CORNWALL
AREA OF OUTSTANDING
NATURAL BEAUTY

Cornwall
Area of Outstanding Natural Beauty (AONB)
Natural Capital Assessment

Main Report

January 2016

Oliver Hölzinger[1] and Pat Laughlin[2]

[1] Consultancy for Environmental Economics & Policy (CEEP)
oliver.h@ceep-online.co.uk

[2] UK Business Council for Sustainable Development (UK BCSD)
Patl@ebc-info.co.uk

Citation:
Hölzinger, O. and Laughlin, P. 2016: *Cornwall Area of Outstanding Natural Beauty (AONB) Natural Capital Assessment*, The Cornwall AONB Unit, Truro

ceep
Consultancy for Environmental Economics & Policy

Business Council for Sustainable Development United Kingdom

I. Acknowledgements

Our special thank goes to Colette Beckham (Cornwall AONB Partnership) for all her contributions, comments and the management of stakeholders. We would also like to thank Stephen Horscroft and Peter Wills (Cornwall Council) for creating and manipulating valuable economic statistics for the purpose of this investigation as well as Karen Johns and Laura Guy (Cornwall AONB Unit) for organising the Natural Capital hotspot and opportunity mapping workshop. Furthermore, we are grateful to all Steering Group members attendees of the business workshop as well as the hotspot and opportunity mapping workshop for their valuable inputs to this investigation.

Steering Group members (in alphabetic order): Colette Beckham (Cornwall AONB Partnership), Rachel Bice (Cornwall Council), Manda Brookman (Cornwall Sustainable Tourism Project), Kevin Gaston (University of Exeter), Stephen Horscroft (Cornwall Council), Karen Johns (Cornwall AONB Unit), Gary Lewis (Cornwall Wildlife Trust), David Rodda (Cornwall Development Company), Katie Sandow (Cornwall Chamber of Commerce), Matthew Thomson (Fifteen Cornwall) & Victoria Whitehouse (Cornwall Wildlife Trust)

Business workshop attendees (in alphabetic order): Patrick Aubrey-Fletcher (NFU), Colette Beckham (Cornwall AONB), Lauren Faulkner (Cool Earth), Ian Greaves (St Eval candle company), Rupert Hanbury-Tennison (Bodmin Moor Commons Landowners/CLA), Richard Hardy (Cornwall AONB), Alex Huke (University of Exeter), Chris Jones (Woodland Valley Farm), Karen Johns (Cornwall AONB), David Johns (Encounter Cornwall), Veryan Jones (Cornwall Council Strategic Environment), Peter McGregor (Cornwall College) & Lucy Morris (Westcountry Rivers Trust)

Natural Capital hotspot and opportunity mapping workshop attendees (in alphabetic order): Gitty Ankers (Environment Agency), Patrick Aubrey-Fletcher (National Farmers' Union), Colette Beckham (Cornwall AONB Partnership), Simon Browning (Westcountry Rivers Trust), Alastair Cameron (National Trust), Jeremy Clitherow (Natural England), Natasha Collings-Costello (Cornwall Council), Philippa Hoskins (Cornwall Council), Mark Nason (Cornwall College), Vaughan Robbins (Natural England), Wesley Smyth (Natural England) & Naomi Stratton (Natural England)

II. Contents

III. Tables & Figures

1. Introduction & Background

1.1 Project Aims & Objectives

The main aim of this project was to create a shared understanding and vision for Natural Capital management in the Cornwall Area of Outstanding Natural Beauty (CAONB) for the benefit of businesses, people and wildlife alike.

The project objectives were:

1. To establish an indicative but evidence-based Natural Capital assessment and ecosystem service flow analysis for the CAONB: Which natural assets are there in the CAONB, how do people and businesses benefit from them and how may they change? This also includes a monetary case study. (Chapter 2)

2. To identify Natural Capital 'hotspots' which demand additional protection as well as opportunity areas for the strategic creation or enhancement of Natural Capital assets (Chapter 3)

3. To assess business risks and opportunities related to changing ecosystem services: How can changes to the goods and services provided by nature, in the CAONB affect businesses? (Chapter 4)

4. To establish a positive vision and set of key principles for Natural Capital management in the CAONB: How can we better work together to improve natural assets in the CAONB to ensure sustainable growth and wellbeing? (Chapter 5)

5. To introduce tools to better assess, manage and adapt to changing Natural Capital and ecosystem services: Which tools can businesses and other stakeholders use to assess and manage (their dependencies on) natural assets and the goods and services they provide? (Chapter 6).

Furthermore, the report includes a set of recommendations along the project conclusions and feasible next steps in Chapter 7. To make this report most relevant and accessible for a broad audience from different backgrounds the main elements of the report are kept in

plain English without getting too much into the technical/scientific details. Such details including a transparent outline of methods etc. can be found in the relevant appendices.

1.2 Introduction to Natural Capital & Ecosystem Services

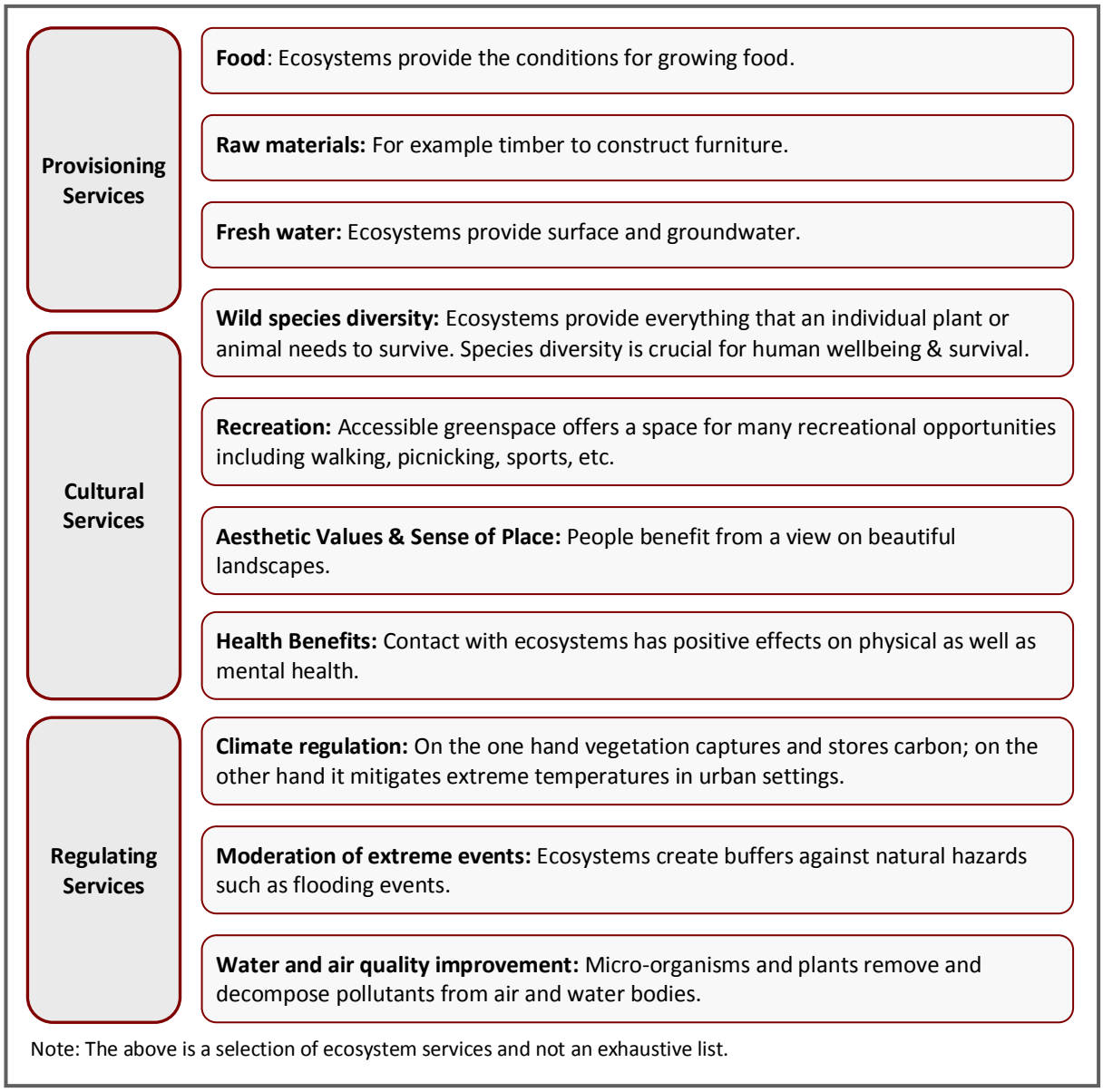
Everyone, including businesses and the economy as a whole, depends on the goods and services nature provides in one way or another. Many businesses depend directly on natural resources and other goods nature provides because they form an input to their supply chain. A restaurant, for example, depends on fish and other foods gathered from nature. This also requires clean water and healthy soils to grow food. But even businesses that do not directly depend on environmental goods as part of their supply chain still benefit indirectly from a healthy natural environment. The tourism industry in the CAONB as an example depends on high quality natural environments because they present valuable visitor attractions. And all businesses and people benefit from the positive effects of wetlands and other green infrastructure elements because they reduce the risk of flooding by storing and retaining flooding water or by slowing down water run-off.[1] Research also suggests that accessible high quality greenspace close to where people live has a positive effect not just on physical but also on mental health and wellbeing.[2] This also includes employees and can reduce sickness absence days. These are just few examples for how all of us benefit from nature.

The goods and services nature provides are called 'ecosystem services' which are commonly defined as *"the benefits people obtain from ecosystems"*.[3] Ecosystem services are often categorised into provisioning, cultural, regulating and supporting services. Provisioning services are the goods and services we physically gather from nature such as food and timber. Cultural services describe the effects of contact with nature on human wellbeing such as recreational opportunities and aesthetic values including related health benefits. When nature has an indirect effect on our wellbeing for example by improving air quality, mitigating the impacts of climate change or reducing the risk of flooding then we describe such services as regulating services. Supporting services such as pollination or soil formation, as the name indicates, support the provision of all other ecosystem services we are directly benefiting from. For more examples for ecosystem services see Figure 1.1 below[4] and for

[1] Birol et al. 2007.
[2] Coombes, Jones, and Hillsdon 2010; Kaplan 1995.
[3] Millennium Ecosystem Assessment 2005, 40.
[4] Supporting services are not listed in the figure because of the indirect effect. The figure only shows so called final ecosystem services with an immediate effect on human wellbeing.

more details about Natural Capital and ecosystem services science see for example the UK National Ecosystem Assessment.[5]

Figure 1.1 Examples for Ecosystem Services



Source: ***Based on TEEB, 2010 and UK NEA, 2011.***

Biodiversity is essential in the context of Natural Capital and ecosystem services. Biodiversity underpins all ecosystem services as all, at least partially, depend on living organisms and processes. Usually the level and stability of ecosystem services also increases with species

[5] UK NEA 2011a.

diversity.[6] This makes species diversity essential for our wellbeing. But biodiversity is not just supporting other ecosystem services but is also an ecosystem service in its own right as people usually have a preference for a diverse flora and fauna as compared to for example monocultures and species poor habitats and landscapes.[7]

Some ecosystem services such as food and timber have a market price indicating their value. But many valuable services such as recreational opportunities or flood risk regulation are not commonly traded on markets – we all benefit from them as 'free-riders' without paying; for example someone creating and managing wetlands that protect our properties and businesses from flooding events. Because of this market failure Natural Capital, which is *"the stock of natural ecosystems that yields a flow of valuable ecosystem goods or services into the future"*[8], often does not have a market price and is therefore frequently undervalued and taken for granted. However, Natural Capital assets do change in terms of extent and condition which also has an impact upon the flow of ecosystem services they provide. As such, many ecosystem services in the UK are already in a degraded and/or declining status[9]. In the following chapters we analysed how Natural Capital and ecosystem services in the Cornwall Area of Outstanding Natural Beauty (CAONB) change and how this could affect businesses and the local economy if no additional action is taken. Furthermore we explored how businesses can assess and manage Natural Capital and their dependencies on it.

1.3 The Cornwall AONB and its Natural Capital

The Cornwall Area of Outstanding Natural Beauty (CAONB) is Cornwall's Protected Landscape and has the same status and level of protection as a National Park. The CAONB includes 12 separate geographical section within Cornwall covering 958 square kilometres altogether. Most sections were designated as Area of Outstanding Natural Beauty (AONB) in 1959 with the Camel Estuary section being added to the AONB in 1981.

AONBs are particularly special landscapes whose distinctive character and natural beauty are so outstanding that it is in the nation's interest to safeguard them. The primary purpose of

[6] Norris et al. 2011.
[7] UK NEA 2011b.
[8] Costanza 2008.
[9] UK NEA 2011b.

an AONB designation, under the National Parks and Access to the Countryside Act 1949, is to *'conserve and enhance natural beauty'*. However, '*in pursuing this, account should be taken of the needs of agriculture, forestry, other rural industries and the economic and social needs of local communities. Particular regard should be paid to promoting sustainable forms of development that conserve and enhance the environment. The demand for recreation should be met so far as this is consistent with the conservation of natural beauty and the needs of agriculture, forestry and other uses'.*

Put simply, Natural Capital is everything natural that is not man-made 'grey' infrastructure. For the purpose of this assessment six different Natural Capital asset categories were defined. These categories were defined after close consultation with the Cornwall AONB Unit and the Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS). Here, it was important to limit the number of asset categories to a manageable amount and some habitats have been grouped to reflect their strong relationship with regards to ecosystem services. The asset categories are summarised in Table 1.1 below.

Table 1.1 CAONB Natural Capital Asset Categories

Natural Capital Assets	Abbreviation	Area (based on 2005 data)
Coast	COA	4,001.3 ha
Heathland, Wetland & Disturbed Ground	HWD	12,695.3 ha
Open Water	OWA	633.9 ha
Semi-Natural Grassland	SNG	5,577.3 ha
Woodland, Scrub & Bracken	WSB	11,758.7 ha
Arable Land & Improved Grassland	AIG	55,680.9 ha
Built Environment	BEN	3,965.5 ha
Total		94,312.9 ha

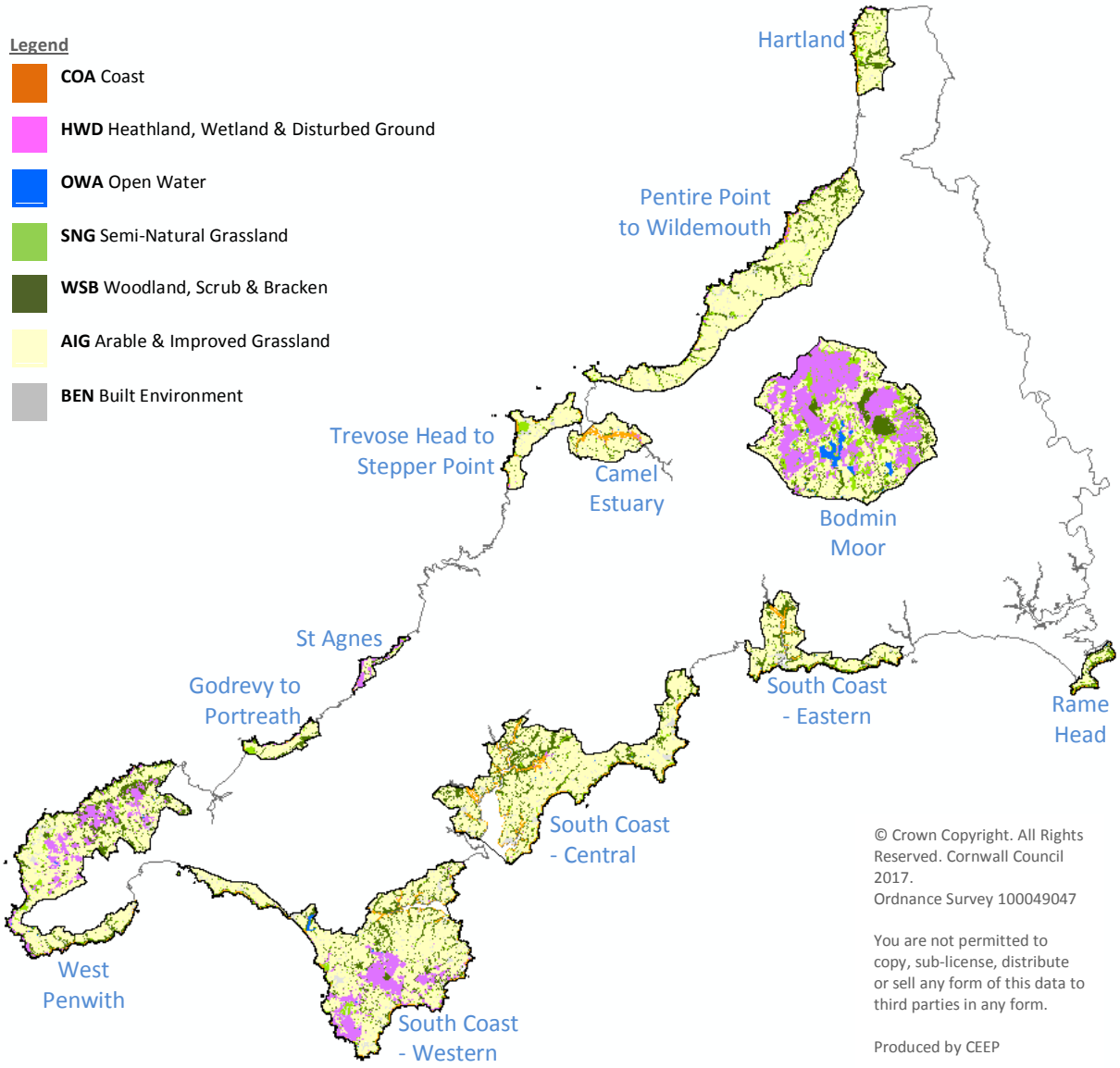
Source: ***Author calculation based on data provided by ERCCIS.***

One can see that the CAONB is dominated by agricultural land-uses covering more than 50% of the assessment area. About 80% of the AIG category is improved grassland whilst 20% is arable land. The second largest category is HWD including about 75% wetland habitats and 25% heathland. Disturbed ground covered only about 82 ha of the CAONB in 2005. The third largest asset category is WSB where woodland is dominant with about 8,750 ha. Most of the woodland area (6,427 ha) is broadleaved or mixed woodland. Bracken and scrub cover about

2,320 ha and 1,745 ha, respectively. Figure 1.2 shows a map of the different Natural Capital asset types within the 12 different CAONB management areas.

