THE CAMBRIDGE NATURAL CAPITAL LEADERS PLATFORM

NATURAL CONVERGENCE: INTEGRATING BUSINESS AND GOVERNMENT STRATEGIES TO MANAGE NATURAL CAPITAL

UNIVERSITY OF CAMBRIDGE
PROGRAMME FOR SUSTAINABILITY LEADERSHIP

Contents

About the Cambridge Natural Capital Leaders Platform

The Platform is a major business-led initiative focusing on practical action and policy influence.

Influential companies with a global reach are working to address the impacts of ecosystem and natural capital loss and degradation on business, their customers and wider society by:

- Triggering significant changes in the business response to sustaining ecosystems and natural capital globally and thereby delivering quality and sustainable lifestyles
- Demonstrating business support for progressive government policy and action to sustain ecosystems and natural capital, both nationally and globally
- Stimulating new ways of thinking so that the future direction taken by business and government addresses risks and grasps opportunities in relation to natural capital.

The Platform offers an exciting portfolio of collaboratories, workshops and partnerships for business, incorporating the very latest content and practice, and with access to leading-edge thinking. The Platform delivers practical reports and outputs around critical issues defined by business in order to inform business strategies

Collaboratory Members

This report

Between December 2011 and July 2012 two groups of diverse business leaders from across the UK wood and dairy industry value chains met with policymakers and academics. They explored how business manages its impacts and dependencies on natural capital through procurement and how this relates to the way government influences natural capital through land use policy. This report represents the output of these processes. The full report, and a separate summary report, can be downloaded from **www.cpsl.cam.ac.uk/natcap**

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Foreword

Given the challenging economic backdrop for businesses, one might be forgiven for being uncertain about where sustainable land use fits in.

What is clear already, however, is that there are pressures and concerns, readily identified in this report, which we are going to have to tackle in order to have any kind of long-term economic future. Businesses are increasingly realising that in order to operate sustainably they must protect and enhance all the environmental resources and services that are used or affected by their operations.

Put simply, businesses depend on the availability of natural resources to make the products and supply the services they sell. For example, timber is one of the most important resources for Kingfisher's business; B&Q alone stocks over 16,000 certified wood and paper products. A journey that began over 20 years ago with the dawn of responsible procurement policies has evolved into a need to demonstrate a resilient business model and secure the future supply of environmentally and socially beneficial raw material for our products.

Over the next two decades, the changes to our society and environment that we are likely to see as a result of resource constraints will require a paradigm shift in the economy and society. The companies that recognise and plan for it now will be the winners of the future.

This report looks at two important components of UK natural capital, grasslands and forests; combined they account for 51 per cent of the land surface and support hundreds of thousands of jobs whilst contributing billions to the economy.

Whilst all agree on the essential value of these resources, different demands are placed on them by industry, retail, local government authorities, energy sectors, conservation bodies and local communities. If we are to avoid a 'tragedy of the commons' in the UK, where poor use or decline of our natural resources arises from multiple individuals acting independently in their own self-interest, we will need to think now about how we can work together.

Responsible, forward-thinking business and effective, well-informed land use policy both play an important part in responding to these challenges.

In compiling this report, we embarked on a journey focusing on what we have in common, land as an indispensable natural resource. Together we looked at how we might balance future environmental, social and economic interests by engaging the stewards of the land, stakeholders in the market, and policymakers, to participate globally in a collaborative manner. The Cambridge Natural Capital Leaders Platform is a great example of just the sort of positive, productive collaboration that is needed to find solutions to the world's resource challenges. The UK land use collaboratory offered a timely model to find ways to maximise the environmental, social and economic potential of working woodlands and grasslands across the UK.

The result is potentially transformative. By working together, we have a great opportunity to create the means to restore and preserve the UK's natural resources, create resilient supply chains, and respond to clean energy demands and the needs of our communities, by using and improving our country's core natural assets.

Ian Cheshire,
Chief Executive Officer,
Kingfisher

Executive summary

A role for business in addressing the natural capital challenge

Natural capital - the biodiversity and ecosystems that comprise our natural resources - provides a range of benefits to society.

From the provision of food to the pollination of crops to the views we enjoy and the regulation of our climate, natural capital underpins almost all aspects of economic activity. But unlike its financial analogy, many of the benefits from natural capital are unrecognised and externalised from economic decision-making, leaving society to consume the products of natural capital at unsustainable rates. Today, natural resources are being consumed on average 50 per cent faster than the biocapacity of the planet for regeneration. Consumption in excess of production means eating into the capital and a third of global ecosystems have now been damaged or destroyed. Regionally, this imbalance can be even more extreme and many national economies rely heavily on the natural capital of other nations to thrive. Over time this overshoot between demand and regenerative capacity continues to grow as populations rise and the underlying capital continues to diminish. The natural capital challenge society now faces is how to produce more with less.

As political institutions struggle to address the problem, exemplified most recently at the UN Rio20+ conference, a clear role for business is emerging. Most companies have significant impacts and dependencies on natural capital which can translate into major risks or major opportunities. As the natural resource consumption overshoot intensifies, companies are facing increasing challenges to their resource security and costs, increasing regulatory and reputational risks, and, in some cases, new market prospects. Responses to these challenges are often required faster than the political process is able to deliver. The University of Cambridge Natural Capital Leaders Platform is a global business initiative that was set up in recognition of these needs, working with a select number of leading edge companies with a global reach to identify where business leadership can respond to the challenges and opportunities natural capital presents. In 2011, members of the Natural Capital Platform explored the need to re-engineer supply chains to ensure demands could be met within the capacity of natural systems, but also highlighted the need for complementary action from the supply side.

The 2012 Natural Convergence report explores this interface further. It reports the findings of two cross-sectorial 'collaboratories' in which companies from across a given natural capital-reliant value chain came together to recognise the challenges natural capital presents to their organisations and wider society, and identified responses with representatives from Government and academia. Both collaboratories focused specifically on the UK, where data were available and where the Government had committed to incorporate the value of natural capital into its future policy. The first collaboratory brought together representatives of businesses reliant on wood production from the UK's forest natural capital, including forest managers, wood board and paper manufacturers, bioenergy suppliers, and retailers. The second collaboratory brought together representatives of businesses reliant on dairy production from the UK's grassland natural capital, including seed producers, farmers, processors and retailers. Together, each explored the way their businesses managed their impacts and dependencies on natural capital from a demand perspective, how this related to the way government influences natural capital supply through land use policy, and where potential for improvements lay.

[1] See the *WRI Millennium Ecosystem Assessment* (2005) and the *WWF Living Planet Report* (2012) for a global perspective or the *UK National Ecosystem Assessment* (2011) for a national perspective.

Working towards a new 'natural capital compact' between wood-reliant industries and Government

Forests are an important component of UK natural capital, accounting for 13 per cent of the land surface.

Almost all are shaped by human intervention to some degree, with a third classified as semi-natural and two thirds as plantation forests. Most forests are privately owned, but these are predominantly on agricultural land or private estates with few owned by commercial forestry companies. In contrast to most other forms of natural capital, public ownership of forests remains significant. Over a third of the UK's forests are managed by the public sector, most of which are under the Government-controlled Forestry Commission. According to the UK National Ecosystem Assessment, the quality of the UK's forest natural capital, as measured by its biodiversity, is generally still good, even in many plantation forests. This capital provides a range of natural dividends. Wood provision is the key monetised ecosystem service provided to society with about 10 million tonnes harvested per year generating annual income in excess of £100 million, primarily from public sector forests. However, forests also provide a significant range of non-monetised services to society.

Insofar as they can be valued, many of these represent potentially higher values than the monetised values. Carbon uptake and sequestration are particularly important, with sequestration values alone estimated at double the value of wood production.

Other regulatory and cycling roles with regards to water, pollution and soil management are also important, as are even more intangible cultural and leisure values, as illustrated by the 300 million visits to forests each year.

