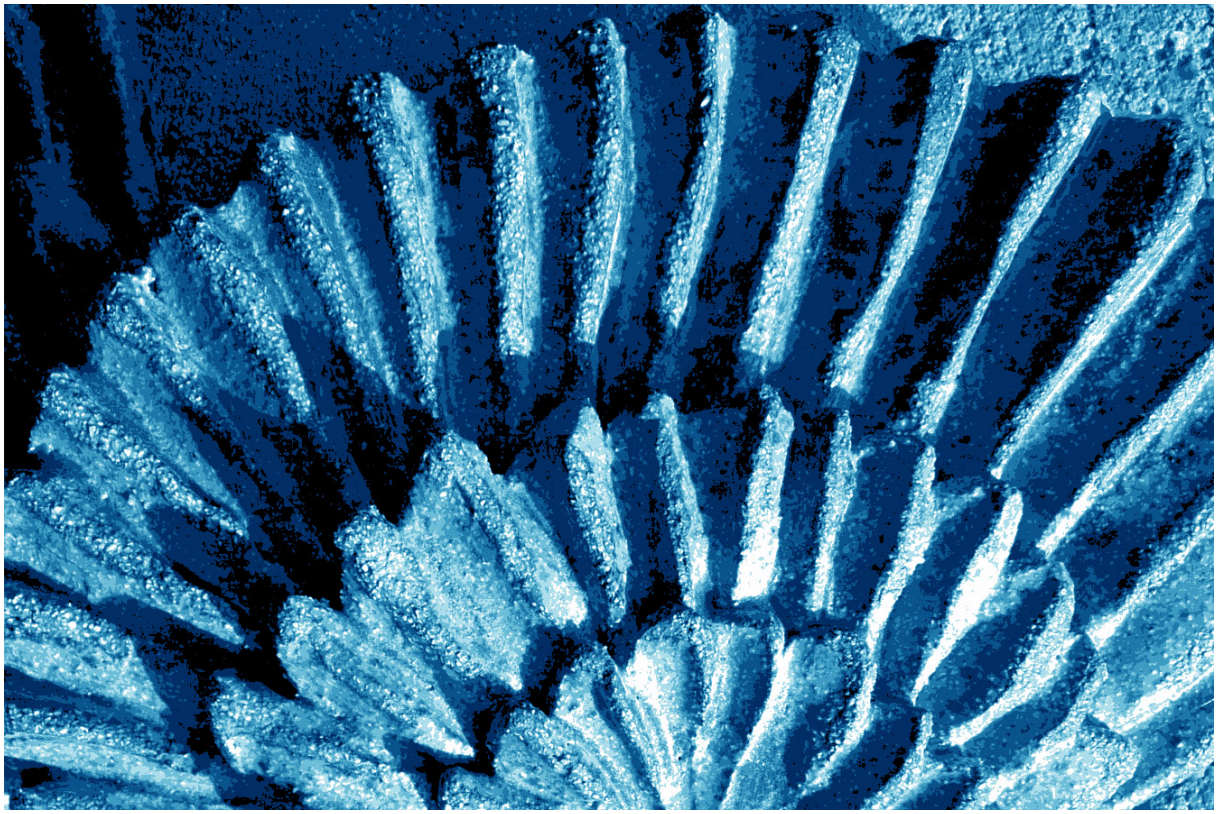
UK National Ecosystem Assessment

Understanding nature's value to society

Scenario narratives for the NEA



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Notes:

This is currently a live document and will change over the time of the project.

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For more information about the National Ecosystem Assessment follow: http://uknea.unep-wcmc.org

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No	Title
1	The Development of Scenarios for the UK National Ecosystem Assessment. Interim Report, May 2010.
2	The utility of existing scenario frameworks for the National Ecosystem Assessment. Interim Report, May 2010.
3	Functional relationships of ecosystem services outputs and drivers of change in the Scenarios for the UK NEA. May 2010.
4	Assessing User Needs of the UK NEA Scenarios through Focal Questions.
5	Scenario narratives for the National Ecosystem Assessment. Interim Report. June 2010.
6	Scenarios for the UK NEA (a sub-global MA): A transparent and flexible methodology. Poster Presentation at Salzau/Germany, June 2010.

Contents

Executive Summary

The development of story-lines for scenario-building exercises is an increasingly essential part of any ecosystem assessment. They provide a bridge between the understanding of the current state and past trends in ecosystem services and the likely policy or management responses that might be appropriate given a range of plausible futures. For the UK NEA, scenarios will be used to explore how ecosystems and their services in the UK change in the future (in this case 2050), and to identify what the possible effects might be in terms of human well-being and who might be affected most. The development of the scenarios for the NEA have been heavily influenced by current and recent UK and European scenarios from other projects; however, they are also the product of extensive consultation with NEA stakeholders as well as reviews of academic papers examining futures across a broad range of subjects. This document provides a thorough outline of six story-lines that are intended to offer plausible, thought-provoking, coherent and internally consistent outlines of the future for ecosystem services in the UK.

The six story-lines that have been developed attempt to cover a range of socio-political and economic ideologies: ***Biodiversity First*** is a scenario where the conservation of biodiversity is a dominant driving force in society. Whilst it is recognised that biodiversity often provides essential benefits to society, its intrinsic value is accorded a pre-eminence in policy and legislation. In contrast, in ***Ecosystem Services***, conflicts with biodiversity conservation can arise if the provision of a given ecosystem service is reduced by the presence of a particular species or habitat. Adapting to climate change is also a priority and which means that some non-native species mat be introduced to provide food, energy or shade. Similarly, biotechnology solutions are adopted to provide drought or flood resistant cultivars of food crops.

In the ***World Markets*** story-line unfettered economic growth through the complete liberalisation of trade is the main goal. International trade barriers dissolve, agriculture subsidies disappear and farming, for example, is now industrial and large-scale. Consumption in society is high which results in greater resource use and imports. Demand for land is very competitive and coupled with reduced rural and urban planning restrictions housing, agriculture and industry fight it out - biodiversity is often the loser. Technological development in all industries is mainly privately funded but nevertheless is burgeoning. Food is cheap and plentiful but of low quality. In ***National Security*** UK industry is protected from foreign investors and imports. Trade barriers and tariffs are increased to protect jobs and livelihoods in the UK; immigration is also very tightly controlled. Technological development is state funded and many industries are subsidised by the state (including agriculture). Food, fuel, timber and mineral resources are prioritised over biodiversity conservation.

Local Stewardship has elements of *National Security* is but far more environmentally benign and although localism is the dominant paradigm, people are less jingoistic and nationalistic. Political power has been devolved and many major issues are decided at a regional or local level (except crucial national aspects like defence); local timber and energy production is encouraged and there is great pride the numerous local food products. This scenario focuses on optimising resources and consumption is reduced to more sustainable (and healthy) levels - GDP is low but sustainable. ***Business as Usual*** is essentially a following-on from current (socio-political, economic, etc) trends. It has elements of all the above although perhaps is closer to *World Markets* than any other.

1. Introduction

The UK National Ecosystem Assessment (UK NEA) is the first analysis of the UK's natural environment in terms of the benefits it provides to society and our continuing prosperity. Part of the Living With Environmental Change (LWEC) initiative, the assessment began in mid-2009 and will be reporting its findings in early 2011. It is an inclusive process involving individuals and institutions with a wide range of perspectives, in government, academia, NGOs and the private sector. For more information on the NEA in general visit: http://uknea.unep-wcmc.org/.

1.1. The role of scenarios within the NEA

Scenarios are an essential part of the ecosystem assessments. They provide a bridge between the understanding of the current state and past trends in ecosystem services and the likely policy or management responses that might be appropriate given a range of plausible futures. In the context of the UK NEA, the aim is to use them to explore how ecosystems and their services in the UK change in the future, and to identify what the possible effects might be in terms of human well-being and who might be affected most. The timeline to be considered extends to 2050.

A work plan for scenarios was agreed following a meeting with the different NEA interest groups in November 2009 (Haines-Young and Potschin, 2010). Its main elements included taking stock of existing scenario studies and review how useful they might be for the purposes of the NEA, what kinds of question that potential users of the NEA were asking about the future, and how the scenario work can best be integrated with the science and valuation components of the assessment. The purpose of this Interim Report is to describe how the important methodological and practical issues surrounding scenario construction have been approached, and to present our recommendations on how the work might be taken forward to its conclusion. Key issues concern the identification of the questions potential users and how current scientific evidence can help our understanding of what the impacts of the different drivers of change might have. We have also considered how the economic assessment of past changes in the output of ecosystem services can be projected forward to better understand what some of the implications of alternative plausible futures might be, and present a flexible analytical framework that could be used in the discussion of response options by the wider NEA network.

1.2. The role of narratives in the NEA scenarios

The scenarios outlined below for the UK in 2050 are partly based on a number of existing scenarios developed for Britain and Europe. The six scenarios use *according* elements from all the scenarios reviewed (see reference list at end of document) rather than re-inventing the wheel; however, they incorporate elements of personal interpretation from the authors as well feedback from focal questions aimed at NEA expert groups and stakeholders.

There is a large degree of correspondence between many of the different scenarios studied (see the CEM review of existing scenarios) and teasing out similarities for various scenarios is not too onerous. However, differences do arise and particularly when you focus on the outcome for any given habitat. Many of the existing scenarios are based on some quantitative exploration of the future and where possible these sources have been used; however, scenario development also inherently draws on expert judgement (as well as the NEA experts people from DEFRA and the

NFU have been consulted) and indeed human imagination (Cork et al., 2006). We have tried to develop *six* scenarios (including a Business as Usual story-line which extends current trends) that take most of the major and pertinent themes from the corresponding source scenarios (they are listed at the end of each section). Hopefully each scenario will come across as plausible, thought-provoking and relevant (Cork et al., 2006) to expert users of the NEA.

Some quantitative description of the changes outlined in the scenarios is provided (e.g., change in habitat area, ecological footprint, yield) which is drawn from existing scenarios as well as relevant peer-reviewed literature and from expert consultation. Some refinement of where these changes will occur is also provided (hopefully also the various NEA stakeholders and chapter lead authors will provide some input here).

Each story-line section is broken into sections covering the main drivers of ecosystem service change (both indirect and direct), governance (external, national, regional and planning aspects), land and sea use (farmland, woodland, grassland, mountain, moor and heath, freshwater, coastal, marine and urban habitats), a regional outlook (settlement patterns, major energy infrastructure, agriculture, recreation, conservation, transport), human well-being (material need, health, social relations and security, freedom and choice), the footprint of ecosystem services overseas (mainly provisioning and regulating: food, energy, consumption and waste generation; but also human well-being). Finally, the effects on the UK's ecosystem services is summarised.

The story-lines are given working titles that are likely to change for the final document.

2. Climate change scenarios

Two scenarios for climate change are defined here (outlining temperature, precipitation, CO_2, drought and flood incidence) that roughly correspond with two extremes (or probability levels) of the UKCIP09 scenarios. The climate change scenarios were made constant for all the socio-political scenarios below mainly because whatever scenario we adopt now will have little consequence for the effects of climate change in 2050 (i.e., there is a considerable time-lag between our mitigation activities and the effects of climate change). However, each of the scenarios will respond differently to climate change (i.e., though mitigation and adaptation activities) and these are outlined in the story-line chapter (e.g., in the World Market scenario climate change mitigation is seen as a waste of resources; in the Ecosystem Services scenario the opposite holds true).

Table 1: Summarised impacts of Low and High climate change scenarios

Climate change scenario	Change in climate change factor in 2050							
	Mean Summer Temperature	Mean Winter Temperature	Mean Summer Precipitation	Mean Winter Precipitation	Drought events	Storm events	CO_2	Sea level
Low	+1.0°C to +2.0°C	+1.0°C to +2.0°C	-5% to -10%	+5% to +10%	One prolonged drought every 10 years	One every 5 years	450ppm	+15cm
High	+3.0°C to +4.0°C	+3.0°C to +4.0°C	-15% to -30%	+15% to +20%	2 consecutive droughts every 5 years	One every 15 years	550ppm	+45cm

3. Story-lines

The following sections outline six variations of story-lines intended to identify a range of plausible outcomes for the UK's ecosystem services in 2050. They present very different futures although hopefully each one is a plausible and useful vision.

3.1. Biodiversity First

Rationale

Biodiversity conservation becomes far more important in society than ever before. It becomes an ideology that pervades political spectrums and social strata; the history of late 20th and early 21st century biodiversity loss has finally struck a societal chord. Biodiversity First adopts an environmental paradigm to nearly all aspects of life and accepts that humans are just another life form and all life has value. Natural ecological processes are equally important even to the extent that they sometimes take precedence over human needs. This attitude pervades all aspects of society from government to industry to household decisions.

Climate change is a high priority issue in the country and this is reflected in numerous adaptation programmes (many of which are biodiversity focussed or use biodiversity as a means of delivering other adaptation aims). Mitigation and adaptation are given equal priority. The population increases steadily by 0.8%/year through ageing, larger families and immigration.