It is worth noting that this assessment is based on 2005 data. ERCCIS was working on an update of the data whilst this assessment was undertaken but unfortunately this data was not ready to inform this assessment. A more detailed habitat analysis and an outline of methods can be found in Appendix A. Larger maps for each management area can be found in Appendix B.

Figure 1.2 CAONB Natural Capital Assets



Source: ***Based on GIS data provided by Cornwall Council and ERCCIS***

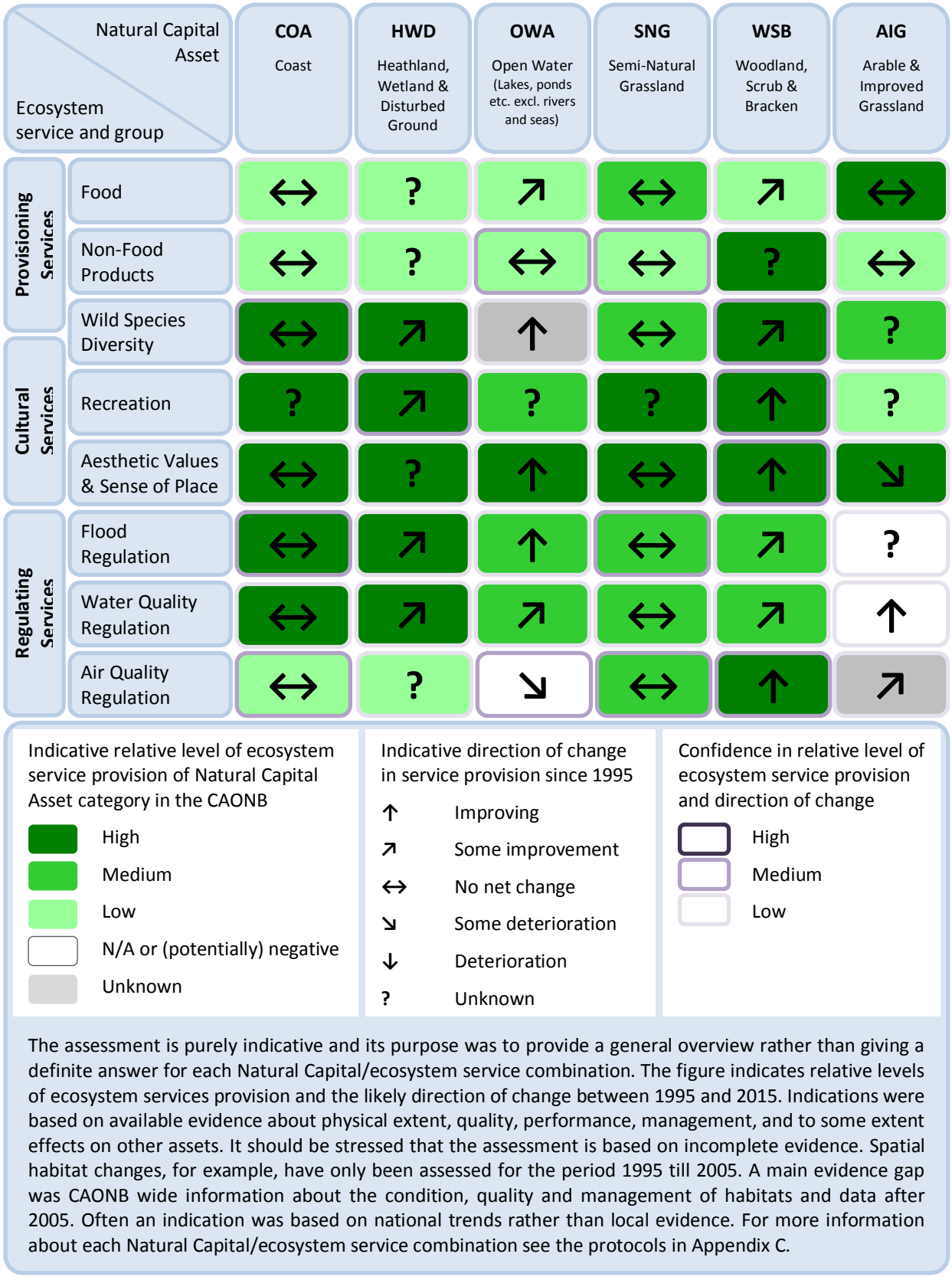
2. Natural Capital Asset & Service Flow Assessment

2.1 CAONB Asset & Service Flow Analysis

Different Natural Capital assets provide different ecosystem services to different extents. The level of ecosystem services provision also changes over time for example depending on changes to the physical extent as well as the quality, condition and productivity of Natural Capital assets. In this Section the attempt has been made to assess the relative importance of each Natural Capital asset category for supporting a set of locally important ecosystem services within the CAONB. Furthermore it has been assessed how the conditions for service provision have changed since 1995 for each asset category/ecosystem service combination. The focus of the assessment was on how the Natural Capital condition for providing ecosystem services changed rather than how the services changed themselves. For biodiversity, for example, the assessment was focussed on how habitat changes affected the condition for biodiversity rather than the occurrence of species themselves because the latter also depends for example on habitat condition and other factors outside the CAONB.

Figure 2.1 indicates the relative level of ecosystem service provision of different Natural Capital assets within the CAONB. The relative level of provision, indicated by the colour in the boxes (dark green: high relative importance; bright green: low relative importance) in this context means that Natural Capital asset A is likely to provide more of a certain ecosystem service per ha than Natural Capital asset B. Within this framework comparison is only feasible for a single ecosystem service across Natural Capital asset categories but not between different ecosystem services in terms of 'ecosystem service A is more important than ecosystem service B' indicating the overall contribution to human wellbeing. The direction of change for each combination since 1995 is indicated by the arrows in the boxes. This is based on the Natural Capital condition for providing ecosystem services rather than the actual ecosystem services observed and is not based on a per-ha value as habitat changes were also factored into the assessment. The colour of the box frames indicates the confidence in the allocated importance and direction of change. Please see the Figure legend/narrative for more information and acknowledge the caveats outlined further below.

Figure 2.1 Indicative Natural Capital Asset and Ecosystem Services Change Analysis



Source: ***Author assessment***

Despite Figure 2.1 painting a quite positive picture this does not mean that everything is great and no further action is required. It is an indicative assessment of the past rather than an outlook into the future. Increasing future pressures and drivers of change for example from development, economic growth and climate change were not factored into Figure 2.1 . Evidence for change since 2005 was also very limited. The potential impact of such drivers has been outlined below. This assessment also contains information about cross-cutting ecosystem services such as health and tourism which are not directly included in Figure 2.1 because they depend on several other ecosystem services. The following caveats and limitations should also be acknowledged when interpreting the findings.

This assessment was based on a literature review of national and local evidence, expert and stakeholder opinion, and the expertise of the consultants. It should be noted that this assessment is purely indicative and the findings presented in Figure 2.1 should be treated with some care. The main purpose was to give a general sense for the overall ecosystem services value and direction of change rather than a definite answer for each Natural Capital asses/ecosystem services combination. Another purpose of the assessment was therefore to identify data gaps to inform future research needs. Furthermore, it should be acknowledged that these are average values across the different habitat types within each Natural Capital asset category as well as across all 12 CAONB management areas. The relative importance and direction of change is often location and context specific and will vary across management areas and also locations within the areas.

Appendix C details the methods of this assessment including caveats and limitations.. Appendix C also contains a protocol for each Natural Capital asset/ecosystem service combination as presented in Figure 2.1 with more information about why a specific relative importance and direction of change has been ascertained. A summary for each assessed ecosystem service (including tourism and health benefits as cross-cutting ecosystem services) can be found below.

Food Provision

The main Natural Capital asset for food provision in the CAONB is agricultural land. On the one hand a decline of Arable and Improved Grassland (AIG) of -365 ha (-0.7% of AIG) could be observed between 1995 and 2005 – mainly due to afforestation. On the other hand the productivity of agricultural land for providing food in the UK has increased after 2005 which could have offset the losses to land primarily managed for food production. Therefore we assume no significant changes to the provision of food despite the physical area losses.

An economic analysis for the CAONB (resident based) indicates that there may have been a small increase of GVA of the agriculture, forestry and fishing sector from £43.6 million for the period 1997-2004 to £44.6 million for the period 2010-2014; an increase of £1.0 million or 2.2%.[10] However, a range of caveats apply which means that the figures should be treated with caution.[11] Further information about the actual farm outputs within the CAONB would be required to support this analysis.

A recent study analysing the importance of the local food industry for tourism in St Ives suggests that tourists have a preference for food that is produced locally and comes from local Natural Capital resources. The research suggests that locally grown, processed and prepared 'Cornish' food adds value to the tourism experience and attracts visitors. It also suggests that tourists have a preference for small local food shops over chains and that they are willing to spend more on food whilst visiting when compared to everyday life.[12]

Provision of Non-food Products

Woodland is the most important resource for the provision of non-food products such as timber within the Cornwall AONB. The physical extend of the woodland resource has increased (+285.8 ha or +2.5% between 1995 and 2005) and there was also a higher uptake

[10] Many thanks to Stephen Horscroft from Cornwall Council for sharing and manipulating this data.
[11] The analysis is based on the 'best fit' of Output Areas with the AONB management areas as GVA data for the AONB itself was not available. The data is based on resident employment rather than workplace which means that it is based on the GVA generated by people living within the assessed Output Areas rather than businesses located within the Output Areas. As the GVA data has been downscaled to the Output Areas using employment data the figures could also be biased if for example per-head productivity is higher/lower within the AONB Output Areas as compared to the rest of Cornwall.
[12] Dukes and Beech 2016.

of Woodland Grant Schemes and Higher Level Stewardship schemes. However, there was not just an increase in the total extent of woodland across the CAONB but also a shift from coniferous to mixed and broadleaved woodland (-174 ha or -13% of coniferous woodland between 1995 and 2005). Data after 2005 was not available. Overall it is estimated that the total harvesting level across the CAONB has not changed significantly between 1995 and 2015 although the use of the harvested resource has changed for example from chipboard to woodfuel production for low quality woodland resources.[13] These variations also mean that the price for softwood, (which is recovering after its low in 2003 but still only reaches about 50% of a peak value in 1995[14]) may not be a reliable indicator for the whole woodland resource because it is unclear if and to what extend softwood was substituted by hardwood and price statistics for hardwood are lacking. The net effect is uncertain and more data about the actual timber production and usage within the CAONB would be required to make a judgement.

Wild Species Diversity/Biodiversity

Coastland (COA), Heathland, Wetland and Disturbed Ground (HWD) and Woodland, Scrub and Bracken (WSB) have been identified to be the most important Natural Capital assets for supporting biodiversity. The importance of Open Water (OWA)[15] is uncertain as no information about the biological quality of this resource could be obtained. The indicated improvements of HWD and WSB are mainly related to physical habitat gains. However, especially for HWD the changes were very marginal and the effect of increased areas of disturbed ground is unknown. A shift from coniferous woodland to mixed and broadleaved woodland is also likely to improve conditions for biodiversity.

It needs to be stressed that this assessment is almost exclusively based on an analysis of physical habitat changes between 1995 and 2005. Information for changes afterwards as well as CAONB-wide information about the habitat condition and quality was not available which means that uncertainties are high. Furthermore we were assessing the condition of Natural Capital resources for supporting biodiversity rather than directly observing

[13] Personal comment Jez Ralph from Timber Strategies.
[14] Source: Forestry Commission coniferous standing sales price index (real prices) for Great Britain; Fisher Index
[15] Please note that rivers and streams were not included in the assessment.

biodiversity changes. What is certain is that Cornwall-wide species decline is rapid and continuing. This is in line with the national trend. The recently published State of Nature 2016 Report suggests that more than 50% of species in the UK declined between 1970 and 2013.[16] This seems contrary to the findings as outlined above for the CAONB and several reasons could apply: (1) the habitat condition for supporting biodiversity is slightly improving within the CAONB but not enough to make up for former deteriorations, (2) condition in the CAONB is slightly improving but 'spill-over effects' from other areas (e.g. rest of Cornwall) mean that the expected effect (species increase) cannot be observed because conditions at the landscape-scale are still deteriorating and species do not just stop at the AONB boundaries but migrate across space, (3) there may have been a decline in habitat condition/quality within the CAONB which overcompensates for the physical increase by area of biodiversity supporting Natural Capital assets, or (4) a combination of those. It could also be that biodiversity is actually increasing within the CAONB despite an overall decline at the Cornwall-wide level but considering the rather small habitat changes this is a less likely scenario. Unfortunately, CAONB-specific species information was not available.[17] The pressure from future development may also offset former efforts to improve the conditions for biodiversity if not designed in a sustainable manner and directed to areas of low biodiversity value. Climate change also means that a strong green network is needed so that species can migrate across space when adapting to a warmer climate. That all indicates that significant additional efforts will be required to halt and reverse continuing species loss – within the CAONB but also in Cornwall as a whole and beyond.

Recreation

Almost all Natural Capital assets assessed as part of this exercise were identified as important for recreation with Arable and Improved Grassland being less valuable as public access is often limited. The creation of woodland and increasing uptake of Woodland Grant Schemes and Higher Level Stewardship indicates some increase in recreational opportunities in woodland areas. The creation of wetland on accessible land also indicates some increase in recreational opportunities of wetland sites. What we do not know, however, is if the

[16] RSPB et al. 2016.

[17] Raw species data is available for the CAONB but a detailed assessment of such data was outside the scope of this study.

condition of existing Natural Capital assets has changed for example in terms of the appearance of litter etc. Recreational value is often also linked to biodiversity and as outlined before the direction of change for biodiversity values across the CAONB is rather uncertain. The creation of lakes and ponds also indicates increasing recreational value of these resources e.g. for recreational fishing but the overall importance of these Open Water (OWA) resources for recreational purposes remains uncertain because we do not know to which extend such resources are accessible and used for recreational activities. Unfortunately detailed statistics for the recreational fishing sector in Cornwall are not available.[18]

For the future it is important to monitor how the availability of recreational resources changes in relation to increasing demands because of population growth but also potential increases in visitor numbers due to tourism. The value of Natural Capital assets in the CAONB for recreation could decline in case available spaces become overcrowded which would also have an effect on other ecosystem services such as biodiversity.

Aesthetic Values & Sense of Place

A large body of evidence demonstrates that people prefer to live in areas with high quality environmental landscapes and many studies suggest that such green landscapes can also increase for example property prices and land values.[19] One UK study suggests that in environmental landscapes with trees, property values can increase by an average of 7%. This could also lead to an increase in council taxes and therefore support of public services.[20]

All assessed Natural Capital assets across the CAONB are important for the aesthetic value of the landscape. Especially a high habitat diversity is often seen as being valuable in this respect. This is also why the creation of lakes and ponds as well as woodland is likely to have added aesthetic value to the agriculturally dominated landscape. These types of habitats are generally highly appreciated in terms of their aesthetic value. The creation of wetland is also likely to contribute to aesthetic values because it contributes to habitat diversity but the

[18] IFCA 2015.
[19] See e.g. Saraev 2012 for an overview.
[20] Forest Research 2010.

effect of disturbed ground is uncertain. For the future it would be important to direct new development to spaces that are less significant in terms of the aesthetics and that development does not affect the overall character of the landscape. The Natural Capital Planning Tool (NCPT) could help to ensure a net-positive impact of planning and development on Natural Capital (see Section 6.4).

Flood Regulation

Especially the expansion of wetland and woodland habitats is likely to improve the capacity to store flooding water and reduce water run-off in case of a flooding event to some extent. The creation of ponds and lakes is also likely to have a positive effect. The effect of changes to the management of agricultural land on flood risk regulation in the CAONB is uncertain. Intensive drainage of agricultural land has the effect that water is shifted off the land surface quickly which can add to flood pressure downstream. This effect can be mitigated by waterside vegetation such as grasses and trees. The loss of sediment from farmland can also lead to sedimentation of water bodies, which in turn reduces storage capacity and contributes to flood risk. But farmland can also be managed to hold and store flooding water and therefore contribute positively to flood risk regulation.[21] The effect very much depends on management practices and location. More information about agricultural management practices in the CAONB would be needed to allow a final judgement but the net effect of agricultural land is potentially negative; especially when considering alternative management practices and land-use options.

Even if the assessment may seem to indicate a slightly positive development since 1995 this is unlikely to be enough to prepare the CAONB for the likely increased appearance and magnitude of storm events due to climate change which makes additional efforts to create water storage capacities and reduce water run-off sensible. Future development and the sealing of soils that comes with it is also likely to contribute to the added pressure; but also to the demand for additional flood regulation services as more people and properties are likely to be affected by flooding events. Therefore, new developments should be required to

[21] Firbank et al. 2011.

provide green infrstucture and Sustainable Urban Drainage schemes (SuDS) to a much greater extent to mitigate future flood risk.

Water Quality Regulation

Coastland and Wetland are likely to be the most important Natural Capital assets in terms of water quality regulation. There is evidence that sand dunes and shingle reduce diffuse pollution to the marine environment with positive effects on bathing water quality. Wetlands have a positive effect especially because wetland vegetation is often in contact with water and improves water quality for example by denitrification and mineralisation of pollutants. Agricultural assets are likely to have a negative effect on water quality. The more intensive the fertilisation of land the more excess nitrogen compounds which cannot be taken up by plants can be released as nitrate to ground and surface water. Other agricultural contaminants include phosphorus, sediments and pesticides.[22] Nationally, the use of inorganic fertilisers and excessive use of pesticides has been steadily reduced within the past 30 years or so but the overall effect is still likely to be negative. The level of diffuse pollution from farming could be mitigated for example by introducing grass buffer strips and ponds to trap contaminants.

Air Quality Regulation

Vegetation cover and leaf area in particular are crucial for air quality regulation services which makes woodland resources the most important natural air quality regulator. The afforestation activities since 1995 in the CAONB are likely to have a positive effect on air quality regulation but this effect may be offset by increasing traffic due to increasing visitor numbers. The effect of agricultural land-uses is uncertain. On the one hand vegetation on farmland has some positive effect on air quality regulation by capturing pollutants from the air. On the other hand farmland is a major source for ammonia which is a nitrogen compound released by the breakdown of livestock urine, manure and inorganic fertiliser. Ammonia harms biodiversity and can cause odour nuisance. The net effect on air quality in

[22] UK NEA 2011b.

the CAONB is not clear but reduced fertiliser usage is likely to have caused some improvement.

