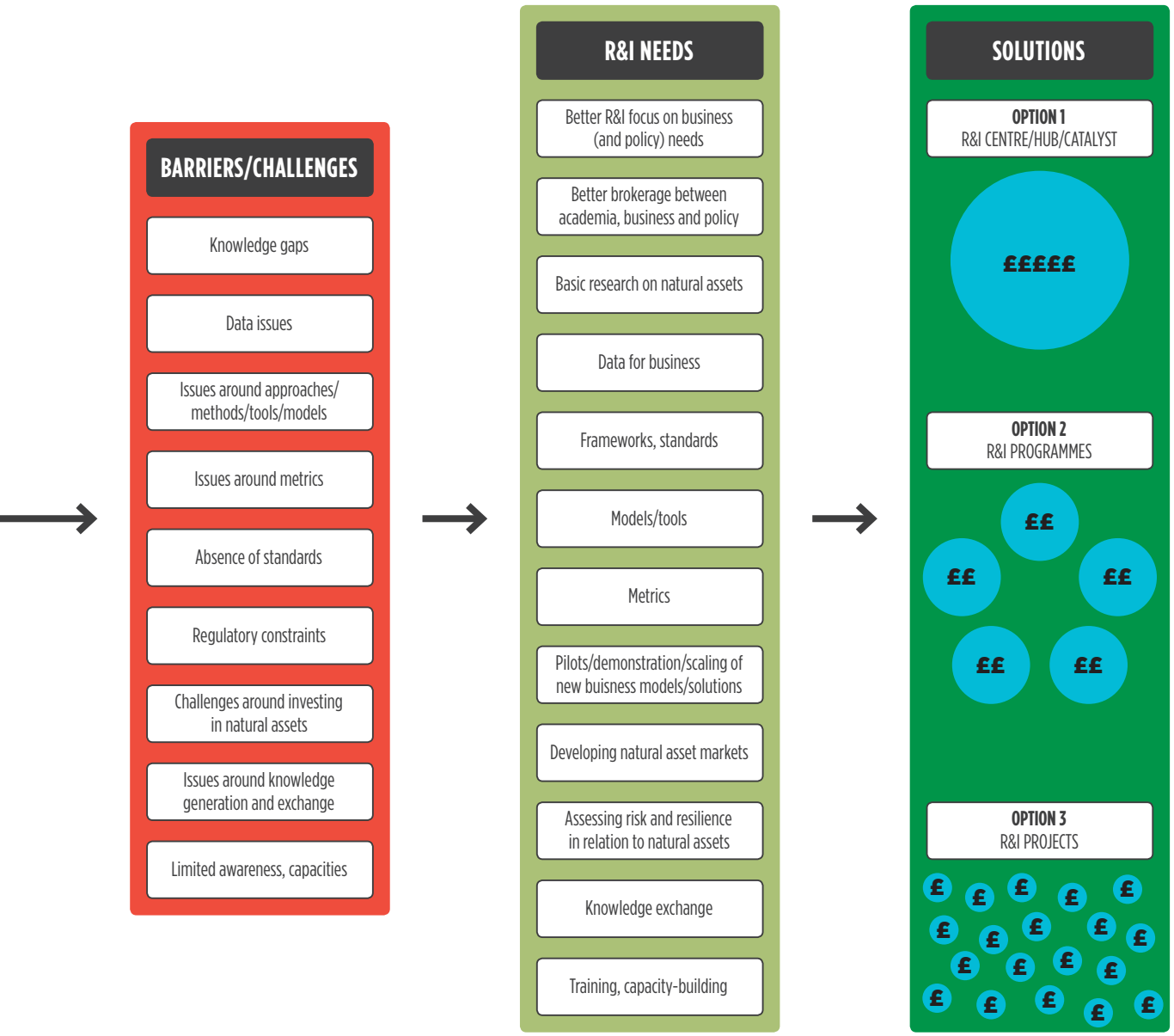
10. **EXISTING RELEVANT R&I and UKRI FUNDING INSTRUMENTS** that might be of relevance are discussed in the full report, highlighting some pertinent examples.

11. **OPTIONS FOR MEETING R&I NEEDS.** Three possible options are described: Option 1 – a centre/hub/catalyst to coordinate and catalyse UK R&I investment and knowledge exchange on natural assets; Option 2 – addressing bundles of R&I needs through targeted programmes; and Option 3 – addressing specific R&I needs individually through targeted projects. The pros and cons of these options are outlined in the report.

Figure 1: Overview of Drivers, Activities, Barriers/Challenges, R&I Needs, Solutions



12. **NEXT STEPS to validate, develop and refine a Natural Assets R&I Agenda in support of UK policy and business** are described including further consultations and a possible cross-sector workshop later in 2019, and follow-up consultation with academia and potential funders (both public and private sector) to explore funding opportunities in depth and frame outline funding proposals.



1. Introduction

1.1 Purpose of the paper

The purpose of this paper is to provide a synthesis and analysis of findings from three high-level sector Round Tables on measuring and valuing natural assets[4] – with the infrastructure sector (June 2018), the land management sector (November 2018), and the insurance/financial services sector (January 2019) – and to identify options for the development of a Natural Assets Research and Innovation Agenda in support of UK policy and business.

The Valuing Nature Programme convened the Round Tables for UK Research and Innovation (UKRI). The objective of the Round Tables was to identify the research and innovation (R&I) needs and priorities of business and policy organizations in each sector, so that current and future research has enhanced utility for these sectors.

Each Round Table considered:

- **current activity to measure and value nature in the sector** (e.g. uptake of natural capital assessments, natural capital accounting, biodiversity no net loss/net gain approaches), the **direction of travel** in this respect, and the **related knowledge needs;**
- **the extent to which these knowledge needs may be supported by existing output from R&I** (e.g. data, tools, methods, models) and how uptake of this output may be accelerated (e.g. through collaborative working between the academic, business and policy communities, filling knowledge gaps); and
- **what further R&I investment may be needed** to support the sector in measuring and valuing nature, and **what role the Natural Environment Research Council (NERC), other parts of UKRI, or other funders may have** in supporting that.

NERC, and UKRI more broadly, are interested in maximizing **benefit to the UK economy from publicly funded UK environmental research.** The Round Tables therefore focused on organisations with significant operations in the UK (not necessarily UK-owned), but also considered how these organisations are integrating natural capital in their business decision-making internationally.

4 The term 'natural assets' is taken here to incorporate the concepts of natural capital (stocks), ecosystem services (flows) and biodiversity.

1.2 UKRI/NERC interest in a Natural Assets R&I Agenda

UKRI engagement with business and policy

As part of UK Research & Innovation (UKRI)[5], the Natural Environment Research Council (NERC)[6] has a role in supporting business, policy-makers and wider society access the latest research to address business challenges and provide robust evidence for policy-making, thereby maximising the value from publicly funded research. NERC does this by working with business, policy-makers and wider society to:

- understand their needs and priorities, sharing these with the academic research base;
- support partnerships with the research base by signposting to where particular research strengths exist and facilitating access to knowledge, skilled people, data and infrastructure;
- inform the direction of novel strategic research and innovation investments which translate research into business and policy-relevant tools and approaches;
- strengthen the capacity of the research base to address the needs of business, policy and society.

NERC investment in a natural assets research and innovation agenda

Issues around 'natural capital' and 'valuing nature' are increasingly of interest to business, policy-makers and society. As primary funders of the £7M Valuing Nature Programme, a five year interdisciplinary research programme due to end in 2020, NERC is investigating how valuing nature research can be translated into business and policy decision-making, and what role UKRI and NERC might have in supporting this. Through the three Round Tables, NERC has intended to:

- understand what business in particular (but also policy-makers and society) are doing to develop and operationalise the concept of valuing nature / natural capital within their organisations;
- identify where there are opportunities to apply existing knowledge/data/skills from the research community and to identify what new knowledge is required to help business and policy-makers do this;
- gauge the interest and capacity of business and others to work collaboratively with the research base to access knowledge;
- explore different models of collaboration and funding, which would enable greater interaction between academia, policy and business around this agenda, and is workable for and brings benefits to all.

5 https://www.ukri.org/

6 https://nerc.ukri.org/innovation

The Valuing Nature Programme[7] already supports academic-business-policy collaboration, for example through the Business Interest Group[8], Business Impact Schools[9] and funding Valuing Nature placements[10] for academics to work within policy and business settings. The aim is that the findings of the individual Round Tables, and this paper, will inform future investment in research and innovation.

1.3 The policy context

Global level

There has been considerable change in the global policy context in recent years, sending a clear signal to the private sector on the need for a transition to environmental sustainability, including the sustainable use, conservation and restoration of natural assets.

A key development has been the adoption of the Sustainable Development Goals (SDGs), set by the UN General Assembly in 2015 for the year 2030.[11] SDG14 (Life below water) and SDG15 (Life on land) are of particular relevance in driving business action related to natural assets. However, many other SDGs encourage business action for the sustainable use, conservation and restoration of natural assets. SDG3 (Good Health and Wellbeing) includes access to green space and nature for urban populations – for businesses, the link between resilience and wellbeing of workforces and the quality of their surroundings is becoming increasingly apparent. SDG6 (Clean Water and Sanitation) includes securing sufficient quality and quantity of water resources, which water companies recognise means better management of the natural environment to store, filter and regulate flows of water. SDG9 (Industry, Innovation and Infrastructure) targets *inter alia* sustainable infrastructure and industrialisation and thus discourages unsustainable use of natural assets. SDG11 (Sustainable cities and communities) targets *inter alia* protection of natural heritage. SDG12 (Responsible production and consumption) targets *inter alia* sustainable management of natural resources, and environmentally sound management of chemicals, thus reducing pressures on biodiversity. SDG17 (Partnership for the Goals) targets development of multi-stakeholder partnerships including business.

The 2015 Paris Agreement of the UN Framework Convention on Climate Change[12] set a long-term goal of holding the global average temperature increase to well below 2°C and pursuing efforts to limit this to 1.5°C above pre-industrial levels. This is driving mitigation actions by businesses to reduce the build up of greenhouse gases in the atmosphere, including actions to safeguard and restore natural assets that capture carbon, and is also driving adaptation actions by businesses, including nature-based adaptations.

7 http://valuing-nature.net/

8 http://valuing-nature.net/business-interest-group

9 https://valuing-nature.net/valuing-nature-business-impact-schools

10 https://valuing-nature.net/valuing-nature-placements

11 Transforming our World: the 2030 Agenda for Sustainable Development. United Nations – sustainable development knowledge platform. Retrieved 30 March 2019.

12 Paris Agreement. United Nations Treaty Collection. Retrieved 30 March 2019.

The Convention on Biological Diversity (CBD) is the key driver at the global level for the sustainable use, conservation and restoration of biodiversity. Action is currently set within the context of the CBD Strategic Plan for Biodiversity 2011–2020, including the Aichi Biodiversity Targets.[13] These targets, and their translation at EU and national levels through EU and national biodiversity strategies and action plans, have had considerable influence on business, though business awareness and consideration of biodiversity in most sectors trails far behind awareness and consideration of climate.

The Millennium Ecosystem Assessment (MA),[14] published over the period 2001–2005, popularised the concepts of natural capital (stocks) and ecosystem services (flows), framing the natural world in economic terms more easily understood by decision-makers in both the public and private sector. Part-inspired by the MA, but also by the Stern Report on the Economics of Climate Change, the study on *The Economics of Ecosystems and Biodiversity* (TEEB),[15] published over the period 2008–2010, made the case for systematic appraisal of the economic contribution of biodiversity and ecosystem services to human wellbeing, and for routine steps to prevent that contribution being lost or diminished through neglect or mismanagement. Together, the MA and TEEB have helped stimulate uptake of the concepts of natural capital and ecosystem services in both the public and private sectors worldwide.

Notably, one of the TEEB reports focused on business and enterprise.[16] The Natural Capital Coalition,[17] which has emerged out of TEEB work with business, has helped to accelerate the integration of natural capital in business decision-making through the development of the *Natural Capital Protocol,*[18] a standardised approach to making natural capital assessments.

A UN-led initiative to develop a system of environmental economic accounting (SEEA)[19] for the public sector has helped to stimulate parallel work on corporate natural capital accounting (a key contribution to natural capital assessment). Other initiatives at global level have addressed other stages of the integration of natural capital in business decision-making, including in relation to investment (e.g. IFC Performance Standard 6[20] that provides guidance on biodiversity conservation and sustainable management of living natural resources), reporting (e.g. the Global Reporting Initiative[21]) and financial disclosure (e.g. the Task Force on Climate-Related Financial Disclosures [TCFD][22] – which is inspiring parallel thinking on financial disclosure in relation to natural capital).

13 COP 10 Decision X/2. *Strategic Plan for Biodiversity 2011-2020*. Retrieved 30 March 2019.

14 Millennium Ecosystem Assessment. Retrieved 30 March 2019.

15 The Economics of Ecosystems and Biodiversity. Retrieved 30 March 2019.

16 TEEB in Business and Enterprise. Retrieved 30 March 2019.

17 https://naturalcapitalcoalition.org

18 Natural Capital Protocol. Retrieved 30 March 2019.

19 https://seea.un.org/home/Natural-Capital-Accounting-Project

20 https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps6

21 https://www.globalreporting.org/information/sustainability-reporting

22 https://www.fsb-tcfd.org/

The recent, influential IPBES Global Assessment Report on Biodiversity and Ecosystem Services [23] has informed business and consumer perceptions of natural assets, documenting 'unprecedented decline' in nature and calls for 'transformative changes to restore and protect nature'. Business and consumer awareness of, and responses to, human impact on nature have also been stimulated by influential television series such as Planet Earth 2 and the current Netflix series, Our Planet. This is evidenced, for example, by numerous business commitments to reduce use of plastics (e.g. see New Plastics Economy [24], UK Plastics Pact [25]). There is now a growing global movement, under the heading of a 'New Deal for Nature', [26] bringing together business, policy and third sector actors towards achieving a 'Paris moment' for biodiversity (equivalent to what was achieved in Paris for climate) at the forthcoming 15th Conference of the Parties to the CBD to be held in October 2020 in Beijing. This movement is likely to serve as a further driver for the integration of nature in business decision-making – for example to reduce impacts on natural assets and grasp opportunities to protect and enhance natural assets.

EU level

Developments over the last ten years or so in EU policy mirror those at global level. In many cases the EU has been in the vanguard of environmental policy developments at the global level.

EU legislation has been an important driver for many businesses in tackling environmental impacts and dependencies. Since the 1970s, the EU has agreed some 200 pieces of legislation to protect the environment. These include measures for the protection of species and habitats, chemical risks to the environment, wastewater treatment, freshwater quality, the marine environment, air quality, environmental liability, etc. The robust punitive measures enshrined in this body of law, backed by the European Commission overseeing implementation, the third sector acting as watchdog, and the European Court of Justice ensuring that Member States apply the law equally across the EU, has inculcated in the private sector a strong compliance orientation in relation to the environment.

Over the last decade or so, the EU 2020 Strategy [27], which stresses sustainable growth, together with related policy on resource efficiency [28] and other policies that address the relationship between business and nature, such as that on the circular economy,[29] and perhaps above all ambitious EU targets relating to climate and energy (the 20/20/20 targets set in 2009,[30] the current 40/32/32 targets [31] and the 2050 long-term strategy [32]) have driven changing business perceptions, from seeing natural environment as a financial liability to seeing it as a major source of risk, but also as a major opportunity in achieving sustainable business growth.

23 https://www.ipbes.net/news/Media-Release-Global-Assessment

24 https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy

25 http://www.wrap.org.uk/content/the-uk-plastics-pact

26 In 2020, we need a New Deal for Nature.

27 COM(2010)2020. *EUROPE 2020. A strategy for smart, sustainable and inclusive growth.*

28 COM(2011)0021. *Resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy.*

29 COM(2013)0398.
Towards a circular economy: A zero waste programme for Europe.

30 Directive 2009/28/EC.
Directive on the promotion of the use of energy from renewable sources. **This set 3 targets:** a 20 % reduction in EU greenhouse gas emissions from 1990 levels; a 20 % improvement in the EU's energy efficiency; and a 20 % of EU energy from renewables (wind, solar, biomass, etc.).

31 2030 Climate and Energy Framework.

32 https://ec.europa.eu/clima/policies/strategies/2050_en

EU biodiversity policy first incorporated the concepts of natural capital and ecosystem services in 2006,[33] and has since increasingly stressed these concepts.[34] The European Commission has supported business uptake of these concepts through investments in research and innovation (e.g. the project OpenNESS[35] and We Value Nature[36] and numerous projects addressing nature-based solutions[37]) and the EU Business and Biodiversity Platform[38], which in particular promotes corporate natural capital accounting, stimulates finance for business projects in relation to biodiversity and natural capital, and stimulates business innovation that delivers benefits for nature. The European Commission's Sustainable Finance Initiative[39] is working to build a finance system that supports sustainable growth. While the Initiative is currently more focused on climate-related aspects of sustainability, there are plans to address consideration of natural capital under this initiative in the next year or two.

UK and devolved administrations levels

In the UK and at the level of the devolved administrations, there has been considerable movement in the policy framework in relation to natural assets over recent years.

The 2011 Natural Environment White Paper (NEWP)[40], the first White Paper on the natural environment to appear for over 25 years, set out Government policy for protecting and improving the natural environment. It promoted a *'move from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and coherent ecological networks.'* The NEWP established the Natural Capital Committee and a time-limited Ecosystem Markets Task Force (EMTF). The EMTF's Final Report, Realising Nature's Value[41], identified a wide range of opportunities for businesses to protect and/or value nature.

The UK Government's Industrial Strategy (2017)[42] identifies 'clean growth' as one of the four 'grand challenges' for industry – with a focus on the development, manufacture and use of low carbon technologies and development of the 'bio-economy' – the use of renewable biological resources from land and sea to produce food, materials and energy. It promotes green finance and highlights the need to 'regenerate natural capital' in the countryside. This is further elaborated in the Clean Growth Strategy (2017)[43], which seeks, inter alia, to enhance natural capital, making provision, for example, for the design of a new system of agricultural support to focus on delivering better environmental outcomes, a new network of forests in England, a zero avoidable waste target for 2050 and minimising negative environmental impacts of resource extraction, use and disposal.

33 COM(2006)0216.
Halting the loss of biodiversity by 2010 – and beyond – Sustaining ecosystem services for human well-being.

34 COM(2011)0244.
Our life insurance, our natural capital: an EU biodiversity strategy to 2020.

35 *Operationalising Natural Capital and Ecosystem Services.*
http://www.openness.eu/

36 http://www.wevaluenature.eu/

37 European Commission – Nature-based Solutions
https://ec.europa.eu/research/environment/index.cfm?pg=nbs

38 http://ec.europa.eu/environment/biodiversity/business/index_en.htm

39 https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en

40 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228842/8082.pdf

41 https://www.gov.uk/government/publications/realising-natures-value-final-report-of-the-ecosystem-markets-task-force

42 https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

43 https://www.gov.uk/government/publications/clean-growth-strategy

The NEWP announced the intention to achieve no net loss and where possible net gain of biodiversity in development – for example in relation to housing and infrastructure development. Defra developed principles and metrics for biodiversity offsetting and published a Green Paper on Biodiversity Offsetting in England[44] in 2013. This was followed by a number of Defra offsetting pilots, which were evaluated in 2014[45] and Defra-commissioned research on lessons learned from other countries for the development of offsetting markets.[46]

The 25 Year Environment Plan[47] (January 2018) adopts a natural capital approach in setting targets for clean air and water, thriving plants and wildlife, reducing environmental hazards, sustainable use of natural resources, enhancing the beauty of and engagement with the natural environment, mitigating and adapting to climate change, minimising waste, managing exposure to chemicals, and enhancing biosecurity.