The wood-reliant industries represent an important and historic sector that harvests and adds value to one of these forest ecosystem services: timber.

Worth several billion pounds, employing several thousand people and supplying a range of products valued by society, the wood-reliant industries are an important part of the UK economy. Furthermore, these industries represent both a significant dependence and influence over UK forest natural capital. This is achieved in part by generating the economic demand for planting or maintaining forests in the first place but also through the impacts of wood harvesting activities. In the past, harvesting techniques have been damaging to other ecosystem services but modern wood production can now be largely compatible with other ecosystem services.

This is partly due to various market-led initiatives that have established voluntary harvesting standards to ensure wood is extracted with minimal disturbance to other services. It is also due to public policy, both through regulation and through the management of public forests which have increasingly had remits extending beyond timber production and into the production of additional ecosystem services. The result is that most modern wood production and use in the UK retains a large degree of compatibility with other ecosystem services.

Despite the importance of both forest as a natural asset and the industries that both rely on and support it, both are facing significant challenges.

Although increasing over the last century, total coverage of UK forests is still very low compared to European averages. Fragmentation and poor management are also causing serious biodiversity concerns and potentially threatening resilience. Almost none of the services produced, including timber, are being generated at optimal levels, with around half of forests without recognised management for any ecosystem services. At the same time, wood-reliant industries are facing serious challenges to the continued supply of wood.

UK wood production only meets about one fifth of national demand, making most companies heavily reliant on imports from international ecosystems with associated risks to security of supply and prices. Policy interventions have helped some, but exacerbated the problems for others.

Better maintenance, management and enhancement of the UK's forest natural capital would be to the benefit of wood-reliant businesses and UK society as a whole. However, it has not happened largely because of a general failure to recognise the total value of forest natural capital and the full range of services it provides.

Forest-reliant businesses rarely collaborate across sectors to manage a common resource or present a common voice to Government. Instead of a unified call to improve a common resource, Government is faced by conflicting demands from competing business sectors. Equally, Government policies rarely operate at a holistic level or fully recognise the non-economic benefits forests provide. Instead, of deciding how much forest we should have in order to maximise overall value, the UK's forest natural capital is driven by market forces acting on the few benefits that have monetary value, and instead of incentivising the provision of non-monetary services, forest managers are left to balance the provision of free services with those that generate a profit.

The companies in the collaboratory recognise the challenges facing UK forest natural capital and accept a central responsibility for driving change in collaboration with policymakers.

They now call for a new approach to UK forest natural capital management in which forest-reliant businesses collaborate in recognition of a shared reliance on a single resource and work with a Government that presents a holistic approach to the management of natural assets. In 2012 the Independent Panel on Forestry (IPF) made a set of recommendations to Government on the improvement of the national forestry sector. In a parallel set of statements the companies in this collaboratory commit to the following positions and recommend fellow wood-reliant businesses follow suit to:

1. Further the understanding of forests:
The companies believe public perceptions of forest values, and the role wood-reliant industries play in providing them, are key and are committed to promoting the messages that 'forests provide multiple benefits' and 'forest management is beneficial for both wood and other ecosystem services'.

2. Improve forest management:
The companies recognise a clear role for business in increasing the proportion of forests under recognised management and

developing new forest supply chains. They commit to increasing the proportion of wood purchased from forests under recognised management schemes and to working with suppliers to create new wood supply chains.

3. Increase forest cover:

The companies believe economic forces are the only realistic way a significant increase in forest cover can be achieved, but that generating the economic conditions required is largely a role for Government. They commit to support such policies through provision of data or through purchasing commitments when economically viable.

In support, the collaboratory companies request that the Government:

1. Recognise and support the role business can play in the provision of a range of ecosystem services:

The companies would like the role of forest managers in the provision of a wide range of services to be better recognised and further incentivised through the creation of markets for non-monetised ecosystem services.

2. Support wood-reliant industries through a holistic forest industry action plan:

In line with the recommendations from the IPF, the companies support the creation of a wood enterprise action plan to encourage development of all wood-reliant industries.

3. Define the role of forests as a key national natural asset and create the economic conditions to achieve this:

Companies require clear guidance on the target for total forest cover as part of the national natural capital mix and for the economic conditions required to reach this to be created through purchasing guarantees, favourable finance and existing national and European subsidy schemes.

Working towards a new 'natural capital compact' between dairy-reliant industries and Government

Grasslands are an important component of UK natural capital covering 38 per cent of the total land area.

These range from lightly managed, 'semi-natural grasslands' dominated by conservation areas and light agricultural production, to more heavily managed, monoculture 'improved grasslands' where most commercial agricultural production is focused.
Unlike forests, where state ownership and management is significant, ownership and management is almost entirely under the private sector. According to the UK National Ecosystem Assessment, biodiversity levels of grasslands vary widely, from highly biodiverse semi-natural grasslands to very low diversity improved grasslands. The ecosystem services generated also vary between grassland types.

Dairy provision is the key monetised service of value to society, with around 13 billion litres of milk produced per year, most of this being produced from improved grasslands. However, there are also a variety of non-monetised services of significant value. Some grasslands play a significant role as habitats for pollinators; some have a significant role in carbon storage and sequestration and some play an important role in water and nutrient cycles. Many grasslands, including improved grasslands, also have important cultural, aesthetic and landscape values, with many considering the archetypal dairy farm an iconic component of the British countryside.

The dairy-reliant industries are also an important part of the UK economy, adding over £9 billion of gross added value as well as meeting nearly all of the national demand for an important dietary component that is consumed by 99 per cent of the population.

Like the wood-reliant companies they also access a single service from natural capital and have spent considerable effort in ensuring they do this with the minimum impact possible. Also like the wood-reliant companies, the dairy sector potentially plays a significant role in the provision of non-target services, both by driving the creation and management of grasslands and through specific activities by dairy farmers. However, methods of milk production can vary quite widely, from low yield, low input production which relies largely on local grass productivity to high yield, high input production with a heavier reliance on external fertilizer and feed. The net impacts of these production methods on natural capital vary widely and precise data are lacking.

However, in general low input systems have fewer negative impacts on ecosystem services whilst high-input systems can have significantly net-negative impacts on ecosystem services . Over time, a variety of factors have pushed the UK dairy industry towards higher yield, higher input production with associated higher impacts on ecosystem services. Costs of production are rising and, for many, milk prices have not kept pace. To continue to produce milk profitably in a global market the industry has been consolidating - individual farmer numbers have been declining, herd sizes and yields increasing.

A number of environmental initiatives are in place to address the subsequent impacts on

[2]For the purposes of this report only the impacts on UK natural capital are considered, but impacts of high input systems are even greater when the impacts on international ecosystems are included

other ecosystem services, but these largely focus on mitigating the impacts of demand for dairy, not on increasing the supply of other ecosystem services. In contrast to wood-production from forests, the focus on milk production from grasslands is now so intense that it is often produced at the expense of other ecosystem services.

The dairy industry now represents an industry at an economic and environmental crossroads.

The economic implications generally grab the headlines, but the long term impacts of having a net-negative impact on natural capital could be even more serious. Dairy-reliant industries do not want to produce dairy products at the expense of other ecosystem services and indeed thrive on a reputation and responsibility for countryside stewardship.

However, they need to remain profitable if they are to continue to produce the dairy products UK society wants and needs. Society also needs dairy producers to play a natural capital stewardship role – few industries manage such a large proportion of the nation's natural assets. But modern dairy production methods and the economics driving them are increasingly difficult to reconcile with a natural capital stewardship role. Expecting dairy farmers to produce milk profitably, whilst simultaneously providing a range of other ecosystem services for free, is increasingly unrealistic.

The companies in this collaboratory recognise a shared dependence on a single ecosystem service, agree on the challenges facing the dairy sector and accept a pivotal role in addressing them.