Health Benefits

Health is a cross-cutting ecosystem service as it basically depends on all other ecosystem services. Natural Capital provides a valuable setting for outdoor activities and therefore contributes to physical health. Large scale studies undertaken in the Netherlands, Sweden and Japan have provided a body of evidence suggesting that the availability of accessible local greenspace and human health are directly related.[23] Contact with nature also improves mental health which relates to aesthetic values. Research from the United States suggests that the view of woodland can improve mental health by breaking down stress.[24] Ulrich (1984) also found that the view of woodland from hospitals has a positive effect on recovery times.[25] About three out of four UK adults agree that green spaces are important for their general health.[26] Considering the likely improvements in these areas across the CAONB since 1995 it is likely that the overall effect on health is also positive. Further improvements could be made not just by improving the Natural Capital resources but also by encouraging 'green exercise' and contact with nature for example by organising health walks and outdoor school classes. Some kind of eco-paperchase or geocaching for tourists may also be an interesting concept which could also promote the CAONBs environment more generally. This could potentially be combined with a Payments for Ecosystem Services (PES) scheme (see also Section 6.8).

Tourism

Natural Capital in the CAONB is crucial for the tourism industry and for branding the CAONB as tourist destination. The value for tourism mainly depends on recreation and aesthetic values but is also influenced for example by biodiversity as well as water and air quality

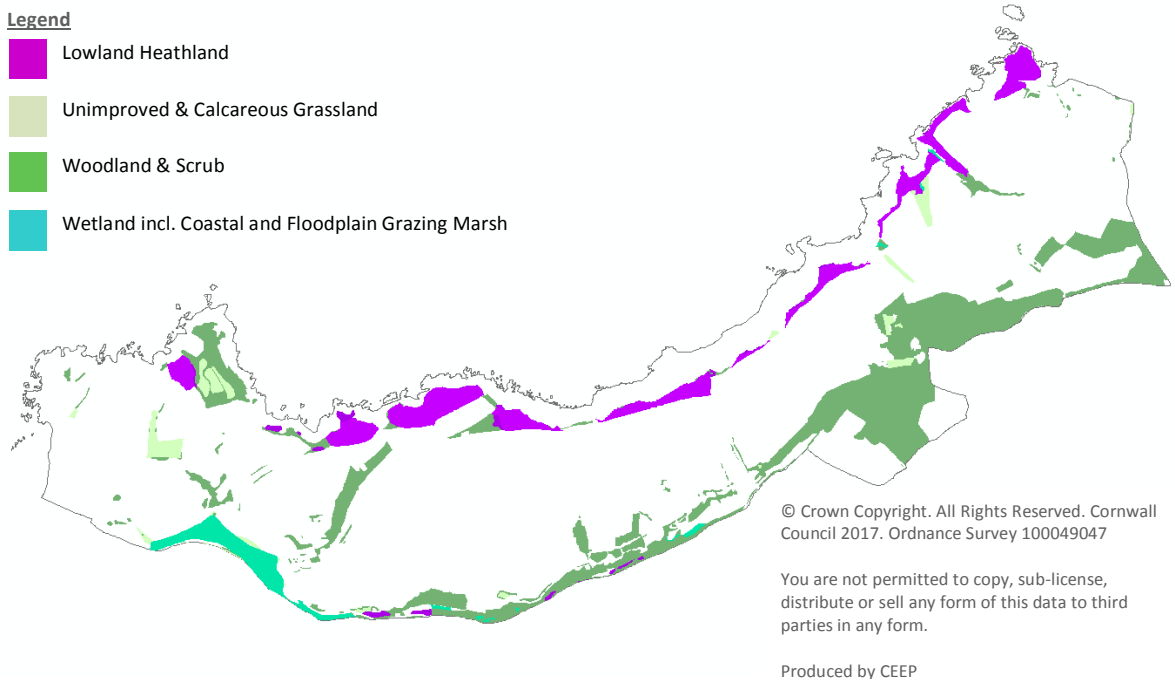
[23] Vries et al. 2003.; Grahn and Stigsdotter 2003.; Takano, Nakamura, and Watanabe 2002.
[24] Ulrich and Simons 1986.
[25] Ulrich 1984.
[26] Kuppuswamy 2009.

regulation services. Protecting and enhancing high quality Natural Capital assets is therefore key for tourism in the CAONB and warmer temperatures due to climate change may actually attract more visitors in the future. To make the CAONB even more attractive for tourism, Natural Capital enhancements may be very beneficial for the industry. Deterioration and mismanagement or neglecting Natural Capital on the other hand could significantly harm the CAONB as tourism destination and therefore also the local economy. One of the many examples why the economy and environmental management are complementary rather than conflicting goals - you can't have one without the other.

2.2 Economic Valuation Case Study: Godrevy to Portreath AONB Section

As part of the project a range of Natural Capital assets and the ecosystem services that flow from them have been assessed and quantified for the Godrevy to Portreath section of the Cornwall AONB. Aim of the case study was to establish an indicative monetary assessment of ecosystem services provided by the Natural Capital assets woodland, wetland, heathland and unimproved grassland within this section of the AONB. These Natural Capital asset categories differ from the standardised categories used within the rest of this report because these categories represent a better fit for monetary valuation allowing a more detailed assessment. Please note that the assessed assets only cover 20% of the Cornwall AONB section 'Godrevy to Portreath' and that only a small set of 4 ecosystem services was quantified. Figure 2.2 shows the Natural Capital assets for which services were quantified.

Figure 2.2 Godrevy to Portreath Case Study: Geographical Scope



Source: ***Based on GIS data provided by Cornwall Council and ERCCIS***

The aim of this exercise was to show that Natural Capital assets have a value beyond those values for provisioning services (food, timber etc.) already indicated by their market price. Having no market price or explicit quantified value for ecosystem services often results in the misjudgement that such ecosystem services are self-evident or even without value. The high complexity of ecosystem interactions makes their value even more intangible and reinforces a tendency to neglect them.

> *"Because ecosystem services are largely outside the market and uncertain, they are too often ignored or undervalued…"*[27]

This undervaluation can result in poor decision making and the degradation of Natural Capital assets that provide these services, leading in turn to a progressive undersupply of services, and finally to a decline of overall human wellbeing. Economic valuation of Natural Capital and ecosystem services serves to mitigate this information bias and to make the value of services provided by Natural Capital more visible and tangible for non-specialists which generates awareness for such benefits. This in turn supports more sustainable decision-making through the improved consideration of formerly overlooked values.

[27] Costanza et al. 1997, 269.

To quantify ecosystem services values in monetary terms the so-called benefit transfer approach has been applied. Valuation findings of studies carried out elsewhere were transferred to the assessment area applying suitable precautions and assumptions. This approach allowed transferring values from primary valuation studies carried out outside the CAONB to our specific case study context. The benefit transfer approach can for example be applied if people were asked what they would be willing to pay to access a woodland site for recreational purposes as part of a primary valuation study somewhere else in the country. This value can then be transferred to the case study site. For further information about the benefit-transfer approach and how scientists calculate values for non-market ecosystem services see for example Defra's 'Introductory Guide to Valuing Ecosystem Services'.[28] Please see Appendix D for how the approach has been applied for this assessment.

It should be acknowledged that a number of limitations and caveats apply to such monetary assessments. Primary valuation studies have their own imperfections and applying the benefit transfer approach can result in transfer errors because the study area (where primary valuation studies were carried out) is not entirely similar to the policy area (in this case the Godrevy to Portreath AONB section). Even if adjustments were applied as carefully as possible, for example to account for variations in the population density, a benefit transfer error can never be ruled out. Further limitations are linked to general scientific uncertainties such as the future impacts of climate change. It should also be noted that the values produced in this study are gross rather than net values. Neither alternative land-use options nor the costs of land management, etc. have been considered. For these reasons, calculated values should be regarded as essentially indicative of the magnitude of the service.

The ecosystem services values assessed within scope of this project are not only stated as annual values; they are also stated as capitalised value over 50 years. To calculate the 'net present value' of future benefit a discount rate of 1.5% has been applied.[29] A *ceteris paribus* future (everything else remains equal) has been assumed. This means that all variables such as population or impacts of climate change were set constant over time. Both, population

[28] Defra 2007.
[29] Hölzinger 2014b.

growth and climate change impacts can be expected to increase the values of ecosystem services over time due to resource scarcity considerations. This is another reason why the findings of this assessment should be interpreted as the baseline of the real ecosystem services value. To account for uncertainties, a sensitivity analysis was applied. Using sensitivity analysis, every value is stated as a 'central estimate'[30] with a range, following best practice recommendations.[31] For more details about the methods and caveats see Appendix D.

The focus of this assessment was on 'non-market' services which usually do not have a market price excluding services like timber and food provision because such products already have a market price indicating their value. The following ecosystem services were assessed:[32]

- Wild species diversity
- Recreation and aesthetic values
- Flood regulation
- Global climate regulation
- Water quality regulation

These services were selected because they were comparatively easy to quantify as part of this exercise. Further services such as health benefits could be quantified if additional resources become available. Monetary values presented in this case study should therefore generally be treated as a baseline of the total or real value of non-market ecosystem services.[33]

[30] If not stated otherwise values are generally stated as 'central estimate'.
[31] EFTEC 2010.
[32] Please note that not all stated ecosystem services were assessed for all Natural Capital assets.
[33] This effect is not implemented in the sensitivity analysis. Therefore, the real value of ecosystem services may even exceed the upper threshold of the sensitivity analysis.

Table 2.1 Godrevy to Portreath Case Study: Assessed Natural Capital Assets

Woodland	**148.9 ha**
Broadleaved	102.0 ha
Coniferous	14.1 ha
Scrub	32.8 ha
Wetland	**15.9 ha**
Floodplain Grazing Marsh	14.1 ha
Other	1.8 ha
Heathland	**51.4 ha**
Grassland	**14.6 ha**
Calcareous	3.6 ha
Neutral	11.1 ha
TOTAL	**230.9 ha**

Source: ***Author calculation based on data provided by ERCCIS.***

The indicative baseline value of ecosystem services provided by these Natural Capital assets has been valued at £210,500 annually resulting in a value of £7.48 million when capitalised over 50 years. The high range of the sensitivity analysis of £1.85m - £43.07m for the capitalised value is because different discount rates were applied and because the geographical aggregation level for wild species diversity values are different for the high estimate of the sensitivity analysis (see Appendix D for details). In addition, assessed Natural Capital assets store an estimated amount of 58,800 tonnes of carbon valued at £13.45 million.

This means that the indicative baseline value of the assessed Natural Capital assets in the Godrevy to Portreath section of the Cornwall AONB add up to just under £21 million combining the capitalised ecosystem services flow and carbon stock value, stating the central estimate. Most of this value is related to stored carbon in vegetation and soils (£13.45m), followed by flood risk regulation services (£3.76m) and wild species diversity (£2.63m). Detailed findings are summarised in the tables below. For more information about methods and calculations see Appendix D.

Table 2.2 Annual Flow Value

Broad Habitat Type / Assessed Habitat Area		Woodland 149 ha			Grassland 15 ha			Wetland 16 ha			Heathland 51 ha			TOTAL 231 ha		
Ecosystem Service		High	**Central**	Low	High	**Central**	Low	High	**Central**	Low	High	**Central**	Low	High	**Central**	Low
	Wild Species Diversity	£0.522	**£0.030**	£0.015	£0.004	**£0.002**	£0.001	£0.013	**£0.008**	£0.002	£0.057	**£0.034**	£0.010	£0.596	**£0.074**	£0.028
	Recreation & Aesthetic Values				£0.003	**£0.002**	£0.001	£0.049	**£0.006**	£0.003	£0.017	**£0.011**	£0.006	£0.069	**£0.020**	£0.010
	Flood Regulation	£0.122	**£0.072**	£0.022	£0.004	**£0.002**	£0.001	£0.023	**£0.013**	£0.004	£0.031	**£0.018**	£0.006	£0.180	**£0.106**	£0.032
	Water Quality Regulation							£0.016	**£0.011**	£0.005				£0.016	**£0.011**	£0.005
TOTAL														£0.861	**£0.210**	£0.075

Notes:
All values are stated in million pounds (£m); 2015 prices.
Blank cells do not mean 'no value', but that a monetary value could not have been calculated within scope of this assessment.
Where monetary values have been calculated this may only cover a proportion/element of the full value of the referring ecosystem service.

Legend:
Central Central estimate
High Higher threshold of the sensitivity analysis (even if the real value could still exceed this threshold)
Low Lower threshold of the sensitivity analysis

For valuation methods, underlying assumptions and limitations see the relevant sections of the report.

Source: ***Author calculations***

Table 2.3 Capitalised Flow Value

Broad Habitat Type / Assessed Habitat Area		Woodland 149 ha			Grassland 15 ha			Wetland 16 ha			Heathland 51 ha			TOTAL 231 ha			
Ecosystem Service		High	**Central**	Low	High	**Central**	Low	High	**Central**	Low	High	**Central**	Low	High	**Central**	HM Tr.	Low
	Wild Species Diversity	£26.10	**£1.08**	£0.37	£0.19	**£0.08**	£0.02	£0.65	**£0.27**	£0.06	£2.86	**£1.20**	£0.25	£29.81	**£2.63**	£1.81	£0.69
	Recreation & Aesthetic Values				£0.16	**£0.08**	£0.03	£2.45	**£0.23**	£0.08	£0.84	**£0.40**	£0.14	£3.46	**£0.71**	£0.49	£0.24
	Flood Regulation	£6.10	**£2.55**	£0.53	£0.19	**£0.08**	£0.02	£1.14	**£0.48**	£0.10	£1.56	**£0.65**	£0.14	£8.99	**£3.76**	£2.59	£0.78
	Water Quality Regulation							£0.81	**£0.39**	£0.13				£0.81	**£0.39**	£0.27	£0.13
TOTAL														£43.07	**£7.48**	£5.16	£1.85

Notes:
All values are stated in million pounds (£m); 2015 prices.
The capitalised value represents the present value of ecosystem services provided over a time period of 50 years.
Blank cells do not mean 'no value', but that a monetary value could not have been calculated within scope of this assessment.
Where monetary values have been calculated this may only cover a proportion/element of the full value of the referring ecosystem service.

Legend:
Central Central estimate
High Higher threshold of the sensitivity analysis (even if the real value could still exceed this threshold)
HM Tr. This value is based on the higher discount rates recommended by HM Treasury and is stated for comparability purposes only.
Low Lower threshold of the sensitivity analysis

For valuation methods, underlying assumptions and limitations see the relevant sections of the report.

Source: ***Author calculations***

Table 2.4 **Carbon Stock Value**

		Assessed Area	Carbon Stock	**Stock Value**
Carbon	Woodland	149 ha	41,415 t	**£9.48m**
	Grassland	11 ha	675 t	**£0.15m**
	Wetland	16 ha	12,055 t	**£2.76m**
	Heathland	51 ha	4,626 t	**£1.06m**
	TOTAL	227 ha	58,770 t	**£13.45m**

Source: ***Author calculations***

As mentioned before this assessment only took a couple of services into account which means that the true value of the assets and the ecosystem services that flow from them are likely to be significantly higher. Further ecosystem services that could be valued in monetary terms include for example food, timber, ornamental resources and health benefits. It is important to recognise such unquantified values as well.

3. Natural Capital Hotspot & Opportunity Mapping

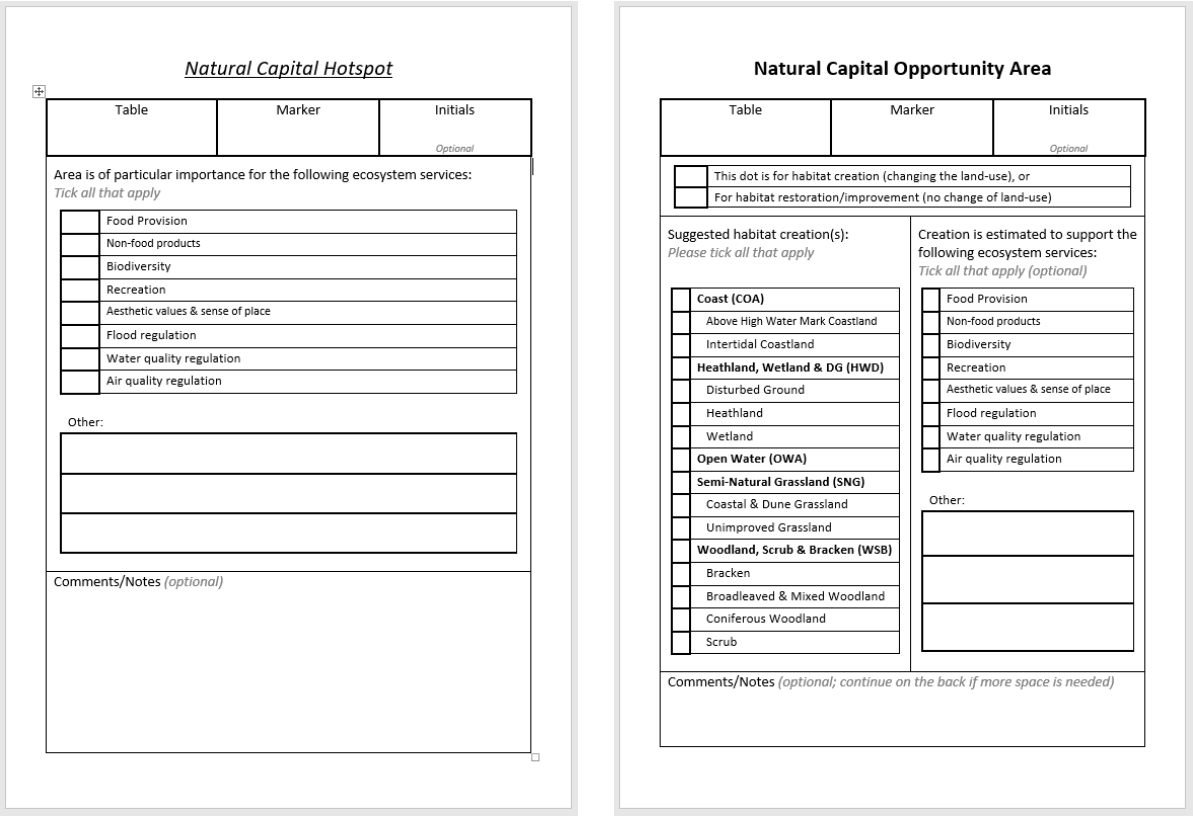
On the 12th of December 2016, The AONB Unit was hosting a Natural Capital hotspot and opportunity mapping workshop in Mount Pleasant Eco Park, Porthtowan. The workshop was run by CEEP. Aim of the workshop was to identify:

- Natural Capital hotspots that are particularly important in terms of providing multiple ecosystem services and therefore deserving additional protection, and
- Natural Capital opportunity areas where the restoration, improvement or creation of high quality Natural Capital assets would be most beneficial and effective.