The Government has recently adopted a Green Finance Strategy[48], which recognises the role of the financial sector in delivering global and domestic climate and environmental objectives. It sets out the proposals for green finance at the heart of delivering the 25 Year Environment Plan, Clean Growth Strategy[49] and Industrial Strategy[50], and how the proposals support the UK's economic policy for strong, sustainable and balanced growth.

The December 2018 Draft Environment Bill[51] and related Policy Paper make clear that the Government intends to put environmental ambition and accountability at the heart of government. The draft Bill plots a course to: establish a pioneering new system of green governance; improve air quality; restore and enhance nature; improve waste management and resource efficiency; and improve surface water, ground water and waste water management. Provision is made in the draft Bill to make net gain of biodiversity mandatory for housing and infrastructure and this intention was confirmed by the Chancellor in his Spring Statement[52] in March 2019. Defra is currently looking at how best to implement such net gain, including through the stimulation of an effective market.

Defra is also developing a new Environmental Land Management (ELM) scheme with a view to shifting farm support after Brexit. The new support regime would be oriented towards providing "public money for public goods" as a further shift towards improving natural capital outcomes from farming beyond what the current EU Common Agricultural Policy allows.

Climate change policy has continued to tighten with business implications for the better management of natural resources. In May and June 2019 a net zero target for GHG emissions in 2050 was set, notwithstanding the shortfall for the trajectory for the previous 80% reduction target.

44 Defra (2013) Biodiversity offsetting in England. Green paper.
https://consult.defra.gov.uk/biodiversity/biodiversity_offsetting/supporting_documents/20130903Biodiversity%20offsetting%20green%20paper.pdf

45 Evaluation of the biodiversity offsetting pilot phase – WC1051
http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18229

46 Duke, G and ten Kate, K. (2014) *Exploring lessons learned from biodiversity offsetting markets in other countries that could inform appraisal of options for delivering offsets in England. Final report to Defra (project code WC1098)*. Forest Trends, Washington D.C.
https://www.forest-trends.org/publications/exploring-lessons-learned-from-biodiversity-offsetting-markets-in-other-countries-that-could-inform-appraisal-of-options-for-delivering-offsets-in-england/

47 https://www.gov.uk/government/publications/25-year-environment-plan

48 https://www.gov.uk/government/publications/green-finance-strategy

49 https://www.gov.uk/government/publications/clean-growth-strategy

50 https://www.gov.uk/government/topical-events/the-uks-industrial-strategy

51 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766849/draft-environment-bill-governance-principles.pdf

52 Government to mandate biodiversity net gain
https://deframedia.blog.gov.uk/2019/03/13/government-to-mandate-biodiversity-net-gain/

This has very significant implications for business with respect to the necessity to include reparations to natural ecosystems, net gain and activities such as soil carbon growth and new forest planting, as all routes to net zero will require substantial compensation for the inevitable residual emissions.

The Government has recently embarked on the Dasgupta Review on the Economics of Biodiversity[53] (led by Treasury) – a biodiversity equivalent to the Stern Review on the Economics of Climate Change – which will build on the UN/EC sponsored study on The Economics of Ecosystems and Biodiversity and is likely to be influential in shaping thinking on natural assets.

The Natural Capital Committee has been particularly influential, providing advice to the Government through its annual 'state of natural capital' reports, working papers and research reports[54]. This has included making the case for investing in natural capital, integrating natural capital accounting (NCA) in the Treasury's Green Book, Securing Office of National Statistics commitment to national natural capital accounts[55], piloting corporate NCA and advancing natural capital valuation and introducing the natural capital approach in the 25YEP.

The Committee now focuses on helping the Government deliver its 25YEP[56], issuing recent advice (May 2019) on environmental net gain[57], marine management[58] and soil management[59].

In Wales, the Wellbeing of Future Generations Act 2015[60] (notably the goal 'A Resilient Wales') and Environment (Wales) Act 2016 have advanced consideration of natural assets by government and business. In Scotland, the Greener Strategic Objective[61] (2007) 'to improve Scotland's natural and built environment' and Scotland's current National Performance Framework[62] outcome that 'people value, protect, enjoy and enhance their environment' have influenced business consideration of natural assets. 'Increasing natural capital' is a national indicator, measured annually (since 2007) by the Scottish Natural Asset Index[63]. In Northern Ireland, Prosperity Agreements[64] have been instrumental in engaging business in reducing environmental impacts and enhancing economic prosperity and wellbeing.

53 https://www.cser.ac.uk/news/dasgupta-lead-uk-review-eco-biodiversity/

54 Natural Capital Committee documents
https://www.gov.uk/government/collections/natural-capital-committee-documents

55 Office for National Statistics - Natural Capital
https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/methodologies/naturalcapital

56 Natural Capital Committee's advice on government's 25 Year Environment Plan
https://www.gov.uk/government/publications/natural-capital-committee-advice-on-governments-25-year-environment-plan

57 Natural Capital Committee's advice to government on net environmental gain
https://www.gov.uk/government/publications/natural-capital-committee-advice-to-government-on-net-environmental-gain

58 Natural Capital Committee advice on marine management
https://www.gov.uk/government/publications/natural-capital-committee-advice-on-marine-management

59 Natural Capital Committee advice on soil management.
https://www.gov.uk/government/publications/natural-capital-committee-advice-on-soil-management

60 https://gov.wales/topics/people-and-communities/people/future-generations-act/?skip=1&lang=en

61 https://www2.gov.scot/About/Performance/scotPerforms/objectives/greener

62 https://nationalperformance.gov.scot/what-it

63 https://www.nature.scot/professional-advice/planning-and-development/valuing-our-environment/natural-capital-asset-index

64 https://www.daera-ni.gov.uk/articles/prosperity-agreements

2. Current activity and direction of travel

This section outlines current activity and direction of travel, as revealed through the three Round Tables. It then draws out commonalities and differences in terms of activity and direction of travel between the three broad sectors.

2.1 The infrastructure sector

The Round Table with the infrastructure sector revealed considerable activity, across the sector, related to measuring and valuing natural assets, including by energy distribution companies, road and rail infrastructure companies, water and wastewater infrastructure companies, construction companies, consultancies and insurance companies. The main areas of activity are outlined below, with some examples.

Biodiversity assessment, accounting and delivery of biodiversity 'no net loss'/'net gain'

Given the focus of the infrastructure sector on the construction and maintenance of major linear infrastructures – such as power transmission lines, road and railways, and of localised infrastructures such as electricity grid sub-stations and water treatment works – it is not surprising that the focus of the sector has been on *meeting National Planning Policy Framework (NPPF)* requirements related to avoiding and minimising environmental impacts and compensating for residual impacts.

In this context, there has been considerable acceleration of activity in seeking to achieve 'no net loss' of biodiversity during development. The focus here has been on biodiversity, as opposed to natural capital and/or ecosystem services, reflecting NPPF requirements (in England) and the expectations of Local Planning Authorities. Companies such as **National Grid**, **Network Rail** and **Highways England**, in following the mitigation hierarchy, have followed the Defra *Biodiversity Offsetting Principles* and applied the Defra *Biodiversity Offsetting Metric* or adaptations thereof. The metric, used on both the impact and the offset side, measures quantity and quality of biodiversity (area, quality, condition) – it does not involve any valuation.

Moving beyond 'no net loss', there is now considerable movement in the sector towards delivering 'net gain' of biodiversity in development, reflecting the evolution of government policy in this direction.[65] **Network Rail**, for example, has implemented six pilots on biodiversity net gain and has made a net gain commitment for Control Period 6 (starting April 2019). **HS2** is also working to deliver biodiversity net gain through a 'green corridor initiative' (extending well beyond the development red line) under which it will provide funding for landowners to enhance biodiversity to compensate for development impacts. Construction companies and consultants such as **Barratt** and **Atkins** are working with infrastructure companies on how to deliver net gain.

65 Government to mandate 'biodiversity net gain'

Infrastructure and construction companies have also been involved in a number of initiatives in support of net gain, including updating of the Defra Biodiversity Metric[66] and CIRIA principles and guidance on net gain.[67]

Natural capital assessment, accounting and delivery of natural capital 'net gain'

Companies in the infrastructure sector are beginning to move beyond measuring the quantity and quality of biodiversity (with a view to delivering biodiversity 'no net loss'/'net gain' in respect of planning requirements) towards measuring and valuing natural assets (not only biodiversity, but natural capital more broadly considered, and/or ecosystem services), with a view to using this knowledge more strategically to inform corporate decision-making around risk, investment and corporate social responsibility, and with a view to the sharing of costs and benefits among the beneficiaries of ecosystem services.

Water companies appear to be in the vanguard in this respect. For example, **United Utilities** working with **Natural England** has developed natural capital accounts (using the Natural Capital Committee's method) with a view to better understanding what value the company's landholding brings to NW England and how to get the most out of the asset; the accounts reveal that the main value derives from recreational use (not water supply). **Yorkshire Water** has been road-testing the Natural Capital Protocol (NCP) (a standardised approach to natural capital assessment) with support from **Arup** – though the finding has been that the NCP is better suited to corporate supply chains than to asset management.

Transport and energy infrastructure companies are also active in, or moving towards, natural capital assessment and/or accounting. For example, **London Underground** is working on a qualitative analysis of natural assets involving GIS-based biodiversity mapping. **Highways England's** sustainable development strategy recognises environmental capital (along with financial, social and human capital) and the company is interested to develop an approach to assess natural capital values in financial terms to inform project appraisals. **Network Rail** aspires to apply the NCP and value ecosystem services.

Looking to the future, **Wessex Water** has aspirations to deliver gains in natural capital (i.e. going beyond biodiversity net gain) in its 2020–25 business plan. The company anticipates that natural capital net gain will become an Ofwat requirement.

Companies note that work on 'no net loss'/'net gain' – where the focus is on measurement of quantity and quality of biodiversity (species, habitats) with no or limited attention to valuation – is somewhat separate from work on natural capital assessments and accounting, where the asset under consideration is more broadly defined (incorporating both the biotic and abiotic components of the environment) and there is much greater focus on valuation. There is a need to bring these two strands of work together.

Generating data, information management

Network Rail is working on a biodiversity information management system, making use of both external data and data generated internally to inform planners and route managers.

66 Defra Biodiversity Metric — Introduction to the Proposed Updated Metric (BD2020-10)

67 Biodiversity Net Gain — Principles and Guidance for UK construction and developments *(RP1048)*.

Modelling natural assets

A number of companies in the infrastructure sector are also major landowners. **Network Rail**, for example, is the 5th largest landowner in the UK and **United Utilities** the 10th largest (with major landholdings in NW England). These companies have consequently been active for many years in consideration of natural assets from the point of view of good land management, for example managing railway land as wildlife corridors, and managing upland catchments to improve water quality. Infrastructure companies with considerable land-holdings are more likely to engage in work to model land use and its effects on infrastructure and on the delivery of statutory requirements such as water quality standards. For example, **United Utilities** is working to merge land management and water quality models to provide new perspectives on how to deliver statutory water quality standards.

Developing standards

A number of infrastructure/construction companies – including **WSP** and **Barratt** – are engaging with BSI-led work to develop a British Standard on natural capital.

Investing in natural capital/ green infrastructure/ nature-based solutions

Infrastructure companies own and manage considerable grey infrastructure assets but increasing recognition of the value of natural assets is leading to growing interest in green infrastructure. For example, **London Underground** is looking at how and where to retrofit green infrastructure (e.g. trees planting, SUDS), where possible from a civil engineering perspective, including through influencing neighbours and stakeholders. **Arup** has worked on coastal re-alignment, for example in the Humber Estuary, involving the development of green infrastructure as a flood defence. **EDF Energy** is interested in whether green infrastructure can to some extent substitute grey infrastructure solutions to protect nuclear power plants. **United Utilities** employs constructed wetlands as nature-based solutions to wastewater treatment. **Willis Towers Watson** is working on the value of green infrastructure, including coastal wetlands, mangroves and coral reefs, in reducing risks of coastal flooding and enhancing resilience in the face of climate change – i.e. working to strengthen the risk narrative that links natural assets with man-made assets and that can stimulate the emergence of financial products, such as resilience bonds, for investment in green infrastructure and the protection of natural assets.

Capacity-building

National Grid is working with senior management to build capacity across the business on natural capital and ecosystem services.

Developing markets for natural assets

Linked to, and following on from, work on biodiversity 'no net loss'/'net gain' and natural capital assessments and accounting, companies are also beginning to explore opportunities around the development of markets for natural assets. Over the last few years, Defra has piloted biodiversity offsetting, including market-based approaches, and offset markets are likely to expand rapidly in England if biodiversity net gain in development is indeed mandated under the forthcoming Environment Act.

Infrastructure companies such as **Highways England** are interested in trading biodiversity units to facilitate offsetting, and are also looking to extend this to the trading of ecosystem services. **United Utilities** are similarly looking at setting up markets for ecosystem services to deliver catchment management, considering how to

capture value from 'stacking' ecosystem services such as water supply, carbon storage, flood protection and biodiversity.

2.2 The land management sector

The Round Table with the land management sector revealed considerable activity, across the sector, related to measuring and valuing natural assets, including by agricultural and forestry landowners, non-governmental landowners, landowning water utilities and infrastructure companies, landowner representative bodies, food retail companies; statutory and charitable bodies advising on land management, land surveyors and other advisers/ consultants. The main areas of activity are outlined below, with some examples.[26]

Natural capital assessment and accounting

A number of companies and others in the land management sector have piloted approaches to natural capital assessment and natural capital accounting (NCA). For example, **Crown Estate Scotland** (CES) has piloted the Natural Capital Protocol[69] (NCP) at varying scales including at farm level. They found the NCP to be useful in understanding farm impacts and dependencies on natural capital, establishing a baseline and measuring improvements over time.[70] CES is now seeking to integrate natural capital assessment into Integrated Farm Management Plans.[71]

In England, **The Crown Estate** (TCE) piloted corporate NCA at the Windsor Estate in 2014; TCE found difficulty in putting values to unique biodiversity assets (e.g. ancient trees, SSSIs) and is now working to strengthen methods and data, e.g. to get a better handle on recreation value. More recently, TCE's 2017 Total Contribution Report[72] takes a capitals-based approach to impact measurement and valuation. **The National Trust** has similarly piloted corporate NCA at the Wimpole Estate. They found problems with partial accounts and with tenant willingness to share data. **Natural England** has applied NCA to National Nature Reserves, also finding problems with partial accounts – in particular, NCA does not work well for biodiversity. Natural England is now working to bring qualitative data into these accounts to address this. The **Wildlife Trusts** have similarly carried out NCA on their reserves, and found that public goods values (for recreation, etc.) are often significantly higher than production values.

As already highlighted in the infrastructure section above, water utilities are also developing approaches to assessment and accounting for natural assets. **Scottish Water** and others are working, through **UK Water Industry Research** (UKWIR), on a quantitative tool for NCA and social capital assessment, including in Phase 2 the development of a more qualitative approach. **United Utilities** are piloting corporate NCA at both company and sub-catchment levels. **Anglian Water** has worked with the University of East Anglia to create a natural capital asset check and risk register across the company's estate and the wider region, identifying benefits to the company and others.[73]

68 Note: some of the examples mentioned here for the land management sector overlap with those mentioned for the infrastructure sector, as some infrastructure companies also manage significant land holdings.

69 A decision-making framework to identify, measure and value impacts and dependencies on natural capital) – see https://naturalcapitalcoalition.org/natural-capital-protocol

70 https://naturalcapitalcoalition.org/crown-estate-scotland-complete-natural-capital-protocol-application

71 https://www.fas.scot/integrated-land-management-plans-ilmps

72 https://www.thecrownestate.co.uk/en-gb/our-business/integrated-annual-report/total-contribution

73 https://www.anglianwater.co.uk/environment/our-commitment/our-projects/natural-capital.aspx

Wessex Water has carried out natural capital assessments and accounting on its own land holdings; they are finding challenges in doing this at multiple scales (business, region, landholding, project-level) and in finding accounting procedures that work across these scales.

Clinton Devon Estates are currently doing corporate NCA using the ORVal tool[74] (developed at University of Exeter) looking at dependencies and risks.

Developing datasets

The Woodland Trust has developed a canopy map dataset[75] to assess how the landscape is linked through canopy cover and understand change in ecological connectivity and permeability of the landscape over the last 100 years. Lots of natural capital thinking is blind to this connectivity. A challenge is to translate this knowledge to action, engage landowners and find the right incentives to enhance connectivity.

Developing indicators and metrics

The measurement and valuation of natural assets requires appropriate indicators and metrics. **Natural England** is working with the Environment Agency to review and identify indicators and metrics for natural capital and ecosystem services. Much of the required data to populate these indicators is missing – Natural England is looking at how to fill these data gaps and the validity of proxies. **The National Trust** is looking at the use of natural capital indicators within the context of trialling payment for public goods – in particular indicators for cultural services (e.g. number of visits, members' use, educational services, 'nature connectedness' as a measure of wellbeing).

Anglian Water has developed natural capital metrics – covering soil, water, bathing water, biodiversity – for its 2020–25 business plan[76]; these metrics address extent and condition (especially in relation to major investments) but not necessarily value.

Developing tools

A good number of businesses and other organisations in the land management sector have developed or are developing tools that support the measurement and valuation of natural assets and consideration of natural assets in business decision-making.

For example, **National Grid** has (with **AECON**) developed a natural capital tool that produces a baseline for sites, identifies how to grow natural assets and who to work with. The tool also attributes monetary values (for internal use only – some values are difficult to calculate and may be controversial). The tool informs business decisions which integrate measures such as visual screening, flood security and ecological connectivity in new infrastructure.

The company **Environment Systems** has developed tools that support natural capital assessments and valuation, such as SENCE (Spatial Evidence for Natural Capital Evaluation)[77] which maps and models natural assets and ecosystem services flows, maps risks and identifies opportunities to enhance ecosystem services.

Natural England is working with University of Oxford to develop a new tool on how to bring biodiversity net gain decisions into development planning (housing, infrastructure, etc.) – the tool is a matrix which provides 'answers' on where biodiversity net gain can be located and the natural capital outcomes of the various options.

74 https://www.leep.exeter.ac.uk/orval

75 https://www.woodlandtrust.org.uk/blog/2018/03/tree-canopy-cover-results

76 Anglian Water – Our Plan 2020 to 2025 https://www.anglianwater.co.uk/about-us/our-strategies-and-plans/2020-2025/

77 Introducing Sence https://www.envsys.co.uk/news/introducing-sence/

The **Joint Nature Conservation Committee** – not itself a landowner or manager – is developing tools and models to interpret biodiversity data in terms of natural capital; this includes application of remote sensing data to support measurement of corporate supply chain impacts on extent and quality of habitats.

Investing in natural capital/ green infrastructure/ nature-based solutions

SEPA recently hosted a VNP placement looking at potential for private sector investment in natural capital with a focus on Speyside;[78] in general, there is interest to invest in natural capital but landowners struggle to see how to secure a return on investment.

Developing functioning markets for natural assets

A number of companies are pro-active in exploring and/or stimulating the development of markets that capture the value of natural assets. For example, **3Keel** has developed the 'Landscape Enterprise Network' (LENS) approach with **Nestlé** and **Business in the Community**[79], which seeks to activate regional natural capital markets with investors. LENS uses network analysis to identify and engage with regional players, seek to understand their needs in relation to natural assets and ecosystem services, map multiple value chains relating to these assets and services and identify opportunities for co-investment in the same natural asset(s).

No abstract valuation is involved – economic value is instead defined by the price point; this circumvents the problem of assigning values to ecosystem services. 3Keel has applied the LENs approach in Cumbria, Greater Manchester, Yorkshire, Hampshire and Avon.