The conservation sector is larger than every before and consists mainly of state, county and NGO led organisations. There are more jobs in the biodiversity field and they have slowly become far better paid too reflecting the need to get the best people. The conservation of biodiversity is focussed across all habitats and land and sea uses although the majority of the attention falls on farmland habitats because of its dominance in the British landscape. However, all land managers have to produce regular biodiversity management plans and any business that has an off-site impact on biodiversity also follows similar guidelines.

Main Drivers

Demographic

One of the main drives in this scenario as the population increases steadily by 0.8% year^{-1} through ageing, larger families and immigration (which is controlled and only allows skilled workers in). Household size increases though so housing demand is fairly static.

Socio-political

The national government has environmental and biodiversity as the mainstay and backbone of much of its policy prescription. This affects all walks of life. For example, businesses have 'biodiversity impact plans', school children are taught ecology and biodiversity conservation at an early age and even households are subsidised to produce 5-year biodiversity plans.

Regional government is somewhat similar to 2010 although funding from national government is heavily dependent upon environmental performance.

Economic

Economic growth remains modest (1% of GDP/year) but is more immune to slumps and crashes. National debt has all but disappeared and the balance of trade is positive because of an emphasis on more sustainable consumerism. Employment is high but is mainly within the tertiary and quaternary industries.

Science and Technology

This scenario embraces science and technology and most of society are far more appreciative of funding in these sectors. However, there is an emphasis on developing technologies that solve environmental problems. Genetically Modified Organisms biotechnology is not embraced.

The energy industry is heavily funded for the development of renewable conversion technologies. However, despite the UK's wealth of wind, wave and tidal power new energy plant developments only go ahead if their impact on ecosystems is minimal. This results in a greater number of small-scale plants and even domestic energy systems. The nuclear and coal industry is dead, and all that remains of fossil fuel use is some natural gas. Vehicles are mostly powered by advanced non-petroleum based fuels that are non-polluting.

Cultural, ideological and religious

The UK is more multicultural than in 2010 and more accepting of the diversity of faiths and beliefs. Environmentalism is clearly a dominant theme throughout society (almost to the extent that it becomes a religion - many more people believe in Mother Gaia or consider themselves and has been incorporated into the teachings of all them main faiths too.

Consumer attitudes have changed. There is less interest in the celebrity culture and fashion; perhaps life is a little less exciting but it is definitely more responsible. Credit cards are not popular and people like to spend what they have. The upside of a greater emphasis on biodiversity conservation is that the UK is a more attractive place to spend time in - even in the non-traditional holiday areas. However, in areas of conservation importance access is strictly controlled - there are plenty of places where people can enjoy the countryside though.

Eating habits have also changed and although the fast food of 2010 can be found it is of much better quality. Vegetarianism is far more popular to the extent that it is often the meat eater at dinner parties who feels awkward.

Governance

External

The UK fully signs up to (and abides by) most international agreements on climate change mitigation and adaptation and biodiversity conservation. Good international relations are very important and the diplomatic corp is larger than ever. The EU dominates our legislature and we depend heavily on it for much of our trade.

National

The UK hasn't participated in a war in over a decade and its armed forces are dwindling. The UK seeks to maintain its membership of international organisations that promote a peaceful co-existence (UN) but although it remains a part of NATO it provides fewer servicemen to overseas

disputes. Overseas development participation has increased and is also focussed very much on sustainability and conservation projects.

Closer to home the government is largely more socialist in outlook: inequality is a major theme and most people are happy to see the old vestiges of the 'have and have not' UK disappear.

Adaptation to climate change is led through government initiatives although the emphasis is on ecosystem-based adaptation programmes. Less money is spent on mitigation directly and on autonomous adaptation schemes.

Regional

Regional government exists much as it does in 2010. Regional economic development is managed in much the same way and county/town councils still provide the normal street, cleaning, housing and education services.

Planning

Planning is very strictly controlled, both in rural, urban and coastal areas. Guidance and legislation on the effects of development on biodiversity are strictly controlled and adhered to.

Land and Sea use

Farmland

Agricultural area decreases from 77% in 2010 to about 70% in 2050 - this frees up more land for nature conservation which has priority over other land-use conversions. As a consequence major climate change corridor projects are established which help to connect habitats or soften the landscape enough to ease the dispersal of species affected by CC.

New policies supporting farmers to use sustainable and wildlife friendly management reinforce the agri-environment schemes set up by the CAP. The importance of maintaining productivity is not neglected (yields continue to increase although cropped land area declines) as the government encourages local food production to keep transport costs down. Biodiversity is a main priority but climate change adaptation only slightly less so. A large private and government extension service provide detailed and bespoke management plans for each farm. As a consequence biodiversity adaptation (and some mitigation) needs are carefully balanced to meet regional and national targets. Rural UK in 2050 looks more like rural UK in 1940 than 2010.

Farming has embraced modern agronomy (integrated crop management; precision farming) and husbandry improvements (focus on adaptation to the local conditions rather than out-and-out productivity) and whilst there is a role for biotech farming it is mainly applied where it can reduce agrochemical use. However, biotech adoption in other parts of the world (e.g., drought and salt-tolerant crops) means that the UK imports a lot of (crop-based) raw protein and carbohydrate commodities too. A huge focus on healthy eating (partly due for environmental reasons, partly due to excessive NHS costs) and reducing food waste has an impressive impact on our food usage. R&D funding in agri-related science is higher than ever before.

Pressures on livestock farming mounted in 2020 (welfare, pollution, adaptation and mitigation) and meat consumption has declined since; it results in reduction in specialised livestock farms

but (partly due to climate change) the number of mixed farms increases (this helps to increase landscape heterogeneity and boost biodiversity levels in rural areas). Another consequence is the proliferation of livestock breeds that can cope with nutrient-poor (but biodiversity-rich) grasslands (they are also more tolerant of the extremes of climate change). The Holstein-Friesian dairy breed is not as popular - although high yielding it was too prone to disease and infirmity in adverse conditions. Animal welfare is also a major factor in consumer demand for meat - all products now are certified and have chain of custody labels so the consumer knows exactly where and how it was reared. As a consequence locally-produced 'quality' meat is far more abundant than cheaper intensive systems.

Low quality arable land neighbouring the existing Ancient Semi-Natural Woodlands (ASNWs) is targeted first for woodland planting but in areas with high densities of ASNW the conversion to woodland is made regardless of agricultural quality (although it may only be comparatively thin strips). Grassland famers in the west and north see a change to arable where topography allows and semi-natural habitats on the steeper slopes. Rise in mixed farming systems (15%) and the reduction in the 20th century trend for specialisation. Crops yields have risen slightly due to technological advances and better agronomy; conversely, milk and meat yields have not advanced as much, partly due to the use of breeds that provide 'quality' rather than quantity but also because of climate change has reduced the quality of forage and cattle feed.

Woodland

Woodlands are considered one of most important habitats for biodiversity and a strong push to restore Planted Ancient Woodland Sites (PAWs) and derelict ASNWs as well as create 'new native' woodlands is reflected through government and EU policy. The public are also enthusiastic supporters. The downward trend in agricultural land use means that woodland planting is easier. This is reinforced by support payments focussed on sustainable and wildlife friendly farming. The prime focus is to extend existing ASNWs but also to connect them, where possible, by new planting. Plantation woods are slowly converted to more natural compositions and structures; some areas (e.g., Chilterns) maintain a focus on high quality wood production.

Native tree species are heavily and almost exclusively promoted although there is a policy to utilise southern and eastern European genotypes in a hope they will be better adapted to climate change. Existing plantation woodlands are subsidised for replanting with native species after harvesting. Scotland's conifer plantations gradually switch to a higher percentage of oak and ash dominated woodland; native Scot's pine woods are also encouraged.

Woodland creation satisfies the need for carbon mitigation and as biodiversity is the dominant driver of woodland management more ASNWs are brought back into coppice management (and used for local fuelwood supplies which are supported by a subsidised SME industry); however, a mixed woodland structural approach is advocated and many ASNWs are left as minimum intervention.

Grassland

The UK's semi-natural grassland suffered decades of neglect and destruction in the 20th century and consequently a major programme or restoration and recreation is under way. Recreating species-rich grassland habitats is a very slow process but most sites are located next to existing remnants. A support programme for local farmers is introduced to help them fund and manage local sheep and cattle breeds for maintaining grassland swards.

Mountain, moor and heath

The UK's mountain zones also have a particular focus because of their vulnerability to climate change. Huge species translocation programmes are introduced to ensure alpine species from continental Europe survive in more northerly zones. Similarly, Scottish alpine species severely threatened are relocated to Scandinavia.

Freshwater

Rivers and streams are afforded the same biological protection that other habitats in the UK including water quality. Particular attention is paid to the removal of invasive exotic species and the prevention of new problems species arriving in UK waters. A programmed of 'de-straightening channelised rivers (i.e., make them meander again) to introduced greater structural heterogeneity (bends, shallows, pools, riffles) is introduced to improve biodiversity (and help flood alleviation). Agricultural runoff from fertilisers and FYM/slurry causing eutrophication and pesticides are strictly controlled with large (25 metre buffer strips) compulsory around all water courses).

Coastal

Large areas of coastline implement managed retreat programmes and biodiversity along the coast flourishes despite some loss of precious ecosystem. Marine ecosystems are also given greater protection and many species begin to regain pre-1960s population levels. Greater emphasis is given to understanding off-shire ecosystems and more sea habitats are given conservation designations.

Marine

Marine ecosystems are given a high priority and the UK adopts all global, EU and many new national biodiversity and sustainable fishing laws and protocols. Sea fish stocks are given far better protection and a rise in sustainable farmed off-shore fisheries partly meets our fish demands. A few areas of biodiversity importance around the coast of Britain are given better conservation designations and very little fishing or other harmful activity is allowed. Sea level rise is combatted by a programme of managed retreat which results in more coastal habitats. Where possible, ecosystem-based adaptation strategies are also adopted rather than hard defences traditionally applied.

Urban

Urban areas are not neglected - the use of trees and gardens is encouraged for biodiversity as well as climate change adaptation. However, a large screening programme identifies potential problem species that may pose invasive tendencies under a new climate so some species are banned or eradicated. More urban green-space is adopted but the focus is equally on biodiversity and recreation - park wardens are also conservationists now and many of these urban gardens manage to maintain biodiversity despite high public use. In peri-urban zones tree planting increases near existing woodland areas. Smaller organic farms selling direct to the public via organic box schemes or in farm shops increase.

Regional outlook

Settlement patterns

Most housing remains much as in 2010. New developments are kept to brownfield sites and because of a a high tax on single-dwelling households more people stay with their parents until marriage and flat sharing is common with young people. Nearly all housing stock in 2050 meets strict energy conservation requirements (even listed buildings) after a decade long programme of rehabilitation. The desire to move to the country for the affluent is tempered by a renewal in urban infrastructure making many UK cities very attractive places to live.

Major energy infrastructure

The major changes in the energy sector for the UK are an increase in off-shore wind turbines all around the the coastline (away from any precious coastal habitats though) and a greater abundance of small-scale renewable energy systems in urban areas (solar, etc). Wind turbines also proliferate along major transport networks.

Agriculture

A loss of agricultural area in lowland rural England results in greater conversion to nature conservation and woodlands (+8%). A rise in mixed farming systems changes much of the typical East Anglian landscapes from the 'prairie' type large fields to smaller, mixed cereal and grassland. Landscape heterogeneity increases but more in areas with high concentrations of ASNW.

Upland rural - some loss of livestock farming converts to nature conservation (12%); some farms have started arable production where topography and climate change has allowed (4%). Far greater landscape heterogeneity as with lowland.

Recreation

Many areas of the UK have transformed their appeal for people wanting weekend or longer leisure opportunities. A nationwide programme to develop disused footpaths and open access areas as enthusiastically taken up by the public. Rural UK has a

Conservation

Existing areas of precious conservation woodlands are targeted (e.g., Wye Valley, White Peak, New Forest, South East) but a plan to create woodland corridors and soften agricultural landscapes to promote species dispersal in the face of climate change is also introduced. However, woodland planting is encouraged in most areas if a biodiversity gain can be seen. Farming changes most radically in traditional livestock areas and in the large wheat prairie regions of the east resulting in more mixed farms in both areas. Floodplains and rivers are also targeted as areas for increased ecosystem restoration (reflecting centuries of human over exploitation and abuse). Many montane habitats given stricter biodiversity protection and intensive species translocation projects target the most vulnerable species.

Transport

Transport networks remain the same as in 2020 - planning permission for road building and new rail routes is too difficult to overcome. Personal responsibility results in greater car share and technological improvements reduce car pollution and CO_2 emissions; however, there is still a

strong cultural need for personal mobility and car use, despite more car sharing, continues to increase.

Human well-being

Material need

Despite a large societal concern for the environment and biodiversity, many people still enjoy a consumer lifestyle similar to that of UK 2010 although there is certainly more consumption of ethical and sustainable goods (long lasting and well made). Eating out patterns change slightly and there is a greater emphasis on local, quality food and drink.