Altogether 12 representatives from different stakeholder organisations participated in the workshop. For a full list of attendees see the acknowledgements of this report. After an introduction of Natural Capital and the project, two breakout sessions took place; one for identifying hotspots and one for identifying opportunity areas. For each breakout session participants were allocated to three different tables; each with an A0 map showing Cornwall's Natural Capital asset types (see Table A.1) and the AONB boundaries.

In the first session participants were asked to place green stickers on the map where they thought the most valuable Natural Capital assets were located that would deserve additional protection e.g. from development. Participants were asked to focus on areas that provide multiple and high value ecosystem services within the AONB. However, stickers could also be placed on areas outside the AONB in case the loss of that Natural Capital asset would significantly impact on ecosystem services within the AONB (e.g. buffer zones or connection links for biodiversity, recreation etc.). Furthermore, participants were given the opportunity to add more detail to each sticker by drawing a unique number on them and completing a sheet to indicate for which ecosystem services they thought this area would be of particular importance (see Figure 3.1).

Figure 3.1 Natural Capital Hotspot and Opportunity Area Sheets for Mapping Workshop



Natural Capital Hotspot

Table	Marker	Initials *Optional*

Area is of particular importance for the following ecosystem services:
Tick all that apply

- Food Provision
- Non-food products
- Biodiversity
- Recreation
- Aesthetic values & sense of place
- Flood regulation
- Water quality regulation
- Air quality regulation

Other:

Comments/Notes *(optional)*

Natural Capital Opportunity Area

Table	Marker	Initials *Optional*

- This dot is for habitat creation (changing the land-use), or
- For habitat restoration/improvement (no change of land-use)

Suggested habitat creation(s):
Please tick all that apply

- **Coast (COA)**
- Above High Water Mark Coastland
- Intertidal Coastland
- **Heathland, Wetland & DG (HWD)**
- Disturbed Ground
- Heathland
- Wetland
- **Open Water (OWA)**
- **Semi-Natural Grassland (SNG)**
- Coastal & Dune Grassland
- Unimproved Grassland
- **Woodland, Scrub & Bracken (WSB)**
- Bracken
- Broadleaved & Mixed Woodland
- Coniferous Woodland
- Scrub

Creation is estimated to support the following ecosystem services:
Tick all that apply (optional)

- Food Provision
- Non-food products
- Biodiversity
- Recreation
- Aesthetic values & sense of place
- Flood regulation
- Water quality regulation
- Air quality regulation

Other:

Comments/Notes *(optional; continue on the back if more space is needed)*

Source: ***CEEP***

In the second breakout session a similar approach was used but this time participants were asked to place stickers on the same map where they thought the creation, restoration or improvement of Natural Capital would be most beneficial for the AONB. This time participants were prompted to complete the opportunity area sheets for each sticker for

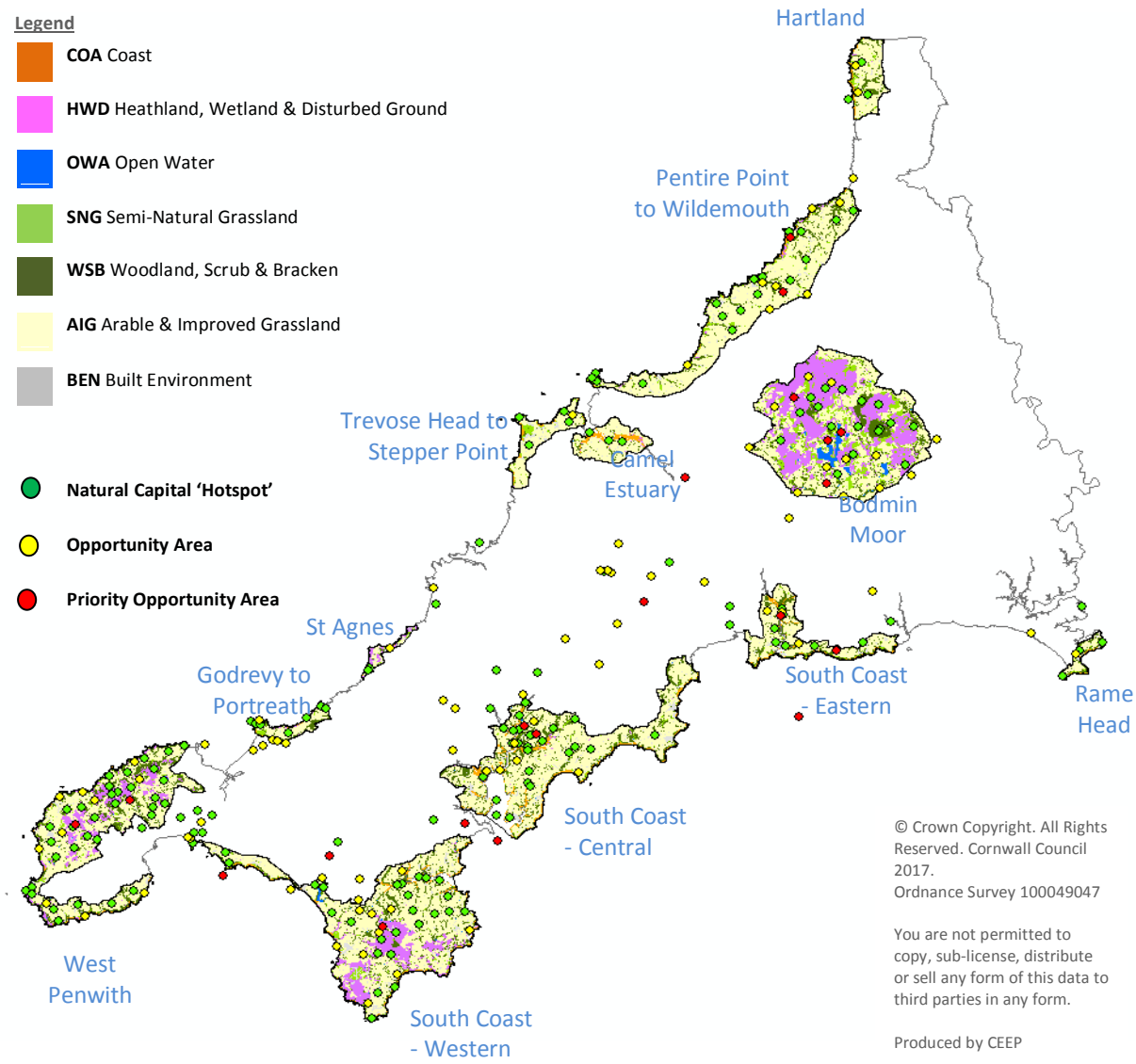
example to identify which kind of Natural Capital asset should be created. Participants also had to choose between red and yellow stickers where the red stickers represented priority markers indicating that investment in Natural Capital in these areas would be most effective and yellow stickers for less-prioritised areas. To simulate resource restriction each table was only given 6 red stickers so that participants had to discuss and choose the most important areas on the map.

Overall participants were very engaged and proactively approaching the exercise with minimal facilitation required. The feedback after the workshop was also positive and participants mentioned that it was not always easy but they could definitely see the value in the exercise.

After the workshop all stickers and notes/comments from referring sheets were digitalised in GIS format and provided to the Cornwall AONB Unit.[34] Altogether 166 Natural Capital 'hotspots' were identified. Furthermore the participants identified 105 Natural Capital opportunity areas; 20 of which were marked as priority areas. The map below shows the sticker locations from all three tables combined.

[34] Please contact Colette Beckham (cbeckham@cornwall.gov.uk) in case you are interested in the more detailed findings and the GIS layers.

Figure 3.2 Cornwall AONB Natural Capital Hotspot and Opportunity Map



Source: ***Based on GIS data provided by Cornwall Council and ERCCIS***

4. Sector Analysis & Natural Capital Interdependencies

4.1 Context

There are synergies between the core purposes of the Cornwall AONB (to conserve and enhance natural beauty) and the opportunities to strengthen and grow Cornwall's natural capital. The protected landscape provides both economic and recreational value; biodiversity; heritage and culture –its protection and enhancement is vital. This factor is recognised in the Cornwall Economy and Cultural Strategy[35] which sets out the '*Responsible use of the natural environment as a key economic asset'* in its Vision Statement, and by a number of stakeholders, including Cornwall Chamber in its 'Business Plan for Cornwall'[36], which states the particular importance of the natural environment in developing 'Brand Cornwall'. [37]

Businesses therefore have a major role to play if the CAONB Partnership is to meet the objectives set out in its Management Plan.[38] While this requirement applies specifically to the traditional industries of tourism, fishing and agriculture, it is equally important to the achievement of the goals set out in Cornwall Council's Economy and Culture Strategy[39]; the Cornwall and Isles of Scilly Local Enterprise Partnership (LEP) Strategic Economic Plan[40]; and the Environmental Growth Strategy.[41]

While all the aims of the CAONB Management Plan are important, those of particular relevance to the requirement to create a case and support for investment in Natural Capital in the CAONB from the business community are:

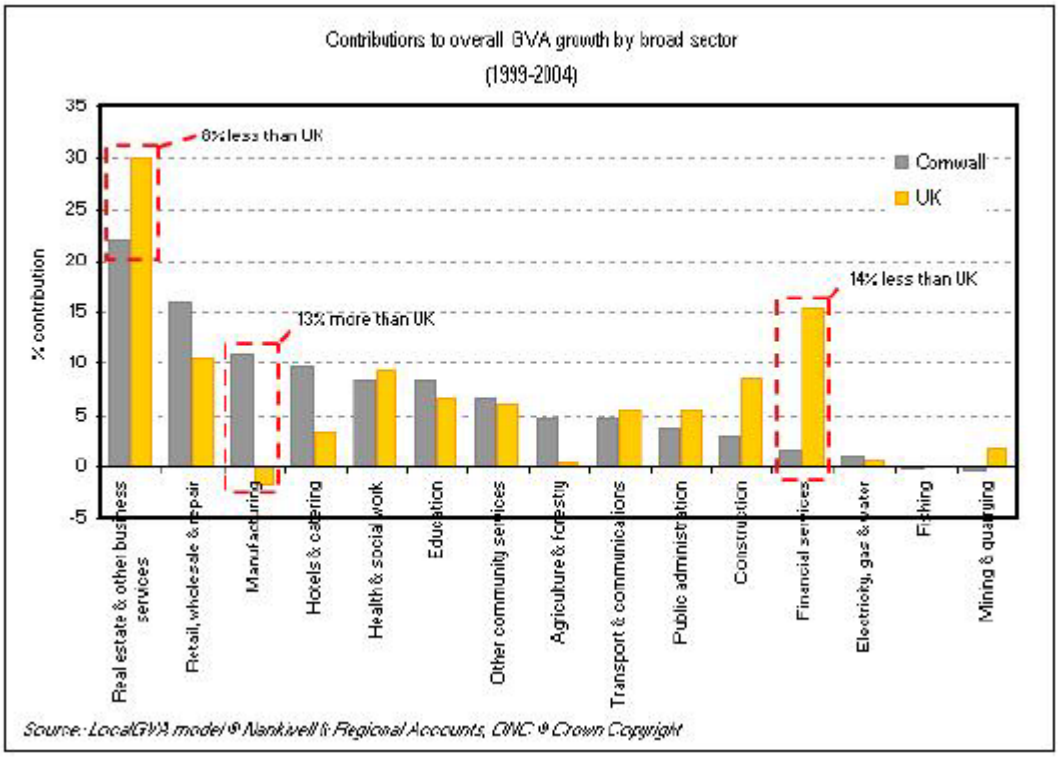
- Cultivating Character
- Managing Development
- Investing in Nature

[35] Cornwall Council 2013.
[36] Cornwall Chamber of Commerce 2015.
[37] Ibid.
[38] Cornwall AONB Partnership 2016.
[39] Cornwall Council 2013.
[40] Cornwall & Isles of Scilly Local Enterprise Partnership 2014.
[41] Cornwall & Isles of Scilly Local Nature Partnership and Cornwall Council 2016.

- Nurturing Heritage
- Revitalising Access
- Responding to Climate Change
- Promoting Prosperity

An Evidence Base Review produced for the Cornwall & Isles of Scilly Economic Development Strategy identified the importance of tourism, agriculture and forestry and the agri-foods sector (manufacturing) to the Cornish economy when compared to the rest of the UK.[42]

Figure 4.1 Contributions to Overall GVA growth by Broad Sector 1999-2004

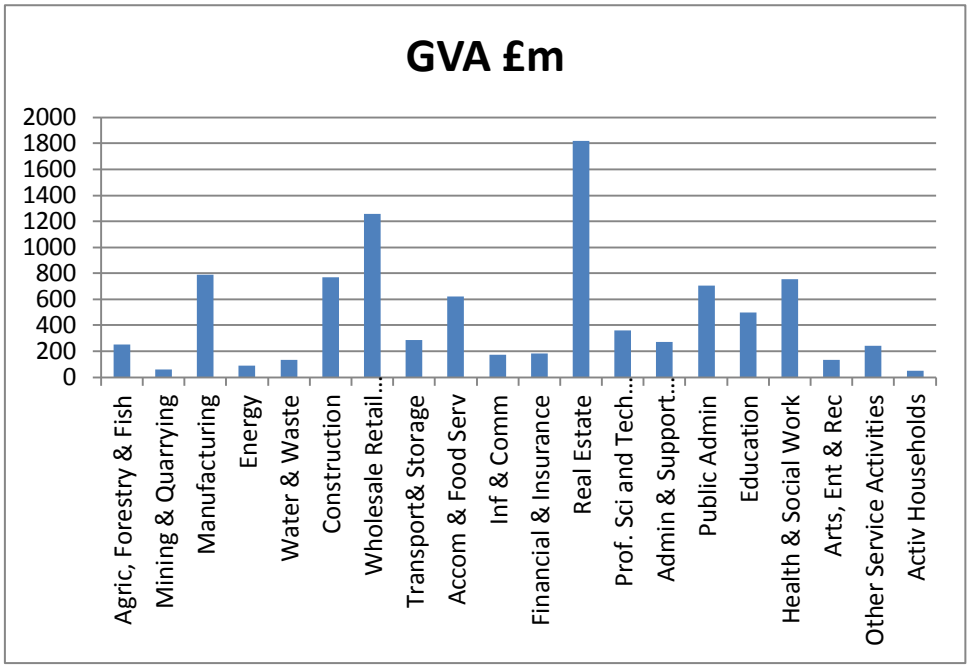


Source: ***Adopted from Cornwall and Isles of Scilly Economic Forum 2007, p. 7.***

Figure 4.2 shows the actual GVA contribution by sector based on 2014 data and Figure 4.3 the % contribution to overall GVA and the creation of jobs. This data confirms the importance of the tourism sector (taking account of accommodation, food services, retail and the arts and entertainment classifications) to the overall labour market in Cornwall.

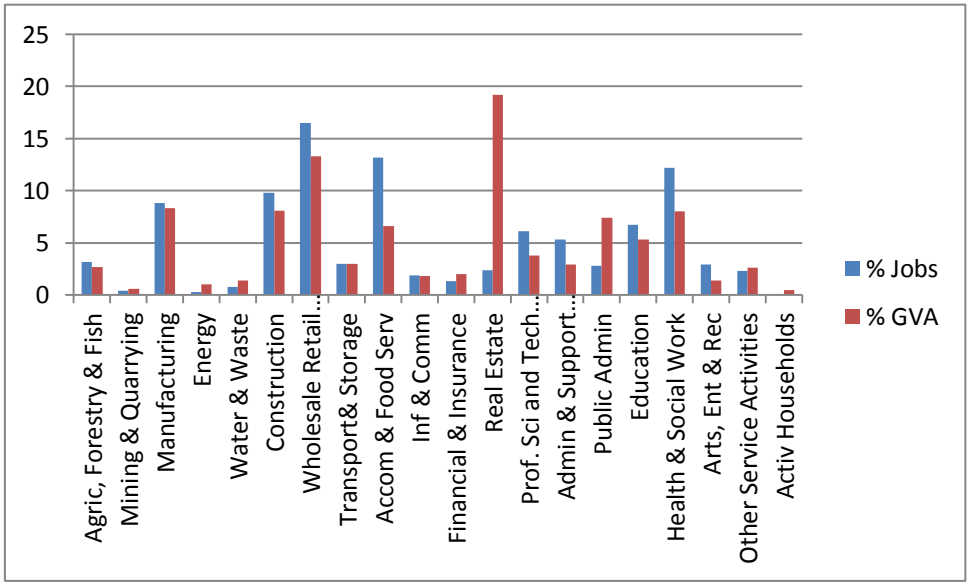
[42] Cornwall and Isles of Scilly Economic Forum 2007.

Figure 4.2 Contributions to Overall GVA by Sector in Cornwall – 2014 Data



Source: ***Cornwall Council***

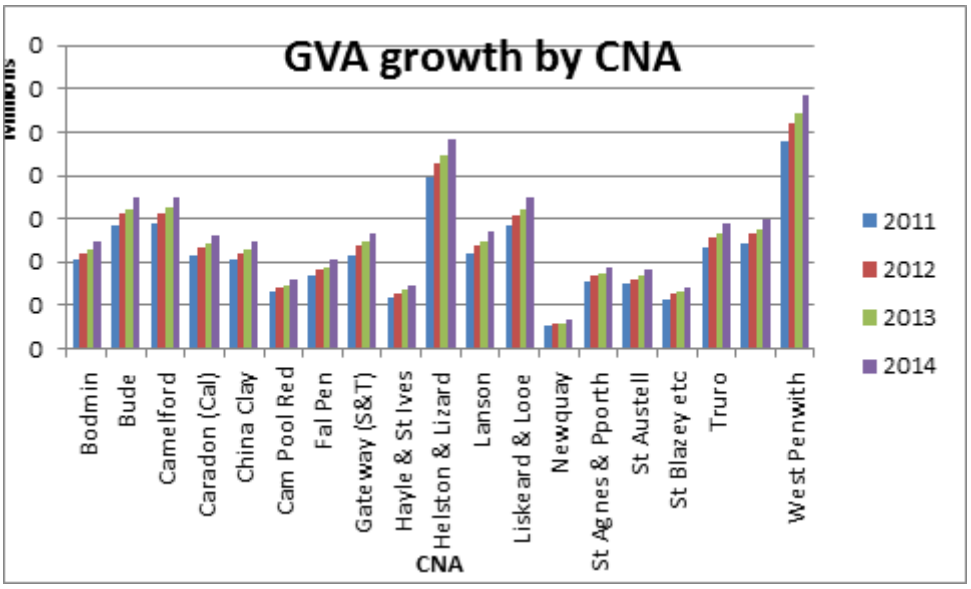
Figure 4.3 % Contributions to Overall GVA and Job Provision by Sector 2014



Source: ***Cornwall Council***

While this data represents sector activity across the whole of Cornwall, Figure 4.4 demonstrates the growth in GVA contribution across those geographic areas which equate to the CAONB and where the core sectors of tourism, agriculture, fisheries and forestry are of major importance.