They believe that addressing their impacts on natural capital and ecosystem services should go beyond damage minimisation and risk management and instead move towards a vision of a UK dairy industry with a net positive impact on natural capital. However, they believe that neither the information nor the economic and regulatory frameworks required to achieve this exist at present. To address the information shortage, the companies commit

to the following actions, and recommend fellow businesses in the dairy value chain follow suit:

1) Continue to strive towards addressing the impacts of dairy production on ecosystem services:
The companies in this collaboratory commit to continued and improved engagement with natural capital impact mitigation initiatives to work towards a goal of dairy production with zero negative impacts on ecosystem services.

2) Commission, support, exchange and contribute to research:
Lack of data was identified as one of the key barriers to progress with regards to natural capital. The companies in this collaboratory commit to supporting research to identify the exact relationships between all economically feasible methods of milk production and ecosystem services; the options available to address the negative impacts; what they would cost to implement and the options available for how to pay for these changes. This research would need to include the relationships with international natural capital not covered in this report.

3) Consolidate the natural capital targets across initiatives:
With numerous dairy initiatives relating to environmental goals the companies in this collaboratory commit to working together to consolidate all of the targets addressing natural capital together with economic and social targets into a single manifesto for the development of UK dairy.

4) Be open to a variety of potential changes:
The companies in this collaboratory recognise the scale of the challenge facing dairy with respect to natural capital and commit to considering the full range of evidence-based solutions, even if some of these potentially take the industry in significantly different directions to current practices.

At the same time, the companies request that the Government take a clearer position on the UK's natural capital as a whole, identifying the natural capital outcomes that are required, implementing the economic, regulatory and incentivising frameworks required to support them and allowing market forces to determine the optimal way for businesses to achieve them.

Specifically the companies request:

1) Support for their request for additional data:
Whilst the companies recognise a central role in addressing the lack of data available regarding the relationships between dairy and natural capital they also call for support from Government where possible, both in terms of extending the work of the National Ecosystem Assessment and in terms of setting standards for the metrics required for businesses wishing to assess their own impacts on natural capital.

2) Clearer policy frameworks for ecosystem services:
The externalisation of many grassland ecosystem services from the economic decisions governing grassland management is key to the impacts of dairy on natural capital. The Government has taken steps towards identifying the potential for additional markets for ecosystem services and the companies in this collaboratory urge the Government to adopt policies that incentivise the creation of these markets.

3) More targeted use of national and European subsidies:
The companies recognise the current pressures on Government spending and highlight the reform of national and European subsidies as the key way Government can provide economic incentives for positive change. They urge reform to focus on providing the economic incentives for implementing proven natural capital management techniques.

Synthesis - A Natural Capital Compact between business and Government

The two collaboratories identified a number of important parallels as well as differences with important implications for how different sectors can both improve their own performance and work better with Government to promote the maintenance, management and enhancement of natural capital for the benefit of business and society.

Firstly there was a universal recognition of a clear business need, role and responsibility for natural capital management. All companies agreed a vision to move from minimising impacts on natural capital (which generally still left a net negative impact) to active maintenance, management and enhancement of natural capital (achieving a net positive impact) and encouraged other companies to follow suit.

Secondly there was a universal recognition of the need for a new Compact between business and government. Whilst business has a clear role to play in natural capital, it also faces distinct limitations that can only be met through good governance. Business stewardship of natural capital is largely restricted to accessing natural resources in the 'best' way. Government needs to complement this by ensuring the natural resources they have access to are supplied in the 'best' way.

The Compact would require that:

Businesses take a new, collaborative approach to natural capital management whereby multiple, diverse business sectors recognise and value a shared reliance or impact on a given natural resource and collaborate to directly manage it and/or inform Government as a single, coherent voice of the policy support required.

Government take a corresponding, holistic approach to the management of national natural assets to maximise the benefits they generate in which the targets for natural capital are clearly articulated, the expectations and roles for business are clearly described and the frameworks required to make changes economically feasible are put in place.

However, the collaboratories also illustrated the differences in the challenges facing different industries. For some, achieving a net positive impact on natural capital might be an achievable goal, requiring better coordination within the industry and between industry and Government and relatively minor changes to the economic frameworks to strengthen economic incentives. For others, the industry might be much further from a net positive position. In such cases, either large scale changes may have to be faced, or the natural capital costs need to be recognised and rationalised against the benefits of the services they provide.

Increasingly businesses are recognising the need to reform the way they engage with the external world, building sustainable operations that generate clear, net-positive value for society which translates into clear, long term competitiveness for the company.

For companies with a clear reliance on natural capital there are a number of compelling arguments for embracing wider natural capital stewardship into core business processes.

Potentially, wood-reliant, dairy-reliant and a host of other natural capital-reliant businesses could be playing a central role as stewards of UK natural capital, profitably and sustainably creating value from the services they require whilst simultaneously maintaining, managing and enhancing a range of additional services with value to society. The 'Natural Capital Compact' recommended by this report highlights the role of business leadership in achieving this goal, but also illustrates the essential role Government must play in ensuring the appropriate frameworks and safeguards are in place to enable this vision to be realised.

Introduction

The natural resources that underpin every aspect of society have been externalised from the economic frameworks that determine behaviour leading to unsustainable consumption.

Natural capital – the living species and ecosystems of the planet – generates a 'dividend' of ecosystem products and services that society relies on to function; from food and fibre provision to climate and water regulation (see Figure 1)[1]. The productivity, adaptability and resilience to change of natural capital is generally related to the diversity of its biological content, or biodiversity[2]. However, our existing economic and accounting systems almost entirely fail to recognise the role natural capital plays. Whilst sustainable management of financial capital is generally accepted as a core tenet of economic frameworks, natural stocks are unmonitored and the products and services they generate treated as infinite flows[3]. Consequently, apparently rational economic decisions can lead to ecosystem services being consumed faster than they are generated whilst the underlying natural capital that generates them is damaged or destroyed. Two thirds of the services provided globally by natural capital are now in decline[4]. Three of the nine, key planetary boundaries have now been breached and a further three are threatened (Figure 1)[5]. In 2008, global supply of services from natural capital, or 'biocapacity' was estimated to be 12 billion global hectares (gha)[a], or 1.8 gha per person. Global demand for services from natural capital, or the ecological footprint, was estimated at 18.2 billion gha or 2.7 gha per person. In other words, the Earth was needing one and a half years to replenish what we use in a year[6].

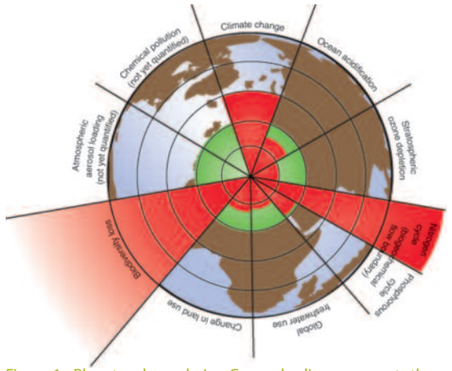


Figure 1 - Planetary boundaries. Green shading represents the calculated safe operating space for humanity, red wedges represent actual levels. Biodiversity loss, climate change and nitrogen cycle interference are calculated to be above safe levels. Rates of land use change are approaching unsafe levels[5]. Image reproduced courtesy of the Stockholm Resilience Centre

Natural capital and ecosystem services

Natural capital refers to the Earth's **biodiversity** and the **ecosystems** this forms. Just like its financial namesake, natural capital can generate a flow of dividends or benefits to society known as **ecosystem services**. Almost every aspect of human society ultimately depends on ecosystem services. In general, the productivity, resilience and capacity to adapt to change of natural capital are directly related to its level of biodiversity.

Ecosystem services can be categorised by type. **Provisioning services** include the foods we eat, the water we drink and the fibres we use. **Regulating services** include the interactions that regulate our climate, pollinate our crops or filter our water. **Cultural services** include the aesthetic, health and spiritual values people ascribe to natural environments. **Supporting services** include the capture of energy from sunlight, the formation of soil and the cycling of nutrients.