United Utilities is also looking at the creation of markets for natural capital, and working on future public sector payments for public goods. **Wessex Water** has trialled a reverse auction system for farmers, EnTrade[80], under which farmers make bids for Wessex Water funding to deliver interventions to remove nutrients from catchments; this is based around the price of intervention, and so circumvents the need to value benefits.

Quality assurance and certification

The **Soil Association** works with around 6000 businesses on sustainability quality assurance, providing knowledge and management systems to track the benefits of sustainable use (of soils) and is engaged in certification (>1.5 m ha worldwide, particularly for textiles). To some extent natural assets are already taken into account in assurance/certification schemes, although not monetarily valued.

Capacity-building around decision-making for natural assets

Scottish Water is working to factor considerations of natural and social capital into catchment-scale decision-making within the context of Sustainable Growth Agreement with SEPA[81]

78 https://www.sepa.org.uk/media/372005/vn_-business_investment_in_nc-_executive_summary.pdf

79 https://www.bitc.org.uk/sites/default/files/practical-economics-of-ecosystems-report.pdf

80 https://www.entrade.co.uk/Case_study

81 https://www.sepa.org.uk/media/360985/scottish-water-sga.pdf

Anglian Water is involved in a range of initiatives seeking to integrate knowledge of natural assets in business decision-making. This includes: work as part 'Natural Capital East', a business coalition working on the commercial opportunities around enhancing natural capital; work with the Cambridge Institute for Sustainability Leadership (CISL) Natural Capital Impact Group focusing on food, beverage and apparel supply chains[82]; and work with the Rivers Trust and local estates to look at investment in natural capital around boreholes.

United Utilities is also working on the integration of natural capital considerations in business decision-making, including in terms of communicating these considerations across the business, with suppliers and with landowners in catchments.

2.3 The insurance/ financial services sector

The Round Table with the insurance/financial services sector revealed considerable activity, across the sector, for measuring and valuing natural assets, including by banks and institutional investors, insurance companies, insurance brokerage and advisor companies, benchmarking agencies, innovators and asset owners, trade bodies, finance sector think-tanks and consultancies. The main areas of activity are outlined below, with some examples.

Natural capital assessment and accounting

A number of companies active in the finance sector are active in the development of environmental profit and loss accounts. For example, S&P Trucost produced the first environmental profit and loss account (EP&L) for Puma.

The uptake of natural capital assessment in the finance sector has been promoted through the development of a Finance Sector Supplement to the Natural Capital Protocol (NCP), work that has also been led by **S&P Trucost**.

The **European Investment Bank (EIB)** is working with WAVES, Eurostat the European Environment Agency and **eftec** to look at how to bring national-level Natural Ecosystem Assessments down to the level of individual investment projects.

Data

A frequent issue raised by the finance sector in measuring and valuing the liabilities and impacts of investments is access to relevant data, at the right level of granularity. The required granularity differs for different audiences (e.g. portfolio managers, ESG managers) and for investment decisions at different levels, from the individual asset (e.g. a mine), to corporate (e.g. the mining company) to investment portfolio. Impact investors typically looking at specific commodities (e.g. palm oil, cotton) or specific environmental issues (e.g. deforestation, water) rather than biodiversity, ecosystem services or natural capital, for which data needs are more complex. Data is sparse even for a single ecosystem service such as pollination.

82 https://www.cisl.cam.ac.uk/business-action/natural-capital/natural-capital-impact-group

Some work is being done to address the data needs. For example, **S&P Trucost** is putting together datasets around carbon and water for valuation of investment, and developing a carbon pricing risk dataset describing how investment portfolios may be at risk from carbon price increases in the future.

Standards

Multilateral banks – such as the **European Investment Bank (EIB)** – have for many years adhered to IFC Performance Standard 6 (dating from 2006 and updated 2012) on 'Biodiversity Conservation and Sustainable Management of Living Natural Resources' [83].

The **UK Sustainable Investment and Finance Association (UKSIF)** is working with the BSI on a Standard for Green Bonds.

Models and scenarios

The insurance industry routinely uses natural hazard risk modelling to inform underwriting decisions with the focus being on corporate liabilities. **Willis Towers Watson (WTW)** is beginning to consider how risk management models may also be used on the asset side of the balance sheet, to inform investment decisions. At present, data and modelling focus on climate-related risks and there is scope to give more prominence to natural capital depletion risks and the 'resilience dividend' (i.e. reduced liabilities) arising from investment in natural assets. For example, WTW is working with University of York on a NERC-funded project to assess the role of coral reefs in alleviating coastal flooding from cyclones and related storm surges and exploring the development of an insurance product for fishermen whose livelihoods depend on the reef and investing part of the proceeds in reef conservation [84].

The **Cambridge Institute for Sustainability Leadership (CiSL)** is doing scenario analysis on how pollination declines may affect financial markets.

Investment principles/purposes

The finance sector is beginning to develop and embrace principles/purposes that guide investment in natural assets. To date, the insurance/financial services sector has focused more on climate change in addressing sustainability. While many investors claim to fully address ESG (environmental, social and governance) criteria, most focus on carbon emissions (as a proxy for climate change) and attention to natural capital has been very limited. For example, the **Green Investment Bank** has five green purposes to guide sustainable investment – carbon emissions reductions, effective use of resources, biodiversity gain, protecting/enhancing the natural environment, and a sustainability 'catch-all' – but has so far concentrated on the first two, where there are good metrics and more mature markets. **UNPRI** is seeking to move investor principles beyond addressing carbon emissions (climate change mitigation) to addressing water, deforestation, biodiversity, etc. (climate change adaptation).

Financial instruments

There has been rapid growth in green bonds in recent years. For example, the **Climate Bonds Initiative (CBI)** works to mobilise the bond market for investment in resilient forestry, agriculture and fisheries (as climate change solutions). Banks such as **Barclays** are increasingly working on green bonds.

[83] IFC Performance Standard 6
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps6

[84] Coastal Ecosystem Recovery Financing for the Future (CERFF)

Investments in natural capital tend to carry higher risk than investors are used to. For this reason, governments are increasingly interested in working with the private sector to offer blended finance instruments in which public sector funding takes first risk and thereby reduces the cost of borrowing. For example, the **European Investment Bank** is piloting the Natural Capital Finance Facility, which blends EIB lending with grant funding from the EU LIFE programme. **Vivid Economics** has been working with Defra on design of a UK blended finance instrument for natural assets investments.

Project pipeline

A number of financial sector organisations – including the **European Investment Bank** and **Credit Suisse** – are working with the Coalition for Private Investment for Conservation (CPIC)[85] to stimulate a pipeline of investable projects that benefit natural assets. CPIC is for example developing blueprints for suitable investment projects.

Investor sentiment

There is a change in the distribution of wealth and in investor perceptions, driven in particular by female and younger investors looking for environmental and/or social impact as well as financial return. For these and other investors, reputation is becoming a more important factor. **CISL** are doing work looking at how much return on investment people may be willing to give up in exchange for positive environmental impact.

Divestment

The **UN Principles for Responsible Investment (UNPRI)** is working to identify 'stranded assets', not only in relation to carbon but also in relation to water and land use, e.g. are there high-water-use companies operating in regions that will become increasingly water stressed?

2.4 Cross-sector commonalities and differences

A number of commonalities and differences in terms of activity and direction of travel can be identified across the three broad sectors (infrastructure, land management and insurance/financial services) addressed by the three Round Tables.

It should be stressed here that no mention of an activity in one or another of the Round Tables does not necessarily mean that the sector is not engaging in this activity – simply that no example was brought up at the Round Table.

Biodiversity assessment, accounting and biodiversity 'no net loss'/'net gain'

The infrastructure sector appears most active in relation to biodiversity assessment, accounting and consideration of 'no net loss'/'net gain'. No mention of these issues was made by the other sectors. This is to be expected given the particular drivers of these activities in the infrastructure sector (NPPF requirements, forthcoming mandatory requirements for net gain). This is one area of activity where there does appear to be a clear distinction between the infrastructure sector and the other two sectors, though the land management sector is likely to become more active on the supply side once net gain is mandatory.

Natural capital assessment, accounting and natural capital 'net gain'

Both the land management sector and the infrastructure sector (notably, water utilities, which can be assigned to both these sectors) are fairly active in testing approaches to natural

85 Coalition for Private Investment for Conservation http://cpicfinance.com/

capital assessment (e.g. the Natural Capital Protocol – NCP) and natural capital accounting. The insurance/financial services sector has been less active in this, but recent publication of the Financial Sector Supplement to the NCP may encourage more activity. Natural capital assessment and accounting thus appear to be activities for which there is a shared interest across all three sectors. Natural capital net gain remains largely an aspiration at present but may become a regulatory requirement for some sectors (e.g. water utilities) going forward.

Generating datasets, information management

There is limited activity in all three sectors in this regard, with only a small scattering of examples of companies/organisations developing datasets (e.g. **Trucost**, **Wildlife Trusts**) and/or managing internal datasets (e.g. **Network Rail**) for natural assets. Most companies rely on external datasets.

Developing indicators and metrics

There is considerable activity on indicators and metrics in the land management sector, notably in preparation for payments for public goods under post-Brexit agriculture policy, e.g. by **Natural England**, the **Environment Agency** and the **National Trust**. These issues were not mentioned by the other sectors.

Developing tools

There is some limited activity in the infrastructure and land management sectors on the development of tools that support assessment and valuation of natural assets, such as the decision-making tool developed by **AECON** with **National Grid**, and the SENCE tool developed by **Environment Systems**. Such tool development was not mentioned by the insurance/financial services sector.

Modelling natural assets

We had one example of activity on modelling natural assets (**United Utilities**, bridging both the land management and infrastructure sectors) and one example from the insurance/financial service sector (**Willis Towers Watson**). There is a long tradition of modelling in the insurance/financial services sector, though modelling of natural capital is largely limited to applications for disaster risk reduction at present.

Developing standards

Both the infrastructure and the insurance/financial services sectors are working on standards with BSI, the former on a standard for natural capital, the latter on a standard for green bonds. IFC Performance Standard 6 has long provided a standard on biodiversity for banks in the finance sector. No mention was made of developing standards by the land management sector.

Implementing green infrastructure / nature-based solutions

The infrastructure sector is considerably active in investing in green infrastructure / nature-based solutions, including for protection of transport infrastructure, flood defences and wastewater treatment. The finance sector is increasingly active in stimulating a pipeline of investable natural capital / green infrastructure / nature-based solutions projects, e.g. the **EIB** and **Credit Suisse** working with the Coalition for Private Investment in Conservation. This is perhaps an area in which the land management sector is less active.

Divestment

Divestment in areas where natural assets are at risk is an area of activity for the insurance/financial services sector, e.g. **PRI** work on 'stranded assets' due to water depletion. This area of activity is less relevant for the infrastructure and land management sectors.

Developing financial instruments

This activity is most pertinent to the insurance/financials services sector, for example the development of blended finance instruments for natural capital and green bonds for climate-resilient forestry, agriculture and fisheries. The infrastructure and land management sectors per se appear not to be active in developing financial instruments for natural assets – though are likely beneficiaries of such instruments.

Developing markets for natural assets

All three sectors are active, in differing ways, in developing markets for natural assets. The infrastructure sector is largely active on this from the demand-side perspective (i.e. needing to buy credits to offset development impacts), the land management sector from the supply side (i.e. having the potential to enhance nature and sell credits). Some companies span both demand and supply sides (e.g. **Network Rail**, water utilities). Various approaches are being developed such as the LENS approach (**3Keel**) and reverse auctions (**Wessex Water**'s EnTrade platform). No mention of market development was made by the financial services sector though the sector is likely to be key to scaling such markets in future.

Quality assurance and certification

The only mention of quality assurance and certification was made by the land management sector (Soil Association). This does not appear to be an area of activity for the other two sectors.

Capacity-building

The land management sector appears most active in capacity-building, with work to build capacities with suppliers at catchment scale (e.g. **Scottish Water**) and across the business and its value chain (e.g. **United Utilities**). The other sectors did not mention this area of activity though it is likely taking place across all three sectors as they gear up to address natural assets.

3. Drivers for action

This section outlines the drivers (regulatory, policy, risk, return on investment, corporate social responsibility, etc.) of current activity and direction of travel, and the relative importance of these drivers, as revealed through the three Round Tables. It provides some elaboration of key drivers to aid cross-sector understanding, and draws out similarities and differences in drivers between sectors and the likely causes behind these.

3.1 The infrastructure sector

The Round Table with the infrastructure sector identified a number of classes of driver for activity related to measuring and valuing natural assets across the sector. These are outlined below.

Environmental policy and regulation

A number of companies cited the Government's 25 Year Environment Plan (25YEP)[86] as a driver of activity. The 25YEP (2018), as a key policy paper, sets direction of travel, in particular towards much greater emphasis within environmental policy on natural capital, though much of the detail on how this will be delivered remains to be worked out. Companies also cited as drivers the Natural Environment and Rural Communities Act (2006) – though this was said to be poorly written in terms of the requirement to take account of biodiversity – and the 2020 Biodiversity Strategy.

Sector-specific policy and legislation

Perhaps the main drivers for activity related to measuring and valuing natural assets in the infrastructure sector are requirements related to the planning and permitting of new infrastructure developments as set out (for England) in the National Planning Policy Framework (NPPF)[87] and the separate (and more stringent) requirements (in England and Wales) for nationally significant infrastructure projects (NSIP)[88] – in particular obligations of planning authorities to ensure the mitigation of environmental impacts and no net loss or net gain of biodiversity. These planning requirements are a key driver both for operational purposes, in terms of avoiding permitting delays and penalties (where biodiversity has not been properly considered), and for reputational purposes. The Government has recently consulted on making biodiversity net gain mandatory[89] and the Chancellor indicated in his Spring Statement that net gain would be mandated, for both housing and infrastructure, through the forthcoming Environment Act.[90]

86 25 year Environment Plan

87 National Planning Policy Framework

88 National Infrastructure Planning — Legislation

89 Net gain

90 Government to mandate 'biodiversity net gain'

For water sector companies in particular, sector-specific regulation arising from the EU Water Framework Directive is a major driver.

Global level initiatives

Global level initiatives cited as drivers included the SDGs, the Paris Agreement and related initiatives such as the TCFD. The latter gives little consideration to natural assets but is raising awareness among companies of a trend towards financial disclosures relating to environmental risk. Increasing attention in the finance sector to sustainability targets was also cited as a driver for action in relation to natural assets in the infrastructure sector.

Corporate policies, strategies

A number of companies cited corporate policies and strategies as key drivers of activity relating to the measuring and valuing of natural assets. These included, for example, the Transport Strategy for London as a driver for **London Underground**, the Five Yearly Asset Management Plans as drivers for water companies, and **Highways England**'s in-house Sustainable Development Strategy.

There are also important inter-linkages with the carbon accounting and climate mitigation targets of companies which increasingly involves activities to reduce releases of carbon from the natural environment (e.g. soils) and to sequester carbon to offset emissions, for example through woodland and peatland restoration. This carbon accounting strand driven by climate targets needs integration with biodiversity and natural capital 'net gain' activities.

3.2 The land management sector

The Round Table with the land management sector identified a number of classes of driver for activity related to measuring and valuing natural assets across the sector. These are outlined below.

Environmental policy and regulation

The 25YEP is a driver in terms of signposting the way forward on natural assets, as well as influential earlier policy-related work such as the Lawton Review which has stimulated business thinking on ecological connectivity. In Wales, the Wellbeing of Future Generations Act is a key driver. Increasing government interest in natural capital accounting, reporting and disclosure is also acting as a driver.

Sector specific policy and regulation

Activity on the measurement and valuation of natural assets in the land management sector is increasingly driven by expected post-Brexit policy including anticipated payments to land managers for the provision of public goods.[91] These are being explored through pilots of a possible Environmental Land Management Scheme to replace current agricultural payments under the EU Common Agricultural Policy.

Water utilities are in particular driven by water quality regulation, notably the requirements of the Water Framework Directive (e.g. for Sustainable Catchment Management Plans) and Ofwat. Water utilities are in particular anticipating developments in relation to delivery of environmental obligations under the current 2019 Ofwat Price Review.

[91] The future for food, farming and the environment

Corporate policies, business models

Corporate policies and business models and plans are key drivers for many land management companies, including policy promoting long-term resilience (e.g. **Crown Estate Scotland**, **Scottish Water**), new business models (e.g. **The Crown Estate**'s new focus on 'creating places') and Sustainable Growth Agreements (in Scotland).

Cost considerations

Cost is a key driver, for example the costs of meeting water quality targets. This drives activity to find lower cost ways to meet these targets, such as sustainable catchment management reducing the needs for downstream water treatment.

3.3 The insurance/ financial services sector

The Round Table with the insurance/financial services sector identified a number of classes of driver for activity related to measuring and valuing natural assets across the sector. These are outlined below.

Environmental policy and regulation

Government environmental policy and regulation, which increasingly place emphasis on natural assets, are driving sector interest in development of suitable finance instruments and new financial markets for natural assets.

Sector specific policy and regulation

Recent developments in financial reporting and disclosure are important drivers, notably the work of the TCFD – while this is climate-focussed, it is probable that requirements for reporting and disclosure of impacts on natural assets will follow. There is also an increasing recognition that the cost effective delivery of climate targets requires an integrated approach across carbon, energy and natural assets. This will grow further as climate mitigation targets become more ambitious and adaptation investment increases.

Global policy

The SDGs and related developments in policy at the global level are important drivers for the sector. International climate policy has been a significant driver of change in the sector, and has helped stimulate attention to natural assets in terms of resilience in the context of climate change. The next CBD Conference of the Parties in October 2020 (COP 15) may help bring finance sector work on climate closer to finance sector work on natural assets.

Investor expectations

Investor expectations are a key driver for the insurance/financial services sector. There is a growing interest from investors in sustainable investing, particularly from younger and female clients.

Client interests

Banks such as Barclays have been working with farming families and communities for several generations and are in part driven by the long-term interests of these clients to invest in sustainable management of natural assets.

There is increasing pressure from landowners and their representatives (e.g. **NFU**) to consider natural assets.

Commercial markets

Commercial markets are a key driver, providing 'pressure from above' – these typically demand quick returns and so work against longer-term investment in sustainable management of natural assets.

3.4 Cross-sector commonalities and differences

A number of commonalities and differences in terms of drivers of activity on measuring and valuing nature can be identified across the three broad sectors addressed by the three Round Tables.

UK and devolved environmental policy and legislation

UK and devolved environmental policy, notably the 25YEP but also the Natural Environment and Rural Communities Act (2006) and 2020 Biodiversity Strategy and, in Wales, the Wellbeing of Future Generations Act, are key drivers for the infrastructure and land management sectors, less so for the insurance/financial services sector (except indirectly, as a driver on sectors insured/financed).

Sector-specific policy and legislation

Sector-specific policy and legislation are key drivers for measuring and valuing nature, in particular for the infrastructure and land management sectors.

Activity in the infrastructure sector is driven in particular by planning policy (NPPF and NISP-related). Forthcoming mandatory 'net gain' of biodiversity will substantial intensify this driver for the infrastructure sector. Planning policy is less of a driver for the land management sector (which is less subject to planning control) and the insurance/financial services sector (which is only indirectly affected by planning control).

Agricultural policy is a key driver for the land management sector, notably policy signals that agricultural subsidies will be redirected post-Brexit to payment for environmental public goods.

Water utilities are driven in particular by water quality regulations, notably the requirements of the Water Framework Directive and Ofwat. The 2019 Price Review is expected to expand the environmental obligations of water utilities to encompass natural assets.

Global level initiatives

The SDGs act as a driver across all three sectors. The TCFD is particularly influential in the insurance/financial services sector.

Corporate policies, strategies

Corporate policies and strategies, which increasingly prioritise sustainability and resilience, are key drivers of activity relating to the measuring and valuing of natural assets in both the infrastructure and land management sectors.