Health

Health increases across all social groups in the UK although the wealthiest still lead healthier lifestyles. Cleaner air, water, and food (greater percentage of organic products) as well as a switch from junk food to more balanced diets leads to overall health gains. The NHS continues to provide free healthcare for all although the many of the wealthy opt for private health.

Mental health is also improved - the benefits of increasing biodiversity habitats throughout urban and rural UK is paying off for people too

Social Relations and Security and security

People are generally more relaxed and friendly although there is an element of distrust with foreigners; communication systems are more advanced and people are better connected. Literacy levels are higher and more children attain higher levels of performance at school. Local communities experience more 'togetherness', partly due to shared pride in the environment. There is also less vandalism people feel safer.

Freedom and choice

There is greater tolerance of different attitudes except for non-environmentally friendly viewpoints who are often treated like pariahs. On the whole though, there is s live and let-live attitude, an increase in civil liberties (there is a ban on cctv), access to information and expression of views.

The footprint of Ecosystem Services overseas

Despite a very benign approach to habitats and biodiversity in the UK this scenario does not present the best possible overseas ecological footprint. Reliance on food and energy imports remains high and the UK's demand for maintaining a relatively high standard of living ensures imports of high-value goods made in sweat-shops in Asia is high. Waste is also shipped overseas to be sorted and incinerated. Human-well-being overseas directly related to UK service provision is not always very high: the UK is still too *NIMBY* focussed.

Effect on UK Ecosystem Services

Provisioning - food, timber, fuel

- Wood production - minimal increase as most woods are managed for conservation or fuelwood. Small pockets of quality timber production woods are encouraged though.
- Fuelwood production - huge increase in wooded areas coupled with wide-scale wood-fuel energy boilers or log-burners; a return to traditional coppice management was

encouraged to engage rural employment, improve biodiversity and reduce fossil fuel use for heating.
- Crop yields – rise by 5% over 2010 yields due to CC and agronomy improvements
- Fisheries - natural ocean stocks are strictly controlled and protected if threatened. Fish farms increase in abundance but are carefully managed to ensure they don not harm the surrounding ecosystems.
- Animal products – reduction in national production and there are no significant improvements in breeding.

Cultural

- Recreation - Rises in peri-urban and rural areas. The countryside as a whole is more attractive and more people use it for weekend and longer breaks; taking a holiday in rural Britain is very common now too, partly as Spain, Italy and southern France are too hot for most people. A Sunday walk in the country has become a very common pastime - partly due to the scenery but also because walking has been promoted as a healthy national pastime. Biodiversity is main focus but most woods follow FC and WT principles of encouraging access; hot summers increase visitor numbers.

Regulatory

- Carbon - overall gain by 10%; soil carbon increases mainly due to the conversion of land from arable to semi-natural habitats (mostly grasslands and woodlands or scrub) and adoption of mixed farming systems. Also, external nutrient inputs are lowered because of the greater utilisation of leguminous break crops in the rotation. Organic and low-till systems have increased soil carbon stocks too.
- Flood alleviation – is helped immensely mainly due to the greater area of semi-natural vegetation or grassland (vs arable). Coastal flooding is dealt with by encouraging managed retreat.
- Water quality – increases, incidents of pollution and diffuse pollution dramatically declines.
- Erosion control – is improved due to agri-environment schemes like field margins and conversion to woodland (20%).

Main sources

NE *Connect for Life*; Foresight Futures 2020 *Global Responsibility*; Foresight Land Use Futures *Leading the Way*; UNEP *Sustainability First*; PRELUDE *Big Crisis Europe of Cohesion*; ALARM *SEDG*; BESEECH *Global Responsibility*; UKCIP socio-economic *Global Commons*; EU-Ruralis *Global co-operation*.

3.2. Ecosystem Service

Rationale

A campaign of promoting ecosystem services in multifunctional landscapes as essential to maintaining the quality of life in the UK is now embedded in all walks of society (primary schooling all the way to large industry). Society accepts that some sacrifices have to be made and as a result becomes more environmentally aware (e.g., increases in vegetarianism; public transport and stricter development controls); this does not always go down well though as more land is nationalised to meet the demands of full ecosystem service provision (e.g., for public access and management of problem - flood or erosion prone - areas). Habitat restoration and creation is seen as an important component of this campaign but the explicit conservation of

species is sometimes overruled by a 'greater' ecosystem service benefit; this sometimes results in habitat conversion (e.g., semi-natural grassland to woodland). As well as carbon mitigation, an important focus is the enhancement of societies' resilience to climate change through 'ecosystem-based adaptation'. This is seen through habitat creation projects with the aim of reducing the impacts of flood, drought, storms or providing shade whilst continuing to produce food and wood products.

Modern technology is used were appropriate though and even GM biotechnology is adopted if it can be shown to enhance ES. This includes the use of drought-tolerant crops to maintain production and reduce soil erosion.

Society fully adopts a more equitable outlook on life that the UN, EU and UK government promote. It is easier for the poor to rise into well-paid jobs and schooling throughout the country is well-funded by the state and does not give any preference to wealthy or upper class families. Freedom of choice though is a key element in society and referenda are common in many national and regional government decisions.

Optimal Service Provision is key and many ecosystem services in the landscape are a result of careful examination of the trade-offs through scientific review. Nothing is done by second-guessing and achieving a fine balance of ***all*** ecosystem services is seen as a source of pride in many regions. Inevitably some areas focus on one or two ecosystem services to the detriment of others; a national ecosystem services account is set up to maintain and tweak services throughout the UK (and overseas).

Main Drivers

Demographic

One of the main drives in this scenario as the population increases steadily by 0.8% year^{-1} through ageing and immigration.

Socio-political

The national government has introduced ecosystem services as the dominant policy paradigm. All government policies have to consider ecosystem services and hierarchy of advisory 'courts' (with large scientific backup) is set up at national and regional level. This is designed to allow trade-offs between conflicting ecosystem service provision to be resolved in the wherever they arise. This may be easily resolved at local level but often they will need to take into account regional and national balances. The House of Lords and the monarchy are abolished; an elected 7-year term second chamber is created and a president (without much power much like Ireland or Germany) replaces the monarch.

Economic

Economic growth is strong (3% of GDP/year) and very sustainable. National debt is low (but exists) and the balance of trade is slightly negative (despite an emphasis on more sustainable consumerism) due to a continuation of many food imports. Employment is high across primary, secondary, tertiary and quaternary industries.

Science and Technology

This scenario embraces science and technology and most of society are far more appreciative of funding in these sectors. There is a drive towards developing technologies that solve environmental problems, this includes a widespread adoption of many different Genetically Modified Organisms biotechnology (e.g., pathogen, drought, flood, salt tolerance in crops).

The energy industry is heavily funded for the development of renewable conversion technologies as well as nuclear power. However, despite the UK's wealth of wind, wave and tidal power new energy plant developments only go ahead if their impact on ecosystems is minimal. This results in a greater number of small-scale plants and even domestic energy systems.

Cultural, ideological and religious

The UK is more multicultural than in 2010 and more accepting of the diversity of faiths and beliefs; this is backed by a strong utilitarian ethos and greater levels of environmental understanding. Society is more rational and traditional political boundaries are more blurred than every before. This environmental ethos sits equally alongside a social conscience that believes in opportunity and equality for all. The elderly are care after more too and many more grandparents live with their children and grandchildren.

Eating habits have also changed and although the fast food of 2010 can be found it is of much better quality. Vegetarianism is far more popular to the extent that it is often the meat eater at dinner parties who feels awkward; however, the trend towards vegetarianism was not driven by ethical attitudes towards animal rights but rather a better understanding of the ecological footprint of meat production systems.

Governance

External

Decision-making is strongly influenced by EU and other countries ideas although the vast majority of citizens are happy with this; the UK has long since adopted the Euro and trade within the EU strong (mainly with environmentally certified goods). Global issues are dealt with in a global manner and the UK is very connected (diplomatically, economically and socially) to other governments and global institutions. The UK truly believes that global problems require global solutions and problem solving in isolation is pointless; however, the old post-colonial hubristic attitudes to global diplomacy are gone - the UK is a more humble and co-operative country on the world stage.

National

The UK government is as strong (there is little pressure from voters for devolution or decentralisation) reflecting a long-term policy drive that the public wants. Despite greater centralised power, this is seen as a necessary move in in times of huge environmental stresses. The national response to climate change is a well-funded programme of carbon mitigation schemes alongside planned adaptation programmes (also increasing the resilience of communities to better able to adapt autonomously). The government fully insures major climate disasters and develops research bodies to examine how best to live with climate change.

Regional

County, city and parish governance exists much as in 2010; guidance in most issues requiring impact on *any* ecosystem service provision comes from national government although most civil servants and politicians are well educated in these matters. Disputes have to be approved at a national level.

Planning

The planning system is stronger than ever before; in fact many even some management practices require some form of planning permission now (anything that may effect ecosystem services for local or regional citizens; e.g., changing a cropping system).

Land and Sea use

Farmland

As farmland dominates the British landscape it is the prime land area used for locally and regionally designated ecosystem service schemes. Soil erosion, water storage, water quality improvement, flood alleviation, carbon sequestration, recreation as well as food and fuel provision are all targeted throughout the country. High impact environmental problems are targeted first (areas prone to flooding, erosion, for example) but are swiftly followed by schemes set up to improve cultural service provision. Local food production is promoted (although trade with other countries still continues). Farmers are paid to provide services based on local designed ES rates (depending on the suite of ESs a farmer must supply to the local area); however, on the proviso that farmers are seen as custodians of the land and allow access to all land has been introduced by Act of Parliament. This is also backed up by landscape management subsidies from the EU (the EU was an early promoter of the importance of managing land for Ecosystem Services).

As vegetarianism increases the nation's protein requirements are easily met by an increase in pulse production in the UK; large areas grassland are converted to biofuels or woodland resulting in a higher percentage of woodland in the north and western parts of the country where beef, sheep and dairy production dominated. Floodplain woods are encouraged in the main river landscapes in the UK (e.g., Thames, Severn, Trent). However, ecosystem service provision is ubiquitous throughout the UK so most regions see an increase in woodland area (to meet carbon mitigation, recreation and shade needs). Organic farming as well as no-till cultivation increases in usage as soil management is very important.

Woodland

Woodlands are seen as a potential solution to many problems and the conservation of existing ANSWs is maintained; mixed-plantation woods are almost equally important though and home-grown timber production is encouraged (although clear-cut systems are rare and more sophisticated shelterwood or selection system are common). New woodland creation is also heavily supported.

Silviculture becomes a very important skill and profession as the demand for home-grown timber and wood products increases; this is reflected in a continuation of exotic plantation species (some new ones are better adapted to climate change) but all woodland is managed sustainably to meet multiple - and regionally-dependant - objectives. Some localised woody biomass (SRC) production is found on large estates wanting to mechanise as much as possible (large harvester vs men with chainsaws) and similar projects crop up where villages and towns have started

community heat generation systems. Floodplain woodlands utilise willow, alder, birch and poplar but also ash and oak. 'Native woodland creation' becomes more experimental and species normally found in southern Europe are used to create 'neo-native' woods. Despite a reduction in meat production mixed farming systems actually increase in some eastern areas (albeit with extensive meat systems rearing low-yield but hardy breeds) and the reduction in the 20th century trend for specialisation continues resulting a more heterogeneous landscape. Livestock farms in the west and north diversify and reduce their beef and sheep enterprises. More land is used for recreation too and many large privately owned estates are opened up for free public access.

Grassland

Most semi-natural grasslands are protected from woodland or farmland encroachment but they are also utilised for service provision. This includes as grazing land for sheep and beef breeds, recreation and education and on suitable topography even for ethanol biomass from late summer cuts. Areas of traditional species-rich grasslands are restored (e.g., chalk grasslands) often taking poor quality arable land out of production (this is a good example of optimising ecosystem services).

Mountain, moor and heath

Land owners in mountainous regions are thrust forward as important land managers in society. All the ecosystem services of mountainous regions are now monitored and carefully managed to maintain the crucial balance between the main services (recreation, water provision, grazing, flood protection, energy production and, of course, carbon sequestration). Heathland and moorland are also restored for the important service provision it provides (carbon storage, recreation, pollination, water regulation, nutrient cycling), woodland encroachment is prevented.

Freshwater

The conservation and protection of freshwater is one of the highest priority aims of the government - improving the water quality of the nation's rivers, lakes, streams, lochs and other wetland systems is seen as essential. Industry and other potential polluting operations (mainly farming) are monitored to ensure that their activities do not affect water systems. In the case of farming, this includes 25 metre buffer strips bordering rivers for any potentially damaging operation (including organic farming systems).

Coastal

Coastal areas are particularly protected from development and in certain areas coastal erosion is allowed to progress through a system of managed retreat. Climate change adaptation is very important in coastal areas and a process of ecosystem-based adaptation schemes are implemented throughout the UK coastline. Tourism is boosted partly because of cleaner beaches and rivers and open access to all of the UK's coastal areas.