Maintenance, management and reporting of financial capital to maintain and optimise a flow of returns are basic principles of our economic systems. Yet the same rules are not generally applied to natural capital, which has led to unsustainable levels of consumption.

[a]Global hectares (gha) = a biologically productive hectare with world average productivity

Regional imbalances between supply and demand for services natural capital can be even more extreme.

Supply and demand for the services provided by natural capital are far from even: if everyone consumed at the rate of the US we would need four planets to support the demand, whilst if the whole planet had the biocapacity of Brazil, supply would outweigh demand[6]. However, these differences have been more than evened globally through international trade, resulting in a global deficit. In the UK, the natural capital score (a measure of availability and degradation) is a low 119 out of 136 countries[7] and the supply of approximately one third of the UK's ecosystem services are now declining[8]. The resulting biocapacity is 1.34 global hectares per person. Yet UK demand is high, with an ecological footprint of 4.71 global hectares per person meaning we are heavily reliant on the ecosystems of other nations to support our economy[6]. For example, for biomass alone (food, fibres, fuel) the UK economy relies on ~14m ha of natural capital overseas to make up the shortfall[9].

The overshoot between natural capital supply and demand continues to grow.

The global population is estimated to grow from seven to nine billion people with a burgeoning, increasingly demanding, middle class[10]. Such a trajectory is unsustainable and various symptoms are being recognised across the globe - a warming climate, biodiversity losses, pollution, resource insecurities, rising commodity prices[10] – but all ultimately reflect the fundamental failure to incorporate natural capital into the economic frameworks that govern societal behaviour. The challenge now facing society is how to reverse this trajectory and develop a framework that incorporates maintains and sustainably manages natural capital in a way that supports a 'one planet lifestyle'[11].

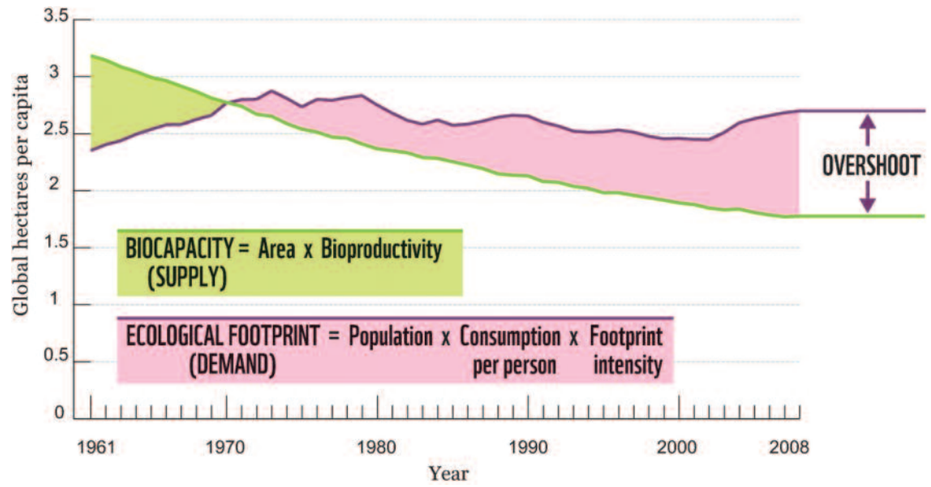


Figure 2 - The growing global natural capital overshoot caused by increasing consumption of ecosystem services and the increasing destruction of the natural capital providing them[6]

Political action on natural capital is happening, but progress is slow.

Policy dialogues worldwide have begun to recognise the need for change with regards to incorporating natural capital and environmental externality management into new 'green economies' and progress is being made in some areas. Natural capital and a transition to a green economy were core themes at this year's UN Conference on Sustainable Development in Rio (e.g. [12]) and whilst a response at a global level appears distant, various nations are beginning to incorporate natural capital valuation, accounting and management into policy[13]. The UK, in particular, has taken significant steps towards addressing the issues, for example introducing mandatory carbon emission reporting and increasing energy efficiency[14,15]. It has also specifically recognised the role of natural capital through the Environmental White Paper (highlighting the Government's intention to value ecosystem services more widely), the National Ecosystem Assessment (effectively the first national audit of natural capital) and, most recently, the establishment of the Natural Capital Committee (with a brief to advise the Treasury on the value of natural capital and help it prioritise actions to support and improve the UK's natural assets)[16,17]. However, as with many complex, global issues progress is slow.

As businesses recognise increasingly imminent impacts from natural capital management, the momentum for action is increasingly shifting towards the private sector.

Whilst many political processes are faltering, some businesses are recognising their increasingly imminent exposure to the risks of natural capital loss as well as the growing opportunities a first mover response might bring[12]. Businesses are highly dependent on natural capital, often benefit from it for free and play a key role in its degradation[18]. The top 800 companies in the world are estimated to benefit from free ecosystem system services valued at $854bn whilst the top 3,000 companies cause $2.15 trillion worth of uncompensated environmental damage[19,20]. A clear business case for a response to natural capital management can therefore be made based on resource security, risk mitigation, new opportunities and social responsibility arguments[18]. And for many companies, action is required faster than political institutions can deliver.

The Natural Capital Leaders Platform is a business-led forum that recognises the challenges presented by natural capital and seek to address them.

The University of Cambridge Natural Capital Leaders Platform represents a group of companies with a global reach that recognise the importance of the natural capital challenge and are prepared to take a leadership position on identifying a role for business in finding solutions. In 2011 the Platform published a report on the need to re-engineer value chaito fit within the limits of natural capital[21]. The report recognised the importance of supply chain management, certification schemes and increased efficiencies as important ways of addressing sustainability from the demand-side, but also highlighted the need for complementary management of natural capital resources on the supply-side. Companies that demonstrate best practice for procuring resources can still face critical resource security issues – either because others are also accessing the same resources from the same ecosystems without coordination, or because without an idea of overall capacity 'best practice' may not be nearly sufficient.

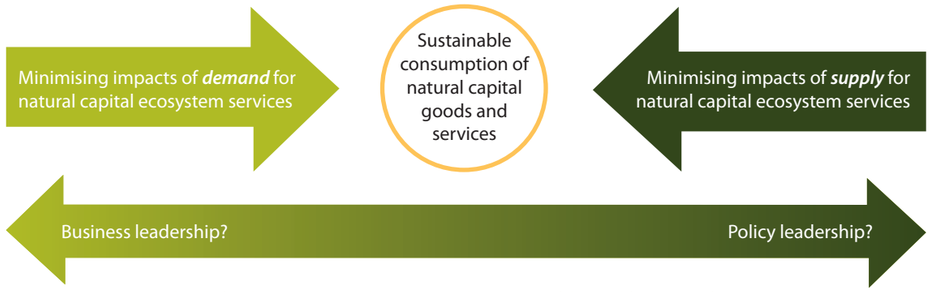


Figure 3 - Business is already familiar with the need to minimise the impacts of demand for services from natural capital through increased efficiencies and the reduction of unintended impacts, but sustainable use of natural capital also requires an understanding and management of natural capital supply – ostensibly a role for land use policy but neither policy nor business is ideally set up to promote such an approach

The Natural Convergence report sets out to explore this interface further, using the results from two cross-sectorial discussion processes.

In late 2011 two parallel 'collaboratories'[b] were established for two broad industry sectors with a direct reliance on services provided by UK natural capital. The sectors chosen were wood-reliant companies in the forestry sector and dairy-reliant companies in the agricultural sector. Both represented a well-established part of the UK economy in which multiple industries accessed a common natural resource and both represented sectors in transition. Each collaboratory included representatives from across the value chain together with relevant policy makers and academics, enabling a unique perspective on shared resource dependence that is rarely available to sector-specific groupings. Collaboratories met several times over an eight month period from 2011-12.