Cost considerations

Cost was noted as a key driver for the land management sector, with specific reference to water utilities. While cost considerations were not mentioned by the land management or insurance/financial services sectors as key drivers, they are likely to be so.

Drivers specific to the finance sector

The insurance/financial services sector is driven by a number of drivers that are less relevant to the infrastructure and land management sectors. These include increasing investor expectations relating to the environmental sustainability of investments and increasing client interest in such sustainability. Commercial markets however tend to impede consideration of the sustainability of investments due, for example, to the short term performance management and assessment criteria used in company valuations and remuneration structures.

Overview

In general, sector specific policy and legislation have been key drivers for the consideration of natural assets by the infrastructure and land management sectors. These sector specific drivers have now been boosted by the increasing cross-sector drive in UK environmental, industrial and agricultural policy to address natural assets, including through the NEWP, 25YEP, Industrial Strategy, Green Growth Strategy, forthcoming Environment Bill (including mandatory 'net gain') and post-Brexit agricultural policy. For the insurance/ financial services sector, global developments such as the SDGs and Paris Agreement, EU and UK climate targets, the TCFD and the EU Sustainable Finance Initiative have been important drivers. The increasing global and cross-sector national policy emphasis on natural assets has put in place a more productive policy landscape within which to find common ground across sectors.

4. Barriers and challenges to expansion of activity

This section outlines the barriers and challenges to expansion of activity in relation to measuring and valuing natural assets, as revealed through the three Round Tables. Barriers and challenges are categorized and some elaboration is provided to aid cross-sector understanding. Similarities and differences in barriers and challenges between sectors and the likely causes of these are identified.

4.1 The infrastructure sector

Key barriers and challenges to the expansion of activity in relation to measuring and valuing natural assets in the infrastructure sector include:

Knowledge gaps

Round Table participants identified barriers and challenges relating to missing knowledge and innovation. This included: knowledge and innovation on financing for natural capital; knowledge on how to differentiate between public and private benefits, and between local, national and global benefits, in natural capital accounting; knowledge on ecosystem thresholds and tipping points as well as on marginal change in ecosystem services; knowledge on how to address recycling and other waste management practices (such as anaerobic digestion of waste to feed back in to soil) within natural capital assessments.

Data issues

Round table participants identified a range of barriers and challenges relating to data. This included: absence of good quality data; insufficient granularity in the data; data on ecosystem services tends to be generic and not specific to the infrastructure in question; lack of data to support valuation of less tangible ecosystem services.

Issues around approaches, methods, tools, metrics, standards

Round table participants identified a plethora of approaches, methods and tools for the measurement and valuation of natural assets, fast-moving developments in approaches, methods and tool for assessment and accounting, and the absence of standards in this respect, as key challenges. Different approaches, methods and tools give different answers and one can almost select approach, method and tool to give the preferred answer. The lack of standards – including agreed terminology that works across sectors – is moreover a barrier to reaching consensus among stakeholders.

While there is a need for the standardisation of approaches, methods and tools, Round Table participants noted the challenge of catering to the differing needs of different kinds of infrastructure companies. For example, water companies are asset-centric, others less so. There is equally a challenge in developing approaches, methods and tools that work across multiple scales, from site to corporate supply chain to investment portfolio.

Round Table participants identified the complexity of natural systems as a key challenge.

Approaches and methods need to be simple enough for businesses to apply in a cost-effective way, but at the same time must not be overly reductionist to the point that they do not adequately reflect reality. A specific issue in this content relates to assessing equivalence between development impacts on nature and offsets, in particular where the offset is of a differing habitat type and/or distant from the impact.

Developing measurement and valuation approaches and methods that bring together biodiversity, natural capital and ecosystem services is also a challenge. Work is ongoing to incorporate biodiversity within the NCP, led by the Cambridge Conservation Initiative with the Natural Capital Coalition.[92]

Regulatory constraints

The absence of a mandatory requirement for biodiversity net gain in development planning is a barrier to scaling proper accounting for development impacts on natural assets. On the other hand, the heavy regulation of water utilities is a barrier to innovation, as regulators are unwilling to accept uncertainty associated with green solutions. Safety regulations, for example relating to nuclear power, or to rail infrastructure, are also a constraint on the uptake of green solutions.

Issues related to knowledge generation and exchange, awareness and training

Round Table participants identified securing cross-organisational understanding and buy-in for the consideration of natural assets in business decision-making as a key challenge.

Many companies in the infrastructure sector are dominated by engineers, who are focused on built assets and typically unfamiliar with concepts related to natural assets. This challenge relates to building and communicating a convincing case, demonstrating the relevance of measuring and valuing natural assets at Board level – in terms of the impact on risk, return and reputation – and building internal capacities and resources for this.

4.2 The land management sector

Key barriers and challenges to the expansion of activity in relation to measuring and valuing natural assets in the land management sector include:

Knowledge gaps

Round Table participants identified barriers and challenges relating to knowledge gaps, including: what natural assets exist and what ecosystem services these assets supply; the value of ecological connectivity within natural capital thinking; the relative performance of green versus grey infrastructure (e.g. natural flood management, constructed wetlands, upland restoration; effects of grey infrastructure on downstream assets).

Data issues

Round table participants identified a range of barriers and challenges relating to data. These included: availability of relevant data at land parcel scale; missing national datasets (e.g. recent data on priority habitats); availability of data relevant to complex supply chains; availability of relevant earth observation data; high costs of obtaining new data on, and monitoring of, natural assets.

92 Natural Capital Coalition — Biodiversity

Issues around approaches, methods, tools, metrics, standards

Round Table participants identified a range of barriers relating to approaches, methods, tools and metrics including: lack of standard metrics and valuation methods; difficulty in obtaining full accounts; lack of simple accounting methods for use at farm scale; scaling accounts from farm to corporate scale; dealing with qualitative data in accounts; dealing with complexity of ecological-social-economic systems; dealing with biodiversity in accounts; issues around putting values on nature – what should and should not be monetised; incorporating natural capital accounts in corporate decision-making.

Regulatory constraints

Round Table participants identified various regulatory constraints that obstruct investment in natural assets, including: single focus regulations and consequently multiple regulatory frameworks for multiple sectors dependent on and/or impacting the same natural assets; low tolerance of uncertainty in some regulatory frameworks (e.g. relating to water quality).

Challenges around investing in natural assets

Round Table participants identified challenges around securing investment in natural assets including: dealing with multiple asset owners and multiple ecosystem service beneficiaries at landscape/catchment scale; linking farm-scale interventions with landscape/catchment scale needs; the absence of suitable brokers for landscape/catchment-scale investment in natural assets involving multiple players; the absence of reliable models and scenarios to predict capital growth and revenue streams from investment in natural assets; securing return on investment in natural assets; the disconnect between natural capital value, land value and market price and the related difficulty in incentivising investment in natural assets; incentivising farmers to manage land for, and innovate in favour of, natural assets.

Issues related to knowledge generation and exchange, awareness and training

Round Table participants identified challenges around communication and awareness of issues related to measurement and valuation of natural assets, including: the absence of shared visions/frameworks for natural assets, at national, regional and catchment scales; communicating natural asset considerations with landowners and managers, and across landowning corporations; limited public recognition of the public goods benefits arising from private sector investment in natural assets; and problems with terminology/language.

4.3 The insurance/financial services sector

Key barriers and challenges to the expansion of activity in relation to measuring and valuing natural assets in the insurance/financial services sector include:

Data issues

Round table participants identified a range of barriers and challenges relating to data. This included: data availability; data quality; appropriate granularity of data; data interpretation; limited resources for longer-term monitoring and datasets; and the challenge of verifying impact without costly ground-truthing.

Issues around approaches, methods, tools, metrics, standards

Round Table participants identified a range of barriers relating to approaches, methods, tools and metrics including: the plethora of valuation techniques, tools and metrics and questions around their credibility; the complexity of biodiversity and the related challenge to develop simple metrics; the absence of ideal metrics and the need for proxies; difficulties in applying methods and tools across differing scales from asset level to corporate to investment portfolio; and difficulties in comparing risk and impact between assets and companies and investment portfolios given the geo-specific nature of natural capital.

Challenges around investing in natural assets

Round Table participants identified a range of market constraints to investing in natural assets, including: the challenge to demonstrate a return on investment in natural assets; the absence of markets for natural assets; demonstrating the materiality of biodiversity and natural capital in investment.

Issues related to knowledge generation and exchange, awareness and training

Round Table participants identified a range of constraints relating to research and innovation, knowledge exchange and training, including; limited UKRI funding available for co-creation of research by business and academia[93]; limited training in hard, technical and numerical skills in doctoral training programmes; shortage of skills, knowledge and interfaces across the project pipeline, among proponents, brokers and investors; absence of an accepted vocabulary relating to biodiversity and natural capital in particular for the insurance/financial services sector.

4.4 Cross-sector commonalities and differences

A number of commonalities and differences in terms of barriers and challenges to measuring and valuing natural assets can be identified across the three broad sectors addressed by the three Round Tables.

It should be stressed here that no mention of a barrier/challenge in one or another of the Round Tables does not necessarily mean that the sector does not face a specific barrier/challenge – simply that no example was brought up at the Round Table.

Knowledge gaps

Both the infrastructure and the land management sectors identified barriers relating to knowledge gaps whereas knowledge gaps were not specifically identified as a barrier by the insurance/financial services sector – though it seems unlikely the sector does not face knowledge gaps.

The infrastructure and land management sectors specified somewhat differing knowledge gaps but it is likely that most of the gaps identified are of relevance to both sectors, e.g. knowledge on ecological thresholds and tipping points, and performance of green infrastructure versus grey.

93 UKRI funding, other than through Innovate UK, typically funds only the academic component of a project, limiting the ability of business to engage in co-creation of research, while Pathways to Impact statements are not scored in proposal evaluation, limiting the incentive for academia to seek co-creation with business.

The land management sector tended to stress gaps in more basic knowledge on the natural assets themselves and the ecosystem services they supply, whereas the infrastructure sector placed more emphasis on allocation of benefits among beneficiaries and at differing scales, and on knowledge and innovation on financing for natural capital. A waste infrastructure company noted a specific gap relating to how recycling may be addressed within natural capital assessments.

Data issues

All three sectors identified barriers and challenges relating to data. A number of these are shared between the sectors, such as data availability, data quality and appropriate granularity of data. Both the land management and insurance/financial services sectors identified costs of longer-term monitoring and datasets as a constraint and this is likely to apply also to the infrastructure sector. Sector specific data issues for the infrastructure sector included missing natural assets data specific to the infrastructure in question, and for the land management (including food and beverages) sector data relevant to complex supply chains.

Issues around approaches, methods, tools, metrics, standards

All three sectors identified barriers and challenges relating to approaches and methods, tools, metrics and standards. For all three sectors, the plethora of available approaches, methods, tools and metrics, fast moving developments in these, and the absence of standards in this respect, was identified as a key challenge. All three sectors mentioned the challenge of applying methods across differing scales – from site to corporation to supply chain to investment portfolio, with the focus more on site and company scale for the infrastructure and land management sectors, and more on portfolio scale for the finance sector. All three sectors also highlighted the challenges involved in measuring and valuing biodiversity and integrating this in natural capital assessments and accounts. All three sectors highlighted the challenge in developing simple methods that nonetheless reflect the complexity of natural-socio-economic systems.

The land management sector highlighted challenges around 'partial accounts', dealing with qualitative data in accounts, and agreeing on what should and should not be monetized.

Regulatory constraints

Both the infrastructure and land management sectors identified regulatory constraints to uptake of the measurement and valuation of natural assets, whereas regulation was not identified as a constraint by the insurance/financial services sector. The emphasis however differed between the infrastructure and land management sectors in this respect. The infrastructure sector identified the absence of mandatory net gain (net gain is expected to be mandated in the forthcoming Environment Bill) and inflexible regulations on water quality (water utilities) and safety (transport and energy companies) as key constraints. The land management sector instead identified conflicting multiple regulatory frameworks across sectors, relating to the same natural assets, as a key constraint.

Challenges around investing in natural assets

Securing investment in natural assets was a challenge identified by both the land management sector (largely from the perspective of the investment proponent) and the insurance/financial services sector (from the perspective of the investor). Both sectors identified challenges around securing a return on investment in natural assets. The land management sector highlighted issues relating to multiple asset holders and ecosystem services beneficiaries, the absence of suitable brokers, and the disconnect between natural asset values and land prices. The finance sector highlighted the absence of suitable markets, and challenges in demonstrating materiality of biodiversity and natural capital in investment.

Issues related to knowledge generation and exchange, awareness and training

All three sectors identified challenges related to these issues though the emphasis varied between sectors. The infrastructure sector highlighted the challenge in securing corporate buy-in for the consideration of natural assets in business decision-making – perhaps a particular challenge in a sector dominated by engineers. The land management sector instead highlighted a broader communications and awareness challenge both within corporations and with external stakeholders including multiple landowners and beneficiaries at catchment scale. The insurance/financial services sector highlighted the limited research and innovation funding for co-creation of knowledge between academia and the sector, limited relevant training and a shortage of skills across the investment project pipeline.

5. Cross-sector research and innovation needs

This section outlines the cross-sector research and innovation (R&I) needs in relation to measuring and valuing natural assets, as revealed through the three Round Tables. R&I needs specific to one or more sectors are also identified. R&I needs are categorized and some elaboration is provided to aid cross-sector understanding.

The categorization below is intended to assist understanding of the main thrust of each need, and does not reflect any particular scheme. Many of the R&I ideas touch on more than one of the categories and many ideas are inter-linked across categories.

Research and innovation needs identified by the three Round Tables in general flow logically from the preceding analysis of existing activity and direction of travel, drivers of activity and key barriers and challenges. However, there may be some needs which logically arise from the foregoing barriers and challenges which were however not voiced in the Round Tables and thus do not appear here as needs.

5.1 Business-oriented R&I

A key theme coming through from the three Round Tables is **the need for R&I in relation to natural assets to be better focused on business and policy needs.**

Key to this is:

- **creation of suitably-framed R&I funding instruments** that are designed to incentivise R&I that meets business and policy needs;
- **increased investment in the co-creation of R&I relating to natural assets,** involving research funders, business and academia, in the design and development of Announcements of Opportunity;
- **appropriate partnership between business and academia in R&I proposals** in response to funding opportunities;
- **appropriate representation of business and academia on proposal evaluation panels;**
- **co-direction by business with academia of funded R&I programmes/projects,** with a view to ensuring that outputs meet business needs and are framed through a business lens.

In general, there is a need to **better broker interaction across academia, business and policy** in this complex, multi-disciplinary, multi-sector space, with a view to identifying and delivering the required knowledge, data, frameworks, approaches, methods, tools, metrics and models to accelerate business decision-making and investment in measuring, valuing, protecting and enhancing natural assets, ensuring appropriate synergies and avoiding duplication of effort.

5.2 Basic research on natural assets

The infrastructure and land management sectors both identified needs for basic research on natural assets to underpin measurement and valuation. R&I needs include: (a) filling knowledge gaps on what natural assets **exist and what ecosystem services they supply** and how these relate to economic values and existing market pricing; (b) **identifying which natural assets, UK-wide, are closest to critical tipping points** and what interventions are required to avert these tipping points; (c) **Improving understanding of the links between soil health and water quality.**

5.3 Data for business

Assessing data needs and provision

A key need raised by the Round Tables with both the land management and the insurance/financial services sectors, and likely to apply also to the infrastructure sector, is to assess **what data on natural assets is optimally required** to integrate consideration of natural assets in business decision-making, **to what extent this can be met by existing monitoring and datasets and to what extent new monitoring and datasets are required.** Given that data cannot be expected to be comprehensive/ideal, such an assessment would need to consider how much uncertainty businesses in each sector can work with.

Linked to the above, and likely to apply across the three sectors, is the need to **clarify, for business, the roles of the various players in gathering, interpreting and packaging data on natural assets.** Many bodies gather, interpret and package relevant data– who gathers, interprets and packages what data and what roles should be played by these players in optimising data provision for business?

Any such assessment and clarification is likely to require an iterative process working with business; businesses may not always know, at the outset, what data could be of most use to them, while data providers may not always understand, at the outset, what data might be of use for business and in what form this might most usefully be provided. This can build on relevant work already done by organisations including the Natural Capital Committee, JNCC and CEH. [94]

Making existing data accessible and useful

All three Round Tables identified needs relating to **enhancing access to and utility of existing relevant data.** Data arising from UKRI-funded research is typically open access – but often scattered, and/or formatted in a manner that is not immediately appropriate for business. There is a need to enable business to look up relevant data, in relevant formats, quickly and easily. As an example of meeting this need, the UK Government is in the process of making parts of the Ordnance Survey MasterMap freely available; [95] this opens up opportunities for mapping of natural assets and related natural capital accounting.

Another example of meeting this need, cited by the finance sector, is the IBAT tool. [96] The land management sector however noted that there are restrictions on use of the publicly funded UK soil map (copyright held by Cranfield University); [97] there is a need to make this freely available.

Enhancing access to and utility of data may involve development of **algorithms and statistical techniques to interpret key datasets** in support of business decisions.

The infrastructure sector noted that beyond enhancing access to data, there is a need to **ensure data is at the required level of granularity** and **enable querying of datasets** so that businesses can obtain **data specific to the site of business operation.** The finance sector noted the large volume of quality data in Biological Record Centres and collected by volunteer networks and suggested **better use could be made of volunteer data** through links to academia and business.

The finance sector identified a need to **re-purpose relevant data to inform financial decision-making** – e.g. data gathered for scientific research, or for compliance purposes such as reporting to the Water Framework Directive, can be re-interpreted and re-purposed to inform financial decisions.

94 For example, CEH work on environmental data management, work of the LWEC Ecosystem Task Force on development of a monitoring action plan for biodiversity, natural capital and ecosystem services

95 https://www.ordnancesurvey.co.uk/about/news/2018/mastermap-announcement.html

96 https://www.unep-wcmc.org/resources-and-data/ibat

97 https://data.gov.uk/dataset/ea1442bf-ba77-42cc-80e7-2ea339ccb28a/natmap-national-soil-map

Filling key data gaps

Both the land management sector and the insurance/financial services sector Round Tables identified a need to **fill key data gaps with reliable, comprehensive datasets in processed/usable form.** The land management sector identified for example, (1) an updated dataset on Priority Habitats; (2) datasets on the wider countryside (beyond priority habitats); (3) a national tree canopy map; (4) datasets relevant at land parcel scale; (5) datasets relevant to complex agricultural/food supply chains.

The insurance/financial services sector identified needs to **provide coherent data across spatial scales,** from field parcel scale and asset scale to corporate level to investment portfolio level to global level, allowing for aggregation across these scales. The sector also called specifically for a **global map of geo-location of the real economy (financial assets, companies)** allowing analysis of supply chains and the natural assets they rely on.

Data quality assurance

The insurance/financial services sector Round Table identified a need to **enhance transparency on data quality.** Including datasets used by intermediaries that work with investors. What level of confidence can be attached to each dataset? How reliable is the data to underpin investment decisions?

Monitoring including remote sensing

The insurance/financial services sector – and to some extent the land management sector – highlighted the need **to enhance long-term monitoring datasets including through use of remote sensing.** Such datasets are of particularly high value to investors who are typically far removed from the ground and need to understand investment impact. There is a need to deliver relevant datasets in a form useful for investment and insurance decision-making; most long-term datasets are currently compliance driven and may not offer the right kinds of data or in the right form for investment and insurance. Linked to this is a need to **assess the role that can be played by earth observation of various spectra and resolution in supplying relevant data and data products.** This also involves **development of algorithms** that can deliver relevant near-real-time data on natural assets at relevant spatial scales.