Figure 4.4 GVA Growth by Location 2014



Source: ***Cornwall Council***

The Environmental Growth Strategy identifies the following contributions by sector and sub-sector to the local economy. Although these figures relate to the whole of Cornwall some conclusions can also be drawn about the relative importance to the CAONB.

Table 4.1 Examples of Economic Value of Key Sectors in Cornwall

Sector	Activity	Value
Tourism	General	£1,850m *13% of GVA; 1 in 5 jobs*
	Surfing	£153m
	Walking – coastal path	£175m
Agriculture	Crops	£53m
Fishing	Annual catches	£35m

Source: ***Cornwall & Isles of Scilly Local Nature Partnership and Cornwall Council 2016, p. 10.***

More recent aims set out in the Economic Plan extend the interest in sectors which depend on the natural environment (Natural Capital) with an emphasis on:

- Growing the agri-food manufacturing sector and agri-tech from local supply
- Renewable energy – technology and generation (solar, wave technologies and geothermal)
- Forestry and forestry products from improved woodland management
- Marine engineering and ports development

All of these activities, and an expanding tourism sector reflecting the growing interest in 'staycation', mean that it is of increasing importance that the business community has a good knowledge and awareness of the role of Natural Capital and the relevance of ecosystems services to continuing business success. Most importantly, there is a need for individual businesses in the priority sectors, especially those operating in the CAONB, to understand the full extent of their dependency on Natural Capital, the impact of specific business activity, any associated detriment, and the consequential risk to future sustainability.

A map of dependencies and impacts for the renewable energy sector will be of particular importance as this sector continues to grow. Cornwall is already considered to be one of the UK's leading counties for producing renewable energy with PFA reporting that 30% of energy is now provided by the sector, predominantly from solar photovoltaic arrays.[43]

4.2 The importance of Business Engagement and Awareness Raising

The Cornwall and Isles of Scilly Strategic Economic Plan[44] clearly recognises the connection between the environment and economic success and states that "*Our economic growth vision is a thriving and vibrant Cornwall and Isles of Scilly economy benefitting from our vast local assets and innovating our way into global markets: A unique blend of 'people and place' where the environment is valued both as a business asset and an inspiration for life*." Therefore improving the business understanding of the role and objectives of the CAONB, and raising awareness about business dependency and impact – key issues for this research project – are essential both for the delivery of economic potential and to support the

[43] PFA Research, September 2015, accessible from https://www.pfa-research.com/2015/09/cornwall-leading-the-sw-renewable-energy-market/
[44] Cornwall & Isles of Scilly Local Enterprise Partnership 2014.

creation of the business case for investment in Natural Capital – the basis of economic success.

The current position in Cornwall was discussed at the Inaugural meeting of the Project Steering Group. The general view from practitioners representing environmental organisations and business networks was that, despite the increases in natural 'disasters' – floods, storms, high winds and recent climatic change - current knowledge and understanding of the issues surrounding climate change and human impact on Natural Capital were generally low.

While a number of the organisations represented on the Steering Group had initiated relevant projects, it was recognised that these were generally local and limited in reach, and that more collective work needed to be done. One crucial issue was to simplify the technical and scientific language surrounding the topic and to make activity more relevant to the business community, its competitiveness and profitability. Business competitiveness is recognised in the LEP's Strategic Economic Plan as a key weakness in the economy.

It was also recognised by the Steering Group that current engagement activity was somewhat piecemeal and that a cohesive business communication plan and activity schedule was required. It was suggested that this should include a regular communication mechanism covering policy initiatives, challenges and potential solutions aimed at reducing impact and optimising the business return from investment in Natural Capital enhancements.

Various methods of communication were considered. Steering Group members felt that business workshops were an effective way of conveying common messages and some headway had been made in this area, for example the recent LNP/LEP business workshop which had achieved cross-sectoral representation, although this had dealt with relatively small numbers.

It was therefore agreed that the CAONB research project should include a pilot business workshop to publicise the work being undertaken and the results; together with the

introduction of some common methodologies for assessing business dependency and impact.

Some members felt that the connectivity between key business sectors, e.g. tourism, food, farming and recreation had not been adequately explored and that there could be benefit in considering a geographically based workshop which brought together cross-sectoral representation to consider the interdependencies of business activity which was dependent on Natural Capital. However, after discussion it was decided that a general workshop with a broad invitation list would provide best benefit.

The option to conduct an additional geographically-based workshop to test interdependencies was proposed by the Steering Group but has not been pursued to date. However it was noted that in relation to business dependencies, the Steering Group considered that boundary issues, the effect of activities outside the CAONB or on its boundaries should be taken into account in any overall assessment of impact on Natural Capital within the CAONB.

4.3 CAONB Business Workshop

A business-focused workshop was held on 15 June 2016 at the Mount Pleasant Ecological Park at Porthowan.

Purpose of the workshop

The agreed objectives for the event were:

- To raise awareness and increase understanding of the importance of ecosystems services to the health and wellbeing of the residents of Cornwall and its economy, and the value added by the Cornwall AONB,
- To demonstrate the importance of Natural Capital to the local economy and to key business performance,
- To examine changes in the local environment, the impacts of development and the risks imposed by climate change, and

- To consider measures which businesses can take to reduce impacts and enhance the quality of the landscape.

In line with the thoughts of the Steering Group there was mixed knowledge and understanding of the 'science' of Natural Capital and its relevance to the business community.

Participants questioned the status of Natural Capital as identified for the CAONB area and felt this was more closely equated with the position for Cornwall overall. Threats from the new development plan were considered to be significant together with the apparent effects of climate change, and the possible loss of investment from environmental stewardship schemes as a result of Brexit. Bodmin Moor, was considered to be at particular risk.

It was noted that some businesses had recognised either that they could be at risk or that there was reputational (business) value to be gained by investing in specific improvements. These businesses were requesting help with identifying the most appropriate investments to be made.

Assessment of Business Dependencies and Impacts Protocol

Attendees considered the extent of the research undertaken via the CAONB project and considered its application to their ongoing activity. They then worked with a process based on the newly published Natural Capital Protocol[45] which sets out a methodology to determine general business dependencies and impacts, to value these, and to identify consequent business risks and opportunities. The Protocol was developed for the Coalition by the WBCSD (World Business Council for Sustainable Development) – the parent body of project partner UK BCSD.

An ancillary publication, The Natural Capital Protocol Primer, sets the scene by stating that as a starting point *'Every business wants to create greater value, be more efficient and make better decisions'*.[46] It sets out a rationale for adopting the Protocol as a tool which allows a business to measure, value and integrate Natural Capital into existing business processes by

[45] Natural Capital Coalition. Natural Capital Protocol 2016
[46] Natural Capital Committee 2016, 1.

asking 'Why', 'What', 'How' and 'What Next'; and providing benefit as shown in Table 4.2 below.

Table 4.2 Business Case for the Natural Capital Protocol

Rationale	Benefit
Operational (regular business activity)	Improve efficiency, use less raw material, reduce risk and cost
Legal and regulatory	Reduce compliance costs
Financing	Improve access to finance, attract new investors and reduce the cost of borrowing
Reputational and Marketing	Improve relationship with stakeholders from investors to consumers and workforce Differentiate products, increase sales and revenue
Societal	Gain 'social licence' to operate by identifying and reducing impacts on the local community

Source: ***Adopted from Natural Capital Committee 2016, p. 1.***

The workshop used the protocol tools to identify business dependency and impact for a tourism business, an arable business, farming (livestock) within the CAONB area, and its effect on business activity outside the CAONB area, and a mixed farm and tourism business with a standalone renewable energy supply.

The blueprint for the assessment is set out in Table 4.3 and Table 4.4 below (based on an extract from the Natural Capital Coalition Protocol):

Table 4.3 Measuring Business Dependencies

Business Inputs	Examples of Dependency on Natural Capital
Consumptive	Energy
	Water
	Soil/ Climate - Food for animals or humans
	Raw materials, e.g. wood
Non-Consumptive – Essential Regulation	Flood Attenuation
	Pest control
	Waste management (circular economy)
	Emissions (air quality)
Non-Consumptive –Experience (Recreational tourism)	Topography, habitat, biodiversity or heritage
Non- Consumptive - Well-being/spiritual (Guest or employee satisfaction from environment; Health and wellbeing tourism from access to Natural Capital)	Topography, habitat, biodiversity or heritage

Source: ***Adopted from Natural Capital Protocol***

Table 4.4 Impact Drivers

Category	Examples of Measurable Impact Driver
Business Inputs	Level and type of water use
	Construction of structures e.g. barriers or dams for aquaculture, footpaths/roads
	Use of natural resources/raw materials
	Growing food
	Land take- built environment
Business Outputs	Pollutants (air, water and soil)
	Waste materials
	Emissions (air quality)
	Disturbances (e.g. light pollution)
	Landscape, soil or habitat erosion

Source: ***Adopted from Natural Capital Protocol***

Because of time constraints the participants did not consider fully the risks associated with business dependency which could be affected by significant change in the Natural Capital assets or by inadequate management of impacts, especially in high value or sensitive landscape areas.

Feedback from Participants

The general view of those present was that while it was difficult to separate the business activity into the categories proposed by the protocol, this methodology did provide a framework for an assessment which could be accessed by an SME. However, it was also clear that a more prescriptive form, which defined the categories more clearly, needed to be developed to enable this to be used most effectively by a range of businesses.

The following comments were made by participants:

- It would be necessary to allocate a direct financial measure to the dependencies/impacts to enable a business to see the direct effect on its performance and profitability.

- The financial impact or business benefits may take some time to be assessed accurately and data would need to be collected over a reasonable period (which could require support).

- Legislative or fiscal measures should not be overlooked and may prove to be more effective in generating behavioural change and investment plans to mitigate impact as these had a proven track record of success, e.g. smoking ban, drink driving.

Although, initially, the Workshop Groups found it difficult to apply the methodology proposed, some common thinking emerged when the results were analysed. This demonstrates that although the reported assessment categories are hard to interpret as written, they can be used by a range of businesses and business associates once they are applied to practical situations. Outputs from the workshop sessions were disseminated but no direct feedback has been received.

However, the overall assessment of the workshop reaffirmed the initial view that the general appreciation of the linkage between successful economic sectors such as tourism and Natural Capital, and particularly the associated impacts and challenges created by a growing visitor economy, were very low. Also, despite recent experience of severe weather conditions there was an equally low understanding of the potential for climate change adaptation, mitigation and improved resilience through increased investment in natural (capital) infrastructure. Likewise, a real recognition of the importance of the CAONB in this context and its role was generally somewhat undervalued.

Based on the outputs from the Workshop session, a simplified 'assessment tool' in the form of a short business survey has been developed. The aim was to reach a wider cohort of Cornish businesses and to relate their business dependencies and impacts to specific activities within the key economic sectors of tourism, agriculture/horticulture, and agri-food manufacture. For example 'Tourism' has been broken down into six subsectors and questions posed to relate business activity to the local environment. The survey also sought to identify any specific actions that individual businesses may have already taken to mitigate environmental impact. If the methodology is successful, this could be extended to wider manufacturing, fishing/marine industries, renewable energy and forestry.

Once sufficient responses are available an analysis of results will be prepared to demonstrate the dependencies in each category of activity, the likely impacts and resulting business risks using a simplified 'traffic light' system. Outputs will be used to create a dependency and risk report and to identify activity which may require remedial action. This mapping can then be linked to the scientific analysis of the state of Natural Capital and the provision of ecosystems services identified from the main research and mapping of the CAONB area.

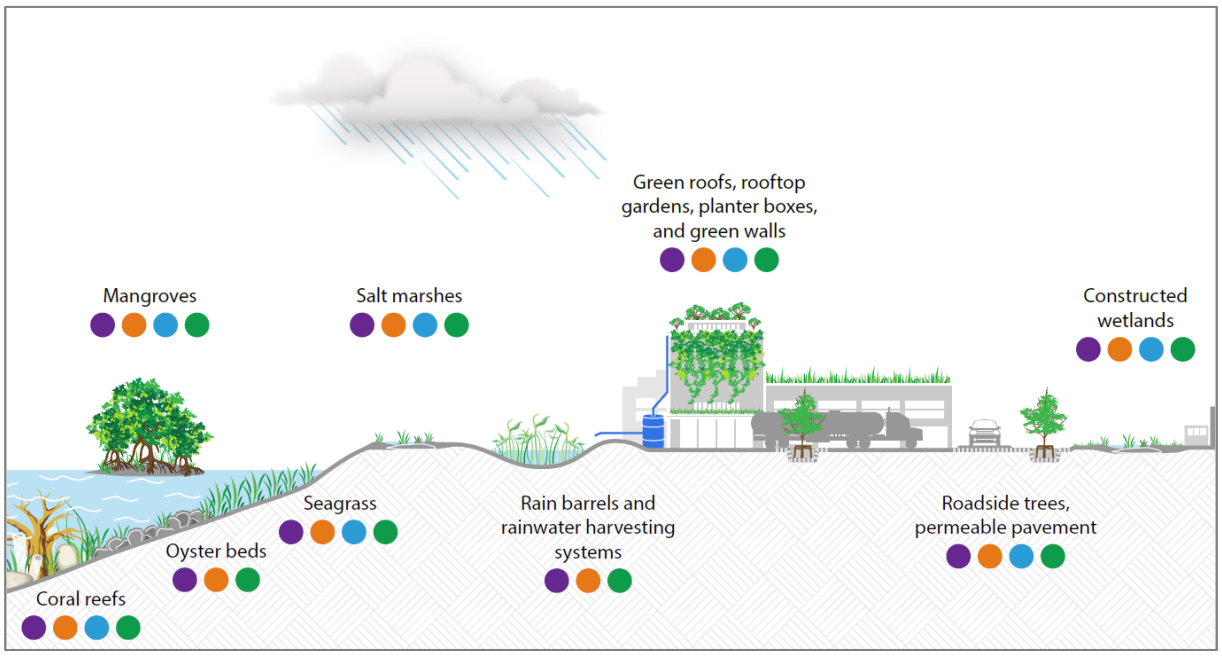
For the pilot the survey has been distributed via the networks of Cornwall Council, Steering Group members and those businesses attending the business engagement workshop.

Measurement and Valuation Tools

The workshop also considered some forms of valuing/measuring the cost of dependency and impact and a management approach to reducing risk based on the Ni4Biz protocol[47] developed by the WBCSD to align with the Natural Capital Protocol (see also Chapter 6).

This methodology assesses the advantages of investing in natural (capital) infrastructure to replace traditional 'grey' infrastructure (concrete) where viable and practicable in new development, as part of prevention and enhancement measures taken by individual businesses to reduce local 'risk', and in mitigation measures such as flood attenuation. To date most examples have been taken from outside the UK but it would be possible once the dependencies, impacts and associated risks are identified and valued, to consider a similar proposal for investment in Cornwall. Such an assessment could be linked to an investment plan arising from the opportunities mapping and form an integral part of building up the business case for investment in Natural Capital in the CAONB. An example of the types of activity considered to date by the WBCSD[48] is shown in Figure 4.5.

Figure 4.5 Examples of Natural Infrastructure Solutions

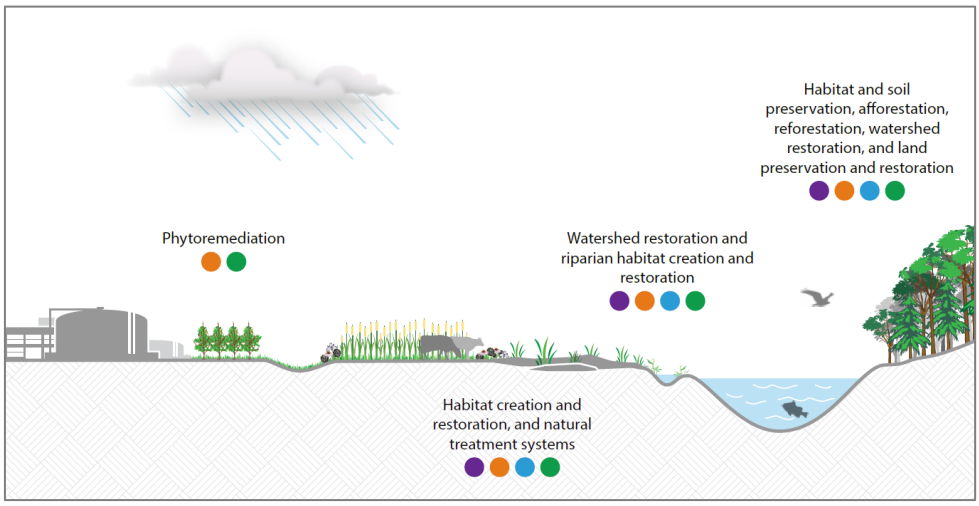


Source: ***Adopted from WBCSD 2016, p. 6.***

[47] http://www.naturalinfrastructureforbusiness.org/
[48] WBCSD 2016.

These investments have been delivered in conjunction with companies largely to reduce business risk from extreme occurrences such as floods or operational impact such as emissions or pollutants; to manage the shortage of resources such as water; or to improve habitat and biodiversity on which a business may depend. The associated benefits have also been mapped, including the enhancement to ecosystems services which these have created to complete the overall investment and benefits picture.

Figure 4.6 Benefits of Natural Infrastructure Investment



Source: *Adopted from WBCSD 2016, p. 7.*

WBCSD has also set out a protocol for assessing the business benefit from investment in natural infrastructure as part of its Ni4Biz toolkit (www.ni4biz.org). The format is illustrated in Table 4.5 below.