Marine

Marine habitats are given greater conservation protection through a number of European and British laws. Marine habitats are protected and sustainable fishing is very important. Co-operation with neighbouring countries ensures that fish populations are protected and are only allowed to be harvested sustainably. The fishing industry declines somewhat (although there is an increase in small vessels) but many ex-fishermen switch to eco-tourism which booms in

coastal regions. Renewable energy provision via off-shore wind farms increases although this is carefully designed to minimise marine habitats important for biodiversity.

Urban

Urban areas are greened more with a greater role for urban trees, gardens, urban farms and a greater usage of green roofs. The housing stock stays static with an emphasis on restoring and upgrading old stock to improve energy efficiency.

Urban tree planting increases to provide shade, flood alleviation, air purification and carbon mitigation. Woodlands also connect into the peri-urban areas. There is an increase in small market producers, urban farms and forest gardens to meet demand for produce with low food-miles. The peri-urban environment is similarly developed - there is a dramatic woodland increase to accommodate rising demand for recreation but also a rapid increase in small farms and market gardens.

Regional outlook

Settlement patterns

The south-east still has the largest proportion if people in the UK although this is mainly due to a fairly static building construction programme in the UK. The restoration of old housing stock and conversion of redundant warehouses largely improves the green housing infrastructure. Cheap housing is abandoned in favour of well-designed and comfortable builds. Shared green space is common and all housing developments have a large area of garden or woodland for recreation (and growing vegetables).

Major energy infrastructure

An extensive programme of developing renewable energy across the UK to harness wind, sea, solar and biomass resources in the most optimal manner is implemented. Conflicts between landscape aesthetics and energy are much rarer with most people accepting the 'necessary evil' of a local wind farms etc. Nuclear power is also a major provide of energy in some coastal areas.

The UK's energy requirements have actually diminished since 2010 due to better technology in transport and housing (increasing efficiency) and a changes in behaviour.

Agriculture

Lowland rural farmed areas become slightly more heterogeneous; woodland area increases and there is some increase in mixed farming in eastern counties. Many areas with high concentrations of ASNW or with major river networks also increase woodland cover. Farming adopts many environmental management measures (such as precision techniques) and organic production increases (although it remains a niche market). Meat production declines and cheap, factory-farmed meat is almost impossible to buy; instead, meat now is a luxury product and is often sourced from organic mixed-farm systems or from farms managing conservation grasslands. In areas of high erosion risk, many farms are compensated to maintain winter cover crops (ensuring bare winter soil does not occur) and spring cereal cropping.

Floodplain areas are targeted for ecosystem service provision and there is a moratorium on housing development; large areas of land are converted from arable to grassland or floodplain woodland.

In the uplands, the landscape changes slightly where farms have ceased to graze beef cattle and sheep; large areas of improved grassland are either restored to moorland or become woodland.

Recreation

Most of the UK sees far greater recreation in rural and urban areas. Urban areas, in particular, have increased green space and many cities have seen increases in visitor numbers. Traditional high visitor number rural areas continue to attract many people (although more use extended public transport systems to get there) but most rural counties develop recreation activities and consequently boost visitor numbers.

Conservation

Biodiversity conservation is important but a more pragmatic view of conservation is taken than in the *Biodiversity First* story-line. Where species conservation conflicts with the greater good the utilitarian view will win out. This is not normally a problem as many ecosystem service programmes improve biodiversity and are mutually beneficial; however, in circumstances where ecosystem function is paramount, some species may lose out. For example, maintaining woodland landscapes in the south requires the translocation of better adapted southern European tree and shrub species, as a consequence, some important biological relationships between native woody species and fungi, insects and birds break down.

Transport

The decarbonisation of the road transport system is all but complete. New technologies and improvements in electric vehicle systems means that air pollution from the internal combustion engine does not plague the towns and cities of the UK. Aviation, shipping and heavy transport are use biofuels, much of which is grown in the UK and the EU. Short-hop air travel has disappeared from the UK (replaced by rail); short-distance travel is largely undertaken by bicycle and cycle lane networks are extensive, well maintained and easy to use.

Human well-being

Material need

Compared to 2010 societies material needs are lower and less sophisticated; there is a still a string demand for electrical goods for domestic and leisure purposes but most aspects people are happier to get by with possessions that work well and last longer. Locally produced items are very important and in many parts of the UK regional variation sin clothing style can be seen.

Health

Society in the UK benefits form improved nutrition; cleaner air, water, and food; better access to information about health and medicine; reduced stress; and better mental health. Technological improvements have also advanced surgical techniques and drug development; however, the power of large pharmaceutical companies has reduced (in the EU) and the government and other EU countries inject considerable funding into a global initiative to developing ‘drugs for all’ without that allow even the poorest access to the latest medicines.

Bioprospecting for pharmaceuticals is considered a global good for all and patents are not allowed.

Social Relations and Security

Society is more secure mainly due to greater equality and better standards of living for all; the gap between the poor and rich is at an all-time low. People are more connected with each other both within the UK and overseas. Free communication systems are universal. Literacy is higher due to better funding in state education - private schooling has been abolished in the UK. University education is free for all.

Freedom and choice

Tolerance, live and let live. increased political freedom, civil liberties, information flow, movement, expression, and association

The footprint of Ecosystem Services overseas

The UK is focussed on living within its means where it can however, it recognises the importance of trade and also depends upon goods and services that it cannot provide by itself. Food, energy and home goods are imported from the EU and elsewhere; however, all goods must have environmental certification (which relate to 'high' ecosystem service standards). Despite this the UK's ecological footprint, whilst a lot lower than 2010, is marginally above the global average for 2050.

Effect on UK Ecosystem Services

Provisioning

- Wood production - home-grown timber is encouraged and supported by the public - everyone wants to live in a house 'made in Britain' large plantations (sustainably managed) in the traditional areas (Wales, Borders) are joined by new woodland planting in (carefully chosen) sites in the north of Scotland.
- Fuel-wood production - increases due to SRC production (15%).
- Biofuels from cropped land increases considerably to meet energy requirements (20%).
- Crop yields – overall production declines slightly as the cropped area reduces; technological advances in agronomy and a warmer climate maintain the trend of increasing yields though.
- Animal products – meat consumption declines and the super-high yielding dairy and beef breeds of 2010 have almost disappeared to make way for better adapted animals and a focus on flavour, not quantity.
- Marine - natural (sea and freshwater) stocks are strictly protected and only harvested under a regime of sustainable catch - the total natural catch is far lower than today's. Farmed fisheries proliferate (off-shore) but follow careful management guidelines so they don't affect natural ecosystems.

Cultural

- Recreation - Rises in peri-urban and rural areas. The countryside as a whole is more attractive and more people use it for weekend and longer breaks. A Sunday walk in the country has become a very common pastime - partly due to the scenery but also because walking has been promoted as a healthy national pastime. Some key areas have been nationalised in order to maintain them for public use.

Regulatory

- Carbon - overall gain by 10% in lowland areas previously dominated by arable; Soil carbon increases mainly due to the conversion of land from arable to semi-natural habitats (mostly grasslands and woodlands or scrub) and adoption of mixed farming systems. Also, external nutrient inputs are lowered because of the greater utilisation of leguminous break crops in the rotation. Organic and low-till systems have increased soil carbon stocks dramatically.
- Flood alleviation - the restoration and creation of floodplain woodlands becomes a major factor in reducing flood impacts.
- Erosion control – problem areas throughout the UK are targeted and controlled by forcing new management (e.g., change to woodland, grassland or no-till cultivation). This is one of the main success stories.
- Water quality – vastly improved everywhere; polluters are fined heavily so rarely make mistakes.

Main sources

NE *Connect for Life*; Foresight Futures 2020 *Global Responsibility*; Foresight Land Use Futures *Leading the Way*; UNEP *Sustainability First*; PRELUDE *Big Crisis Europe of Cohesion*; ALARM *SEDG*; BESEECH *Global Responsibility*; EU-Ruralis *Global co-operation*; Zero Carbon Britain 2030: A new energy strategy.

3.3. World Markets

Rationale

High economic growth through a greater focus on removing barriers to trade is the fundamental characteristic of this scenario. International trade barriers dissolve and markets are liberalised in the EU; agriculture declines but becomes more industrial and large-scale. Demand for land is very competitive and housing or small-scale industrial units are often the winners; however, food production is still deemed more important than many other (uneconomic) land uses (albeit in a highly industrial manner).

Innovation is strong throughout many sectors but is almost wholly privately funded; most innovations are designed to increase economic growth rather than solve environmental problems. The service sector increases and schooling is designed to provide children with vocational skills rather than the traditional skills of 2010. State schooling is underfunded and in decline; most people aspire to send their children to a private school even if many cannot afford it. Social inequity is higher than ever before; who you know is more important than what you know.

Society is reluctant to waste money on planned adaptation to climate change (let alone mitigation); when climate change affects industry or housing it is often the poor who are dealt the biggest blow.

As in land-based food production, food supplies from the seas are equally seen as source for exploitation without recourse to any sustainable management. Fish stocks plummet and a few species have been wiped out in the North Sea. Most fish is imported from Asia now. Desalination plants are built in a areas on the east coast to meet water demand for the south and eastern counties. ‘Home-grown’ fossil fuel energy production is on its last legs and has been overtaken

by imports of gas from Eastern Europe and privately funded nuclear industry in the UK. Consequently, coastal areas are built upon to accommodate power plants and gas pipeline stations.

Main Drivers

Demographic

The UK's population rises through immigration and and increase in the 60+ age cohort; however, more people wish to live alone and the average household is smaller than 2010 - consequently new housing is in strong demand and planning restrictions on green belt and rural areas is relaxed throughout the UK often resulting in changes in agricultural, woodland and grassland habitats to development.

Socio-political

A strong libertarian outlook on life is pursued without recourse to many environmental or social equity standards. In many walks of life the government has a hand-off approach. The welfare state has all but disappeared and government is strongly centralised.

Economic

The dollar was replaced as the world's reserve currency in 2020 and ten years later the 'globu' was taken up by the vast majority of countries as their sole currency. This allows greater trade between countries and stabilises many economies after a few turbulent years. The UK is fully determined to be part of an expanding global trade system.

The working week is now longer than ever and since the UK's full departure form the EU has become deregulated and many people now work 50-hour weeks. Holiday has also been reduced to a maximum of 10 days for most working people, pension age for men and women is 70.

Science and Technology

Large increases in technology which are mostly privately funded and consequently benefit the rich more than the poor.

Cultural, ideological and religious

Environmental needs do not go unhindered but only if the market provides an opportunity to pay for them. Consequently, many people do not

Governance

External

Membership of trading partnerships with other countries often have more influence on the day-to-day lives of the UK public. The government is happy to let external market forces dictate the pace of life. The UK has long since left the EU and is more concerned with forging partnerships with the far east and a renewed USA.

National

A strong centralised government rules without too much interference in peoples lives. There are a minimal set of environmental standards that maintain important aspects of urban life (e.g., air quality) but otherwise there are few restrictions on economic growth unless a market is created

to protect some services (e.g., the rural beauty in the Cotswolds). Climate change is hardly given any attention in national policy; certainly there is no mitigation programme to speak of and adaptation is all local and autonomous. Any recourse to renewable energy production is solely down to a decline in fossil fuel resources rather than concern for eh environment.

Regional

Very little regional power exists in the UK; most council services are now private (waste disposal, education, planning, housing) and council tax does not exist (but you pay a private company fee to deliver the essential services to your neighbourhood. Even policing has been partly privatised (the hierarchy is nationally led by a government police force but beat patrols are all done by private companies).

Planning

Much reduced in power and influence on regional and local urban and rural character. Many small towns are either subsumed by larger neighbours or become one long ribbon development. the CPRE has no influence anymore.

Land and Sea use

Farmland

Climate change has had a major impact on global food production but the majority of the UK sees benefits; this, and a large R&D effort has resulted in increases in agricultural production despite a decline in area (through more intensive production). Even though all land-based subsidies are removed it's a good time to be a farmer although the industry is dominated by large agri-businesses and the supermarkets. Technological advances in agriculture push yields to new heights; GM is very much part of this. Specialisation is normal in farming and there are very few mixed farms; farm size continues to increase as does the average field size. Large factory pig/dairy/beef/poultry units which produce cheap meat efficiently rise up everywhere. Internal petroleum prices rocket so woody biomass cropping and other cropped biofuels increase to meet demand. Agricultural production intensifies on the best land but lower grade land is utilised for biofuels such as SRC where it's escaped housing development. Climate change presents a problem but advanced husbandry, housed livestock in air-conditioned units and GM crop breeding result in high adaptation in the sector.

Woodland

Modern arable farms are now large deserts of cereal or protein crops which results in hedges and some woodlands being grubbed out. Lower grade agricultural land is lost to housing and industry in peri-urban areas and in lowland rural counties. Apart from a massive increase in willow for short-rotation coppice, most surviving woods have become replanted with exotic species to maintain timber production. Woodlands maintained for conservation and recreation have minimal importance. Intensive management of existing woodlands is promoted (including coppicing ASNWs). This scenario results in a huge decline in biodiversity in rural UK.

Grassland

Semi-natural grasslands are not considered a high priority and many are consequently converted to biofuel cropping or housing. Some grasslands on steep slopes gradually convert to scrub and woodland.