There is a need also to consider **what further technological development in satellite imagery may be required** to improve data on natural assets for insurance and investment purposes.

The land management sector identified a need to **review the utility of drones and other remote sensing technology to monitor natural assets at farm scale.**

5.4 Frameworks, standards, models, metrics and other tools for business

All three Round Tables identified needs in relation to the development of frameworks, standards, models, metrics and other tools for the measurement and valuation of natural assets.

Developing coherent frameworks and standards

The infrastructure sector identified a need for coherent **frameworks and standards that work flexibly across sectors** for measuring and valuing natural assets.

There is a need in particular to **develop a common currency for valuation of natural assets** that can capture both monetary and non-monetary values and help ensure that natural assets are given due weight in decision-making.

The land management sector called specifically for a **consistent natural capital accounting framework that works across the variety of land management contexts** with standardised metrics and valuation methods applicable at farm and corporate scales. This framework should address the extent to which accounts should be full (as opposed to partial) and to what extent can/should they include qualitative elements.

Bringing together, consolidating and validating methods, tools and metrics

The infrastructure and insurance/financial services sectors both noted a need to **bring together the plethora of existing methods, tools and metrics** for measurement and valuation of natural assets, **consolidate and enhance interoperability of these methods, tools and metrics** where this is appropriate, **validate methods, tools and metrics,** and **help businesses select the right ones for the right purposes.**[98] Linked to this is a need identified by the infrastructure sector to **develop agreed common definitions/terms** relating to the measurement and valuation of natural assets.

The land management sector specifically identified a need to **review the Environment Agency's natural capital calculator in relation to enforcement undertakings** and assess to what extent this delivers uplift in natural assets.

Developing new methods, metrics and tools

Notwithstanding the plethora of existing methods, metrics and tools, there remains a need for new ones, in particular **methods, metrics and tools specifically oriented for business applications.** The insurance/financial services sector called in particular for: (a) methods/tools that are not overly reductionist (e.g. in treatment of biodiversity and ecosystem services), but at the same time not overly complex; (b) methods and tools that combine valuation of both natural and social assets/capital; (c) methods and tools that integrate consideration of marginal change, thresholds and tipping points in ecosystems. The land management sector identified a need for tools that deliver simplified output (e.g. up/down arrows) for hands-on farm and estate management.

The infrastructure sector instead identified a need to **map ecological opportunity at scale** (UK or country scale) to identify where investment in natural assets can deliver 'biggest bang for the buck' in terms of ecological benefit – including research on equivalence of natural assets across habitat types and locations. A number of counties have already done such mapping.[99] This can help businesses contribute to ecological restoration through forthcoming mandatory 'net gain' requirements, and respond to the need to address connectivity to build resilient ecosystems.

Finally, the land management sector identified a need to **develop models and scenarios that link land management to the ecosystem services 'cascade'** (natural assets → ecosystem function → ecosystem services → benefits → values); there is a need for better understanding of how land management affects this cascade.

98 There would be a need to consider to what extent such functions are addressed by existing and forthcoming initiatives, e.g. Natural Capital Coalition's, Natural Capital Toolkit, Ecosystem Knowledge Network's, Tool Assessor, EU H2020 Valuing Nature Network, We Value Nature, The Social and Human Capital Coalition

99 The Nature Recovery maps produced by the wildlife trusts are relevant, see, https://www.wildlifetrusts.org/nature-recovery-network. The CEH landcover map is also of relevance here: https://www.ceh.ac.uk/services/land-cover-map-2015

Natural capital accounting

The infrastructure and land management sectors identified knowledge needs relating to natural capital accounting (NCA), including: (a) **research on appropriate boundaries for NCA,** e.g. to what extent should valuation include upstream and downstream impacts and dependencies, how do you value local versus global benefits, and what should be excluded from the valuation and simply retained as uncertainty; (b) **developing approaches to incorporate ecological connectivity in NCA** (e.g. between high-nature-value habitats, across landscapes and landowners); (c) **applying NCA to decision-making on grey versus green infrastructure;** (d) **integration of the circular economy (recycling, re-use) and life-cycle assessment with NCA** to enhance relevance to the waste sector.

5.5 Pilots, demonstration, scaling of new business models and solutions

Both the infrastructure and land management sector Round Tables identified R&I needs in relation to piloting, demonstrating and scaling new business models and solutions that integrate consideration of natural assets. There are commonalities in particular around needs at catchment scale.

Scaling uptake of natural capital thinking by business

The infrastructure sector highlighted R&I needs related to scaling uptake of natural capital thinking by business. This included: (a) **research on how to accelerate uptake by business of natural asset considerations in decision-making,** how to move beyond the front runners, get to scale – what lessons can be learned from the carbon emissions experience, or other issues which have gone to scale (e.g. antimicrobial resistance, AMR), what role for leaders, professional associations, etc?; (b) **proof of concept/demonstration of approaches and methods and peer-to-peer learning across sectors** in real-world market contexts – there is a role for academia working with business to translate research into practice, accelerate methodological improvements and enhance rigour and independence of findings; (c) **establishment of a pre-competitive space for innovation in relation to natural assets** – are there lessons that can be learned on this, e.g. from EPSRC work with the automotive industry?

Piloting and demonstrating at catchment and regional scales

The land management sector identified R&I needs in relation to the **development and implementation of the 14 regional Natural Capital Plans** proposed under the 25YEP[100] – these need to engage asset owners and be more than just Defra-family plans. The RSA Commission on the Future of Food, Farming and the Countryside has proposed national strategic land use frameworks[101], which would need to be linked to regional Natural Capital Plans. The Wildlife Trusts have developed 'Ecological Opportunity' maps (a Nature Recovery Network)[102] that are relevant in this context, helping to identify best locations for investment.

100 25YEP, p140: https://www.gov.uk/government/publications/25-year-environment-plan

101 https://www.thersa.org/globalassets/pdfs/reports/rsa-our-common-ground.pdf

102 A Nature Recovery Network to Create a Wilder Future https://www.wildlifetrusts.org/nature-recovery-network

Both the infrastructure and the land management sector identified a need for R&I that **pilots and demonstrates landscape/catchment-scale, cross-sector approaches to investing in natural assets through land management** – e.g. through action research in 'landscape laboratories', learning by doing with business to address questions such as: how can disparate regulations and regulatory bodies and sectors work together on natural assets to enhance public goods; how to engage multiple asset owners and ecosystem services beneficiaries; how to secure investment in multiple ecosystem services rather than just one or two with higher short-term value (e.g. flood risk reduction); how to manage inter-dependencies and trade-offs between services; how do approaches transfer between differing environmental, social and economic contexts; and what approaches and methods can be used to create and sustain the relevant partnerships?

Needs specific to the infrastructure sector

The infrastructure sector identified a need specific to the sector, namely **research and scenario building to identify key opportunities to enhance natural assets in relation to the UK National Infrastructure and Construction Pipeline.** This might include pilots/demonstrations for green infrastructure linked to a major development initiative (e.g. Oxford-Cambridge corridor), complementing the mandatory environmental assessments that developers will do with a view to optimising outcomes for natural assets.

Farm-focused needs

The land management sector identified a number of R&I needs focussed at farm scale. These included: (a) **running robust trials for post-Brexit agri-environment payments for public goods** to assess what works and what provides best value for money in terms of benefits to natural capital and ecosystem services – what does a farm system that delivers on natural assets look like?[103] (b) **developing a natural assets farm advisory service** to advise on what natural assets mean to individual farms, what practically can be done to enhance natural assets – to make it real for people 'at the coal-face'; (c) **building understanding on how to incentivise a basic level of good land stewardship** – without worrying too much about putting a value on things.

5.6 Developing natural asset markets, stimulating investment in business solutions

All three sectors identified R&I needs in relation to the development of markets that value and enhance natural assets and stimulating investment in business solutions relating to natural assets.

103 Defra is inviting environmental land management (ELM) trials but these might be enhanced and made more rigorous by additional R&I.

Regulation and policy for markets that value and enhance natural assets

All three sectors identified R&I needs relating to regulation and policy for markets that value and enhance nature. Needs include: (a) **assessing how to establish markets for natural assets that are good for both nature and society** – including consideration of equivalence of natural assets across geographical locations and habitat types; (b) assessing **what regulatory and policy change is needed to create and scale markets** that internalise public goods deriving from natural assets, generate return on investment in natural assets, and thereby drive due consideration of natural assets in insurance and investment decisions; this includes consideration of regulatory requirements for corporate reporting on natural assets (equivalent to the work of the TCFD); (c) **assessing what regulatory 'floor/ baseline' and what planning framework is required to enhance the basic level of good land management** – this includes social science research to ensure societal benefits.

Accelerating investment in natural assets

All three sectors identified need for R&I on accelerating investment in natural assets.

The insurance/financial services sector suggested **development of a road map for R&I in support of accelerating uptake of natural capital thinking by the insurance/financial services sector** including consideration of the key players (private sectors, public sector, third sector, academia) and their respective roles.

The infrastructure sector suggested; (a) **examining how biodiversity can be recognised by business as a 'material' issue,** e.g. in relation to return on investment or risk – what role might regulation, investor sentiment, etc. play in this respect and what knowledge is needed to assess this; (b) **research on how best to deploy finance for natural assets** – with a focus on what kinds of investments give greatest ecological returns; (c) **research on the bankability of projects/innovations that create/restore natural assets,** e.g. how to make a sufficient return on investment, how to incorporate the value of natural assets for climate change adaptation and/or mitigation (in terms of avoided costs) in investment decisions.

The land management sector suggested: (a) R&I to **develop new business models for investment in natural capital;** (b) a **review of approaches to brokering investment in natural assets with multiple beneficiaries** – what brokerage mechanisms are most effective? (c) research to **better differentiate who benefits from, and who pays for, investment in natural assets,** and how this might be adjusted to enhance investment in these assets, e.g. sustainable drainage in urban areas is paid for by the water utility but there are multiple beneficiaries (e.g. roads as less surface water, less flooding of houses).

Markets for soil natural assets

The land management sector identified a specific R&I need to **assess the relationship between soil health, costs of maintaining/restoring soil health, and market returns from agriculture in the medium- to long-term** – is there a clear return on investment, who benefits, who pays? What potential is there to develop a soil carbon market and what lessons can be learned from other carbon markets?

Linking natural capital value and commercial value

The land management sector identified a specific R&I need to **explore the relationship between natural capital value and commercial value (land prices, market prices, rental returns), with a view to engaging landowners/ managers** – this includes identifying which ecosystem service flows deliver benefits that can be monetized through existing markets, which have potential to be monetized through new markets, and which cannot be monetized.

Broader considerations

The land management sector identified a need for **research on the leakage effect** – to what extent does managing one land area for longer-term ecological resilience increase pressure to use other land in less sustainable ways, leading to no net gain or net loss, and how can this be addressed?

The infrastructure sector suggested research on the **ethics and risks of monetising and trading natural assets** and how to manage these ethical issues and risks. Such research is likely to be of value to all sectors.

5.7 Assessing risks and resilience in relation to natural assets

The insurance/financial services sector identified R&I needs on risks relating to natural assets. These needs include: (a) **natural assets and materiality** – pension funds are required to consider financial materiality in relation to investments, where are the emerging risks, to what extent may these be 'financially material', what might be the next 'dieselgate' in terms of natural assets? (b) **linking risk assessment with impact assessment** – how can insurance industry experience in modelling risk (considering hazard, exposure and vulnerability) be adapted to assess impacts of investment decisions? (c) **the intersection between physical risk and transition risk** – insurers and investors face increasing risk from degradation of natural assets, yet transition to more sustainable finance carries its own risks; how do these two areas of risk intersect and how can transition risk be mitigated to accelerate transition and reduce physical risk? (d) **stranded assets related to natural capital** – are there such stranded assets, what are they and where are they?

Related to these issues, the infrastructure sector identified a need for **research into the relevance and value of natural assets for business resilience in the face of climate change.** What would the 'do nothing' option mean in terms of resilience? What habitats and species offer greatest functionality for resilience?[104] How might investment in natural assets help meet corporate climate change objectives?

104 see: Davies, H. et al. (2014) *Review of literature – how transport's soft estate has enhanced green infrastructure, ecosystem services, and transport resilience in the EU.* Natural England Commissioned Report NECR169. ADAS.

5.8 Knowledge exchange, training and capacity-building

All three sectors identified R&I needs relating to knowledge exchange, training and capacity-building.

Academic/professional training and capacity-building

Both the infrastructure and the insurance/financial services sectors identified training needs. The infrastructure sectors called for **investment in new research and innovation skill sets** to meet the needs of business in relation to measuring and valuing natural assets – e.g. skills in natural capital valuation in practice, and in operating and communicating at the nature-business-finance interface. More specifically, the insurance/financial services sector suggested the **development of PhD programmes** that provide the relevant skills for academics to engage effectively with the insurance/financial services sector on natural assets – for example business modelling, risk analysis, monetisation of natural asset values.

Knowledge exchange

All three sectors identified needs relating to knowledge exchange from academia to business and vice versa, and within and across sectors.

The land management sector suggested R&I investment to **make better use of existing research output related to measuring and valuing natural assets for land management** including: collating and reviewing existing data, models, tools and knowledge; identifying what has practical relevance for land management; and translating this through a business lens to make it more useful for landowners and managers. This might involve organising materials according to user needs, e.g. by scale (land parcel, farm, corporate, supply chain, landscape) or by purpose (assessment, accounting, decision-making, reporting). The sector suggested also **collating real-world experience and good practice related to measuring and valuing natural assets for land management,** including from landowners and managers who are already piloting this, the Defra Pioneer Projects, experience from other EU countries, etc., and enhancing sharing of knowledge between actors.

The infrastructure sector similarly suggested **development of a knowledge hub** which brings together relevant knowledge and experience on measuring and valuing natural assets, including the business case for this, horizon scanning on this issue, linkages between business initiatives and academic R&I, and opportunities to take forward business-academia collaboration. This would need to be done in a safe environment allowing frank and open exchange between business and academia.

The insurance/financial services sector similarly suggested R&I investment to **facilitate knowledge exchange across the insurance/financial services** sector and with academia on how they are addressing natural assets – possibly involving periodic round-tables. A specific suggestion was to **require all research projects to produce a one page summary of each relevant research report,** reviewed by a business practitioner to ensure this is accessible to the insurance/financial services sector.

Raising awareness and understanding

All three sector Round Tables identified need for R&I investment in raising awareness and understanding on natural assets in business and among the general public.

The finance sector suggested that this might be facilitated by **developing a lexicon for communicating on natural assets** that is meaningful for the sector and can be embedded in existing decision-making processes. Sector-specific lexicons are likely to be useful for other sectors.

The land management sector identified a need to **develop a clear business case for landowners and managers to address natural assets in business decision-making** – what do the concepts of natural capital and ecosystem services mean for farmers, what language/terminology carries greatest traction, what are the drivers for farmers and how can we use these to make the case? Developing a sector-specific business case is likely to be useful for other sectors.

Both the infrastructure and land management sectors identified the need to **raise public awareness and shift public opinion on the importance of natural assets,** in order to create a groundswell of demand for investment in and restoration of natural assets – how can we make natural capital the next 'marine plastic'?

6. Extent to which needs may be met by recent/ongoing UKRI-funded R&I

This section provides a thematic analysis of recent and ongoing R&I supported by UKRI and which may be of relevance to the needs identified in Section 5. A thorough analysis of the extent to which this R&I meets the identified needs is beyond the scope of this paper.

6.1 Overview of recent and ongoing research activity

Infrastructure sector and land management sector

A recent scour of research databases using the terms 'valuing nature', 'green infrastructure', 'natural capital' and 'ecosystem services' identified over 650 relevant projects supported by UKRI, with a combined value of £350M. This is predominantly made up of research grants (75%).

It is likely that many of these projects may be producing output with potential utility to the infrastructure sector and land management sector though an analysis of this is beyond the scope of this brief paper. Moreover, the use of other search terms, for example 'environmental impact', 'offsetting', etc., might yield many more research projects of potential relevance.

Of the 650 projects identified with the above search terms, 24 contain the word 'infrastructure' in the title (see **Annex 2**). These projects are particularly likely to deliver output of relevance to the infrastructure sector.

Examples of projects likely to deliver outputs of relevance to the agriculture and land management sectors are shown in **Annex 3**.

Insurance/financial services sector

A recent scour of research databases using relevant search terms identified over 340 projects funded within the past 10 years (**Table 1**). These have a combined value of ~£250M. This is predominantly made up of research grants (67%) however there are also significant numbers of studentships (9%), fellowships (6%), collaborative R&D (4%) and feasibility studies (3%).

It is likely that many of these projects may be producing output with potential utility to the insurance and financial services sectors. A selection of the 240 projects identified and likely to deliver output of relevance to the insurance and financial services sectors is shown in **Annex 4**.

All three sectors

The extent to which projects work collaboratively with stakeholders – including business – varies, with some focussing on addressing specific gaps in scientific understanding whilst others take existing research and work with end users to maximise benefit to relevant sectors. In general, knowledge exchange is becoming an increasingly important aspect of successful funding bids and working closely with potential users to deliver beneficial societal impacts is a funding requirement.

Table 1: Numbers of projects funded within the past 10 years of relevance to the insurance/financial services sector.

Search Terms	Funding Organisation								Total
	AHRC	BBSRC	EPSRC	ESRC	Innovate UK	MRC	NERC	STFC	
Biodiversity AND Insurance							7		**7**
Carbon accounting			1	2	2		3		**8**
Carbon offsetting					2		2		**4**
Environmental economics		2	1	4			7		**14**
Green bond							1		**1**
Green finance				2			1		**3**
Green investment	1						1		**2**
Impact bond				2					**2**
Impact Investing				3					**3**
Impact investment				4	2				**6**
Mitigation banking		2	9	8	2	2	15	1	**39**
Natural asset AND Investment	3	1	37	26	36	1	31	1	**136**
Natural Capital AND Finance	1		3	18			30		**52**
Natural Capital AND Investment							1		**1**
Payments for ecosystem services			11	5	4	1	35		**56**
Sustainable finance				2					**2**
Sustainable investment			3	1	2	1	1		**8**
Total	**5**	**5**	**65**	**77**	**50**	**5**	**135**	**2**	**344**

6.2 Relevant research output — tools and methods

Many different tools and methods for measuring and valuing natural capital and/or ecosystem services exist. The Joint Nature Conservation Council and NERC funded a piece of work to help users to identify the most appropriate assessment tool. The resulting 'Tool Assessor'[105] is hosted by the Ecosystems Knowledge Network (**Table 2**).

This Tool Assessor looks at 14 of the most commonly used tools and methods and, for each, provides a comprehensive fact sheet detailing the input data required to run the tool, the form of output produced, the geographic scale over which it can be applied, the land uses that it considers, and the cost, software and skill requirements to operate it. This is an extremely useful and highly recommended resource for any person or organisation wanting to find out more about the tools available for natural capital assessment.

105 https://ecosystemsknowledge.net/resources/guidance-and-tools/tools/tool-assessor

Table 2: Overview of tools included in the Tool Assessor.