Table 4.5 WBCSD Ni4Biz Assessment Categories

Category	Examples of Areas of Assessment
Financial (Economic) Criteria - direct financial benefits	• Capital cost savings (on risk protection/reduction) • O&M savings • Return on investment from say energy efficiency and savings • Revenue creation – increased turnover because of e.g. yields or visitors
Environmental Co-Benefits	• Improvements in water, soil and air quality • Resource conservation/Waste reduction • Habitat creation, restoration and connectivity (between landscape features)
Social Co- Benefit	• Enhanced public health, community and liveability • Operational safety • Job creation and skills development • Social licence to operate – reputational value (new customers/customer retention)

Source: ***WBCSD 2016.***

The business workshop also considered examples of various methods adopted throughout the UK for incentivising investment by business in Natural Capital/natural infrastructure. Some examples are given in Table 4.6. These were all the result of collaborations – some driven directly by the private sector as a result of the identification of supply chain business benefit; and others by policymakers or environmental practitioners.

It should be noted that these are only examples but they generally recognise the benefits of collaboration between public, private and third sector organisations and in one case was driven by a creative and cultural initiative led by the third sector.

Table 4.6 Examples for Co-operative Projects

Initiator	Objective	Partners
Heineken	Hereford Orchards Network of Excellence: Promoting sustainable orchard management and improving biodiversity	Heineken, Hereford Cider Growers
	Profiting from Sustainability project in Yorkshire and Project Skylark– supply chain development: Introduced low carbon grower – implementing sustainable farming practices, reduced chemicals and cultivation methods to increase soil fertility	Future Food Solutions, Heineken, PepsiCo, Coca Cola, maltsters and farmers
Scottish Government	Aberdeen Land Use Strategy: Spatial framework to inform decisions on Land use change	NFU, RSPB, estates and farms, tourism network
Coigach-Assynt Landscape Partnership , NW Scotland	Expansion of native woodland, improving connectivity and resilience of habitats, local employment and training	Scottish Wildlife Trust, Scottish Lands & estates, farmers, crofters, local community
C-Space Trust	Lambeth Floating Marsh: improve banks and reduce flooding along industrialised sections of the Thames	Local Arts & Science Groups to provide community and educational resource for local schools

Source: ***Author***

5. Vision & Principles

5.1 A Vision for Natural Capital in the CAONB

The research team proposes that consideration should be given to supplementing the 20 year vision as stated in the Management Plan[49] as follows:

> *By 2026 Natural Capital in the Cornwall AONB is systematically monitored and managed not just to protect but enhance its value in terms of ecosystem services to businesses, people and wildlife alike. Sustainable investment plans and mechanisms are implemented to create bigger, better and more joined up Natural Capital assets making the AONB resilient to the effects of climate change. Everyone, including businesses and tourists, should be aware of their impacts and dependencies on Natural Capital and re-invest in this valuable asset to secure it for their own benefit as well as future generations.*

This project has indicated, although based on limited evidence, that the designation as an AONB has been effective in the way that detrimental change appears less significant than reported outside the AONB boundaries and UK wide. However less detrimental change does not mean no change or enhancement. Considering the substantial importance of a healthy natural environment for sustainable economic success, not least of the Cornish tourism industry, further efforts and reliable funding mechanisms are necessary to secure a sustainable future of the CAONB.

The balance of economic growth and the requirements for social change, i.e. the need for additional housing across Cornwall, when coupled with the effects of climate change, present an ever growing challenge requiring additional efforts and resources to manage the

[49] "*The status of the Cornwall AONB as a nationally and internationally important protected landscape, with equal status and protection to that of a National Park, is recognised by all.*
The landscape characteristics that combine to give Cornwall AONB its natural beauty, unique identity and sense of place are fully understood. The AONB landscape is conserved and enhanced at every opportunity through effective partnership working; achieving environmental growth, reversing losses of natural capital, biodiversity and heritage and improving resilience to climate change. A landscape that is accessible and appreciated by all. Communities and businesses in Cornwall are underpinned by a protected landscape that provides prosperity, good health and a high quality of life. They understand the value of the Cornwall AONB and take advantage of the opportunity it provides, while reinvesting in the landscape in order to sustain these benefits long term."
(Cornwall AONB Partnership 2016, 13)

AONB. Stakeholders who benefit from healthy and high quality Natural Capital assets in the Cornwall AONB, regardless of their location, need to understand its value to them and re-invest to secure a sustainable future; not just because other funding streams come under increasing pressure and uncertainty for example because of Brexit. A first step would be to better inform and educate relevant stakeholders depending on Natural Capital that the benefits they receive in the form of ecosystem services are not a given and that investment is required to sustain their own interests by protecting this valuable asset.

5.2 Key Principles for Natural Capital Management in the CAONB

The management and protection of ecosystems are global priorities. The Sustainable Development Goals (SDG), adopted in 2015, task governments, business and other stakeholders to *"protect, restore and promote sustainable use of ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss"* (SDG 15) and to *"conserve and sustainably use the oceans, seas and marine resources for sustainable development"* (SDG 14). Most of these requirements can be applied to the Cornwall AONB and to the environment of the County.

The AONB Management Plan[50] sets out a series of actions for delivery over the lifetime of the Plan. From the findings of this research project we propose that these are underpinned by the following:

- The completion of a comprehensive survey and accessible data report on the status and condition of Natural Capital in the AONB including blue infrastructure and the marine environment.
- The establishment of a set of quantifiable indicators (including quality, condition and demand) against which changes to Natural Capital in the AONB can be monitored.
- A recognised 'natural (capital) infrastructure first' policy where stakeholders are educated and encouraged to use natural systems instead of 'grey' manmade engineered solutions to achieve their objectives – e.g. wetlands instead of floodwalls to manage flooding risks.

[50] Cornwall AONB Partnership 2016.

- A structured business engagement and awareness raising programme organised with partners and developed as part of their annual programmes.
- A process to support businesses to better assess their impacts and dependencies on Natural Capital in the AONB including where and how their supply chain is also reliant on Natural Capital input.

6. Tools and Mechanisms for Natural Capital Management and Investment

6.1 Overview

The assessment and management of Natural Capital is often complex and can be challenging; especially when focussing on multiple ecosystem services and trade-offs. Fortunately, there are a range of tools and mechanisms available that can help with these kind of assessments. Within this Chapter we introduce tools that can help businesses and other organisations within the Cornwall AONB to better assess and manage Natural Capital and ecosystem services and identify some investment models which may be applicable. Table 6.1 provides an overview of the tools and mechanisms considered and what they are for. A brief introduction to each listed tool and mechanism is provided in the following Sections.

Table 6.1 Natural Capital Tools Overview

Tool/Mechanism	What is it for?	Whom is it for?	Section
Ni4Biz	A methodology for assessing the business benefits of investing in natural infrastructure (capital) to reduce business risk from resource limitation, regulatory requirements, changing climate and severe weather events, and stakeholder concerns and challenges	Businesses	6.2
Corporate Ecosystem Valuation (CEV)	To assess business dependencies and impacts on Natural Capital and ecosystem services	Businesses	6.3
Natural Capital Planning Tool (NCPT)	To assess the impact of proposed plans and developments on Natural Capital and ecosystem services	Planning authorities & developers	6.4
Monetary Ecosystem Assessment	To assess the monetary value of ecosystem services in a specific area	Local authority/ AONB	6.5
Natural Capital Accounting	To account for the true value of Natural Capital assets	Local authority/ AONB	6.6
Cost Benefit Analysis (CBA) & Multi-Criteria Decision Analysis (MCDA)	To assess if a project affecting Natural Capital is worthwhile considering social impact	Local authority/ AONB & other organisations	6.7
Payments for Ecosystem Services (PES) & Visitor Payback	A voluntary scheme where the beneficiaries pay for the provision of ecosystem services	Local authority/ AONB & e.g. tourism industry	6.8
Carbon Offsetting & Trading	A voluntary PES scheme where businesses can buy carbon credits to support e.g. afforestation projects	Local authority/ AONB	6.9
Biodiversity Offsetting	An obligation for developers to compensate for biodiversity loss due to development	Local authority	6.10

Source: ***Authors***

Please note that there are more tools that could potentially be applied within the CAONB so this list is not exhaustive. For an overview of further tools see for example the National Ecosystem Approach Toolkit (NEAT) or the Ecosystem Knowledge Network tools section.

6.2 NI4Biz

The NI4Biz platform is one of a suite of tools developed by the WBCSD to aid business with decision-making relating to sustainable development, the introduction of sustainable behaviours, and improving sustainable business growth.

For the purposes of the tool, natural infrastructure is defined as planned or managed natural or semi-natural systems that can help business use ecosystems services to replace 'grey infrastructure' such as traditional water management and treatment systems. Although many of the case study examples relate to major infrastructural substitution, the methodology can equally be applied to small-scale or local applications such as green roofs or wildflowers, local tree planting and habitat creation.

The aim of the platform is to strengthen the business case for investing in natural infrastructure by demonstrating that natural infrastructure solutions are not only cost-efficient and can reduce a company's risk exposure, but also have compelling co-benefits to society and the environment.

The platform contains materials which illustrate:

- the business case for investing in natural infrastructure,
- case studies from different industries leveraging various ecosystem services, and
- decision-making tools, including a cost-benefit analysis tool.

The business case can be assessed against a range of categories as illustrated in Table 4.5 of this report. All materials, including the decision-making tools, can be accessed online at www.NI4BIZ.org and include a series of factsheets addressing a range on Natural Capital projects.

6.3 Corporate Ecosystem Valuation (CEV)

WBCSD in partnership with IUCN, PWC, and ERM developed a Guide to Corporate Ecosystems Valuation (CEV)[51] which has been road-tested by companies on an international scale. Its basis were the findings of TEEB (The Economics of Ecosystems and Biodiversity), an initiative of the G8 Environment Ministers between 2007 and 2010.

The guide aims to help businesses identify and understand their impacts and dependencies on ecosystems and ecosystems services and to make informed decisions about future operational activity which help manage business risk but may also identify new business opportunities. The processes developed have formed the basis of the Natural Capital Protocol assessment which sets out a methodology for businesses to determine their dependencies on Natural Capital and the likely impacts of their operational activity, as set out in Tables 4.2 to 4.4 of this report.

The CEV process is complementary to other business tools (e.g. ESIAs, LCAs) and the Guide provides:

- A framework for improving corporate decision-making through valuing ecosystem services
- Resources to help navigate through related jargon and techniques.

It does not provide a mechanism for calculating values for ecosystems services or a price list which can be used for financial calculations but can be used to complement the more quantitative mechanisms available.

In parallel, WBCSD has also developed training material, tools and approaches to help companies better manage their ecosystem-related impacts and dependence. The Business Ecosystems Training (BET) course is a freely-available, modular capacity building program which aims to increase the knowledge and understanding of the links between ecosystems and business. The package has four modules:

- Module 1: Understanding the links between ecosystems and business.

[51] WBCSD 2011.

- Module 2: Assessing business impacts and dependencies on ecosystems.
- Module 3: An introduction to valuing ecosystem services.
- Module 4: Managing and mitigating business impacts on ecosystems.

For further information see WBCSD's Guide to Corporate Ecosystem Valuation or a short guidance prepared by CEEP as part of the National Ecosystem Assessment Follow-On (NEAFO) project.[52]

6.4 The Natural Capital Planning Tool (NCPT)

The Natural Capital Planning Tool (NCPT) allows an assessment to be made of the impact of a proposed plan or development design on 10 different ecosystem services including for example recreation and air quality regulation. The tool indicates the direction of change as well as the magnitude of the impact.

In 2011 the UK Government published its Natural Environment White Paper 'The Natural Choice – Securing the Value of Nature' acknowledging that *"Planning has a key role in securing a sustainable future. However, the current system […] is failing to achieve the kind of integrated and informed decision-making that is needed to support sustainable land use."*[53] Shortly afterwards in 2012 the new National Planning Policy Framework (NPPF) was published explicitly stating that *"The planning system should contribute to and enhance the natural and local environment by […] recognising the wider benefits of ecosystem services."*[54]

The NCPT is designed so that its application does not require specific ecosystem services expertise. It requires entering a range of indicators such as the land-use changes associated with the proposed development or plan. The NCPT is based on a Multi Criteria Decision Analysis (MCDA) framework and the outcome is a table indicating for each assessed ecosystem service as well as for all ecosystem services together if the impact of the plan or development is positive or negative and what the magnitude is applying a scoring system which was informed by an expert and stakeholder group when developing the tool.

[52] Hölzinger 2014a.
[53] HM Government 2011, 21.
[54] DCLG 2012, 25.

The application of the NCPT could result in a requirement for additional investment in on-site Natural Capital protection or enhancement to allow development to proceed. The NCPT could also serve as valuation system for ecosystem services offsetting (see also Section 6.10) and therefore provides for targeted off-site investment in Natural Capital in case on-site impact is unavoidable.

The NCPT is in a testing and development state and not available in the public domain yet. However, there may be an opportunity to include the CAONB as a case study partner for this ongoing research project. For more information about the NCPT see the project report of the last project stage[55] or contact the tool developer and project coordinator Oliver Hölzinger.[56]

6.5 Monetary Ecosystem Assessments

A monetary ecosystem assessment is an assessment of the value of ecosystem services provided within a specific spatial area such as the CAONB. The aim is to translate environmental values into a common metric everyone can understand, i.e. money. This makes environmental values more visible and tangible; especially to non-specialists and is consistent with the views expressed by participants at the business engagement workshop.

Usually the 'external' value of Natural Capital and ecosystem services is hidden because ecosystem services such as air quality regulation, recreation or aesthetic values are not traded on markets and therefore do not have a market price indicating their value. Because people can benefit from these services for free they are often overlooked, undervalued and taken for granted.

A monetary ecosystem assessment uses indirect quantification techniques to reveal the value of such services. This can help to generate a general awareness of the value of ecosystem services and Natural Capital and the need for active management and funding. It can also be used to communicate the value of ecosystem services to non-specialists and decision-makers or to promote certain high-quality assets such as the CAONB. An initial monetary ecosystem valuation case study for Godrevy to Portreath can be found in Section

[55] Hölzinger, Laughlin, and Grayson 2015.
[56] Oliver.hoelzinger@t-online.de

2.2 of this report. This could be extended to the whole of the CAONB or Cornwall including as many ecosystem services as possible. For more information about (monetary) ecosystem assessments see for example the Ecosystem Assessment Guidance published by CEEP as part of the National Ecosystem Assessment Follow-On (NEAFO).[57]

6.6 Natural Capital Accounting

The purpose of Natural Capital Accounting is to integrate the external and usually hidden value of Natural Capital into financial accounting. In conventional financial accounting external (social/environmental) values such as carbon storage are usually not accounted for which means that especially environmental services are often neglected. This can lead to the perception that environmental management services such as those provided by local authorities or land-managers are purely a liability rather than an asset providing valuable ecosystem services to society.

Both, the UK Government and the Office for National Statistics (ONS) have, amongst others, highlighted the importance of Natural Capital accounting for a sustainable economy and the ONS is committed to fully include Natural Capital into UK Environmental Accounts by 2020.[58] As for monetary ecosystem assessments a monetary quantification of ecosystems is required for Natural Capital Accounting. The results are often summarised in a Natural Capital Balance Sheet which shows both, private and social asset values and liabilities.

Establishing a Natural Capital Balance Sheet reveals the true value of environmental assets owned and/or managed by an organisation. It can for example help park departments of local authorities to negotiate budgets because a Natural Capital Balance Sheet shows that parks and other environmental assets are not purely a liability but indeed a valuable asset. For more information about Natural Capital Accounting see for example this report produced for the Natural Capital Committee (NCC).[59]

[57] Hölzinger 2014b.
[58] HM Government 2011; ONS 2012.
[59] Eftec 2015.

6.7 Cost Benefit Analysis & Multi-Criteria Decision Analysis

Cost Benefit Analysis (CBA) and Multi-Criteria Decision Analysis (MCDA) are tools that can be used to assess the desirability of a project. CBA is based on monetary quantification whilst MCDA uses a simpler scoring and weighting system which does not require monetary assessments.

In this context we focus on social CBA which explicitly considers external (social/environmental) impacts of a project such as the value of health benefits provided by a greenspace site. The purpose is to assess if a project provides 'good value for money'. In a CBA all costs and benefits associated with a project are compared and the main outcome is commonly a Benefit-Cost Ratio (BCR). The BCR shows the social benefit (or cost) of a project for each £1 invested.

MCDA in contrast does not require monetary quantification. It is based on a scoring system where the impact of a project such as a Natural Capital intervention is judged by the assessor (or for example a stakeholder group). The impact across relevant criteria is assessed using a simple scoring system such as '+++' and '--' for each criterion. This means that the reliability of the outcome very much depends on the expertise and judgement of the tool user and the selection of relevant criteria.

CBA and MCDA can for example be used to show potential funders that a project such as the creation of Natural Capital assets is worthwhile and money well spent. But CBA and MCDA can also be used to assess and monitor the success (or not) of already realised projects to communicate success stories with stakeholders. For more information see for example the CBA/MCDA Guidance produced as part of the NEAFO.[60]

[60] Sunderland and Hölzinger 2013.

6.8 Payments for Ecosystem Services & Visitor Payback

Payments for Ecosystem Services (PES) is a voluntary scheme where the beneficiaries of ecosystem services (e.g. tourists) pay for the provision of these ecosystem services (e.g. by land owners or nature conservation organisations). Visitor payback is a specific PES scheme where visitors benefiting from ecosystem services such as green recreational opportunities contribute towards the costs for providing and managing these services.

The idea behind PES is that beneficiaries of ecosystem services also pay for them instead of benefiting as 'free rider' without contributing to the costs of Natural Capital management etc. Beneficiaries (and potential buyers in a PES scheme) can be individuals but also businesses or other organisations and there are many different examples available such as the Wetland Example of Payments for Ecosystem Services (WEPES) project by the Westcountry Rivers Trust in west Cornwall.

A PES scheme that could offer a particularly interesting opportunity for the CAONB is visitor payback or 'visitor giving'. CAONB visitors and hence the local tourism industry are strongly benefiting from local high quality Natural Capital assets. But usually visitors do not have to pay for the cultural ecosystem services such as recreational opportunities or the aesthetic value of Natural Capital within the CAONB; they can use these natural services for free. Considering that the natural environment is one of the key attractions for visiting the CAONB a visitor payback scheme may be a good opportunity to generate additional funding for Natural Capital management, creation and enhancement.

A survey conducted in 2013 identified 32 Visitor Giving Schemes across the UK, 7 of which were located in AONBs and another 15 in National Parks.[61] Research by the Peak Tourism Partnership on visitors' attitudes to donating to conservation projects revealed that 74% of visitors supported the principle of supporting local conservation work and expressed a willingness to contribute through donations or voluntary levies. The Exmoor Paths Partnership reported that a single small hotel raised an average of £1,000 each tourist season from placing a levy on meals and accommodation.[62] Such levies could also be tested

[61] Reed et al. 2014.
[62] Ibid.

and implemented within the CAONB tourism industry if the mutual benefit can be demonstrated. However, experience shows that it is important that such a scheme is well designed and created in close collaboration with the industry.