Mountain, moor and heath

Some parts of mountains areas are maintained for the best services they supply (i.e., freshwater provision, wind for energy generation and also for recreation near large conurbations). However, in many mountainous areas, deregulation and lack of environmental protection have resulted in development or conversion to woodland in the warmer climate - large confer and even eucalyptus have begun to appear in many hilly areas on the UK.

Freshwater

The UK's rivers are in poor condition in terms of biodiversity, water quality and the presence of invasive species. Many threatened species in 2010 are now extinct (e.g., water vole) and even species that gained ground in the late 20th century are now all but gone (e.g., otter). Farmers do not have to consider water quality and can spray pesticides and fertiliser near water courses with impunity.

Coastal

Coastal erosion is a continuing problem in many areas and does involve state intervention except where there is huge investment threatened (affluent housing, major ports, desalination plants).

Marine

Since the removal of the Common Fisheries Policy the seas around the UK have become a free-for-all (except the exclusive economic zone of 200 nautical miles from the coast). Most commercial fish populations have been over-harvested and marine aggregate extraction has also increased in many areas. The other overseas exclusive economic zones are fiercely protected too.

Urban

An expansion of housing into green belt and parks and gardens results in 60% of green space lost; street trees are replaced as they die but otherwise there is no urban woodland planting. Urban space has diminished considerably as the demand for housing targets every space available. IN peri-urban areas there is a large decrease (20%) in woodland and farmland due to housing expansion and small-scale industry.

Regional outlook

Settlement patterns

Continues to be concentrated in the south-east and in urban areas although the demand for housing everywhere increases and many small towns join up or are subsumed into larger conurbations. There is a higher percentage of urbanisation for the poor and the rural areas continue to see the wealthy move in and out-compete locals; more gated communities crop up in rural areas to counter the need to pay for private policing.

Major energy infrastructure

Dependancy on nuclear power and fossil fuels continues and with the exception of biofuel use there is very little use of renewable energy. One large exception is a large tidal barrage system across the Severn estuary that provides energy for 5% of the UK's needs has been in use since 2025. Technology continues to improve efficiencies in most energy sectors.

Agriculture

Lowland rural areas see a decrease in existing woodland by 5% but woody biofuel area increases by 30%. Housing stock increases with new towns built - this results in an overall farm area decrease by 8%. In upland rural areas the cooler climate is utilised for housed livestock production in valley bottoms – most feed is imported. Overall there is still a decline in farm area by 10% though.

Recreation

The UK sees a huge decline in internal and overseas tourism partly due to a less attractive UK (both in rural and urban areas); the wealthy middle classes around the globe still travel extensively but the UK is losing out as a tourism destination. Recreation in the UK is now more home-based than ever before. Sophisticated virtual worlds via your home entertainment systems provide most people (if you can afford it) their leisure, entertainment and information needs. You can even go for a 20 mile hike in the Alps without leaving your living room.

Conservation

Conservation of biodiversity has little value except in cases where it is linked with the preservation of landscapes in wealthy areas. Conserving rare species is not considered a priority for government but rather an expensive hobby with no real value. Species extinction is considered normal and just the consequences of survival of the fittest.

Transport

The transport network is heavily biased in favour of cars and air travel - motorway widening schemes reduce farmland area more and a few new toll motorways are created between London and the Manchester-Leeds belt. Nearly all the major airports expand including Heathrow and Birmingham - in east London an airport is built in the Thames Estuary destroying precious conservation habitats.

Human well-being

Material need

People strive for personal wealth and material possessions or experiences. This is truly the age of mass consumerism. Mean income is higher than every before and the poor have higher incomes too (but see below); the private education sector has increased considerably as state-funded schooling is under-funded and in decline. Many services are provided by private companies.

Health

Health standards are very high for those that can afford it; the NHS is a shadow of its former self and struggles to cope with quality service provision. Obesity increases massively due to poorer nutrient diets and less exercise (linked to more people spending their leisure time at home in virtual worlds). There is a rise in diabetes, cancers, stress, and other 'affluenzic' diseases. An increase in human health pandemics results in many deaths every decade in the the UK.

Social Relations and Security

This is a disjointed and unfriendly society. People feel secure if they can afford to pay for security services or live in gated communities. Despite a higher standard of living for the poor

there is great resentment of the rich who live in a different world almost. Street violence and mass protest and other civil unrest is common. Further afield, the UK is increasing strong-arming itself towards other developing countries in its struggle for diminishing resources.

Freedom and choice

Freedom is more restricted for all although the rich have more access, more say and more influence than the poor. Many goods that were once public are now private - this affects access for recreation, food and decision-making. Increasingly, politics is becoming a commercial enterprise and it becomes more difficult for someone to enter national politics without funding. Underground political movements spring up but are suppressed on a regular basis by the government under 'state terrorism' laws.

The footprint of Ecosystem Services overseas

Of all the story-lines here this one has the highest overseas footprint. The reliance on food, energy, consumer goods, waste disposal, travel and tourism is larger than ever before.

Effect on UK Ecosystem Services

Ecosystem service that have monetary value and are easy to trade are protected, many others are not

Provisioning

- Wood production - very little, mostly imports from eastern Europe despite high transport costs.
- Fuelwood production – 15% increase due to high fossil fuel costs. More efficient boiler designs means that some (affluent) local communities adopt fuelwood as their energy source for heating.
- Crop yields – increase dramatically, free market enterprise has pushed RandD development rapidly (+15%); overall national production in cereals and protein crops increases despite loss of land.
- Animal products – similar increase in yield per head but overall national production stays the same as 2010 levels due demand for cheap, low quality meat.

Cultural

- Recreation - declining opportunities for woodland and farmland recreation. Most woods are intensively managed for fuel to supply local heat generation systems; farming has reduced the beauty of much of the countryside (-10%). 'High quality' rural recreation remains an expensive past-time - game shooting and even a day in the country is an exclusive treat for the few.
- Historic and spiritual values throughout the UK have been degraded or lost. These are seen as non-tangible, pointless and not worth conserving. Beautiful landscapes remain in areas almost exclusively utilised by the wealthy (i.e., homes, services are too costly for most people).

Regulatory

- Carbon - land carbon stocks slightly decrease due to loss of woods and conversion of farm to housing (-15%).
- Flood alleviation - none; society does not adapt but suffers CC consequences.
- Erosion control – neglected problem, increases in some areas due to lack of vegetation.

- Water quality – declines to mid-1980s levels
- Invasive species numbers increase due to more un-regulated trade, an increase in traffic (a main vector for many species) and climate change; very little is done to control species except in affluent areas although this is always dealt with without state aid.

Main sources

Foresight Land Use Futures *Competition Rules*; UNEP *Markets First*; Foresight Futures 2020 *World Markets*; UKCIP socio economic *World Markets*; BESEECH *World Markets*: ALARM *GRAS*: ACCELERATES *A1*; EU-Ruralis *Global Economy*;

3.4. National Security

Rationale

Climate change and increases in global energy prices (resulting in huge transport costs) force many countries to (mutually) attempt greater self-sufficiency (and efficiency) in many of their industries. Britain is no exception and agricultural and other primary industries 'optimise' (rather than intensify) accordingly. It's all about getting the most out of the resources available but accepting that the late-20th century approach to intensification results in external environmental costs. Protectionism and trade barriers are put in place to secure the health of the UK's industries.

Biodiversity is not considered as important to this paradigm - however, society has a greater appreciation that non-biological resources are vital to sustainable production systems. Hence, many farmers manage their soils and erosion is less of a problem, but overall, farm biodiversity is not well conserved.

Main Drivers

Demographic

Society in the UK is very UK-focussed; immigration is practically non-existent except for the most skilled workers. As many 'indigenous' citizens return to doing more manual labour jobs the need for low-skilled immigrants disappears. The housing stock increases to meet the demand for single-occupancy households but this is mainly concentrated in brown belt development and results in an increase in new flat complexes. Population growth is 0.5% year.

Socio-political

The is a strong centralised government with more power taken from local authorities. Membership of the Eu has been rescinded and the UK is, for the foreseeable future - going it alone more than every before. Ties exist with important trade countries for goods and services the UK cannot supply on its own but otherwise the UK is focussed on home-grown issues and gets less involved in global politics.

Economic

Economic growth is lower (but more sustainable) than the World Markets scenario. Planning is strongly controlled by the state and although it allows for the expansion of home-grown industry (if it provides jobs and benefits for the wider community) it does not threaten green belt or rural land. Every last resource in the UK is utilised for the provision of goods and services: this

sees the resurrection of the many coal mines; greater protection of the UK's fisheries and the conversion of non-productive land to farming. Resource consumption is somewhat curbed and a more sustainable and less profligate society arises.

Science and Technology

Innovation continues at a medium pace but is focussed on sustainable resource technologies with the use of GM and other biotechnology encouraged as much as possible.

Cultural, ideological and religious

Societies' response to climate change is mixed. At the government level there is an appreciation that climate change can affect the UK's ability to produce food and may result in a greater frequency of catastrophic events. Therefore some planned adaptation takes place (e.g., hard sea defences, new crop species); however, society as a whole is more sceptical and autonomous adaptation is more common. Societies belief in technology as a solution to solving global crises is absolute.

Governance

External

There is very little external influence on the UK's governance; the UK is no longer a member of the EU although it retains its seat in the UN council.

National

The UK has a strong centralised government which has taken more power away from the EU and also local authorities. A national programme of achieving as much self-sufficiency as possible is underway and the government expects everyone to do their part. Climate change is seen as a major threat to the UK's economy and welfare and is taken seriously; however, a far greater emphasis is place on adaptation than mitigation. This adopts as many technological solutions as possible.

Regional

A centralisation of power has reduced local authorities to be the providers of mundane, day-to-day- services like waste collection; many other services are centrally controlled now including road maintenance, planning, schooling and social services.

Planning

Has been centralised and local authorities no longer provide planning departments. This is to ensure that all planning decision fit into a greater national vision of how the UK should develop local housing, transport networks and industry.

Land and Sea use

Farmland

The push for self-sufficiency is also driven by (or drives) technology advances (which *are* exchanged between scientific and innovation communities across the world as are other 'knowledge exchanges') and production increases. Hence precision farming and other sustainable techniques are promoted and constantly evolve; it is realised that harming natural

resources will harm future production (although it's more about looking after the soil than wildlife *per se*).

GM crops are also heavily utilised and are considered essential to sustainable land management. Plant-based protein is quickly realised to be a more optimal use of agricultural land and meat production is heavily taxed with a climate change levy (and thus declines becoming a food for the affluent); this results in some surplus agricultural land becoming available for SRC bio-ethanol production as well as new forest plantations for timber. Subsidies continue but are provide by the UK government; nothing (including legislation) comes from the EU and the links to a united Europe have diminished.

Woodland

Forestry is an important sector and home-grown timber production is promoted. Climate change has put pay to the concept of native species and foresters are free to experiment with exotic trees (with the exception of some potentially problematic species). Ancient semi-natural woodlands are managed for fuelwood but in some cases for quality timber or furniture products (although in places conservation objectives are met too). Plantations are the dominant woodland type though. Many grassland areas of the west and north become either plantation woodlands or SRC for bio-ethanol.

Grassland

Semi-natural grassland becomes a conservation luxury society cannot afford to keep and is now either harvested for bio-ethanol or converted to woodland if the topography is too difficult for farm machinery. This results in a huge decline of native grassland communities.

Mountain, moor and heath

Many of these habitats have increased woodland cover to accommodate the drive for home-grown timber. Overseas conifer species are widely used (Monterey and Corsican pines cope well with the climate and soils

Freshwater

Freshwater resources are protected and use is governed by licence (e.g., for irrigation or drinking water). A programme of installing new pipelines from mountain regions to the south is introduced; more reservoirs are built also.

Coastal

Coastal resources are protected if they are important for the economic growth of the UK; desalination plants, nuclear power stations and some built on areas are given priority for sea-rise defence. In other areas high value farmland is also protected from sea intrusion.

Marine

The fish resources of the water around the UK are harvested as before but under strict sustainable catch quotas. The water are heavily protected from other nations by the Royal Navy. Renewable energy schemes are also heavily promoted and include a huge programme of off-shore wind farms and wave energy units. The Severn tidal barrage scheme also provides 5% of the UK's energy demands.

Urban

Large market-gardens and urban-gardens (not just allotments) increase; even 'forest gardens' bloom (*a la* Cuba in the late 20th century). Green space for recreation (e.g., lawns and ornamental gardens) almost disappears and makes way for food gardens (although these do provide areas for relaxation despite their prime food producing role). The housing stock is maintained and improved for energy efficiency; new housing is built to high energy standards but is small and uninviting. Peri-urban zones are similar to urban but small agricultural fields also dominate; market gardens thrive.

Regional outlook

Settlement patterns

Major new housing developments are focussed in existing urban areas as any potential productive land is strictly protected from development

Major energy infrastructure

Wind energy is heavily subsidised and much of the coast around the UK is utilised; nuclear power is also developed through a programme of developed world control of uranium resources. However, uranium is one of the few overseas resources required for energy production and much of the UK relies on a continuation of fossil fuels use from North Sea gas beds and the remaining coal seams.