Tool	Multi Scale	No. of models	Environmental setting			Ecosystem service categories represented			Experience of use		Open access	Software		
			Terrestrial	Freshwaterr	Marine	Provisioning	Regulating	Cultural	UK	Outside the UK		Excel	GIS	Web based
ARIES	✓	11	✓	✓	✓	✓	✓	✓		✓	✓		✓	
Benefits of SUDS (BeST)		19	✓	✓		✓	✓	✓	✓		✓	✓		
Co$ting Nature	✓	7	✓	✓		✓	✓	✓	?	✓	✓		✓	✓
Eco Serv-GIS		10	✓	✓			✓	✓	✓		✓		✓	
GI Valuation Toolkit		14	✓				✓	✓	✓		✓	✓		
i-Tree Eco	✓	7	✓				✓	✓	✓	✓	✓	✓		
InVEST	✓	18	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
LUCI	✓	9	✓	✓			✓		✓	✓			✓	
Natural Cap. Planning Tool		10	✓	✓		✓	✓	✓	✓			✓		
ORVal	✓	1	✓					✓	✓		✓		✓	✓
Participatory GIS tool		5	✓	✓	✓			✓	✓		✓			✓
SENCE	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	
TESSA		10	✓	✓		✓	✓	✓	✓	✓	✓			✓
Viridian		5	✓	✓			✓		✓				✓	

6.3 Examples of relevant tools

The following are examples of tools of relevance to the three sectors addressed, developed through UKRI-funded R&I.

Relevant to the infrastructure sector

The excel-based Natural Capital Planning Tool (NCPT) [106] was initially developed through funding from the Royal Institute of Chartered Surveyors Research Trust, and subsequently tested, refined and delivered as an operational tool with funding provided by NERC.

The NCPT was developed to give local authorities, planners and developers a fit-for-purpose, easy-to-use tool enabling them to identify and deliver opportunities for environmental net gain, and also to assess the impacts a proposed development design may have on natural capital and ecosystem services over 25 years post-development.

The tool considers a range of ecosystem services including space for recreation, the mitigation of flooding events and air quality regulation as well as their associated health and wellbeing benefits.

The tool has been applied to Central Bedfordshire, which is facing considerable development pressure with anticipated population growth of 30% by 2036. In order to accommodate this, it is expected that around 40,000 homes will be built over the next 20 years (together with related infrastructure including roads, energy distribution, water and waste water). At the same time, Central Bedfordshire Council recognises that its environment is *"key to its identity and widely valued by our residents, visitors and businesses."* In this context, the NCPT was used to assess 8 potential sites brought forward for development in terms of both their location and design, against a policy goal of achieving 'environmental net gain.

The results from the NCPT application indicate that, in principle, all assessed sites offer opportunities for enhancement of natural capital. As shown in **Figure 2**, recreation, which includes the physical and mental benefits associated with activities such as walking, sport and leisure in a natural environment, is the largest potential benefit. Assessment of planning design was more mixed and highlighted the importance of working closely with the planners and developers to make the most of net gain opportunities where possible.

Central Bedfordshire Council concluded that this approach provided an objective and simple means of assessing proposals put forward, working collaboratively with site promoters to negotiate enhancements to master-plans, and providing a measure of whether proposals are capable of achieving net gain in natural capital.

Figure 2: Example output from the Natural Capital Planning Tool for one of the sites assessed.

	Development Impact Score Average Per-Hectare		
Ecosystem Service	Max possible	Adjusted Scores	Min possible
1. Harvested Products	+0.2	-2.33	-3.0
2. Biodiversity	+4.6	+0.27	-0.4
3. Aesthetic Values	+6.6	+0.98	-3.4
4. Recreation	+10.0	+4.68	+0.0
5. Water Quality Regulation	+2.3	+0.02	-2.3
6. Flood Risk Regulation	+3.0	+0.51	-0.0
7. Air Quality Regulation	+0.8	+0.11	-0.4
8. Local Climate Regulation	+5.4	+0.79	-2.7
9. Global Climate Regulation	+4.0	-0.32	-1.0
10. Soil Contamination		+0.00	
Development Impact Score		+4.71	

106 Natural Capital Planning Tool
http://ncptool.com

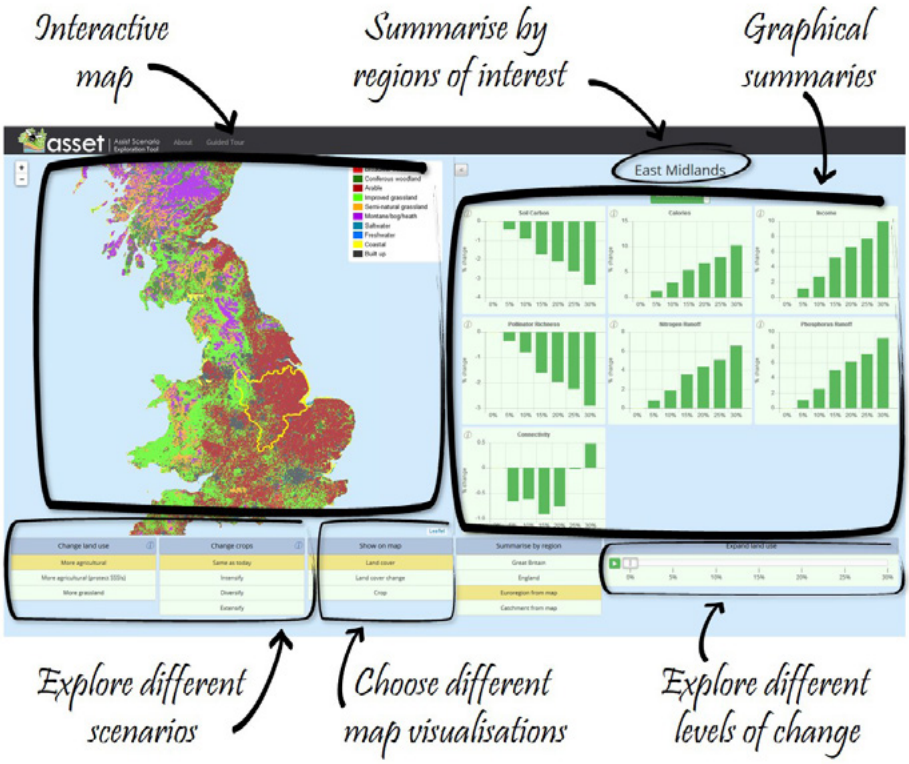


Figure 3: Screenshot from the Assist Scenario Exploration Tool (see http://assist.ceh.ac.uk/content/asset-assist-scenario-exploration-tool for more information)

Relevant to the land management sector

The NERC assist (Achieving Sustainable Agricultural Systems[107]) programme is a five-year £11 million research programme that, with support from the farming industry, will meet the challenge of feeding growing populations without causing unacceptable environmental damage. The Centre for Ecology & Hydrology in partnership with Rothamsted Research and British Geological Survey will develop innovative farming systems in collaboration with industry and stakeholders to: increase efficiency of food production, improve resilience to extreme events, and reduce the environmental footprint of agriculture. By bringing together this expertise in management of natural resources with crop production the programme will be able to examine fully the impacts of intensification on the wider environment, and develop synergistic farming systems that contribute towards environmental sustainability. The outputs of the assist programme are made available for stakeholders to explore and use (**Figure 3**) and ongoing feedback on how these can be optimised is welcomed.

This programme is funded by NERC as part of its national capability, which enables the UK to deliver world-leading environmental science, support national strategic needs, and respond to emergencies. National capability funding targets in particular research that integrates over at least national spatial scales and decadal time-scales.

assist will provide the community with validated biophysical models and data at the field and national scale, a UK-wide research infrastructure using commercial farms, and tools to explore and synthesise the data generated. It will provide opportunities for new partnerships between the wider academic community and industry to address critical knowledge gaps, including the socio-economic barriers to uptake and implementation of these new farming systems, and the integration of advances in crop breeding. Together these activities will support the agricultural industry in assessing the potential to meet ambitious goals for environmental sustainability whilst remaining competitive in the global market.

107 Achieving Sustainable Agricultural Systems https://assist.ceh.ac.uk/content/about-assist

Relevant to the insurance/ financial services sector

The valuation of natural assets as providers of ecosystem services has received a lot of attention over the past 10 years. Initially this work focussed on individual services, such as the carbon storage benefit of woodland, the flood mitigation benefit of upland and riparian habitats, and the health benefits of access to recreational green space.

For example, a 2016 study led by the University of California found that more than US$625 million in property damages were prevented in the U.S. during Hurricane Sandy in 2012 by coastal wetlands along the Northeast coast[108]. Scientists from the conservation, engineering and insurance sectors used the latest modelling techniques to study the impact of Hurricane Sandy when New York and New Jersey were badly hit by storm surges. Quantifying the economic value of natural defences supports their inclusion in risk models and raises other challenges such as the location of the natural defence and the location of the beneficiary – in this case the value of natural defence to properties accumulates as you move upstream away from the coast.

More recently, as complex processes have been better represented in mathematical models and computing power has increased, it has been possible to look simultaneously at multiple services. The Natural Environment Valuation Online (NEVO)[109], completed in 2018 and now available for trial combines multiple biophysical models run online in real time for the purpose of natural capital management and investment. It works across multiple land uses such as agriculture, livestock, woodlands and urban areas, and considers multiple benefits and trade-offs.

NEVO is intended to support informed, transparent and efficient environmental decision-making for a broad range of sectors, including valuing existing and new land use options, helping prioritise environmental interventions and investments and signposting those options that provide the greatest net benefits and value for money for the taxpayer.

Whilst natural asset valuation studies are becoming more prevalent, effective mechanisms for enabling private investment by companies who do not manage land themselves are still poorly understood. A 2017/2018 Valuing Nature Programme Placement, focussing on the Spey catchment in Scotland, set out to understand how private sector investments could be increased or diversified. The study found that whilst businesses recognise the importance of natural capital to their business success, this does not currently translate into significant investment. Despite business interest in diversifying and increasing their investments in the environment, they find it difficult to identify tangible returns on investment.

An ongoing EU-funded H2020 project is aiming to address this gap. Nature Insurance value: Assessment and Demonstration (NAIAD)[110] aims to operationalise the insurance value of ecosystems to reduce the human and economic cost of risks associated with water (floods and drought) by developing and testing – with key insurers and municipalities – the concepts, tools, applications and instruments (business models) necessary for its mainstreaming. Amongst other things, NAIAD aims to develop financial instruments and novel business models in support of the implementation of nature-based solutions.

108 Narayan, S., Beck, M. W., Wilson, P., Thomas, C. J., Guerrero, A., Shepard, C. C., ... & Trespalacios, D. (2017). The value of coastal wetlands for flood damage reduction in the northeastern USA. *Scientific reports*, *7*(1), 9463.

109 Natural Environmental Valuation Online
http://www.exeter.ac.uk/leep/

110 Nature Insurance Value: Assessment and Demonstration
http://naiad2020.eu

6.4 NERC Knowledge Exchange contacts

NERC currently funds several knowledge exchange activities focussing on natural capital and ecosystem services and with relevance to the infrastructure, land management and insurance/financial services sectors. These activities are targeted towards better collaboration between the academic and practitioner communities and are looking for opportunities to work closely with industry in order to understand how best use can be made of relevant science. Primary contacts for this are the NERC funded Knowledge Exchange Fellows.

- **Charlie Stratford**, Natural Capital and Healthy Local Economies.
- **Alister Scott**. Mainstreaming green infrastructure.
- **John Hillier**, Insurance Sector.

Further details of NERC Knowledge Exchange Fellows and their project details can be downloaded from the NERC Knowledge Exchange Fellowships[111] webpage.

6.5 Other knowledge resources

A number of platforms bring together relevant knowledge on measuring and valuing natural assets for business – the following list provides some relevant examples.

UKRI-funded

- Valuing Nature Programme[112] – UK interdisciplinary research programme funded by UKRI and Defra, with business engagement focus.

Other (non-UKRI)

- We Value Nature[113] – a recently started EU-funded research and innovation project which aims to accelerate uptake by business natural capital assessment, natural capital accounting, nature-based solutions and green infrastructure, with plans to address barriers and opportunities with the finance sector.
- Natural Capital Hub[114] – Managed by the Natural Capital Coalition, a global multi-stakeholder collaboration aiming to harmonize business approaches – see in particular the Finance Sector Supplement to the Natural Capital Protocol and related resources[115].
- Ecosystems Knowledge Network[116] – UK Network sharing knowledge on practice of putting environment at heart of decision making – currently running annual Natural Capital Investment Conferences[117].
- Cambridge Institute for Sustainability Leadership, notably the Natural Capital Impact Group[118] and Centre for Sustainable Finance[119] – CISL aims to empower leaders from the worlds of business, government and finance in environmental sustainability.
- EU Business @ Biodiversity Platform[120] – Includes work streams on natural capital accounting, innovation and finance – see for example a recent brief on Scaling Business and Biodiversity through Innovation and Positive Impact Finance[121].

111 NERC Knowledge Exchange Fellowships https://nerc.ukri.org/funding/available/schemes/kefellows/

112 Valuing Nature Programme http://valuing-nature.net/

113 We Value Nature https://wevaluenature.eu/

114 Natural Capital Hub https://naturalcapitalcoalition.org/hub/

115 Natural Capital Protocol – Finance Sector Supplement https://naturalcapitalcoalition.org/tag/finance-sector-supplement/

116 Ecosystems Knowledge Network https://ecosystemsknowledge.net/

117 Natural Capital Investment Conferences https://ecosystemsknowledge.net/naturalcapitalconference

118 Natural Capital Impact Group https://www.cisl.cam.ac.uk/business-action/natural-capital/natural-capital-impact-group

119 Centre for Sustainable Finance https://www.cisl.cam.ac.uk/research/centre-for-sustainable-finance

120 EU Business @ Biodiversity Platform http://ec.europa.eu/environment/biodiversity/business/index_en.htm

121 Scaling Business and Biodiversity through Innovation and Positive Impact Finance http://ec.europa.eu/environment/biodiversity/business/news-and-events/news/news-105_en.htm

7. Relevant UKRI funding instruments/programmes

This section provides an overview of relevant UKRI and Innovate UK funding instruments and programmes that might be suited to supporting the R&I needs identified in Section 5.

A large number of funding mechanisms exist to promote the exchange of knowledge from academia to business, policy and wider society, as well as to drive world-leading academic research related to real-world challenges. Funding is available from the EU, UK public bodies (including Research Councils, Innovate UK[122], national academies) as well as universities and the private sector. Each funder has their own rules for who is eligible to lead bids, who is eligible to receive financial support (i.e. Research Councils only fund academia whereas Innovate UK fund both business and academia), what subject areas they are willing to support, what criteria they use to allocate funding and how the application process operates. Universities may have funding drawn from Research Councils or through internal sources that they can use to facilitate academics working with business, policy and wider society.

As highlighted by the Dowling Review of Business-University Research Collaborations[123] (July 2015), support for business-university interactions is complex. The creation of UK Research & Innovation (UKRI)[124] in April 2018, a new organisation incorporating the seven Research Councils, Innovate UK and Research England, responds to the Nurse Review[125] of research councils. Although in its early stages, the creation of UKRI signals evolution in how the academic-policy-business interface as well as the interface between research disciplines (which crosses the boundaries between the seven research councils) are supported.

'Collective funds' (Annex 5, Table 1), which aim to drive high quality multi-disciplinary and inter-disciplinary research and innovation, are now an important and significant source of funding. Developing bids for these collective funds led by UKRI, such as the Industrial Strategy Challenge Fund[126], Strategic Priorities Fund[127], and Strength in Places Fund[128], requires collaborative working across UKRI, and with academic, business and policy partners.

122 Innovate UK https://www.gov.uk/guidance/innovation-apply-for-a-funding-award

123 Dowling Review of Business-University Research Collaborations https://www.gov.uk/government/publications/business-university-research-collaborations-dowling-review-final-report

124 UK Research & Innovation (UKRI) https://www.ukri.org/

125 Nurse Review https://www.gov.uk/government/publications/nurse-review-of-research-councils-recommendations

126 Industrial Strategy Challenge Fund https://www.ukri.org/innovation/industrial-strategy-challenge-fund/

127 Strategic Priorities Fund https://www.ukri.org/research/themes-and-programmes/

128 Strength in Places Fund https://www.ukri.org/funding/funding-opportunities/strength-in-places-fund/

NERC also works directly with the broad environmental science community, and research users, to identify priority research areas, topics and partnerships to take forward through our strategic research activities through core funding. Decisions to allocate funding to a new strategic research priority are primarily made through one of three routes: Joint strategic response (JSR)[129], Strategic Programmes[130] and Highlight Topics (HT)[131] (Annex 5, Table 2). The appropriate pathway depends on considerations such as the nature of the challenge, its scale and complexity. Each of these funding modes requires a community effort to develop and deliver, and NERC strongly encourages its partners to pitch ideas and work closely with its Head Office to explore the most appropriate models for collaboration and funding. NERC and the six other Research Councils, also support postgraduate training, with NERC supporting two distinct types of PhD training (Annex 5 Table 2): open (responsive) PhD training through Doctoral Training Partnerships (DTPs)[132], and focused (targeted) training to address key technical and academic challenges through Centres for doctoral training (CDTs)[133]. All current NERC funding opportunities are advertised[134].

Other organisations within and beyond UKRI also provide relevant funding opportunities (Annex 5 Table 3), including Innovate UK's Knowledge Transfer Partnerships[135] and Smart grants[136], and the Biotechnology and Biological Sciences Research Council (BBSRC) Industrial Partnership Awards[137] and LINK scheme[138]. Innovation opportunities offered by Innovate UK are advertised[139].

Not discussed in this report in any detail are funding opportunities from other parts of Government, for example Defra, or devolved administrations.

129 Joint strategic response (JSR) https://nerc.ukri.org/research/portfolio/strategic/joint/

130 Strategic Programmes https://nerc.ukri.org/research/portfolio/strategic/areas/

131 Highlight Topics (HT) https://nerc.ukri.org/research/portfolio/strategic/topics/

132 Doctoral Training Partnerships (DTPs) https://nerc.ukri.org/funding/available/postgrad/responsive/dtp/

133 Centres for doctoral training (CDTs) https://nerc.ukri.org/funding/available/postgrad/focused/cdt/

134 NERC funding news and calls https://nerc.ukri.org/funding/application/currentopportunities

135 Knowledge Transfer Partnerships https://www.gov.uk/guidance/knowledge-transfer-partnerships-what-they-are-and-how-to-apply

136 Smart grants https://www.gov.uk/guidance/smart-innovation-funding-for-game-changing-ideas-from-business

137 Industrial Partnership Awards https://bbsrc.ukri.org/funding/filter/industrial-partnership-awards/

138 LINK scheme https://bbsrc.ukri.org/funding/filter/stand-alone-link/

139 Innovation competitions https://apply-for-innovation-funding.service.gov.uk/competition/search?utm_source=innovateuk&utm_medium=website

8. Options for delivery of cross-sector R&I needs

In this section the authors suggest three options for delivery of the R&I needs identified in Section 5 above. These options are not necessarily mutually exclusive.

The three options are not explicitly linked to the specific R&I funding instruments outlined in Section 7. Rather, they provide a basis for discussion on what approach might be most appropriate going forward. Once there is consensus on the best option (or options), attention can be turned to how this might be funded (for example by UKRI, the private sector and others) and the funding instruments to be considered.

Section 5 of this report details a long list of R&I needs, some of which are more generic and/or systemic and others more specific. Further work is likely to be needed to validate, refine and prioritise this long-list and ensure that key needs have not been omitted. The R&I needs vary considerably in terms of the level of R&I investment implied; some may be relatively small and targeted pieces of work, while others are more systemic and substantial.

The very fact that the R&I needs have been expressed suggests that: (a) they are not met by existing R&I output; or (b) business is not aware of relevant existing R&I output; or (c) existing relevant R&I output is not reaching business in the required format. Further work may be needed to assess the extent to which the identified R&I needs may be met by existing R&I output, building on the work outlined in Section 6 of this report, before deciding on further R&I investment. There may be some scope for repackaging of previous research output to better meet business needs.

During the period of this work there has been ongoing re-enforcement of the relevance of natural assets and of the need to change our management of natural assets to halt decline and start recovery, in terms of economic, social and biodiversity value. The recent announcement that the UK is to move to mandatory biodiversity net gain for built development and the recent UK Government adoption of a net zero climate target are prime examples of how policy demands are running ahead of the R&I needed to assure delivery by the private sector.