This report represents a summary of the discussion, conclusions and recommendations made in both of these processes. The participants of each collaboratory are summarised in Table 1.

Table 1 - Summary of the collaboratory participants

Wood-reliant industries collaboratory	Dairy-reliant industries collaboratory
Forestry Commission (England) - Forest management	AB Agri- Seed production
Egger UK - Wood particle board	Bayer CropScience - Crop protection
Norbord Europe - Wood particle board	First Milk - Farming Cooperative
Grupo Andre Maggi - Commodities	OMSCo - Farming cooperative
DS Smith Packaging - Paper	Yeo Valley - Farming / processing
Iggesund - Paper	Volac - Milk Processor
Drax Power - Bioenergy	Nestle - General processor
B&Q PLC - Retail	Unilever PLC - General processor
Kingfisher PLC - Retail	Asda - Retail
Confederation of Forest Industries (CONFOR) - Trade body	Lloyds - Finance
UK Woodland Assurance Scheme (UKWAS) - Certification	Firbank Ecosystems Ltd / Scohool of Biology, University of Leeds - Independent
Independent Panel on Forestry - Independent	Taylor Metcalf Ltd - Independent
Department for Environment, Food and Rural Affairs (DEFRA) - Government	Department for Environment, Food and Rural Affairs (DEFRA) - Government
Department for Energy and Climate Change (DECC) - Government	University of Cambridge - Academia
University of Cambridge - Academia	

[b]Collaboratories – 'collaborative laboratories' – are run over several months convening a number of stakeholders in multiple face to face, teleconference and email meetings where business leaders are convened and challenged with a number of discussion points to explore potential solutions to a problem.

Collaboratory 1: UK forests and the wood-reliant business sector

The UK's forest natural capital

The UK's forests represent a significant part of the national natural capital.

Forests represent a large part of the UK's natural capital, comprising over 3 million hectares or 13% of the terrestrial landscape[22]. Most of this is in Scotland (45%) and England (42%)[23]. Two thirds of the UK's forests are plantation forests, predominantly coniferous. The other third is classed as 'semi-natural', a mixture of broadleaved and coniferous forests under varying degrees of human influence. About one half of semi-natural woodlands are classed as 'ancient woodland' – areas that have been under natural woodland since at least 1600 and identified as the most biodiverse forests[24].

England is primarily represented by broad-leafed forests, which account for 65%, whereas Scotland is primarily represented by coniferous forests, which account for 82% of forest cover[23]. Sitka spruce accounts for approximately half of all coniferous forest, followed by Scots pine and larch[25]. Oak is the dominant broad-leafed species, followed by birch and ash[23]. The 'quality' of this capital, as represented by the biodiversity of its content which relates to its resilience to climatic change, pests and pathogens, is fairly healthy. A quarter of UK Biodiversity Action Plan (BAP) priority species are found in forests and whilst biodiversity levels tend to be higher in the semi-natural and longer established areas over 2,000 species, including 42 Red Data List species, have been identified in planted forests too[24,26].

Most forest capital is either owned by the state, or by private individuals.

Nearly 40% of the UK's forests are publically owned, with the Forestry Commission managing most of these with Local Authorities and other public bodies managing the rest[23]. Following a brief period of uncertainty this level of public ownership looks set to remain for the foreseeable future[27]. A slightly larger area of 44% is owned by private individuals, predominantly on farmland and private estates. Businesses only control about 12% of forests, with forestry businesses controlling just 1.6%. Charities, community forests and unclassified forests account for the rest (see Figure 4)[23]. The public forest estate is focussed primarily on the coniferous forests, which comprise 87% of Forestry Commission holdings. Management of broad-leafed forests is primarily (92%) under private landowners.

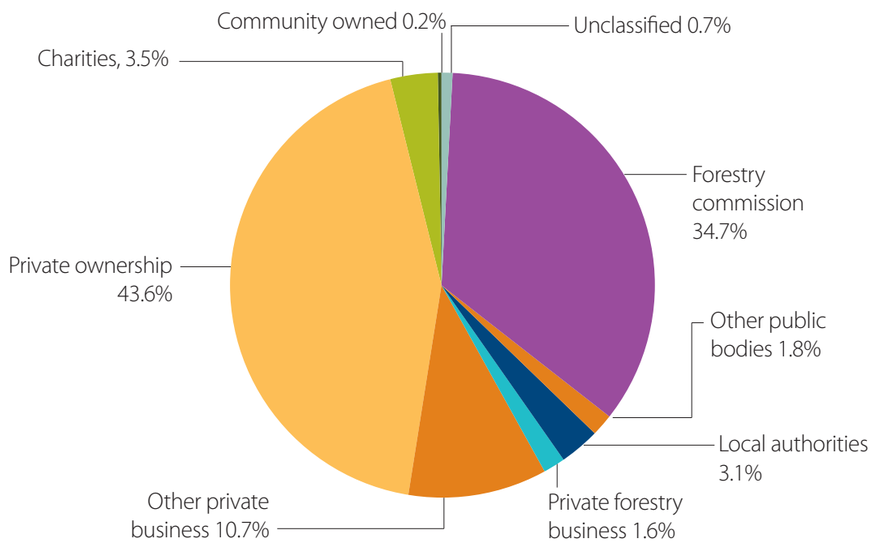


Figure 4 – Control of UK forest natural capital[23]

Wood production is the primary ecosystem service with a clear monetary value generated by forest capital.

Wood or timber production is the primary ecosystem service generated with a recognised monetary value from forests and it is timber production that has primarily shaped forest policy and management over the past century[24]. Timber production in the UK currently stands at about 10m green tonnes per year[28]. This has been increasing in recent years and is set to continue to rise, with over half produced by Forestry Commission forests, but production from the private sector increasing[29].

Wood sale value varies from year to year but generally totals about £100-130m[24]. However, over time an increasingly diverse set of ecosystem services have been generating monetary value in addition to timber. Game shooting is a growing industry valued around £640 million / year and non-timber forest products (e.g. mushrooms, mosses) have an annual commercial value in the region of £9 million[24]. Recreational value is often provided for free by forest managers although the existence of other recreational markets does allow fairly confident estimates of the value. The recreational value of the public forest estate alone has been valued at around £160m a year and the recreational value of all of the UK's forests at £484 million[24,30].

Other ecosystem services do not have realised monetary values but may represent even higher potential values than timber production.

Carbon uptake by growing trees and sequestration in established forests and wood products represent some of the most important non-monetised services UK forests offer society and an important part of a low carbon economy[31,32].

Assigning value can be difficult, but one estimate of the social value of net carbon sequestration has been calculated to be at least double that of timber production whilst the value of forests as a carbon sink based on DECC[c] values for carbon has been calculated to be worth several billion pounds[24].

Social and cultural values – the intangible benefits gained by being able to walk or cycle in a local forest or the role forests play in forming a British landscape - are also extremely significant as demonstrated by the fact that there are up to 300 million recreational day visits to UK forests every year, and by the significant public protest to the planned sale of public forests in 2011[23,33].

Some of these benefits also translate into tangible health values: access to forests has been shown to decrease obesity and increase child health[27]. Further benefits are derived by the role of forests in water cycles, filtration, pollution removal and a host of other ecological roles. These values are managed to a certain degree, partly due to the goodwill of some forest owners who choose to provide additional services such as public access without economic incentive and partly due to changes in the 1990s when their values were recognised and incorporated into management plans and guidance, particularly in public forests.

[c]Department for Energy and Climate Change

The UK's wood-reliant industries

UK wood production supports significant economic activity.