Agriculture

Farmland increases in area throughout the UK and any potential land is utilised for production, even the poorest soils. Woodland is protected as another valuable resource and biofuel production increases on the poorest soils as well as on previously grassland areas in the west and north. In upland rural areas some parts have been converted to arable production (where it is not too steep or undulating); timber production dominates though and the large plantations of the 20th century Borders region shift northwards to the Grampians and other parts of the Highlands. Harvesting technology is such that steep forest slopes present only a small challenge.

Recreation

Although much the the UK landscape is still quite attractive to people for hiking and walks there is less time available as most people are more heavily engaged in work.

Conservation

The UK's species and habitats have little economic use in this scenario (except woodlands) and consequently conservation is a luxury that cannot be afforded. Throughout the UK habitats become more degraded which results in the highest levels of biodiversity loss in a generation.

Transport

The major road networks are maintained and car use increases in the UK. Internal flights are very common although more people use rail travel to commute too. Fossil fuels and biofuels dominate.

Human well-being

Material need

Consumerism is down largely due to lack of supply rather than personal preference; many people return to more traditional past-times including reading. Technology has not been abandoned though and most people are well connected through the internet.

Health

The NHS is heavily funded by the government and a programme of education improves health throughout the UK. A move to more manual labour employment also has health benefits and obesity is declining. Junk food is comparatively rare and although the average diet is not inspiring it is fairly well balanced. Meat consumption declines rapidly which also has health benefits for the nation.

Social Relations and Security

A shared feeling of responsibility and pride in the UK provides a strong backbone for social togetherness and contentedness. The more affluent still enjoy a higher standard of living than the less well off but the poor have a higher standard of living because there is lower unemployment. Crime reduces slightly.

Freedom and choice

An decrease in availability of many luxury goods and even some staple foods does increase inequality ad the affluent manage to maintain a relatively higher standard of living. The government takes more power away from citizens (this is seen almost as a time of war) and the media is also heavily monitored and censored. A rise in nationalism follows the drive towards self-sufficiency.

The footprint of Ecosystem Services overseas

The UK's move towards self-sufficiency, whilst not completely ceasing trade with other countries, has certainly reduced the UK's overseas footprint. Reduced food and energy imports mean that the UK is coming to terms with it's impact on the earths finite resources albeit very slowly.

Effect on UK Ecosystem Services

Provisioning

- Wood production – increase dramatically (15%) due to larger area but also species that cope with warmer conditions and better forestry management.
- Fuelwood production – also increases, it provides a relatively easy fuel to source and provides home-grown jobs.
- Food production sees a large increase of 20% through the UK, especially from plant-based protein and carbohydrate feedstuffs.

Cultural

- Recreation – decreases, people have less time to visit the countryside but are more likely to spend time close to home in gardens etc.

- Historic and spiritual values throughout the UK are preserved and celebrated. Beautiful iconic landscapes that have not been altered too much by the drive towards production are the most popular places.

Regulatory

- Carbon – increase by 15% although mainly dues to biofuel and woodland management
- Flood alleviation – rural flood-prone areas are afforded protection against flood of they are major agricultural production areas. This is done through a series of better soil management, river - re-channeling and hard defence systems.
- Erosion control – strict control and good practice reduces erosion incidences.
- Water quality – declines to mid-1980s levels due to high use of pesticides and fertilisers.
- Invasive species numbers decrease due to less overseas trade, current species are controlled in areas where they pose the largest threat to provision of food.

Main sources

NE *Keep it Local*; Foresight Futures 2020 *Local Stewardship*; elements of UNEP *Policy First* and *Security First*; UKCIP socio-economic *National Enterprise;* Foresight Futures 2020 *National Enterprise*; BESEECH *LOcal Stewardship;* EU-Ruralis *Regional Communication:*

3.5. Local Stewardship

Rationale

As the name implies, Local Stewardship defines a future where society is more concerned with the immediate surroundings (community, land, etc) and strives to maintain a sustainable focus on life within that area. However, unlike the National Security story-line, and despite the local focus, people are more connected and have more solidarity with communities in other countries. This is truly a 'think global, act local' paradigm. The 'Tragedy of the Commons' would not be recognised in the UK. Societal equity is another important aspect and there are very few glass ceilings in any industry, business, politics or schooling. Public schools are abolished. *'Liberté, égalité, fraternité (et fierté locale)'* would be an appropriate motto for the UK.

People travel less and depend more on local resources; more of our food and leisure activities take place in the immediate locale. The implementation of the sustainable management of resources is key (it needs to be) and society relies less on technological innovation. Low carbon economies spring up everywhere and there is a greater use of alternative economies such as LETS (Local Exchange Trading Systems) schemes. Waste is considered an anathema: very little food is wasted and, for example, farmers and small-holders utilise every last part of an animal. Many families keep chickens, pigs or geese in their gardens.

Self-sufficiency is a key concept and many exports and imports are reduced considerably (but exists for commodities not produced in the UK); agricultural land area stays the same as in 2010. The overall levels of biodiversity increase though and many ecosystems, including farmland and woodland, are vastly improved. Climate change is taken seriously and mitigation (an example of the 'think global' aspect) and adaptation projects spring up around the country. Everyone is fully behind climate change measures - many of which are planned and can result in changing or moving housing or industry. Risks and consequences are shared throughout society - losers to floods etc are helped out by the state.

Through local specialisation the UK becomes less homogenised - the landscapes become more distinct and even local economies vary considerably. Technological development does not occur as rapidly as in other countries (there is less private and government investment and society has is increasingly sceptical of technological 'benefits') but does advance in environmental and sustainable fields. Regulation is advanced though, particularly in workers welfare and rights and in environmental protection. Policy encourages smaller enterprises and SMEs proliferate. Although economic growth is much slower the economy is more stable and does not boom and crash.

Main Drivers

Demographic

Immigration is reduced and internal migration between regions falls dramatically too. Population growth from 2010 is very small mainly due to a government policy of rewarding one-child families; however, the population continues to age (although the age of retirement reflects greater health at old age and rises to 70). A focus on sustainable households results in more people living together (i.e., families staying 'nuclear' for longer with many 25 year-olds still living with their parents and flat/house sharing becoming common as in cities like Berlin). As a result, there is no housing crisis and as a consequence much poor quality housing from the 20th century is destroyed to make way for green space.

Socio-political

This scenario is more about 'people-power' than any other; government at national level exists to help implement sustainable lifestyles at the local level. This entails education and planning guidance but many decisions are then taken at a local or regional level. A Mayoral council of three elected members exists in every town and city - they have considerable power (although the government has a veto power to curb excessive judgements should they occur).

Economic

One consequence of this scenario is lower overall GDP; however, the country as a whole is healthier, happier and the environment is better protected. Unemployment is much lower than 2010 and although average income is reduced there is much greater employment security and more people are engaged in labour-intensive jobs. Many traditional crafts and vocations are renewed and the old-fashioned apprentice and journeyman roles are reprised (and provide one opportunity to travel throughout the UK to share and learn new techniques from other counties). The working week is a heavily protected 40 hours; unions have greater powers (but rarely get into dispute). Businesses follow this paradigm and being small and local is a key marketing strategy - large multinational companies take a lower share of the UK market each year. Products tend to be durable and long-lasting.

Science and Technology

An investment in water and energy efficiency is one area where some technological advancement is made; coupled with a greater desire to source diverse energy resources locally (even domestically, more houses take up a mix of solar, ground-source heat and wind) means that the energy industry is radically changed. Fossil fuel hasn't been neglected though and some abandoned coal mines are reworked (fossil fuel use is cleaner in 2050 though and follows stringent filtration and carbon storage legislation).

Cultural, ideological and religious

Society in the UK is more tolerant of ethnic minorities and different religious of cultural views. There is a greater appreciation of nature and the services it provides to society. However, 'localism' dominates everything and becomes the mainstay of our cultural outlook: everything is touched by localism - food, leisure, arts, etc.

Governance

External

Internationally the UK is seen as a autonomous power with friendly partnerships throughout the world although membership of the EU has long been rescinded and the UK's role with other bodies (e.g., UN, NATO) has diminished. Despite the insular stance in the UK it is seen as a progressive and popular nation elsewhere. Membership of important organisations or institutions pursuing environmental governance, poverty alleviation, social equity or 'localism' (e.g., Appellation d'origine contrôlée) are actively supported. Town and city twinning is encouraged and many school children have spent time abroad with other families.

National

A UK government exists but a lot of power has been devolved to regional bodies and mayoral councils. The UK does have better relations with more countries and is not seen as the noisy ex-colonial power any more. *Local Stewardship* is not quite a return to pre-1940s Britain but there are similarities in many aspects; community togetherness and welfare are more important values and 'small-scale' takes precedence over the global aspect of today's world.

Regional

Local governments have more power to change the local economy, planning, schooling and health (all of which can vary across the UK). The mayoral system is popular and powerful.

Planning

Local planning adopts national guidelines but is more or less autonomous; land use is driven by local needs (and a care for the environment) and co-operation between regions is good (e.g., for designing and maintaining conservation park areas that cross borders - many do with the advent of climate change). Many large and small towns have fewer houses; community housing re-development projects are common; public participation in planning is high. Existing housing in floodplain areas is neglected and owners are encouraged to move.

Land and Sea use

Farmland

Agriculture changes considerably as a consequence of two factors: the drive towards self-sufficiency means that some crops are reduced in area (e.g., wheat - exports reduce) to be replaced by more protein and vegetable crops; mixed farms (many organic or low-input) become more common too. Meat production becomes more extensive and traditional, British breeds boom. The drop in overall national meat production is balanced in a rise in pulse production. The second factor is the promotion (through market forces and policy) of a distinct local or regional character for food production. Many areas pride themselves on their local wares and a lot of value-added production arises (e.g., cheeses, ice-creams, bread, etc). Traditional areas for specialist foods return (e.g., the charcuterie products of the black country) and much of the

UK becomes a 'foody' heaven. Agriculture is subsidised by the government and entails a programme of biodiversity conservation and sustainable management practices. The government promotes its regional wares and more foodstuffs and drink achieve AOC certification. Agriculture increases its share of national GDP although economic growth slows. Farm tenancy law is re-examined giving tenants greater power, four generations of security and rent controlled by regional ombudsmen.

Woodland

Most woodlands have a similar woodland composition to today's but are better managed through coppice (used for local domestic energy or other craft products) and other high forest silvicultural systems; lower grade agricultural land is converted to woody biofuel in peri-urban areas and in lowland rural counties (10%). Overall agricultural land area stays the same as in 2010 but changes considerably in type (more heterogeneous) and in average farm size (smaller).

Grassland

Grassland ecosystems are maintained by grazing and provide an opportunity for recreation too. There is a slow increase in diverse grasslands as more farmers restore previous grass fields adjacent to existing using local seed.

Mountain, moor and heath

Mountain habitats are protected from development and provide grazing for sheep and hardy cattle breeds. Recreation is important.

Freshwater

The quality of water in all freshwater habitats improves as a result of better agricultural management and more extensive production systems. Invasive species are controlled and new introductions from overseas decline due to greater border control.

Coastal

In coastal areas managed retreat is common (landowners are well compensated) and hard defences are actively removed in favour of 'softer' approaches. Areas of valuable agricultural land are protected but some farm systems are changed from highly-drained farm land to wetland farm systems (e.g., rice production). Coastal development for shipping, oil and gas is reduced and the UK's coastline and marine habitats reap the benefits.

Marine

Renewable energy from the sea is encouraged and backed by government schemes - wave and tidal energy sources become common (but do not conflict with areas of high biodiversity). Marine bio-resources are managed sustainably and local fish-based cuisine is very popular; many fish populations recover from 2010 levels. Some areas do not fare so well where there has been a long tradition of harvesting at the expense of conserving marine ecosystems.

Urban

In urban areas vast changes occur: the housing stock diminishes to make way for more green space (gardens both for leisure and food production); street trees are planted and maintained and urban farms crop up throughout the UK. In peri-urban areas there is a large increase in

(working) woodlands and conservation areas due to a housing contraction. Small farms (mostly tenanted) arise from the break-up of larger units.

Regional outlook

Settlement patterns

The UK settlement pattern is very similar to 2010 except areas prone to flooding have had the housing stock removed. Existing housing development occurs only in relatively safe and 'climate proof' areas. There is a small outflow of people from urban to rural areas.

Major energy infrastructure

Domestic energy supply is very important in this scenario and many houses are installed with a combination of wind, solar and ground-source heat systems. Energy efficiency is also improved across the national housing stock. Transport adopts a combination of bio-fuel, electric and fossil fuels. Large-scale renewable energy also plays an important part but only where it does not conflict with biodiversity: e.g., wind farms crop up around the coast but avoid major bird migratory routes as well as important marine habitats.

Agriculture

In lowland rural areas farming areas stays the same as in 2010 but the type of farm system changes to become more mixed; the average farm size decreases considerably too as farming is ostensibly available to anyone who is willing to train. In upland areas some grassland ecosystems now support biofuel cropping or woodlands.