One theme which characterises the entire spectrum of R&I needs is that they are driven by a commitment to act, which is shared by business and policy makers alike. The three options proposed here to meet these R&I needs all recognise that the goal of the R&I must be to accelerate progress towards the restoration of nature. This requires the practical and innovative application of coherent knowledge, gathered from diverse and disparate sources across disciplines, at a scale and pace aligned with business, government and civil society appetite to deliver systemic change.

8.1 Option 1: A centre/ hub to coordinate and catalyse UK R&I investment and knowledge exchange on natural assets

Most of the R&I needs identified in Section 5 are inter-connected both within and across the suggested categories of need, reflecting the inter-connectedness of natural, social and economic capital. This inter-connectedness is well understood by business, which is looking for a paradigm shift from a purely economic decision-making process based on owned assets and activities, to a value-based decision-making process which can account for both monetised and non-monetised aspects of natural (and social) capital as applied to the total economy, including both owned and non-owned assets and activities.

The recent IPBES report[140] has indeed highlighted the need for such 'transformational change' in our economies and societies – and the way markets work – if we are to slow and reverse the depletion of natural assets worldwide. R&I investment needs to support this transformation and reflect the scale and interconnectedness of the challenge across sectors, scales, geographies and disciplines.

Rather than seeking to deliver this R&I investment piecemeal, it may therefore be most effective to set up a centre/hub to coordinate and stimulate UK research, innovation and knowledge exchange related to natural assets, with a view to mainstreaming economically viable natural asset enhancement at the required scale and pace.

The purpose of such a centre/hub would be to meet the generic and systemic needs of both policy and business, as well as the specific needs of individual sectors, to ensure synergies and cost-efficiencies in R&I expenditure, prevent duplication of effort or worse, a proliferation of conflicting data, approaches, methods, tools, metrics and standards. The need for bringing more coherence and accessibility to current knowledge and experience in this field was palpable in the Round Tables – many participants commented on the value of bringing together the organisations in their sector to gain a better understanding of the current position, and the value of collaboration across sectors.

Such a centre/hub would need to be equipped with a substantial start-up and core budget and with staff and capacity to attract/leverage substantial additional R&I funding – from both the public and private sectors. It would bring together relevant knowledge and experience, build coalitions and consensus, prioritise investments, stimulate development of key datasets and related products, support development of frameworks, approaches, methods, tools, metrics and standards, support relevant piloting, demonstration and scaling activities (up to the point of commercialisation), help make the case for business consideration of natural assets, and promote relevant training and capacity-building, dissemination and communication.

Such a centre/hub could deliver a coherent body of work over a period of 10–20 years and help consolidate the UK's position as a leader in the field of natural assets – also expanding opportunities to export this expertise.

140 https://www.ipbes.net/news/Media-Release-Global-Assessment

During this period the proportion of funding from the public and private sector is likely to change; a higher proportion of public sector funding is likely to be required over the first 3–5 years, while increasing funding from private interests might be anticipated as the centre/hub builds value and reputation. This funding shift is likely to mirror a shift in the main beneficiaries, from the policy arena in the early years towards business and civil society later on, as application and scaling up of new knowledge and innovations occurs in the mainstream economy.

Such a centre/hub would only be effective if established with business interests fully embedded and led by staff having expertise at the interface between academia, business and policy.

Such a centre/hub might be adapted from the model of the existing Catapult Centres (see Annex 6). For an example of a Catapult Centre, see the Satellite Applications Catapult[141]. The Catapult Centre model may need adjustment, notably taking into account that there may initially need to be a higher proportion of public sector R&I investment. Business R&I investment may initially be limited pending greater business understanding of the potential benefits, and the regulation of natural asset markets underpinned by new policy. This is however already happening; for example, the mandatory approach to net gain for housing and infrastructure development, which the Government has announced will be introduced through the forthcoming Environment Bill, is likely to create a significant market for natural assets. Business R&I investment may increase as the role of natural assets in delivering the net zero climate target in 2050 is mapped out by the Committee on Climate Change and policy makers.

Any such centre/hub would complement the work of bodies such as the UK Natural Capital Committee (which advises government on natural capital), and the Natural Capital Coalition (which supports the uptake of natural capital thinking by businesses and governments worldwide).

8.2 Option 2: Addressing bundles of R&I needs through targeted programmes

A second possible approach to addressing the R&I needs identified in this report might be to put in place one or more thematic programmes, each programme picking up on a bundle of related R&I needs identified in this paper.

Such programmes would each require in the range of £10–20 million, depending on scope and partnership funding. Each would run for a period of around 5 years, and involve a number of R&I calls during its lifetime.[142] An example might be a programme to address the R&I needs related to developing natural asset markets and stimulating investment in business solutions (covering a number of the ideas presented in section 5.6).

Any such programme(s) would need to have a much stronger focus on co-creation and co-delivery with business, and positioning closer to market (at the innovation end of the R&I spectrum) than, for example, the current Valuing Nature Programme. The financial instrument adopted would need to allow for this.

141 Satellite Aplications Catapult https://sa.catapult.org.uk/

142 The current NERC Strategic Programmes offers a potential route to engage on big (£5M+) programme topics. Successful programme areas are typically launched for a c. 5–year period, and typically deliver a number of R&I calls during their lifetime. See for example the SPA programme on climate change investment here.

Clearly, a single, or even several, R&I programmes of this type and scale would only be able to address a part of the R&I needs identified in this report, and there would be a risk that investment fails to deliver the necessary coherence across the piece.

It is also less likely that this approach would capture the export value and international leadership from delivery of solutions that a fully integrated response could deliver. Nevertheless, a key objective should be to exploit these opportunities for the UK research and business communities to maintain and enhance the UK's international standing and economic advantage from leading-edge natural asset management.

8.3 Option 3: Addressing specific R&I needs individually through targeted projects

A third possible approach to addressing the R&I needs identified in this report might be to commission targeted pieces of research and/or innovation, the scale and duration of each piece depending on the nature of the need. These pieces might vary in scale and duration from a few tens of thousands of pounds, to several million, and from a few months to several years. Again, these would need co-creation and co-delivery with business. This may be a pragmatic and rapid means to address a small number of the identified needs, but carries a high risk of investment failing to deliver the necessary coherence across the piece. Such an approach would probably not be able to address the manifold needs to capture knowledge and innovation through business-led activities, as targeted projects would necessarily be narrow and deep and would only be able to engage with a small proportion of the wider activities and interests captured by the three round tables.

9. Next steps

This report has synthesised the findings of the three sector Round Tables, in terms of state of play and direction of travel, drivers for action, barriers and challenges and R&I needs, highlighting commonalities and differences in needs between sectors. It has set this analysis within the context of current and planned regulatory/policy developments and other initiatives relating to natural assets across the UK and globally; provided a rapid overview of existing relevant recent and ongoing R&I investments; and provided an overview of the range of available UKRI funding instruments. Finally, the report has put forward options to address the identified R&I needs, in order to support the urgent need to accelerate business uptake of and integration of natural assets.

This section outlines next steps to take forward this analysis and build consensus around priority R&I with a view to co-creation, with business and policy-makers, of a Natural Assets R&I Agenda, and with a view to accelerating the contribution of business to protecting and enhancing natural assets.

Consultation with relevant policy bodies

The sector Round Tables on which this analysis is based were deliberately focused on engaging business and seeking a business perspective, and did not set out to seek views from the policy or academic communities. However, accelerating business uptake of natural capital thinking with a view to protecting and enhancing natural assets with require close cooperation between the business, policy and academic communities.

A first next step would be to consult on this report with key players in the policy community – at the level of the UK Government and devolved administrations, to better understand the regulatory/policy context, as well as opportunities for collaboration and for leverage of other (non-UKRI) government resources. This consultation is likely to include Government departments engaged in the natural capital arena (Defra, BIS, Treasury – including the Dasgupta Review team), relevant non-departmental public bodies (e.g. Natural England, Environment Agency, Natural Resources Wales, Scottish Natural Heritage, JNCC, Office for National Statistics), the Natural Capital Committee, as well as business groupings engaged in informing and influencing policy in the natural capital arena (e.g. Natural Capital Coalition, Green Finance Initiative, UKWIR, Food, Farming and Countryside Commission, Climate Change Adaptation Sub-Committee).

Cross-sector workshop

Following consultation with the policy community, a key next step would be to prepare and convene a cross-sector workshop to review the analysis and options presented in this report, together with the additional intelligence obtained from the policy consultation, with a view to building cross-sector consensus around an optimal 'UK Natural Assets R&I Agenda' in support of business and policy.

This 'Agenda' would identify 'most promising' areas of R&I – in terms of potential benefits to both business and natural assets – and the respective roles of business, academia, NERC and other funders, and other key players, in taking these areas of R&I forward. It would also consider which of the options outlined in Part 8 of this report, or other options not yet considered, is/are most appropriate to meeting the prioritized needs, and seek to flesh out the most appropriate option in a strategic manner.

The workshop would need to involve business representatives (selected from among the sector Round Table participants, ensuring balanced representation of the three sectors), academics (selected for their ability to look across the piece and consider what R&I support academia can best offer to business) and representatives from the policy and NGO sectors (including potential co-funders).

The workshop report would provide a draft **Natural Assets R&I Agenda**, with fleshed-out ideas on key R&I needs, the role of academia and others, potential impact, funding needs and funding options.

Post-workshop consultation

Following the cross-sector workshop, there would be a need for follow-up consultation with potential funders (both public and private sector) to explore funding opportunities in depth and frame specific funding allocations.

This stage would also include more in-depth analysis of what relevant existing R&I output exists, in order to avoid any duplication of effort and confirm identified unmet needs, and more in-depth consultation with academia to explore what role academia can take in meeting the prioritised R&I needs.

Annex 1 — List of participants in the three Round Tables

RT1 — Infrastructure sector

Surname	Name	Position	Organisation
Canning	Kate	Associate & UK-MEA Research Champion	Arup
Church	Colin	Chief Executive	CIWM
Dobson	Jonathan	Sustainability Strategy Manager	United Utilities
Edmonds	Jamie	Head of Environment	Kier Utilities
Fletton	Mandy	Senior Programme Manager	UKWIR
Forrest	Libby	Policy & Parliamentary Affairs Officer	ESAUK
Gascoigne	Jon	Senior Risk Adviser Capital, Science & Policy Practice	Will Towers Watson
Holm	Colin	Senior Advisor (SD & Climate Change)	Highways Agency
Jones	Clive	Network Manager — Biodiversity and Infrastructure Carbon	Network Rail
Kakouratou	Melina	External Risks Engineer Infrastructure Protection	London Underground
Merriman	Jenny	Head of Natural Capital, Biodiversity & Net Gain	WSP
Nyul	Helen	Group Biodiversity Manager	Barratt
Patmore	James	Biodiversity Manager	HS2
Plester	Chris	Senior Sustainability Adviser	National Grid
Pratt	Sarah	Head of Corporate Sustainability	Barratt
Read	Adam	Director of External Affairs	Suez
Shaffer	Paul	Associate	CIRIA
Skelton	Mark	Executive Director	Temple Group
Wansbury	Claire	Associate Director of Ecology	Atkins
Winter	Hugo	Research Engineer — Extreme Weather and Statistics Specialist	EDF Energy
UKRI & VNP team			
Duke	Guy	Business Champion, Valuing Nature Programme	GD NatCap Ltd
Hails	Rosie	Director Biodiversity & Ecosystem Science and Head of Programme Coordination Team Valuing Nature Programme	CEH
Hughes	Ruth	Senior Programme Manager, Innovation Team	NERC
Stratford	Charlie	Knowledge Exchange Fellow	CEH
Weatherby	Anita	Programme Manager, Valuing Nature Programme	CEH
Young	Peter	Chair, Business Interest Group	Valuing Nature Programme

RT2 — Land management sector

Surname	Name	Position	Organisation
Atkinson	Nick	Senior Conservation Adviser — Evidence	Woodland Trust
Barden	Ruth	Head of Environment & Catchment Strategy	Wessex Water
Biddle	Bill	Estate Manager	Hampton Estate
Bridgewater	Sam	Head of Conservation and Wildlife	Clinton Devon Estates
Browning	Helen	CEO	Soil Association
Bullen	Clare	Strategic Catchment Manager	United Utilities
Cornwell	Sue	National Specialist Manager of the Natural Environment	National Trust
Curtis	Tom	Innovations Partner	3Keel
Deakin	John	Head of Forestry, Windsor Estate	Crown Estate
Dearsley	Jon	Associate Director	Savills
Dolby	Adrian	Head of Agriculture	Buccleuch Estates
Gerrard	Chris	Climate Change and Biodiversity Manager	Anglian Water
Kaushish	Rohit	Economist	NFU
Keyworth	Steve	Commercial Director	Environment Systems
Packer	Mike	Strategy and Business Development Lead	Berks, Bucks & Oxon Wildlife Trust
Plester	Chris	Senior Sustainability Adviser	National Grid
Rose	Paul	Chief Scientist	JNCC
Shephard	Rod	Economic Sustainability Manager	Sainsbury's
Siddiky	Shakera		Sainsbury's
Singleton	Peter	Research, Innovation & Evidence Manager	SEPA
Waters	Ruth	Deputy Chief Scientist	Natural England
Wells	Andrew	Head of Property	Crown Estate Scotland
Williams	Mark	Head of Environmental Science and Regulation	Scottish Water
UKRI & VNP team			
Duke	Guy	Business Champion, VN Programme Coordination Team	VN Programme Coordination Team
Hughes	Ruth	Senior Programme Manager, Innovation Team	NERC
Mitchell	Jodie	Senior Programme Manager, Innovation Team	NERC
Young	Peter	Chair, Business Interest Group	Valuing Nature Programme

Annex 1 — List of participants in the three Round Tables

RT3 — Insurance/financial services sector

Surname	Name	Position	Organisation
Bullock	Steven	Global Head of Research	S&P Trucost
Chimbwandira	Sarah Jane	Director	Surrey Nature Partnership
Gascoigne	Jon	Senior Risk Adviser Capital, Science & Policy Practice	Willis Towers Watson
House	Katie	Senior Analyst	Climate Bonds Initiative
Howard	Simon	Chief Executive	UK Sustainable Investment & Finance Association
James	Gemma	Senior Manager Environmental Issues	UN Principles for Responsible Investment
Maier	Stephanie	Director Responsible Investment	HSBC Global Asset Management
Mayerhofer	Eva	Lead Environmental & Biodiversity Specialist	European Investment Bank
McEntyre	Oliver	National Agricultural Specialist	Barclays
Ruggles-Brise	Archie	Partner	Spains Hall Estate
Seega	Nina	Research Director for Sustainable Finance	Cambridge Institute for Sustainability Leadership
Seimen	Michaela	Executive Director — Sustainable Debt Strategist	UBS
Smale	Robin	Director	VIVID Economics
White	Alex	Policy Manager (Finance)	Aldersgate Group
UKRI & VNP team			
Duke	Guy	Business Champion, VN Programme Coordination Team	VN Programme Coordination Team
Gillies	Rob	Head of Futures	NERC
Hughes	Ruth	Senior Programme Manager, Innovation Team	NERC
Mitchell	Jodie	Senior Programme Manager, Innovation Team	NERC
Stratford	Charlie	Business Development Manager	Centre for Ecology & Hydrology
Young	Peter	Chair, Business Interest Group	Valuing Nature Programme

Annex 2 — Projects of potential relevance to the **Infrastructure Sector**

This list was generated by searching the research database for the terms such as Natural Capital and Ecosystem Service, and then filtering out those whose title contains the word 'infrastructure'. More information about these projects can be found on the UKRI gateway[143] to publicly funded research and innovation.

143 http://gtr.ukri.org/

Funder	Reference	Title
NERC	NE/N017404/1	A Decision Framework for Integrated Green Grey Infrastructure (IGGIframe)
NERC	NE/R013853/1	A materials roadmap for marine infrastructure: a path towards enhanced ecological performance in a changing world
NERC	NE/N016971/1	A national benchmark for green infrastructure
NERC	NE/N017714/1	A National Scale Model of Green Infrastructure for Water Resources
NERC	NE/N017447/1	An Ecosystem Services Approach to Green Infrastructure Partnership Planning
NERC	NE/N019180/1	Arup Global Research Challenge: Delivering green infrastructure in cities through a new business model
NERC	NE/N018745/1	Arup Global Research Challenge: Novel technologies to understand relationships between green infrastructure and environmental quality in cities
NERC	NE/M008274/1	Co-creating railway flood resilience: applying the science of blue-green-grey infrastructure
NERC	NE/S00582X/1	Developing a 'GI4RAQ' platform to predict quantitatively the potential of strategic green infrastructure to improve roadside air quality at planning
NERC	NE/P01254X/1	EKN Tool Assessor: Facilitating the application of innovative tools in the assessment of ecosystem services, green infrastructure and natural capital
NERC	NE/R002681/1	Exchanging knowledge on the multiple values of urban green infrastructure in sub-Saharan Africa
NERC	NE/N017498/1	Green Growth: Increasing Resilience in Cities Through the Delivery of Green Infrastructure-based Solutions
NERC	NE/N013530/1	'Green infrastructure and the Health and wellbeing Influences on an Ageing population (GHIA)
Innovate UK	104014	Green Infrastructure Assets in Urban Heat Island (GIAUrban)
NERC	NE/M008169/1	Improved techno-economic evaluation of Blue Green Solutions for managing flood risk to infrastructure
NERC	NE/N017587/1	Injecting a Natural Capital Planning Tool into Green-Blue Infrastructure Management
NERC	NE/R009236/1	Integrated Green Grey Infrastructure Framework Accelerator
NERC	NE/R00398X/1	Mainstreaming green infrastructure in planning policy and decision making: Translating NERC science into a co-produced spatial planning toolkit
NERC	NE/N005325/1	Open KE Fellowship — MEDIATE: Overcoming barriers to MaximisE Data potential for better blue-green-grey InfrAsTructurE
EPSRC	EP/N029488/1	The systemic city: Infrastructure interdependency and complex value business models
NERC	NE/N017730/1	Tools for planning and evaluating urban green infrastructure — Bicester and beyond
NERC	NE/N017773/1	Tree Selection for Green Infrastructure
EPSRC	EP/N030095/1	Urban green infrastructure: optimising local food and fuel production for regional sustainability and resilience
NERC	NE/N017927/1	Valuing Green Infrastructure Through Tree Assessment TooLs (VITAL)

Annex 3 — Projects of potential relevance to the **Land Management Sector**

This list shows some of the over 650 research projects with potential relevance to the Land Management Sector. More information about these projects can be found on the UKRI gateway[144] to publicly funded research and innovation.