The annual UK timber harvest produced by the public and private forest estates feeds primarily into the saw-mill, wood-based panel, paper and pulp and bioenergy industries (see Appendix for an overview of the wood value chain). The total indirect value of the UK timber industry is thought to be about £18 billion, employing 150,000 people[34,35]. Estimates of the direct total gross added value of timber through the producing and processing industries vary from £1.5 billion[23] to £4.2 billion[27] to £5.6 billion[34] to over £7 billion[35], although these include processing of imported timber. For comparison, this would place direct timber-based economic activities on an equivalent or higher financial importance as the quarrying and mining sector[27]. Of these it is the saw-mill (worth an estimated £897m) and wood-based panel (~£1.51bn) industries that rely most heavily on UK timber, using about 70% of the UK softwood production between them whilst the pulp and paper industry (~£3.9bn) relies more on imported and recycled wood and pulp[23, 36-38]. Bioenergy demands – both small scale wood burning for heat and large scale burning for electricity generation - still represent a relatively small part of the market but are increasing quickly. In 2010 demand for bioenergy demand accounted for just over 10% of stem-wood production – around 1 million tonnes, but this is set to increase to 25 million tonnes by 2020 if the Government's Renewables Roadmap is to be achieved (although the majority of this is expected to be sourced from international ecosystems)[28, 32, 39].

The individual impacts of demand have been well managed through regulation and certification, although there is scope for improvement.

Wood-reliant industries and Governments in the UK have long recognised the need to manage wood extraction sustainably and a number of regulations and guidelines are in place to achieve this. The base guidelines for sustainable management of forests in the UK are set by the UK Forestry Standard (UKFS) which outlines the steps forest managers must take to achieve legal compliance with UK and EU legislation and the further steps they can take to achieve best practice forestr[40]. However, formal certification is provided by the Forest Stewardship Council (FSC) and the Programme for Endorsement of Forest Certification (PEFC)[24] using the UK Woodland Assurance Standard (UKWAS), an independent certification standard based on the UK's governmental requirements set out in the UKFS and those of the two leading international certification schemes, FSC and PEFC[24].

Certification is a voluntary and relatively costly process to undertake but does have proven benefits for biodiversity and ecosystem services[41]. Such approaches are a clear illustration of a largely demand-led approach to sustainability. However, there is still clearly room for improvement. For some, it is the strength of the certification schemes themselves that need still to improve, although these criticisms primarily refer to their impact on tropical forests[42]. In the UK the primary concern is the lack of uptake of certification or similar standards for management[27]. 100% of Forestry Commission forests have now been certified but only about 20% of non-Forestry Commission forests have been certified. This covers about 85% of wood production but leaves 55% of the UK's forests without a certified sustainable management plan[29].

Wood reliant industries also play a significant part in the production of other ecosystem services from forests.

The production of wood stimulates the production of other ecosystem services in two ways. Firstly the very existence of the industry is the reason many of the UK's forests exist. The doubling of forest cover since 1900, and particularly following the wars, was a direct response to the shortage of wood[24]. Secondly, unlike forestry in the tropics[432], the UK's forest history is so interwoven with human intervention that sustainable forest management for wood production also tends to have a beneficial impact on many other ecosystem services[24].

Production of timber from fast growing species, for example, is also one of the most cost-efficient ways to fix carbon, assuming the benefits are realised by embedding the timber into a permanent structure (for example in construction) or if used as wood fuel to replace fossil fuel[24,44]. Thinning practices simultaneously produce wood and increase light levels which in turn lead to increased cultural and biodiversity values. Similar synergies exist when increasing woodland cover, which can benefit social, cultural, regulating and provisioning services if managed appropriately[24].

However, not all scenarios are win-wins. Removing trees to provide wood can have negative impacts on carbon values through soil damage, cultural values by making forests inaccessible or unsightly, biodiversity through habitat disturbance and regulating values if impacting soil or water retention. These trade-offs are exacerbated when employing the most intensive wood production methods such as clear felling and monocultures production.

The challenges facing forest natural capital and the industries reliant upon it

Whilst UK forest natural capital is relatively well managed in comparison to many ecosystems, there is still plenty of scope for improvement.

Society benefits from a range of services provided by the UK's forests, but there is still significant potential for improvement. In terms of total supply, forest cover in the UK has doubled over the past century. However, 13% forest cover is still fairly low compared to the global average of 30% forest cover and the European average of 37% and there is little sign of this improving soon[45,46]. Furthermore, forest locations are still an issue. The placement of forests in unsuitable areas has improved to a small degree with the removal of some forests from unsuitable, peat-rich heathlands but the promotion of forests in optimal locations is still lacking. Forest locations are still largely driven by the existence of subsidies for competing land uses, meaning many forests are in locations unwanted for agriculture and not necessarily the best for providing forest services[47]. There is also scope to improve forest capital quality in terms of biodiversity.

Despite a number of measures to conserve biodiversity through SSSIs[d] or woodland management schemes there is still evidence that biodiversity is declining is some areas, as measured by the status of protected sites and individual species monitoring. This is primarily due to over-grazing, fragmentation, diseases and pests, unsympathetic management practices and potentially from climate change[24]. Production of wood, the current primary economic service, is also far from optimum, with the annual harvest significantly lower than the annual increment. Timber production is particularly poor for hardwoods, which now represent just 5% of the market[29].

The UK harvest average as a whole is about 60% of the annual increment for softwoods, 20% for hardwoods[24]. In England, harvests represent just 39-40% of the annual increment available[44]. These figures are representative of the management levels in UK forests. All of the public forest estate is now managed and the harvest produced is close to the optimum, sustainable level. However, relatively few private forests are managed for timber, or any other ecosystem service. In England 71% of forests have no certification, or Forestry Commission-approved management grants[48].

Finally, whilst some management for non-monetary values is conducted, the lack of clear economic incentives and even scientific understanding means their production is very rarely optimised[24]. This is also related to the lack of forest management, with management schemes tending to benefit production of all services. Some initiatives are underway to generate markets for these additional values - the UK Woodland Carbon Code generates a value for carbon sequestered by newly planted forests for example[49], but in general most of these values have been externalised from economic-based decision making.

Despite playing an important role in both the UK economy and natural capital management, wood-reliant industries are also facing a number of challenges.

The primary challenge faced by wood-reliant industries is the growing imbalance between supply and demand – a parallel story to the global imbalance between biocapacity and ecological footprint. On a global basis, there are no exact figures for comparing demand and potential sustainable off-takes, but forests are clearly becoming an increasingly valuable resource as demands continue to rise, partly in response to population increases and partly in response to new markets such as the use of bioenergy to generate electricity[50].

Some are even arguing that we are approaching 'peak timber'[30]. Particular concerns over sustainability are focussed on the tropical resources where issues lie regarding governance transparency and even the theoretical feasibility of achieving sustainable timber production[43, 51-53] In the UK the current harvest meets about 20% of the 50 million green tonnes demanded by the UK economy[23,36]. This proportion is likely to decrease over time as demand rises and the impacts of a dip in planting in the 1980s hits supplies[48]. The resulting trade deficit totals about £4 billion, with most sawn wood and wood-board imports coming from the EU or US and plywood and wood pulp imports primarily sourced from non-EU sources[23]. The ability to source wood from clearly sustainable sources without the risks and costs associated with imports is therefore of clear value to the wood industries and there is a strong need to see UK production increased. A secondary challenge to the wood-reliant industries is being presented by some of the policies being implemented.

Recently a number of national and international financial incentives have been introduced to promote the use of wood as a fuel, both at the domestic and industrial level. The political intentions were to reduce carbon emissions derived from fossil fuels, but subsidies to the bioenergy industry meant the saw mills and chipboard industries, which potentially source the exact same wood resources, see themselves as competing on a non-level playing field[36, 39, 44, 54-56].

Better management of the UK's forest capital, with a parallel attention to supply as well as demand, would have multiple benefits for business and society as a whole.