There are many different options for designing a visitor payback scheme. One option could be to provide tourists visiting the CAONB with some initial information about the AONB and its Natural Capital or for example a nature walk guide at check-in at local hotels. At check-out they would be asked if they enjoyed their nature experience and if they would like to contribute towards the enhancement of this valuable asset. Other related PES schemes are for example membership fees for regular visitors or business stewardships for businesses directly or indirectly benefiting from ecosystem services.

The success of a PES scheme very much depends on its design and appeal to potential 'buyers' of ecosystem services so it needs to be well designed to suit the local context and demand. For more information about PES see for example Defra's Best Practice Guide.[63] For further details about visitor payback schemes see also the pilot visitor giving report published by Birmingham City University.[64]

6.9 Carbon Offsetting & Trading

Virtually every business, organisation or individual emits carbon and other greenhouse gases – either directly (e.g. fuel emissions from transport or methane from livestock production) or indirectly (e.g. electricity use or livestock consumption). Carbon offsetting is a voluntary mechanism where e.g. businesses who commit to sustainable development and carbon neutrality can offset unavoidable greenhouse gas emissions[65] by buying 'carbon credits'. Carbon credits can be sold e.g. by landowners who invest in afforestation or the restoration of wetlands because such projects sequester carbon from the atmosphere and store it in vegetation and corresponding soils. So basically, the emitters of carbon pay for projects that capture and store the emitted carbon again. Carbon offsetting is a Payments for Ecosystem Services (PES) scheme.

[63] Smith et al. 2013.
[64] Reed et al. 2014.
[65] The emission factor of other greenhouse gasses such as methane can be translated into the equivalent amount of carbon that is needed for offsetting.

For a successful and meaningful carbon-offsetting scheme it is important that all offsetting projects are additional (meaning that the projects would not have happened without the carbon credits). It is also important that both, carbon emissions and carbon sequestration and storage are objectively measured and quantified. For these reasons, it is standard to have an external and independent verification process such as the Woodland Carbon Code developed by the Forestry Commission. The Woodland Carbon Code sets quality standards and for example offers tools to calculate the projected sequestered carbon of a planned afforestation projects. A related standard is the Peatland Carbon Code.

For the Cornwall AONB there may be a potential to attract private funding for afforestation and wetland restoration projects that sequester and store additional carbon from the atmosphere through a local carbon trading scheme. A first step would be to approach businesses in Cornwall to explore if there is scope and acceptance for carbon offsetting.

6.10 Biodiversity Offsetting

Biodiversity offsetting is a measure to compensate for biodiversity losses, e.g. due to development, elsewhere. The idea is that developers have to buy so called 'biodiversity units' for damage to biodiversity on-site. But there is a mitigation hierarchy that needs to be followed where harm to biodiversity should first be avoided and if that is not possible, mitigated. Compensation through offsetting is the last resort.

Biodiversity units are calculated based on the habitat distinctiveness, condition and total area to quantify the effect on biodiversity. However, other indicators such as habitat connectivity could also be recognised. The developer will then have to find an offsetting provider such as a nature conservation organisation that has restored or created habitats to support biodiversity for an offsetting scheme and to buy the appropriate amount of biodiversity units. Again, as for carbon offsetting, additionality is required so biodiversity units cannot be offered for habitat creations that would happen anyway.

In 2012, Defra has published biodiversity offsetting guidance for a pilot scheme for local authorities, developers and offset providers, respectively which can be assessed here. The guidance for local authorities also outlines how biodiversity offsetting obligations can be

implemented through 'Section 106' agreements as set out in the Town & Country Planning ACT 1990. The Community Infrastructure Levy which has been adopted by Cornwall Council may also serve as delivery mechanism.

It should be noted that biodiversity offsetting is often seen as controversial for example because there is strong doubt as to whether the same biodiversity value can be re-created, due to the time-lag between biodiversity loss and creation/restoration. In addition, biodiversity offsetting compensates for biodiversity values but not for other important ecosystem services such as recreational opportunities, flood regulation. Etc. It is feared that developers may use biodiversity offsetting as a relatively simple solution to by-pass the mitigation hierarchy. Therefore we advise that especially potential offsetting providers in Cornwall such as conservation organisations are consulted before a scheme is established. H A Cornwall-wide scheme could particularly benefit biodiversity in the AONB if funds are directed towards the AONB areas. This could be done in line with identified opportunity areas (see Chapter **Error! Reference source not found.**). However, instead of implementing a biodiversity offsetting scheme we would recommend the development of an ecosystem services offsetting scheme that would compensate for losses to several ecosystem services. The NCPT (see Section 6.4) could be used to quantify ecosystem services units in such a scheme.

7. Conclusions, Recommendations & Next Steps

7.1 Conclusions

This assessment has clearly shown that Natural Capital and the ecosystem services that flow from them are of particular importance within the Cornwall AONB; and that the local economy, especially tourism, agriculture, forestry and the agri-food industry strongly depend on them. High quality Natural Capital is also of high value to the local community in terms of wellbeing benefits which is also indicated by the high demand for housing and 'staycations' in the area.

There are signs of positive changes across provisioning, cultural and regulating ecosystem services within the CAONB between 1995 and 2005. This includes for example afforestation and some wetland creation which add value in terms of biodiversity, recreation, flood risk regulation etc. However, this does not necessarily indicate that for example continuing biodiversity loss has stopped and when later data is made available it is possible that any positive gains have been reversed (see Chapter 2).

Equally, drivers of change - residential development, climate change and economic pressures - also mean that additional efforts by all stakeholders, including businesses, are required to better protect and enhance Natural Capital. Otherwise Natural Capital degradation could threaten the 'outstanding natural beauty' of the area which could have significant impacts on key sectors of the local economy (see Chapter 4). The Natural Capital hotspot and opportunity areas identified as part of the mapping exercise (see Chapter 3) could be a good starting point for adding additional protection to particularly valuable assets and for strategically enhancing/creating high quality Natural Capital assets, respectively.

The project has also shown that detailed environmental and economic data at the CAONB level is relatively scarce. This makes an analysis of the Natural Capital and the ecosystem services that flow from them challenging which is why the uncertainties within this report are rather high. The update of land-use data by ERCCIS which is underway will certainly be a big step in establishing a robust and up-to-date evidence baseline. But to assess and monitor

changes to Natural Capital, ecosystem services and biodiversity meaningfully, more relevant and accessible data is required at the CAONB level.

Establishing a robust baseline and monitoring indicators is important because 'what gets measured, gets managed'. More and more funders require a robust monitoring system which allows assessing the success of environmental projects against a clearly defined baseline. Not having these means that the CAONB could miss out on external funding opportunities. Establishing a robust baseline and strong indicators related to ecosystem services and Natural Capital was for example a key priority when selecting and funding the 12 initial Nature Improvement Areas (NIA's) in England.[66]

In the Natural Capital hotspot and opportunity workshop (see Chapter **Error! Reference source not found.**) local stakeholders have identified many locations that are of particularly high value. Furthermore, the workshop has shown that there are many opportunities to improve and create high quality Natural Capital assets within the Cornwall AONB. Some tools and mechanisms to fund such projects have been outlined in Chapter 6 of this report.

The CAONB Management Plan[46] sets out a comprehensive list of planned actions including those directly affecting business such as Actions H, I, R and Y[67], and those which aim to support sustainable business growth especially in the tourism sector such as Actions F and K, M, N and O[68]. However, while the Plan recognises the need for input from the wider

[66] Natural England 2012; Defra 2012.

[67] CAONB Management Plan. Action H: *'Develop a project to support tourism and outdoor leisure and recreation businesses in the promotion of the landscape and culture of the AONB to increase competitiveness and boost AONB awareness*

Action I*: Undertake a project to improve the economics of the forestry and wood products sector with the improvement of supply chains. This in turn should secure improvements for biodiversity and the management of the semi-natural woodland resource within the AONB, particularly in the estuarine oak woodlands of the Fal, Helford & Fowey*

Action R*: Promote and deliver the uptake of the new Countryside Stewardship Agri-environment scheme in areas of biodiversity interests within the AONB in order to maximise take-up and encourage positive land management*

Action Y '*Develop a project to support the agriculture, food and drink sector utilising the protected landscape designation to add value through branding and marketing'*

[68] CAONB Management Plan. Action F: *'develop, consult upon and deliver a series of local sustainable transport schemes within the AONB to reduce reliance on the car for short journeys and encourage sustainable travel in the AONB area and create attractive and vibrant communities which are well connected*

Action K*: Develop a joint Natural Capital Investment plan for the AONB which identifies investment opportunities for the enhancement of ecosystems good and services, highlights geographic opportunity and demonstrates the value of the protected landscape. Use the plan to inform decision-making*

community, there is no specific focus on direct business engagement and involvement. This may be an essential requirement of any future finance plan and the success of proposals such as that set out in Action J[69] of the Management Plan.

Our business workshop and general research suggests that while there is some business awareness and interest in developing the opportunities offered by Natural Capital, business understanding and engagement with the processes for protecting, maintaining and enhancing Cornwall's environmental attributes, especially through the CAONB, appears relatively low. Although a wide range of stakeholders/practitioners are involved with the CAONB Partnership there seems to be no direct mechanism for regular structured business contact.

If the CAONB is to be successful in developing a sustainable financial plan for action then the support and input from local business will be crucial. This will require a greater general awareness of the overall contribution of Natural Capital to the economy of Cornwall, and an improved understanding of the individual dependency on environmental factors and the resulting impact of business activity, ideally presented through a simple monetary evaluation. At the current time the language of Natural Capital appears to remains the first barrier to better engagement. A recognition of the economic value of Natural Capital is considered essential to the successful implementation of Action Z[70] of the plan.

A number of valuable projects have been undertaken by the CAONB, in partnership with key stakeholders and, from discussion, by individual organisations. To make such projects more visible for the wider community a standard methodology for planning, monitoring and reporting project outcomes may be beneficial. Also, a platform where businesses and other

---

Action M: *'Understand better the economic social and cultural value of heritage and the potential for the sustainable reuse of heritage buildings and structures. Enable sensitive reuse to support rural economies and communities through place-based projects'.*
Action N*: Ensure improved management for Scheduled Ancient Monuments through a project to understand their management needs, undertaken practical management working with landowners*
Action O*: 'Develop in an appropriate area of the AONB a project to manage the natural capital, rights of way and heritage using volunteers.*

[69] CAONB Management Plan. Action J: *'Securing financial investment in Cornwall AONB Partnership activity from visitors and businesses through the development of a visitor giving scheme and other initiatives'*

[70] CAONB Management Plan. Action Z: *'Undertake a study to understand the true value of the Cornwall AONB to the Cornish economy'.*

organisations can share success stories and best practice may help them to promote their activities which in turn could encourage more related projects.

The new CAONB Management Plan sets out a comprehensive set of actions to be undertaken with partners. However, our discussions with members of the Steering Group identified that key organisations also have their own priority action plans. To optimise the effect of the funding available it could be beneficial to develop a combined action plan for the implementation of a co-ordinated approach to Natural Capital activity.

7.2 Recommendations – A Comprehensive All-Partner Action Plan

Table 7.1 Summary of Recommendations to form the basis of an All Partner Action Plan

Action	Potential Partner(s)	Timescale
Positive Planning for Natural Capital		
The implementation of advanced monitoring and management practices at the project level focussing on specific local issues. A starting point could be a NI4Biz or CEV case study for a specific sector or company.	UK BCSD; Chamber of Commerce	Short
Trialling the use of the Natural Capital Planning Tool (NCPT) at a key new development site or plan.	Cornwall Council; University of Birmingham	Short
Create a planning investment strategy for Natural Capital	Cornwall Council Planning, LEP	Short-Medium
Investment Funding		
The exploration of opportunities for carbon offsetting and trading.	LNP, Landowners, Forestry Commission	Short-Medium
The exploration of opportunities and acceptance for biodiversity offsetting.	LNP, Wildlife Trust, Cornwall Council	Short-Medium
The creation of a Cornwall AONB Natural Capital investment plan based on created opportunity maps.	Cornwall Council and all relevant stakeholder groups	Medium
The exploration of opportunities for a Visitor Payback scheme in partnership with the tourism industry.	Cornwall Council, Chamber of Commerce, LEP, Tourism Industry	Medium-Long
Widening Business Engagement		
The establishment of closer linkages with Cornwall Awards Scheme for recognition of Natural Capital investments or improved resource efficiency.	Cornwall Council	Short
The introduction of a Cornwall Council Business Charter with specific challenges relating to the protection and enhancement of Natural Capital, the requirement for an environmental dependencies assessment and recognised as	Cornwall Council, Chamber of Commerce	Short

part of a sustainable procurement process.		
The introduction of a special award or merit system aimed at improving business competitiveness such as a High Value Environmental Quality Mark linked to improving business performance and competitiveness with investment standards and to a brand promotion for Cornwall products.	Cornwall Council, LEP, Chamber of Commerce	Short-Medium
The introduction of a Climate Change Adaptation and Resilience programme for the CAONB.	LNP, LEP, Cornwall Council, Chamber of Commerce	Medium
Consider the formation of geographically focused business groups linked to the AONB to determine local needs and set out a strategy and action plan for the protection and enhancement of Natural Capital.	Cornwall Council, Chamber of Commerce, Business Organisations	Medium - Long
Data & Monitoring		
The review of monitoring report indicators with respect to ecosystem services.	Cornwall Council, LNP, Natural England	Short
The creation of a full economic assessment of Natural Capital and ecosystem services value based on an extension of the Godrevy-Portreath case study.	LNP, CEEP	Short
The usage of existing ecological records to assess if Cornwall-wide trends of species loss also apply to the AONB subset.	ERCCIS	Short-Medium
The implementation of an AONB aggregation level for relevant economic data and e.g. visitor statistics.	Cornwall Council	Short-Medium
The establishment of links with partners to collect and generate fit-for-purpose data such as the condition and quality of Natural Capital assets and records for the marine environment.	LNP, ERCCIS, University and Research Institutions	Medium
The update of this Natural Capital Assessment based on updated data in the future.	Cornwall Council, CEEP, UK BCSD	Medium-Long

8. *Source:* ***Authors***

Positive Planning for Natural Capital

In the short term, and in the absence of sufficient funding resources we recommend implementing advanced monitoring and management practices at the project level focussing on specific local issues. Working at the project level has the advantage that very specific issues can be addressed which is difficult when several locations and sectors are engaged. A starting point could be a NI4Biz or CEV (see Sections 6.2 and 6.3) case study for a specific sector. Such opportunities could be explored with the Cornwall growth hub. This could kick-off a social learning process where businesses and other stakeholders can see the value of such assessments, learn from good practice and adopt such practices for their own

management. This process could be enrolled to other sections of the AONB and/or other sectors. It could then lead to other investment streams into Natural Capital such as environmental stewardship..

As development pressure related to business growth as well as the requirement for new housing has been identified as a main driver for current and future land-use changes in the CAONB, support for investment in Natural Capital within the planning system locally is essential. While the Management Plan sets out some comprehensive activity for protection of the CAONB it will be important to demonstrate how smart planning can not only mitigate negative effects but also have positive effects on Natural Capital.

This concept could be explored further through use of the Natural Capital Planning Tool (NCPT). The NCPT is a low expertise, low cost solution to assess and manage the impact of a plan or development on Natural Capital and ecosystem services (see also Section 6.4). As it requires no expert knowledge it could be tested in the production of a Neighbourhood Plan or a key development within the AONB in line with Actions A[71] of the Management Plan. Furthermore, the NCPT could be used to aggregate Natural Capital impact due to development at the Cornwall/AONB level to inform the Council's Annual Monitoring Report.

As the Cornwall Local Plan has set out a high level of development activity it may be beneficial to enter into discussions with the Council's planning service to agree a strategy (which could be set out within a Supplementary Planning Document) setting out a requirement for funds levied from development to be made available for both, on and offsite investment in Natural Capital with priority given to the opportunity areas identified within the CAONB.

Investment Funding

[71] CAONB Management Plan. Action A: *'Encourage and support the production of Neighbourhood Plans within the AONB supported by detailed evidence based on landscape character, natural capital, historic environment, climate change adaptation and biodiversity.*

To attract additional sustainable funding streams for the creation and enhancement of high quality Natural Capital within the CAONB we recommend to explore opportunities for setting up a visitor payback scheme involving the local tourism industry as one of the main beneficiaries of cultural ecosystem services such as aesthetics and recreational opportunities in the CAONB in line with Action J[72] of the Management Plan (see Section 6.8). As Natural Capital is of significant importance for the industry, this would be of mutual benefit and would not necessarily incur high additional costs or a significant additional effort for the industry which is often a barrier for such schemes.

The opportunities for and acceptability of carbon offsetting (See Section 6.9) and biodiversity offsetting (see Section 6.10) as potential funding mechanisms should be explored with stakeholders and partners. This may present an interesting private investment and funding mechanism to enhance Natural Capital value within the AONB. This could be aligned with identified opportunity areas (see Chapter 3).

We also support the proposal for the preparation of a Cornwall AONB Natural Capital investment plan. After exploring several opportunities such as visitor payback with relevant stakeholders to determine viability and support, a suite of investment mechanisms can be adopted in such a plan. However, external funding opportunities such as through Heritage Lottery Funding and European Funding streams (or equivalent national funding sources if available after Brexit) should also be part of the plan.

Any investment plan should set out strategic investment opportunities with clearly defined priorities. This may include some of the elements proposed in this report but more importantly actions on the ground which will enhance or create Natural Capital assets. The outputs of the Natural Capital hotspot and opportunity workshop (see Chapter 3) will serve as valuable resource when developing investment priorities together with relevant stakeholders.

Widening Business Engagement

[72] CAONB Management Plan. Action J: *'Securing financial investment in Cornwall AONB Partnership activity from visitors and businesses through the development of a visitor giving scheme and other initiatives'*

Greater business engagement may need some small-scale incentivisation, focused on improving business or brand reputation and/or increasing business opportunity through for example recognition in public procurement criteria. This could include mechanisms such as:

- Closer linkages with Cornwall Sustainabilty Awards Scheme for recognition of Natural Capital investments in local improvements or improved resource efficiency.
- Introduction of a special award or merit system aimed at improving business competitiveness such as a High Value Environmental Quality Mark (linked to improving business performance and competitiveness with investment standards and linked to a brand promotion for Cornwall products).
- Introduction of a Cornwall Council Business Charter with specific challenges relating to the protection and enhancement of Natural Capital, the requirement for an environmental dependencies assessment and recognised as part of a sustainable procurement process.
- The introduction of a Climate Change Adaptation and Resilience programme for adoption by businesses operating in the CAONB.