Recreation

Local based recreation is just as important as local food production and many people enjoy time in the countryside. Many towns and cities are more attractive places too and restaurants and cafes only sell locally produce food.

Conservation

The effects of this scenario are fairly widespread and ubiquitous; local specialisation means that the landscape is more diverse and protected and consequently biodiversity is less threatened. More sustainable management also reduces off-site pollution. Many parts of rural UK are so well managed that habitat corridors are not needed for species to disperse or migrate; instead, the 'softened' landscape is a friendly enough matrix for for most species.

Transport

Transport networks across the country are maintained but with lower annual investment than other story-lines; fewer people travel pan-UK and trade is much reduced so road wear is reduced also. A rail network is maintained (and nationalised again) and meets much of the UK's leisure, business and industrial transport requirements. Across the country vast sums are spent on extending and improving cycle networks and many people cycle to work (cycles are subsidised for work).

Human well-being

Material need

The belief in sustainable production systems pervades attitudes towards consumption and lifestyles; most people do not want or miss high-tech goods and enjoy a more relaxed pace to life. Simple things provide simple and rewarding pleasures. Food is very important though and many people pride themselves on their cooking abilities - local food is easily sourced obviously.

Health

The health of the nation increases due to lower stress lifestyle, better nutrition, better education, more outdoor work and better housing standards although technological developments in medicine have not progressed as much in other story-lines. Mental health is also much higher than ever before.

Social Relations and Security

The UK is a much happier place. There are lower incidences of crime and aggressive behaviour toward others; tolerance of minorities and different viewpoints is high and many local communities are so well connected and supported that any transgression are easily dealt with if they arise. Community pride and peer pressure to 'behave' is strong.

Freedom and choice

Localism does not mean inconsistent standards in law or freedom; everyone in the UK has a voice, a vote and freedom to do what the want within the laws of a civil society. Many local customs are maintained but these do not encroach on equality and civility. Access to land and production system is good and even the poor have the ability to do well in life if they work hard.

The footprint of Ecosystem Services overseas

This story-line has, along with *Ecosystem Services,* the lowest overseas ecological footprint. The largest footprint is due to food imports as UK output is lower because of the extensive and sustainable systems adopted.

Effect on Ecosystem Services

Provisioning

- Wood production - huge increase in some areas (i.e., traditional wooded regions like south east); many farm woods are renovated to working woods again. Local wooden products are easy to find in shops (everything from spoons to broom handles to tables and joists)
- Fuelwood production – 15% increase due to high fossil fuel costs. More efficient boiler designs means that local communities adopt fuelwood as their energy source for heating.
- Crop yields – declines where old varieties have been adopted; less use of pesticides and inorganic fertilisers also reduces yields.
- Animal products – similar to crop yields.

Cultural

- Recreation - increasing opportunities for woodland and farmland recreation locally is key. Fewer people travel far for leisure. Most woods are intensively managed for fuel to

supply local heat generation systems but also incorporate trails an paths for recreation. The traditional English landscapes of pre-war times are returning and many people love walking in the countryside.

Regulatory

- Carbon - land carbon stocks increase due to better management of woods, farms and grasslands. Marine carbon stocks also increase.
- Flood alleviation - locally designed adaptation plans implemented. Autonomous adaptation is widespread and housing developments in floodplains have been removed and returned to natural ecosystems.
- Erosion control – fully managed and controlled.
- Water quality – improves to almost complete UK-wide favourable status.

Main sources

NE *Keep it Local*; Foresight Futures 2020 *Local Stewardship*; elements of UNEP *Policy First* and *Security First*; UKCIP socio-economic *National Enterprise;* Foresight Futures 2020 *National Enterprise*; BESEECH *Local Stewardship;* EU-Ruralis *Regional Communication;* Burgess and Morris. *2009.* Agricultural technology and land use futures: The UK case. *Land Use Policy.*

3.6. Business as Usual

Rationale

This scenario is essentially a projection based on current trends (taken over 10-15 year averages) and results in a future Britain that is roughly based on today's ideals and political leanings with some leaning towards a trend in improving the environmental and sustainability performance of the UK. Current ideas being developed in academic, government and the media about the way forward for the UK have been adopted. Ecosystem Services becomes an important concept in the UK and influences thinking and policy across government departments. Payment for Ecosystem Services (PES schemes) becomes the dominant paradigm across the country and extends beyond payments for farmers and foresters to manage sustainably and involves villages, towns, companies as well as government payments.

Main Drivers

Demographic

The average household size of 2.4 in 2010 declines slightly as more people enjoy living alone, the divorce rate continues to rise the birth rate declines. Immigration is controlled and only skilled migrants are allowed entry it falls to 250,000/year although emigration rises to 350,000/ year. Population growth slows and the UK has 56 million inhabitants in 2050.

Socio-political

A slow progression towards a low-carbon economy and better environmental standards across industry and society is maintained. There are brief spurts and setbacks depending on the government at the time but climate change mitigation and adaptation is kept on the agenda.

Economic

The employment rate increases from 72% in 2010 to 77%; unemployment falls from 7.9% to 3%. Export goods with the EU and other countries grows to a value of £30 billion in 2050. The UK

follows the same pattern of privatisation of public institutions over a period of 30 years which results in the postal and health services in private hands.

Science and Technology

Technology and science are considered important aspects for a developing society and are maintained although private sector investment is encouraged more too. The UK's gross domestic expenditure on R&D has increased from £25.6 billion in 2008 to £35 billion in 2050; this represents 1.80 of GDP.

Cultural, ideological and religious

The Church of England is in decline and society is more multicultural. Islam is the second biggest faith although the vast majority of people don't have any faith and we are essentially a secular society. More people profess to environmental beliefs but are still reluctant to practice what the preach.

Governance

External

The UK stays in the EU although resists monetary union and the pound is still the national currency in 2050. Strong relationships with the US, UN and NATO remain.

National

The UK government remains a fairly conservative body with a reluctance to implement any major societal changes. The adoption of PES is one important step that transcends political boundaries though. There is a greater emphasis on Public-Private-Partnerships for developing public infrastructure and public services.

Regional

There is an increase in political power of major city majors but essentially most towns and counties retain the same power structure as in 2010.

Planning

As in 2050 except greater emphasis on biodiversity and climate change guidance.

Land and Sea use

Farmland

The current area of agricultural land in the UK of 17.5 million hectares stays the same although cropping changes to reflect the impacts of climate change (new crop species, more perennial crops and biofuels). Agriculture is a varied and changing industry - in some parts of the country large, factor farm units supply cheap milk, pork and beef to the supermarkets; in others, there is greater emphasis on organic farming and quality beef, lamb and pork production. The percentage of arable (28%) and grassland (67%) changes slightly though to 35% to 55% (much of the remaining s converted to woody biomass).

Woodland

The woodland area in the United Kingdom of 2.8 million hectares in 2010 increases to 3 million; of this 55% are sustainably managed. The remaining woodland cover is left unmanaged as it is uneconomic. Greater public access to woodlands is achieved though an amendment to the CRoW Act . The Forestry Commission continues to spend more time and resources developing its woods for public access and leisure activities (e.g., mountain biking).

Grassland

All conservation designated grassland is maintained, mainly by local conservation organisations as government conservation programmes are cut to focus on ecosystem service delivery and climate change adaptation schemes. The area stays constant.

Mountain, moor and heath

Mountain and heath ecosystems are still threatened by afforestation and localised grazing pressure but continue to be a dominant sink for soil carbon in the UK. Upland peat soils, in particular, protected from land use change. Recreation increases in mountain areas although traditional mountain communities (farm based) are in decline and more people are engaged in the tourism and leisure industry. Mountain biodiversity shows a steady decline from 2010 for the next few decades primarily due to climate change; conservation programmes to curb this are expensive and largely unsuccessful.

Freshwater

One success story in this story-line is the continued successes in cleaning the rivers of the UK; however, all is not rosy and invasive species number rise and prove difficult to control with the limited funding the government offers.

Coastal

In 2050 UK ports handle 750 million tonnes of freight, up from 562 million in 2008. The vast majority is inward. Some areas of coast land are under managed retreat regimes but on the whole hard sea defences are employed to hold back rising sea levels.

Marine

The UK sea fish (including shellfish) catch is down to 270 thousand tonnes in 2050, almost half the 2010 figure. Development of off-shore wind farms has slowly picked up and threatens some marine ecosystems.

Regional outlook

Settlement patterns

Government plans to build 1/4 million new houses every year until 2030 (when the UK will reach 27.8 million households) are extended indefinitely and housing development continues for the next 20 years; this results in an average density of 50 dwellings per hectare up from 45 in 2010. Most of this housing is concentrated in the south-east but all major conurbations in the UK see a rise in housing. Building in greenbelt rises and 15% changes to residential use since 2010. Development in areas of high flood risk also continues and in 2050 20% of all dwellings built since 2010 are found within high flood risk areas.

Major energy infrastructure

The UK pushes its 2010 target of 3% of energy sourced from renewables to 8%; a focus on nuclear energy was pushed in 2020 to help alleviate dwindling fossil fuel resources available to the UK. Biofuels from cropped land is also heavily promoted. Energy efficiency continues to improve at a steady pace and cars wit poor economy are heavily taxed.

Agriculture

Arable production starts to encroach into traditional animal production areas in the western and northern parts of the UK. In the south east, climate change makes it difficult for farmers in some years but most have adapted by growing drought-tolerant crops and new crop species. The farmland area stays the same; the average farm size continues to increase at the expense of small, family farms. Large agribusinesses dominate the industry

Recreation

The growth of cheap air travel continues and more people holiday abroad; despite this, day-visits to the UK countryside continues to increase (particularly in the hotspot areas like National Parks). Urban visits also rise as more cities in the UK are rejuvenated; London, Bath, Edinburgh, Manchester and Birmingham draw most visits.

Conservation

The conservation of UK biodiversity is still very important in 2050 but is more and more funded by NGOs and other conservation charities. The government continues to refine biodiversity legislation and adopts revisions from the EU and the CBD but takes a more backseat role in delivering biodiversity conservation guidance and management. Some of this slack is taken up by national bodies under government contracts, the rest by NGOs. The main focus is the delivery of ecosystem services through although this often corresponds well with biodiversity conservation. The is no real regional bias for conservation delivery - most parts of the UK are covered well by national or local organisations.

Transport

New high speed rail networks are developed from London to Birmingham and Glasgow; these greatly reduce travel time and offer a competitive alternative to flying. Car use also continues although the vast majority of vehicles in 2050 use non-fossil fuel drive systems (hydrogen, bioethanol and electric are popular).

Human well-being

Material need

UK society is divided between the have and have nots. Mean income is higher than in 2010 but so is the gap between rich and poor; there is still a glass ceiling for some sectors in society (although things have improved for women). Most people have access to cheap electrical goods and a range of food stuffs (although niche products become prohibitively expensive for most people).

Health

More of the NHS is funded through private finance initiatives which has a serious detrimental affect on national health (i.e., the needs of the patients are not always met). The affluent sections of society are generally healthy due to access to the best medical care and better

education (smoking, drinking and obesity all mainly lower class issues). An increase in human health pandemics throughout the world results in large occasional mortality events across the UK.

Social Relations and Security and Security

In another example of PPP, the standard of policing is very patchy in the UK. Some areas (i.e., affluent) have good policing, many others do not. This breeds resentment and creates a divisive society.

Freedom and choice

Freedom is more restricted than in 2010. Human rights are squeezed further in the name of protecting democracy. The biggest fear remains terrorism and threats from fundamentalist religions continue to rise. Many goods that were once public are now private - this affects access for recreation, food and decision-making.

The footprint of Ecosystem Services overseas

The UK's footprint continues to rise above and beyond the global biocapacity per person of 1.8 gHa from 5.4 in 2010 to 7.5 in 2050. This is despite the UK government's and local authorities' determined efforts to reduce it. Market forces and personal consumption are the main culprits; the south-east local authorities have the highest footprints in the UK.

Effect on UK Ecosystem Services

Ecosystem service that have monetary value and are easy to trade are protected, many others are not

Provisioning

- Wood production - very little, mostly imports from eastern Europe despite high transport costs.
- Fuelwood production – 5% increase due to high fossil fuel costs. Some local communities adopt fuelwood as their energy source for heating.
- Crop yields – increase steadily, government and private R&D has pushed yields higher despite climate change (+7%); overall national production in cereals and protein crops increases.
- Animal products – milk, beef and pork yields continue to increase due to demand for cheap, low quality meat.

Cultural

- Recreation - increasing opportunities for countryside recreation. Better public access to most habitats.
- Some historic and spiritual ecosystem services in the UK have been degraded or lost.

Regulatory

- Carbon - land carbon stocks slightly increase due to better carbon management across sectors (+5%).
- Flood alleviation - localised improvements, mostly in the southern counties.
- Erosion control – slow improvement in management through concerted DEFRA & NFU efforts.
- Water quality – continues to improve.

- Invasive species numbers increase due to more un-regulated trade, an increase in traffic (a main vector for many species) and climate change; control methods are implemented but without real funding are fruitless.