A larger, more productive forest asset base with a deeper value to society at large would have numerous benefits for business and society at large. However, this has not happened before because the overall value offered by forests was largely unrecognised – by government, by business and by society – and so forests have rarely been managed holistically as a shared resource base. Forest-reliant companies have made great strides in ensuring they individually extract wood in the best way possible, but rarely presented a unified position on the need to manage, maintain and enhance their resource base as a whole. Most engagement with policy makers is sector-specific, focussing on the division of resources more than a wider approach to supply.

At the same time, Government has rarely enacted policy for the benefit of natural capital as a whole, instead tending to focus on the individual services it might generate or the individual industry sectors. A clear example of both is the conflict resulting from the policies promoting the use of wood as a fuel source and the sector specific lobbying to promote or oppose this approach.

[d]Sites of Special Scientific Interest

Commitments to action

The companies in this collaboratory recognise a role and responsibility for business in the management, maintenance and enhancement of forest natural.

Global forest natural capital is one of the most important assets human society has control over. This capital has the capacity to generate essential social, regulatory and provisioning services on a perpetual basis. The participants of this collaboratory all represent companies which rely to a greater or lesser extent on at least one of these services. Together, they recognise both a business case and a social responsibility to operate in a way that, at worse, does not degrade natural capital and, at best, enhances natural capital. When done right, economic activity based on wood fibre can be of great value to society, producing products that are strong and lightweight, beautiful and natural, biodegradable and carbon-neutral. It is in the interests of all of these participants that the global demand for wood fibre is met by sustainable practices that operate within the limits of the natural capital productivity, both in terms of absolute off-take and in terms of unintended secondary impacts. Global management of forests cannot yet guarantee these requirements. Management of the UK's forest natural capital is a small but vital piece of this global jigsaw. Maximising productivity within sustainable limits in a way that enhances natural capital will both benefit British society and minimise reliance on resources that are not yet managed in this way. This goal is now in reach, but to achieve it wood-reliant businesses will have to collaborate in ways that reflect a shared reliance on a single ecosystem service and they will require support from government to create the economic frameworks necessary for large scale change.

The companies of this collaboratory now present a set of commitments for how wood-reliant industries can contribute to the management of forest natural capital.

The companies in the collaboratory identified three areas where they believe business can play a key role in furthering the maintenance, management and enhancement of UK forest natural capital:

1. Further the understanding of forests:

The companies believe public perceptions of forest values, and the role wood-reliant industries play in providing them, are vital. They are committed to promoting the messages that 'forests provide multiple benefits' and 'forest management is beneficial for both wood and other ecosystem services'. Various industry-backed efforts do already exist to promote the wider benefits of timber production, either as individual company initiatives (See Figure 5) or joint initiatives such as the Wood for Good campaign[34]. However, these messages would be strengthened if the industry managed to speak as one voice as a single body of businesses reliant on a common resource base. The comparative lack of industry-wide unity has been recognised and there are various attempts to improve this e.g. the July 2012 Timber Industry Associations Accord[36]. The collaboratory members support such initiatives and commit to working together to clarify an industry-wide voice on natural capital.

Figure 5 – A business initiative to promote the multiple values of forests: Taylormade Timber Products Ltd have been promoting the multiple functions of wood on their delivery lorries

Figure 6 – A business initiative to promote forest management: B&Q have partnered with Bioregional to develop and restore new woodland areas that now produce products that feed into their supply chains. Image reproduced from Bioregional's website www.bioregionalhomegrown.co.uk with permission

2. Improve forest management:

The companies recognise a clear role for business in increasing the proportion of forests under recognised management, increasing the effectiveness of current management schemes and developing new forest supply chains. To increase the proportion of forests employing recognised management practices, collaboratory members commit to working towards 100% procurement from independently verified sustainably managed sources by clearly defined dates, commit to forming partnerships with individual suppliers to assist them to get certification and to support efforts by the certification schemes to make certification more accessible to smaller forest managers. To increase the effectiveness of existing guidelines, companies commit to working with certification bodies to increase the emphasis on net positive impacts on natural capital. To promote new supply chains, companies commit to identifying new, unmanaged wood sources and working with forest managers to supply their business, as demonstrated by B&Q (Figure 6). Increased commitment to existing wood industry promotion initiatives such as 'myForest' will also be important.

3. Increase forest cover:

The companies believe that a substantial increase in forest natural capital would be good for business and for society, but that economic forces are the only realistic way a significant increase can be achieved. Generating the economic conditions required to drive this is largely a role for Government, as further explored below, but business can play a key role in facilitating change. The companies in this collaboratory therefore commit to commission, collate and provide the detailed data required on UK wood demand required to support policy change, to build confidence through long term purchasing agreements where possible, to better organise forestry representation when engaging with European Union subsidy reforms and to directly engage with forest creation schemes wherever feasible (see Figure 7 for an example outside the UK).

However, business leadership alone will not be enough to secure sustainable forest natural capital management. In support, the collaboratory companies request that the Government:

1. Recognise and support the role wood-reliant businesses play in the provision of a range of ecosystem services:

Sustainable management schemes and voluntary provision of additional ecosystem services generally incur some level of cost. Until the provision of additional ecosystem services has some level of economic parity with wood production they will rarely be produced at the optimum level. The companies would like the existing role of wood-reliant industries in the provision of a wide range of services to be better recognised and further incentivised through support for markets for non-monetised ecosystem services such as carbon, water, public access or biodiversity through, for example, re-directed subsidies.

Figure 7 – A business initiative to increase forest cover from outside the UK: Brico Dépôt Spain are restoring a 1000 ha cork forest, securing a sustainable supply of FSC-complaint cork in the process

2. Create a holistic forestry industry action plan:
Whilst various initiatives exist to support different aspects of the wood value chain, no single plan exists to promote forests, forestry and the full range of forest-reliant businesses. The collaboratory members request that the Government develops a holistic approach to supporting wood-reliant industries, promoting additional supply without favouring demand from one sector or another, with clear long term goals on wood production backed by long term policies to generate industry confidence, such as procurement commitments or financial incentives. They also request that the Government use and support the companies' commitment to improve the data required to develop a complete picture of wood growth and drain, similar to the US, allowing priority areas to be identified. The companies also request specific support for industries using wood from sustainable sources, either through regulation, financial incentives or public procurement commitments.

3. Define the role of forests as a key national natural asset and create the economic conditions to achieve it:
Whilst forest-focussed commitments are important, it is equally important these are made within the context of a larger plan for the UK's natural assets that clearly illustrate the expected role of forests compared to other land uses and the targets for the future. A drive in favour of forestry one year cannot be replaced by a drive in favour of an alternative land use the following year. The companies in the collaboratory therefore request the Government clearly articulate its position on the nation's natural assets, its targets for the future, the expectations for who is responsible for what and how it expects business to fulfil its role.

The commitments of the collaboratory members are highly complementary to the Independent Panel on Forestry's recent recommendations to Government on improving forestry.

Between 2011 and 2012 a substantial review of the role of the English public forest estate and forestry and woodland policy in general was conducted by the Independent Panel on Forestry (IPF)[27]. This review identified the key challenges facing English forests, many of which were largely applicable to the UK forest estate as a whole and reflected findings from various sources[45,46,58]. The report went on to make a number of policy recommendations to address these. Responses to the Panel's recommendations have been largely positive, although there was some reservations over the lack of recommendation for further public investment[59-61]. These recommendations are now being considered by the Government and a formal response will be made later this year. This report identified many of the same issues identified in the IPF report but outlined where businesses saw a role in addressing them. The findings are therefore highly complementary. Table 2 summarises the key findings of the IPF report and identifies where the collaboratory findings identified a complementary role for business as well as where they identified additional requirements from Government.