144 http://gtr.ukri.org/

Funder	Reference	Title
AHRC	AH/N006232/1	Valuing nature
BBSRC	BB/I000577/1	Linking agriculture and land use change to pollinator populations
BBSRC	BB/P022987/1	Restoring soil function and resilience to degraded grasslands
BBSRC	BB/P023274/1	VOICES: Valuing Orchard and Integrated Crop Ecosystem Services
BBSRC	BB/R00580X/1	Modelling Landscapes for Resilient Pollination Services in the UK
BBSRC	BBS/E/C/00005745	Quantifying ecosystem function and production in grassland landscapes
BBSRC	BBS/E/C/00005746	Enhancing biodiversity in productive agricultural landscapes
BBSRC	BBS/E/C/00005747	Characterising sustainable, adaptive land management systems
EPSRC	1928035	Data analytic technique for land parcel management
ESRC	1944085	Global telecoupling: Linking UK consumption to international natural capital dependencies
Innovate UK	700466	High speed transport tractor suitable for conservation agriculture
NERC	1806209	Investigating the impact of the electrification of transport to reduce carbon emissions on Natural Capital
NERC	1806247	Assessing the economic and conservation impacts of the pine marten, a recovering predator, non-native grey squirrels, and forest land management
NERC	1942319	Developing industry-led tools to improve water and flood defence infrastructure through natural capital
NERC	ceh020005	Natural Capital
NERC	NE/H012435/1	Restoration genetics of degraded forest landscapes: Land management and evolution of reproductive strategies in keystone tree species
NERC	NE/I00307X/1	Integrated Carbon, Water and Land Management for Poverty Alleviation
NERC	NE/I529390/1	Workshop/Seminar: Natural Capital Initiative Biodiversity Offsetting Workshops 2010: Workshop 2 (Scientific and environmental data needs) Workshop
NERC	NE/J014680/1	Biodiversity and the provision of multiple ecosystem services in current and future lowland multifunctional landscapes
NERC	NE/J015210/1	A hierarchical approach to the examination of the relationship between biodiversity and ecosystem service flows across coastal margins
NERC	NE/K015419/1	Supporting ecosystem services on commercial farms: using evidence to inform land management decisions
NERC	NE/K501396/1	South West Water/University of East Anglia collaboration: Reducing River Pollution by Payments for Ecosystem Services

Funder	Reference	Title
NERC	NE/N017587/1	Injecting a Natural Capital Planning Tool into Green-Blue Infrastructure Management
NERC	NE/N018125/1	Achieving Sustainable Agricultural Systems (ASSIST)
NERC	NE/N019504/1	Forecasting land management and extreme weather effects on earthworm populations, soil function and ecosystem services
NERC	NE/P006647/1	NEC05943 Natural Capital Knowledge Exchange to Support Healthy Local Economies (Open Call)
NERC	NE/P007716/1	Mechanisms and consequences of tipping points in lowland agricultural landscapes
NERC	NE/P011160/1	Yorkshire iCASP — Yorkshire Integrated Catchment Solutions Programme
NERC	NE/P01254X/1	EKN Tool Assessor: Facilitating the application of innovative tools in the assessment of ecosystem services, green infrastructure and natural capital
NERC	NE/P016944/1	Natural Environment Valuation Online (NEVO): Web-based tools for natural capital management and investment
NERC	NE/R002622/1	Natural capital assessments in the UK: facilitating Defra Pioneer Projects with NERC-funded research
NERC	NE/R004668/1	LANDWISE: LAND management in loWland catchments for Integrated flood riSk rEduction
NERC	NE/S009450/1	Exploring Local Implementation of DEFRA's 25 Year Plan: Learning lessons from embedding the Natural Capital Approach in a Northern Coastal City Region

Annex 4 — Projects of potential relevance to the **Insurance/Financial Services Sector**

This list shows examples of some of the over 340 research projects with potential relevance to the Insurance/Financial Services sector. More information about these projects can be found on the UKRI gateway[145] to publicly funded research and innovation.

145 http://gtr.ukri.org/

Funder	Reference	Title
EPSRC	EP/J005274/1	Transforming water scarcity through trading
ESRC	1917480	Challenges of accessing mainstream capital for impact investment
ESRC	ES/N013344/2	Delivering Inclusive Financial Development and Growth
ESRC	ES/L016028/1	Euro-China GE: Dynamics of Green Growth in European and Chinese Cities (DRAGON)
ESRC	ES/S011552/1	From philanthropy to impact investment: Private sector initiatives for development in Brazil and the UK
ESRC	ES/J018155/1	Measuring complex outcomes of environment and development interventions
ESRC	ES/P005241/1	Research on China's Financial System towards Sustainable Growth: The Role of Innovation, Diversity and Financial Regulation
Innovate UK	750947	Footprint Web Tool
Innovate UK	102417	Holistic spatial asset investment planning service
Innovate UK	730008	PES Development Project
Innovate UK	104217	PROVIT — Planning Requirements Optioneering Visualisation Investment Tool
Innovate UK	104215	Urban Greenspace Valuation Toolkit
NERC	NE/I022183/1	[Finance] Forest-Finance risk network: towards stable investment environments for forestry
NERC	NE/R014329/1	Coastal Ecosystem Recovery Financing for the Future (CERFF): developing insurance products to enhance response and recovery from tropical cyclones
NERC	NE/K501384/1	Developing a Payment for Ecosystem Service Scheme
NERC	NE/S009450/1	Exploring Local Implementation of DEFRA's 25 Year Plan: Learning lessons from embedding the Natural Capital Approach in a Northern Coastal City Region
NERC	NE/M008541/1	Forests at risk: Awakening the UK timber, forest carbon and forest insurance sectors to the threats of pests, disease and drought
NERC	NE/R006946/1	Linking ecosystem services and businesses through Green Bonds
NERC	NE/P016944/1	Natural Environment Valuation Online (NEVO): Web-based tools for natural capital management and investment
NERC	NE/I00341X/1	Safeguarding local equity as global values of ecosystem services rise
NERC	NE/P011217/1	South West Partnership for Environment and Economic Prosperity (SWEEP)
NERC	NE/K501396/1	South West Water/ University of East Anglia collaboration: Reducing River Pollution by Payments for Ecosystem Services
NERC	NE/G008531/1	Valuing rainforests as Global Eco-Utilities: a novel mechanism to pay communities for ecosystem services provided by the Amazon

Annex 5 — UKRI funding schemes

Table 1. UKRI-led collective funding schemes
(information as of 1 August 2019)

Scheme name	Focus of scheme	Funding
Industrial Strategy Challenge Fund https://www.ukri.org/innovation/industrial-strategy-challenge-fund/	The Industrial Strategy Challenge Fund (ISCF) launched in 2017 is part of UK Government's £4.7Bn investment in R&D over 4 years that will support the delivery of its Industrial Strategy[146]. It brings together leading research and business to tackle the big societal and industrial challenges today, focussed around the four 'grand challenges'[147] of the Industrial Strategy: clean growth; artificial intelligence and data; ageing society, and the future of mobility.	Through the first two waves of funding £986 million of government investment has been secured by 497 projects, in addition to almost £488 million of underpinning investment. Challenge areas shortlisted for future support under ISCF Wave 3[148] include: accelerating detection of disease, commercialising quantum, digital security by design, driving the electric revolution, future flight, industrial decarbonisation, manufacturing made smarter, sustainable plastic packaging and transforming foundation industries. The fund is delivered by UKRI, and provides funding for business and academics.
Strategic Priorities Fund https://www.ukri.org/research/themes-and-programmes/	The Strategic Priorities Fund (SPF) launched in 2018 and builds on the vision of a 'common fund' set out in Sir Paul Nurse's review. The SPF will support high quality research and development priorities[149], seeking to drive an increase in high-quality multi- and interdisciplinary research and innovation, encouraging funding for research that crosses boundaries between UKRI councils and government departments, and responding to strategic priorities and opportunities.	Funding for academics and BEIS Public Sector Research Establishments (such as UK Space Agency, Met Office, National Physics Laboratory).
Strength in Places Fund https://www.ukri.org/funding/funding-opportunities/strength-in-places-fund/	Collective fund launched in 2018, recognising that there are regional disparities that need to be addressed in order for there to be prosperous communities across the UK. The Strength in Places Fund (SIPF) takes a place-based approach to research and innovation funding, to support significant local economic growth.	SIPF Wave 1 awarded 23 bids seedcorn funding[150] to develop full stage bids (to be submitted to a closed call in September 2019). Wave 1 consortia are led by either a research organisation or a business, and involve local leadership organisations. SIPF Wave 2 launched in May 2019 to support collaborative bids from consortia of publicly funded research organisations, businesses, and local leadership, led by either a research organisation or a business. The Expression of Interest phase of Wave 2 closes October 2019. The fund is led by UKRI.

146 https://www.gov.uk/government/topical-events/the-uks-industrial-strategy

147 https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges

148 https://innovateuk.blog.gov.uk/2019/02/05/industrial-strategy-challenge-fund-wave-3-shortlist/

149 https://www.ukri.org/about-us/strategic-prospectus/pushing-the-frontiers-of-human-knowledge-and-understanding/#grants

150 https://www.ukri.org/funding/funding-opportunities/strength-in-places-fund/wave-1-seedcorn-funded-proposals/

Scheme name	Focus of scheme	Funding
UKRI Future Leaders Fellowships https://www.ukri.org/funding/funding-opportunities/future-leaders-fellowships/	Future Leaders Fellowships (FLF) will grow the strong supply of talented individuals needed to ensure that UK research and innovation continues to be world class. The scheme supports early career researchers and innovators with outstanding potential in universities, UK registered businesses, and other research and user environments including research councils' institutes and laboratories. The scheme aims to tackle difficult and novel challenges, and foster R&I career paths at the academic/business and interdisciplinary boundaries.	There will be six calls for these Fellowships; two calls per year between 2018–19 and 2020–21 (financial years), typically awarding 100 fellowships. A Future Leaders Fellowship can be undertaken in a business or academic host, or in collaboration between the two. Fellowships can be undertaken in businesses of any size, in any sector across the UK, and provide long term flexible funding (on a seven year, 4+3 model) to support the fellow's salary and justified research, staff and training costs. This is a single scheme across the entire UKRI remit, with no ring-fenced budgets for specific areas and no barriers to interdisciplinary or cross-sector research.

Table 2. NERC funding schemes
(information as of 1 August 2019)

Scheme name	Focus of scheme	Funding
Strategic Programmes https://nerc.ukri.org/research/portfolio/strategic/areas/	Strategic programmes are major activities that address complex science questions in which the research and innovation is expected to be large-scale and complex, logistically challenging, and/or there are significant opportunities for partnership development. Strategic Programmes may constitute a number of funding streams (capital, training, research, innovation) and involve working closely with business and policy partners.	Programmes might typically range in size from £5 million to £20 million depending on their scope and partnership funding.
NERC Highlight Topics https://nerc.ukri.org/research/portfolio/strategic/topics/	Highlight topics (HT) focus strategic research on defined topic areas and seek to address policy and business challenges where research is required. Ideas for highlight topic areas are sought from the community and considered by NERC's Science Committee, to recommend which priority highlight topics NERC should pursue. When the priority topics have been agreed, there will be an open call for highlight topic proposals.	Supports environmental research investments of up to £4 million and lasting up to 4 years. Academic led bids.

Scheme name	Focus of scheme	Funding
Joint Strategic Response (JSR) https://nerc.ukri.org/research/portfolio/strategic/joint/	When opportunities arise for NERC to work in partnership on small to medium-scale strategic research and innovation activities, this may be achieved through a joint strategic response (JSR). JSR is aimed at providing a timely (2–3 month process from opportunity to decision) response to opportunities for NERC to partner with other research funders such as research councils and government departments. Ideas come from the community and from partner funding bodies that are already prepared to co-fund a joint programme.	The size of the programme varies according to the opportunity, with NERC funding at least matched by the partner organisation. Bids are developed by NERC with the relevant partners and experts.
PhD Studentships	NERC, and the six other Research Councils, support postgraduate training to provide graduates with the skills and experience for success in high-level careers in academia, industry, government and other disciplines. NERC supports two distinct types of PhD training: • Doctoral Training Partnerships (DTPs)[151]. Open (responsive) PhD training across NERC remit, which are training partnerships between research organisations and partner organisations from a wide range of backgrounds. • Centres for doctoral training (CDTs)[152] — focused (targeted) PhD training to address key technical and academic challenges identified by NERC and our partners. Organisations awarded DTP or CDT allocations are able to deliver a number of their NERC studentships as CASE studentships[153] (formerly known as 'Collaborative Awards in Science and Engineering'), whereby studentships are delivered in collaboration with non-academic partners from the private, public and third/civil sectors, and the PhD student spends between 3–18 months with their CASE partner in a workplace outside the academic environment.	NERC awards studentship funding directly to universities and other research organisations, rather than to individual students.

151 https://nerc.ukri.org/funding/available/postgrad/responsive/dtp/

152 https://nerc.ukri.org/funding/available/postgrad/focused/cdt/

153 https://nerc.ukri.org/funding/available/postgrad/focused/industrial-case/

Table 3. Funding schemes offered by other Research Councils and Innovate UK (information as of 1 August 2019)

Scheme name	Focus of scheme	Funding
Innovate UK's **Knowledge Transfer Partnerships** https://www.gov.uk/guidance/knowledge-transfer-partnerships-what-they-are-and-how-to-apply	The Knowledge Transfer Partnership (KTP) scheme helps businesses in the UK to innovate and grow, by linking them with an academic or research organisation and a graduate. A KTP enables a business to bring in new skills and the latest academic thinking to deliver a specific, strategic innovation project through a knowledge-based partnership.	KTPs can last between 12 and 36 months, depending on what the project is and the needs of the business. A KTP is part-funded by a grant (the business contributes to the costs). The fund is delivered by Innovate UK, with co-funding from the Research Councils where projects fall within their remits, and runs continuously throughout the year.
Innovate UK Smart grants https://www.gov.uk/guidance/smart-innovation-funding-for-game-changing-ideas-from-business	Innovate UK Smart grants are available for game-changing and disruptive ideas from business, to carry out ambitious R&D projects with a high potential for commercial success. These can be for a completely new product, service or process, or an unprecedented use for an existing one that take it above and beyond what's currently available.	Open to businesses of any size, funding to both business and academic. Supports innovation at various stages, from early feasibility studies through to prototype testing, development and demonstration.
BBSRC **Industrial Partnership Awards** https://bbsrc.ukri.org/funding/filter/industrial-partnership-awards/	Industrial Partnership Awards (IPAs) encourage and support collaboration between academic research groups and industry. IPAs are academic-led, responsive mode research grants within BBSRC remit, which have significant industrial involvement and contribution	Academic led bids for projects up to £1M (total project cost) and up to 3 years in duration. Industry partner(s) contributes in cash at least 10% of the full project costs.
BBSRC **LINK scheme** https://bbsrc.ukri.org/funding/filter/stand-alone-link/	The LINK scheme supports collaborative research projects between at least one company and one academic partner. LINK projects are academic-led grant proposals within BBSRC remit, which support pre-competitive research that would not be undertaken in this form without LINK support.	Academic led bids for projects up to £1M (total project cost) and up to 3 years in duration, Industry partner contributes cash/ in kind at least 50% of the full project costs.

Annex 6 — Catapult Centres

Overview

The Catapult network was established by Innovate UK, and is one of the ways UKRI supports innovation by UK business. Each Catapult Centre does this by providing access to expert technical capabilities, equipment, and other resources required to take innovative ideas from concept to reality. Catapults are not-for-profit, independent physical centres, which connect businesses with the UK's research and academic communities. A Catapult Centre typically offers the facilities and expertise to enable businesses and researchers to collaboratively solve key problems and develop new products and services on a commercial scale. A Catapult helps turn commercial ideas into a reality, supports businesses to access global growth markets, anchor high value jobs and attract inward investment. Catapults exist to: reduce the risk of innovation; accelerate the pace of business development; create sustainable jobs and growth; and develop the UK's skills and knowledge base and its global competitiveness. Existing Catapult Centres currently exist for Cell and Gene Therapy, Compound Semiconductor Applications, Digital, Energy Systems, Future Cities, High Value Manufacturing, Medicines Discovery, Offshore Renewable Energy, Satellite Applications, and Transport Systems. A Natural Assets Catapult would be something of a departure in having less of a technological focus that existing Catapults.

Funding and governance

Catapults gain their funds from a mix of competitively earned commercial funding and core Innovate UK investment. The funding model varies through the life of the centre, and can be expressed in simplified terms as following the one-third, one-third, one-third model. Under this model, centres are required (when fully established) to generate their funding broadly equally from three sources: business-funded R&D contracts, won competitively; collaborative applied R&D projects, funded jointly by the public and private sectors, also won competitively; and core public funding for long-term investment in infrastructure, expertise and skills development.

Each Catapult centre is a company limited by guarantee (CLG), a separate legal entity from Innovate UK. They are controlled by their own Boards with an Executive Management team responsible for the day-to-day management of each Catapult.

Benefits to business

A Catapult can help businesses develop exciting new ideas within receptive and invigorating environments. A Catapult bridges the gap between business, academia, research and government. It promotes collaboration and knowledge exchange allowing many progressive businesses and organisations to build new partnerships with reduced risks. A Catapult provides an invaluable resource to companies in a wide range of markets and transforms their innovative ideas into new products and services, generating economic growth. Benefits to business include:

- **Skilled resource:** Catapults will employ skilled people to work collaboratively on innovation projects.
- **Access to a dynamic network environment:** Catapults will provide a neutral environment for potential customers to come to understand business-focused innovation. Like-minded people can come together and transfer knowledge as well as create networks. Ideas and concepts can be scoped and prototyped in a faster and more engaging environment than is possible in stereotypical industry environment. Catapults can provide access to technical expertise usually not available to SMEs.
- **Trusted environment:** Catapults will create an environment of trust, in which SMEs are happy to come and share thinking and ideas in the knowledge that intellectually property will be managed carefully.
- **Access to facilities:** Catapults typically also offer state-of-the-art facilities that the industry will want to use and engage with, that are too specialised or requiring capex beyond the means of many companies – though this may be less relevant for a Natural Assets Catapult.

Engagement with the research base

Effective engagement with the UK research base is critical to the success of Catapults. While Catapult centres do not provide funding to support the research base, they do work closely both with partners in the Research Councils, Research England and the research base directly to ensure that there are opportunities for collaboration. Equally, catapults may also be partners or collaborators with research base organisations on funding proposals to the Research Councils and Research England.

Catapults actively encourage discussions with the Research Base to explore new ways of working in partnership. However, a range of Catapult-Research Base engagements currently exist to enable improved access to businesses of all sizes. These can be categorised as follows:

1. **Strategic Relationships** – a series of formal partnerships between the Catapults and research base stakeholders have formed, these include:
   - Catapult – University strategic relationships (UK and International)
   - Government Departments/Agencies (e.g. UKRI, Research England, UK Trade and Investment)
   - Businesses (of all sizes) and business groups
   - Governance/Advisory Group representation

2. **Joint Programmes and Projects** – a large number of joint research and innovation programmes and projects exist where Catapult centres partner with the research base and business, these include:
   - Collaborative projects
   - Contract Research
   - Large scale sector focused programme activities
   - Commercialisation activities
   - Technology and Capability Roadmapping
   - Networks

3. **Developing People and Skills** – Catapult centres and the research base are engaged in a range of people focused business collaborations including:
   - Formal training provision (e.g. studentships – Centres for Doctoral Training, Doctoral Training Partnerships, CASE)
   - Collaborative work through people exchange mechanisms (e.g. secondments, fellowships, Knowledge Transfer Partnerships)
   - Continual Professional Development (e.g. MSc training)

4. **Enabling Access to Capability** – Catapults and research base partners present unique opportunities to effectively utilise and share equipment and facilities including:
   - Equipment sharing
   - Shared asset registers
   - Access to large scale facilities

5. **Informing Policy Development** – Catapult centres and the research base work closely together in shaping the innovation eco-system and informing policy through activities such as:
   - Joint input into Government inquiries/reviews (e.g. Science and Innovation Strategy)
   - Participation on Government advisory/strategy groups (e.g. Industry Leadership Forums)

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The Valuing Nature Programme is a 5 year £7M research programme which aims to improve understanding of the value of nature both in economic and non-economic terms, and improve the use of these valuations in decision making. It funds interdisciplinary research and builds links between researchers and people who make decisions that affect nature in business, policy-making and in practice. See **www.valuing-nature.net**

The Valuing Nature Programme is funded by the Natural Environment Research Council, the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council, the Arts and Humanities Research Council, and the Department for Environment, Food and Rural Affairs.

Further information visit: valuing-nature.net/ business-round-tables

info@valuing-nature.net
@ValuingN

valuing-nature.net

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