Consideration should be given to the formation of geographically focused business groups linked to the AONB to determine local needs and set out a strategy and action plan for the protection and enhancement of Natural Capital.

A programme of action to help businesses assess their level of dependency on Natural Capital, ongoing impact, and the associated risk to business continuity and growth if the status of Natural Capital is diminished whether through human activity, economic pressures, or as a result of climate change should be considered. This could be initiated through mainstream business activity which includes the use of a survey tool to raise awareness and capture base data, together with a supported programme to deliver a simple monetary assessment.

Data Availability, Gap Analysis & Monitoring

One particular problem when conducting this study was the availability of environmental data. This assessment was based on data from 2005 which is weakening the outcomes because we do not know to which degree the circumstances on the ground have changed in the meantime. We acknowledge that this was not possible for this assessment but future assessments would benefit from up-to-date data. We would also recommend that the environmental records include marine habitats so that this important environment for the AONB can be assessed and monitored as well. Another important factor that was limiting the depth of this analysis was the absence of data about the condition and quality of Natural Capital assets.

Another problem was the aggregation level of data. Biodiversity records, for example, were only aggregated at the Cornwall but not at the CAONB level. Therefore certain CAONB-specific environmental and economic data does not need to be newly generated but could be extracted from the Cornwall level. It should for example be possible to be able to assess and monitor actual changes to biodiversity at the CAONB level to analyse if the national and Cornwall-wide trend of species loss also applies to the CAONB. It may be worth exploring if partnerships for example with research institutions and or the local records centre can be established to share and create fit-for-purpose data.

All these measures would help to establish a robust baseline which would allow to systematically monitor impacts on and changes to Natural Capital and ecosystem services across the whole CAONB. However, this is a longer process and may require a considerable amount of funding – especially for creating new data.

In the short term and based on available data a full economic assessment of the value of Natural Capital could be very beneficial. This could basically be an expansion of the Godrevy to Portreath case study assessment (see Section 2.2) across the whole AONB (or Cornwall with an AONB subset) which could also cover additional ecosystem services such as health benefits. This would raise awareness across non-specialists and the business community as people are not necessarily aware of the value of a tree but they know the value of a Pound. ‘Translating’ Natural Capital values into a metric everyone can understand will make the issue much more tangible for the business community and a wider audience. Similar

assessments helped to raise awareness and kick-off follow-on projects for example in Birmingham[73], Staffordshire[74] and The Marches[75]. This could be done using existing available data but would be most sensible after the land-use assessment update by ERCCIS is completed so that it is based on up-to-date evidence.

We would also recommend a review of the indicators used in the monitoring reporting for the CAONB with respect to Natural Capital and ecosystem services issues. The indicators developed as part of the Nature Improvement Area (NIA) monitoring and evaluation framework could be a good starting point.[76]

[73] Hölzinger et al. 2013; Hölzinger, Horst, and Sadler 2014.
[74] Hölzinger and Everard forthcoming.
[75] Hölzinger 2016.
[76] Defra 2012.

9. Abbreviations

AIG	Arable & Improved Grassland
AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BEN	Built Environment
CAONB	Cornwall Area of Outstanding Natural Beauty
CBA	Cost Benefit Analysis
CEV	Corporate Ecosystem Valuation
COA	Coast
CO_2e	carbon dioxide equivalent
ERCCIS	Environmental Record Centre for Cornwall and the Isles of Scilly
GIS	Geographic Information System
Ha	Hectare
HWD	Heathland, Wetland & Disturbed Ground
IPCC	Intergovernmental Panel on Climate Change
LEP	Local Enterprise Partnership
LNP	Local Nature Partnership
m	Million
MCDA	Multi-Criteria Decision Analysis
Mt	Mega Tonnes
NCC	Natural Capital Committee
NCPT	Natural Capital Planning Tool
NEAFO	National Ecosystem Assessment Follow-On
NEAT	National Ecosystem Approach Toolkit
NIA	Nature Improvement Area
NPPF	National Planning Policy Framework
ONS	Office for National Statistics
OWA	Open Water
PES	Payments for Ecosystem Services
PROW	Public Rights Of Way
SME	Small or Medium-sized Enterprise
SNG	Semi-Natural Grassland
UK	United Kingdom
WBCSD	World Business Council for Sustainable Development
WSB	Woodland, Scrub & Bracken
WTP	Willingness-To-Pay

10. References

Alonso, I., K. Weston, R. Gregg, and M. Morecroft. 2012. Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources. Natural England Research Report. Natural England.

Birol, Ekin, Nick Hanley, Phoebe Koundouri, and Yiannis Kountouris. 2007. The optimal management of wetlands: quantifying trade-offs between flood risks, recreation and biodiversity conservation. Environmental Economy and Policy Research Working Paper. University of Cambridge, Department of Land Economics.

Brander, L. M., A. Ghermandi, O. Kuik, A. Markandya, P. Nunes, M. Schaafsma, and A. Wagtendonk. 2008. Scaling up ecosystem services values - methodology, applicability and a case study.

Bullock, James M., Richard G. Jefferson, Tim H. Blackstock, Robin J. Pakeman, Bridget A. Emmett, Richard J. Pywell, J. Philip Grime, et al. 2011. UK National Ecosystem Assessment of Semi-natural Grasslands. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Christie, Mike, Tony Hyde, Rob Cooper, Ioan Fazey, Peter Dennis, John Warren, Sergio Colombo, and Nick Hanley. 2011. Economic Valuation of the Benefits of Ecosystem Services delivered by the UK Biodiversity Action Plan. Report to Defra. London: Aberystwyth University.

Church, Andrew, Jacquelin Burgess, Neil Ravenscroft, William Bird, Kirsty Blackstock, Emily Brady, Michael Crang, et al. 2011. UK National Ecosystem Assessment of Cultural Services. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Coombes, Emma, Andrew P Jones, and Melvyn Hillsdon. 2010. The relationship of physical activity and overweight to objectively measured green space accessibility and use. Social science & medicine (1982) 70 (6): 816–822.

Cornwall & Isles of Scilly Local Enterprise Partnership. 2014. Cornwall & Isles of Scilly Strategic Economic Plan. Truro: Cornwall & Isles of Scilly Local Enterprise Partnership.

Cornwall & Isles of Scilly Local Nature Partnership, and Cornwall Council. 2016. Cornwall's Environmental Growth Strategy 2015-2065. Truro.

Cornwall and Isles of Scilly Economic Forum. 2007. The Economic Development Strategy for Cornwall and Isles of Scilly 2006 – 2021 Evidence Base Review.

Cornwall AONB Partnership. 2016. The Cornwall Area of Outstanding Natural Beauty Management Plan 2016 - 2021 (Public Consultation Draft: February 2016). Truro: The Cornwall AONB Unit.

Cornwall Chamber of Commerce. 2015. A Business Plan for Cornwall: Business Manifesto 2015/16. Redruth: Cornwall Chamber of Commerce.

Cornwall Council. 2013. Economy and Culture Strategy 2013-2020. Truro: Cornwall Council.

Costanza, Robert. 2008. Natural Capital. The Encyclopedia of Earth. Available from <http://www.eoearth.org/view/article/154791/>.

Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, et al. 1997. The value of the world's ecosystem services and natural capital. Nature 387 (6630): 253–260.

DCLG. 2012. National Planning Policy Framework. London: Department for Communities and Local Government.

DECC. 2009. Carbon Valuation in UK Policy Appraisal: A Revised Approach. Department of Energy and Climate Change. Available from <http://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20090715105804_e_@@_carbonvaluationinukpolicyappraisal.pdf>.

Defra. 2007. An introductory guide to valuing ecosystem services. Department of Environment, Food and Rural Affairs. Available from <http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf>.

Defra. 2012. Nature Improvement Area Monitoring and Evaluation Framework.

Dukes, Natalie, and Rebecca Beech. 2016. Leading Locally: Sustainable Food Tourism in St Ives (pre-release). Coventry: Centre for Business in Society, Coventry University.

Eftec. 2015. Developing Corporate Natural Capital Accounts: Guidelines. London.

EFTEC. 2010. Flood and Coastal Erosion Risk Management: Economic Valuation of Environmental Effects. Handbook prepared for the Environment Agency for England and Wales. EFTEC. Available from <http://publications.environment-agency.gov.uk/pdf/GEHO0310BSFH-e-e.pdf>.

ERCCIS, and Cornwall Wildlife Trust. 2010. Cornwall's Land Cover 1995-2005 - Summary of Results of Land Cover Change Analysis 1995-2005. Truro.

Firbank, Les, Richard Bradbury, Davy McCracken, Chris Stoate, Keith Goulding, Ralph Harmer, Tim Hess, et al. 2011. UK National Ecosystem Assessment of Enclosed Farmland. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Forest Research. 2010. Benefits of green infrastructure. Report to Defra and Communities and Local Government. Farnham: Forest Research. Available from <http://www.forestresearch.gov.uk/pdf/urgp_benefits_of_green_infrastructure_main_report.pdf/$FILE/urgp_benefits_of_green_infrastructure_main_report.pdf>.

Forestry Commission. 2008. Woodland area, planting and restocking. Edinburgh: Forestry Commission. Available from <http://www.forestry.gov.uk/pdf/area08.pdf/$FILE/area08.pdf>.

Gorte, Ross W. 2009. Carbon Sequestration in Forests. US Congress Research Service Report. Available from <http://www.fas.org/sgp/crs/misc/RL31432.pdf>.

Grahn, Patrik, and Ulrika A. Stigsdotter. 2003. Landscape planning and stress. Urban Forestry & Urban Greening 2 (1): 1–18.

Hanley, Nick, Ken Willis, Neil Powe, and Maggie Anderson. 2002. Valuing the Benefits of Biodiversity in Forests. Social & Environmental Benefits of Forestry Phase 2. Report to the Forestry Commission. Edinburgh: Centre for Research in Environmental Appraisal and Management, University of Newcastle upon Tyne. Available from <http://www.cbd.int/doc/case-studies/inc/cs-inc-uk7-en.pdf>.

HM Government. 2011. The Natural Choice: securing the value of nature. Available from <http://www.official-documents.gov.uk/document/cm80/8082/8082.pdf>.

HM Treasury. 2003. The Green Book: appraisal and evaluation in central government. TSO, London. Available from <http://www.hm-treasury.gov.uk/d/green_book_complete.pdf>.

Hölzinger, Oliver. 2014a. Corporate Ecosystem Valuation (CEV) Guidance. Guidance document produced as part of the UK National Ecosystem Assessment Follow On (NEAFO). Birmingham. Available from <http://neat.ecosystemsknowledge.net/pdfs/corporate_ecosystem_valuation_ecosystem_proofed_tool.pdf>.

Hölzinger, Oliver. 2014b. Ecosystem Assessment Guidance. Guidance document produced as part of the UK National Ecosystem Assessment Follow On (NEAFO). Birmingham. Available from <http://neat.ecosystemsknowledge.net/pdfs/ecosystem_assessment_ecosystem_proofed_tool.pdf>.

Hölzinger, Oliver. 2016. Marches Ecosystem Assessment - An Assessment of the Natural Capital and Ecosystem Services Value in Herefordshire, Shropshire & Telford and Wrekin. Shrewsbury: Shropshire, Telford & Wrekin Local Nature Partnership.

Hölzinger, Oliver, and Mark Everard. forthcoming. Staffordshire Ecosystem Assessment. Stafford.

Hölzinger, Oliver, Nick Grayson, Mike Christie, and Richard Coles. 2013. Ecosystem Services Evaluation for Birmingham's Green Infrastructure. Birmingham: Birmingham City Council. Available from <http://www.birmingham.gov.uk/greenlivingspaces>.

Hölzinger, Oliver, Dan van der Horst, and Jon Sadler. 2014. City-wide Ecosystem Assessments—Lessons from Birmingham. Ecosystem Services 9: 98–105.

Hölzinger, Oliver, Pat Laughlin, and Nick Grayson. 2015. Planning for Sustainable Land-Use: The Natural Capital Planning Tool (NCPT) Project. London: RICS. Available from <http://www.rics.org/uk/knowledge/research/research-reports/natural-capital-tool-planning-/>.

Hulme, Mark, and Gavin Siriwardena. 2010. Breeding Bird Diversity as a Function of Land Cover. UK NEA Economic Analysis Report.

IFCA. 2015. Recreational Sea Angling Strategy. Penzance: Inshore Fisheries and Conservation Authority.

Jones, Laurence, Stewart Angus, Andrew Cooper, Pat Doody, Mark Everard, Angus Garbutt, Paul Gilchrist, et al. 2011. UK National Ecosystem Assessment of Coastal Margins. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Kaplan, Stephen. 1995. The restorative benefits of nature: Toward an integrative framework. Journal of Environmental Psychology 15 (3): 169–182.

Kuppuswamy, Hemavathy. 2009. Improving health in cities using green infrastructure: A review. FORUM Ejournal 9: 63–76.

Land Use Consultants. 2010. Cornwall AONB Atlas: Companion Report. Truro.

Land Use Consultants. 2013. Cornwall AONB Monitoring: Phase 2. Bristol.

Maltby, Edward, Steve Ormerod, Mike Acreman, Martin Blackwell, Isabelle Durance, Mark Everard, Joe Morris, et al. 2011. UK National Ecosystem Assessment of Freshwaters – Openwaters, Wetlands and Floodplain. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being. Synthesis Report. Available from <http://www.maweb.org/documents/document.356.aspx.pdf>.

Natural Capital Committee. 2016. The Path Towards the Natural Capital Protocol - a Primer for Business. London.

Natural England. 2012. Nature Improvement Area Competitive Grant Scheme General Guidance Notes.

Norris, Ken, Mark Bailey, Sandra Baker, Richard Bradbury, David Chamberlain, Callan Duck, Martin Edwards, et al. 2011. Biodiversity in the Context of Ecosystem Services. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

ONS. 2012. Accounting for the value of nature in the UK - A roadmap for the development of natural capital accounts within the UK Environmental Accounts. London: Office for National Statistics.

Quine, Chris, Christine Cahalan, Alison Hester, Jonathan Humphrey, Keith Kirby, Andy Moffat, and Gregory Valatin. 2011. UK National Ecosystem Assessment of Woodlands. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Read, D. J., P. H. Freer-Smith, J. I. L. Morison, Nick Hanley, C. C. West, and P. Snowdon. 2009. Combating climate change - a role for UK forests. An assessment of the potential of the UK's trees and woodlands to mitigate and adapt to climate change. The synthesis report.

Edinburgh: The Stationery Offi ce. Available from <http://www.tsoshop.co.uk/gempdf/Climate_Change_Synthesis_Report.pdf>.

Reed, Mark, Petrina Rowcroft, Sophie Cade, Alister Scott, Jennifer Black, Amanda Brace, Anna Evely, Sue Savege, and Chris White. 2014. Visitor Giving Payment for Ecosystem Service Pilot. Birmingham: Birmingham City University.

RSPB et al. 2016. State of Nature 2016 Report.

Saraev, Vadim. 2012. Economic benefits of greenspace: A critical assessment of evidence of net economic benefits. Research Report. Edinburgh: Forestry Commission.

Scott, A., C. Carter, Oliver Hölzinger, M. Everard, Dave Raffaelli, M. Hardman, J. Baker, et al. 2014. UK National Ecosystem Assessment Follow-on. Work Package Report 10: Tools – Applications, Benefits and Linkages for Ecosystem Science (TABLES). UK: UNEP - WCMC, LWEC.

Smith, S., P. Rowcroft, M. Everard, L. Couldrick, M. Reed, H. Rogers, T. Quick, C. Eves, and C. White. 2013. Payments for Ecosystem Services: A Best Practice Guide. London: Department for Environment, Food and Rural Affairs.

Sunderland, Tim, and Oliver Hölzinger. 2013. Using Cost-Benefit Analysis and Multi-Criteria Decision Analysis to make decisions under the Ecosystem Approach: Guidance Document. Produced for Work Package 10 of the TABLES NEA Follow-On project. Birmingham: Birmingham City University.

Takano, T, K Nakamura, and M Watanabe. 2002. Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. Journal of Epidemiology and Community Health 56 (12): 913–918.

UK NEA. 2011a. UK National Ecosystem Assessment: Synthesis of the Key Findings. Cambridge: UNEP-WCMC. Available from <http://archive.defra.gov.uk/environment/natural/documents/UKNEA_SynthesisReport.pdf >.

UK NEA. 2011b. UK National Ecosystem Assessment: Technical Report. Cambridge: UNEP-WCMC.

Ulrich, R S. 1984. View through a window may influence recovery from surgery. Science (New York, N.Y.) 224 (4647): 420–421.

Ulrich, R. S., and R. F. Simons. 1986. Recovery from Stress During Exposure to Everyday Outdoor Environments. In The cost of Not Knowing. Barnes, R. et al.

Van der Wal, René, Aletta Bonn, Don Monteith, Mark Reed, Kirsty Blackstock, Nick Hanley, Des Thompson, et al. 2011. UK National Ecosystem Assessment of Mountains, Moorlands and Heaths. In The UK National Ecosystem Assessment Technical Report. Cambridge: UNEP-WCMC.

Vries, Sjerp de, Robert A Verheij, Peter P Groenewegen, and Peter Spreeuwenberg. 2003. Natural environments -- healthy environments? An exploratory analysis of the relationship between greenspace and health. Environment and Planning A 35 (10): 1717 – 1731.

WBCSD. 2011. Guide to Corporate Ecosystem Valuation: A framework for improving corporate decision-making. World Business Council for Sustainable Development.

WBCSD. 2016. The business case for natural infrastructure. Geneva, Switzerland: World Business Council for Sustainable Development.

Willis, Kenneth, Guy Garrod, Riccardo Scarpa, Neil Powe, Andrew Lovett, Ian J. Bateman, Nick Hanley, and Douglas C. Macmillan. 2003. Social & Environmental Benefits of Forestry Phase 2: The Social and Environmental Benefits of Forests in Great Britain. Report to Forestry Commission. Edinburgh: Centre for Research in Environmental Appraisal & Management University of Newcastle. Available from <http://www.forestry.gov.uk/pdf/sebreport0703.pdf/$file/sebreport0703.pdf>.