Main sources

ONS, DEFRA, DECC data, etc

4. Effects of High and Low Climate Change scenarios

The two different climate change scenarios will have dramatic affects on many ecosystem services in all the socio-economic scenarios discussed above. Clearly the High CC scenario will have a greater impact on crop yields, coastal erosion, habitat composition and carbon sequestration to name but a few. These direct impacts will be the same across the socio-economic scenarios; what is different though is the reaction of society in each scenario to CC.

Two scenarios will deal with climate change better than the rest: *Biodiversity First* and *Ecosystem Services* which both place a strong emphasis on adaptation to climate change throughout industries, land use types and habitats. In agriculture, *Ecosystem Services* will be better placed to adapt though as it is more likely to adopt new crop species, new technologies and even GM crops that are more CC tolerant. Conversely, *Biodiversity First*, has a greater emphasis on adapting to CC in the conservation sector through programmes like species translocation, habitat corridors and use of low-latitude genotypes.

Table 2: Ecosystem service 'adaptation capacity' for six socio-economic scenarios under two different climate change scenarios

	Ecosystem Service								
Scenario	Carbon sequestration	Carbon emissions	Crop yield	Prevention of soil erosion	Flood alleviation	Meaningful places	Freshwater provision	Pollination	Climate Change
Ecosystem Services	↑	↑	↗	↑	↑	↑	↑	↑	Low
	↗	↗	↗	↑	↑	↑	↑	↗	High
Biodiversity First	↑	↑	→	↑	↗	↑	↗	↑	Low
	↗	↗	↘	↗	↗	↑	↗	↑	High
Local Stewardship	↗	↗	↓	↗	↘	↑	↗	↗	Low
	→	↗	↓	↗	↓	↗	→	→	High
Business as Usual	→	↗	↗	↗	↘	↘	↗	↘	Low
	↘	↘	→	→	↓	↓	→	↘	High
National Security	→	↘	↑	→	→	↘	↓	→	Low
	↘	↓	↗	↘	↘	↓	↓	↓	High
World Market	↓	↓	↑	↓	↓	↓	↓	↓	Low
	↓	↓	↗	↓	↓	↓	↓	↓	High

Key: ↑ large increase in ecosystems' ability to provide the service; ↗ small increase in ecosystems' ability to provide the service; → ability of ecosystem to provide the service remains the same as in 2010; ↘ small decrease in ecosystems' ability to provide the service; ↓ large decrease in ecosystems' ability to provide the service.

The levels of overall adaptation will be greater in the *BF* and *ES* scenarios compared to the other socio-economic scenarios in the High climate change scenario than in the Low climate change scenario. Whilst the three other scenarios are less committed to adaptation (*NS*, *LS* and *BAU* all reasonably accommodating without having the same levels of commitment as *BF* and *ES*) they are more likely to cope with the Low climate change scenario in most sectors. However, under the High climate change scenario some ecosystem services are likely to decline considerably (carbon mitigation, recreation) whilst others will receive societies' attention (agricultural production).

The *World Markets* scenario dismisses adaptation as a waste of time, effort and resources and will consequently suffer considerable negative effects on ecosystem services in the Low and High climate change scenarios.

5. Discussion

The main aim of this exercise is to develop range of plausible story-lines that present *different outcomes* for Ecosystem Services for the UK in 2050. The scenario story-lines above describe alternative and (hopefully) relatively plausible futures for the UK. They can be roughly grouped into good (Biodiversity First, Ecosystem Services, Local Stewardship) and bad (World Markets, National Security) for ecosystem services (Business-as-Usual has elements of both). Clear differences between all six scenarios do exist in terms of effects of the drivers on habitats and ecosystem services and there are also a number of distinct regional variations. Enclosed farmland, as the dominant land use in the UK, does demonstrate a large capacity to be affected by the different scenarios reflecting it's importance to so many major ecosystem services.

5.1. Similarities and differences between story-lines

The six story-lines presented here can be split into a number of groupings depending on outcome for ecosystem services, habitats, social equity and governance. All the story-lines share a growing decline in resource availability and an ageing population; however, other similarities across all six story-lines are harder to discern. All the story-lines do accommodate some degree of technological innovation but this is focussed in different areas; they will al suffer from the same level of climate change impacts too (but their response is different). Figure 1 and Tables 3 to 4 on the following pages highlight the main similarities and differences.

There are clear splits between the degree of consumerism (high: WM, NS, BAU) and community spirit (high: BF, ES, LS), interdependence (WM, BAU, ES) and autonomy (BF, NS, LS), overseas ecological footprint (high: WM, BAU), landscape heterogeneity (high: BF, ES, LS) and habitat fragmentation (high: WM, NS, BAU) as well as response to climate change through mitigation and adaptation efforts (high: ES, BF, LS).

Settlement developments demonstrate more differences between the story-lines: in WM, ES and BAU there is strong south-east UK focus and in BF and NS it is focussed in current urban areas throughout the UK. Transport and mobility also vary - in WM, BAU and NS there is a greater dependence on fossil fuels, air and car travel and continued investment and expansion of the road network; in BF car use stays high but no new roads are built; in ES and LS the whole transport system is more sustainable, low-cost flights are banned, cycling and walking to work is easier and alternative fuels like electricity and hydrogen are promoted.

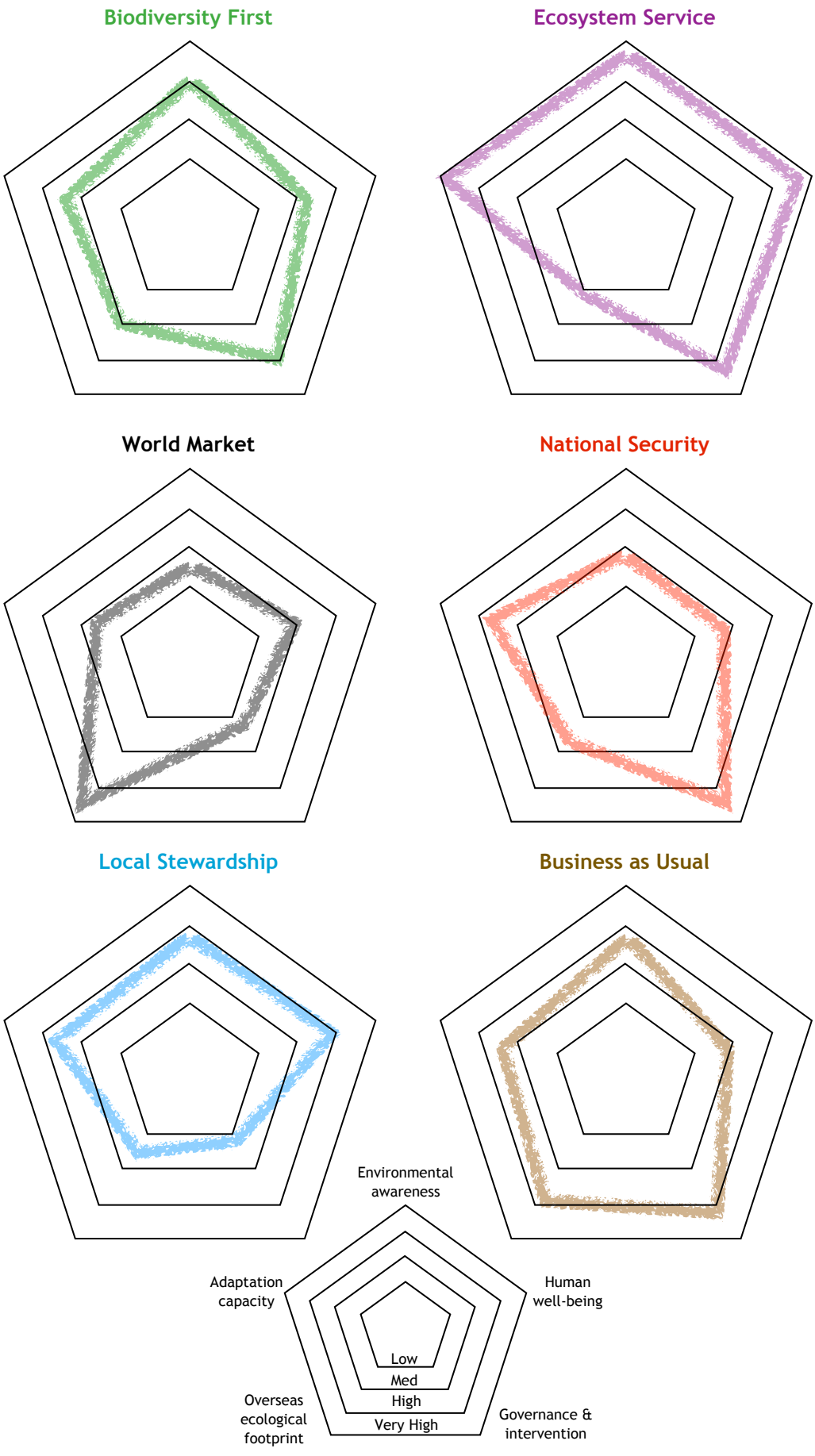

Figure 1: Simplified spider diagrams of drivers & consequences

Table 3: Story-line effects on overseas ecological footprint (scored out of 10, 10 is highest footprint; current UK is 5.4 gHa/cap)

	Biodiversity First	Ecosystem Services	National Security	Local Stewardship	World Markets	Business As Usual
Food	6	4	6	3	7	5
Energy	6	3	3	4	6	7
Consumption and waste	2	2	7	2	8	7
Non-food bio raw materials	4	2	5	3	7	7
Inorganic raw materials	5	3	5	3	7	5
Total score	23	14	26	15	35	31
Conversion to gHa/cap)	**4.6**	**2.8**	**5.2**	**3**	**7**	**6.2**

Table 4: Land and Sea use change since 2010

	Urban	Farmland	Woodland	Grassland	Mountain, moor & heath	Coastal Margins	Marine	Freshwater
Biodiversity First	Increase in green cover through trees, parks and gardens and green roofs	Reduction in area but more sustainable practice. Mixed farms increase	Restoration of ASNWs and PAWS; new woodland planting helps connect ASNWs	Restoration or rare chalk grass habitats prioritised. Other conservation grasslands protected.	Species translocation project helps to adapt to CC	Managed retreat leading to new habitat creation is promoted. Other coastal habitats protected.	Fish stocks protected and habitats given conservation legislation	Tighter legislation on pollutants and invasive species management. 'De-straightening of some rivers.
Ecosystem Services	Increase in green cover through trees, parks and gardens and green roofs. Improve energy efficiency of old housing stock	Change in farm practice to control erosion and increase soil carbon. Some land lost to woodland.	Woodland restoration programme combines conservation and fuelwood prod. Huge increase in woodland cover.	Conservation grasslands protected for amenity, biodiversity and carbon uses.	Carbon stock and water provision in MMH is protected. Amenity encouraged.	Protected from development and managed retreat encouraged.	Sustainable fishing restores fish populations.	Rivers and streams cleaned up and invasive species controlled. Renewed interest in natural swimming and other recreation.
World Market	Street trees replaced at death; many gardens and parks converted to housing.	No subsidy; farming becomes more industrial, large-scale and more specialised.	Some woods grubbed out for housing and other development. Conservation efforts reduced.	More loss of chalk grassland to arable and biofuels.	Loss of MMH habitat to agriculture. Reduced conservation protection.	Development continues into biodiverse coastal habitats. New ports and housing spoils many ecosystems.	Oceans become commons: fish stocks continue to fall	Reduction in water quality. Rise in invasive species.
National Security	Increase in urban farms and allotments. Loss of parks and gardens for leisure.	Optimisation: new tech, GM and switch to crop protein.	Woodlands managed intensively for timber and fuel. New fast-growing species introduced.	Loss of grasslands to SRC where possible. Some is converted to arable.	Lower slopes are converted to plantation forests using exotic species.	Development of desalination plants on east coast. Some managed retreat. New nuclear plants.	UK sea fish stocks harvested unsustainably and protected from foreign fishing boats.	Given little protection. No new invasive species but existing spp increase. Water quality declines.
Local Stewardship	Loss of housing reflecting greater sharing. More green space and urban farms	Farm areas as in 2010; increase in mixed, organic and low-input farms. More on-farm processing.	Conservation woodlands managed sympathetically but also for woodland products (timber, fuel, NTWP, etc)	Chalk grassland is restored and grazed with traditional species	Some adoption of mixed farms on the lower slopes of mountains. Otherwise managed for conservation.	Managed retreat is common except on valuable agri land.	Food resources managed sustainably. Habitats protected.	Improvement in water quality continues. Invasive spp controlled.
Business as Usual	Urban expansion continues at slow pace. Some infilling in green space.	CAP remains, farms get bigger as small farms sell up.	New woodland planting continues at slow pace. Few ASNWs restored or managed for conservation.	Most grassland remains although some threatened by external inputs.	Recreation is popular in Mountains. Slow removal of plantations.	Mostly protected from development except major energy plants (nuclear and hydro).	Some fish populations thrive but others have all but disappeared.	Slow improvement in water quality but invasive species increase.

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