IPF TARGET	IPF RECOMMENDATIONS TO GOVERNMENT	COLLABORATORY COMMITMENTS	ADDITIONAL COLLABORATORY RECOMMENDATIONS TO GOVERNMENT
A society that recognises the full value of forests	To adopt policies and encourage markets that reflect the full value of ecosystem services provided by woodlands, building on advice from the Natural Capital Committee	To collaborate across industry sectors to promote the multiple benefits of wood use and forest management	• To manage forest natural capital as part of a wider framework for natural capital in which the UK's natural resources are managed in a coherent and holistic manner • To recognise the role of wood-reliant industries in providing a wider range of ecosystem services and support them to fulfil this role by establishing markets for additional ecosystem services
Maximising the biodiversity value of forests by establishing a coherent ecological network at a landscape scale	*To commit to sustainably increasing woodland cover to 15% by 2060 by:* • Working with Local Nature and Local Enterprise Partnerships to establish priorities and monitoring progress through the National Forest Inventory • Reforming European and national financial incentives to promote woodland creation and management	*To support the drive towards increased forest cover by:* • Generating confidence in the future of the UK wood production sector • Establishing industry-wide, consolidated, quantitative impact data • To support CAP reform in favour of forests by presenting a coherent, industry-wide message on the need to promote forests • Engagement with local forest-planting schemes	*To achieve the increase of forest cover to 15% by 2060 by:* • Making clearer commitments to the increased use of timber in industries such as construction and biofuels to facilitate long term contracts and increase timber prices and ultimately stimulate planting • Making long term purchase agreements to stimulate new planting
	To increase UKFS compliant management from 50% to 80% within about 10 years by supporting forest owners	*To support efforts to increase the proportion of forests under UKFS compliant management by:* • Committing to move towards 100% procurement from independently verified sustainably managed sources within 10 years • Providing direct support to individual suppliers looking to adopt recognised sustainable management • Support certification reforms that make certification more accessible to smaller forest managers	*To implement IFP recommendations on increasing compliance management by:* • Introducing financial incentives and/or regulation to drive increase levels of sustainable management • To better publicise the potential opportunities to be gained from managing forests to private forest owners potentially unfamiliar with the options • Acknowledging the challenges faced by smaller woodland owners and provision of practical assistance • Ensuring public timber procurement policy commitments are fulfilled • Use of public procurement to stimulate production from new sources
Maximising the social and cultural value of forests by promoting public access	*To increase public access to woodlands by:* • Incentivising woodland owners and monitoring progress • Promoting urban woodland creation through local planning regulations • To support woodland community groups and woodland leisure and tourism business	*Companies could play a limited role in supporting public access to woodlands by:* • Supporting urban woodland creation • Acknowledging that some services will need to continue to be provided for free for societal good	
Maximising the economic value of woodlands as part of a green economy	*To set out a Wood Industry Action Plan that sets out:* • Prioritising wood-based industries for support by the Green Investment Bank • Directing Local Enterprise Partnerships and national / EU funding towards the creation of woodland enterprise zones and supply chain improvement • Encouraging Local Authorities to promote woodland-based business and bring in 'Wood First' policies for construction • Supporting the development of a carbon market	*Companies would contribute to the development of the wood industry by:* • Ensuring Government policy is informed and supported by wood-reliant industries speaking from a single, natural capital perspective and not multiple, sector specific messages • Contributing to the development of local supply chains by setting up new trading partnerships to access unmanaged forests • Supporting other initiatives aiming to promote local wood industry such as 'myForest' • Actively supporting and engaging with the creation of markets for other ecosystem services such as carbon	*Companies would also like to see:* • A holistic view of forest use that promotes increased overall wood production for which individual industries can compete but does not favour one sector over another. • Increased support for industries using UK wood from independently verifiable sustainably managed sources through taxation breaks or public procurement • Provisions to supplement simple Forestry inventory data with data on exact growth/drain ratios to identify where over-exploitation and surpluses occur • Promotion of 'common sense' timber supply chains that harness the latent energy in wood in the most efficient way
Managing the public forest estate as a national asset	To retain the public forest estate under public ownership defined by statute, with management conducted by an evolved Forest Services body working across borders to increase benefits from forests as part of a green economy	To support the development of the public forest management body and ensure that any ecosystem-level voice on behalf of the public sector is matched by an ecosystem-level voice on behalf of the private sector	

Table 2 – Summary of the IPF recommendations to the UK Department for Environment and Rural Affairs (DEFRA) and where collaboratory members could offer support and where additional commitments by Government would be useful

Collaboratory 2: UK grasslands and the dairy-reliant business sector.

The UK's grassland natural capital

The UK's dairy grasslands represent a significant proportion of natural capital, but over time have changed from high biodiversity semi-natural grasslands to low biodiversity improved grasslands.

Grasslands – once a transitionary and fairly rare habitat in the UK - are now an integral part of the cultural landscape and natural capital, although the exact area managed for dairy is a fluid and unclear proportion[62]. According to the 2011 UK land cover map, grasslands account for 38% of the UK's total land area and are mostly found in the wetter, more acidic areas of the north, west and south west of the country[63]. With almost all permanent grasslands a product of human intervention they can be roughly divided into 'semi-natural' and 'improved' grasslands, although in reality there is a continuum between the two. Semi-natural grasslands represent about one third of grasslands or 11% of total land area. These are areas shaped by thousands of years of relatively low-level human intervention and are now mostly under low-intensity grazing and management. Most of these are acidic, upland grasslands dominated by sheep farming but a small proportion are 'priority habitat' lowland grasslands with high biodiversity. Priority habitat grasslands have declined by around 90% over the last sixty years, primarily due to conversion to improved grassland and most that remains is now in protected areas or managed as part of agri-environment schemes[62]. Improved grasslands represent the other two thirds or 21% of total land area. These are areas managed intensively through the application of fertilisers, herbicides, ploughing and seeding to produce food for livestock, mainly beef or dairy cattle or sheep[64]. Biodiversity levels vary between management systems. In semi-natural grasslands biodiversity tends to be much higher and for this reason seven semi-natural grassland sub-categories have been designated priority habitats under the UK Biodiversity Action Plan (BAP)[65]. Improved grasslands tend to be comprised of monocultures of nitrogen-responsive grass species with correspondingly low associated biodiversity. Hedgerows and field margins to improved grasslands can retain significant biodiversity levels, although the value of these habitats is falling with fewer important pollinators and birds as increased nutrient loads have affected species composition[64]. Even in Sites of Special Scientific Interest (SSSIs)[e], sites on improved grasslands were in the worst condition of any habitat, with 75% destroyed or in unfavourable condition[66].

Dairy is one of the key monetised ecosystem services generated from grassland capital.

Grasslands provide a range of important services that benefit society with food production, primarily through dairy but also as meat, being the primary monetised service. Productivity levels vary greatly across grassland types, with improved grasslands supporting far higher productivity. In terms of annual hay production, improved grasslands produce around 10-12 tonnes per hectare whilst production from semi-natural grassland ranges from 80-20% of this[67]. In terms of absolute livestock numbers, similar ranges exist with fertilised, improved grasslands able to support three times the stocking levels of semi-natural grasslands[68]. The vast majority of milk is therefore produced from livestock on improved grasslands with total current UK production close to 13 billion litres per annum. This level has been maintained for the last decade, making the UK the third largest producer in Europe and the ninth largest in the world[69, 70]. This represents a service benefitting almost everyone in the country, with 99% of people regularly consuming dairy products[71]. Other monetised services from dairy grasslands are dominated by additional products from livestock, such as associated beef farming. Some monetary value has also been ascribed to the provision of game shooting services and production of wild foods (such as mushrooms and berries) and another minor, but fast growing, monetised service is the production of bioenergy crops[64].

Grassland natural capital also produces a wide range of semi or non-monetised ecosystem services.

Besides the monetised provisioning services, dairy grasslands also provide a number of regulatory and cultural services. To begin with, grasslands can play a positive role in climate regulation. There is some evidence that sequestration of carbon by grasslands can be important, but many grassland soils tend to be close to carbon saturation meaning they primarily play a role as a carbon store rather than an active carbon sink[62, 64]. Improved grasslands have been calculated to hold about 61 tonnes/ha (compared to deciduous forest with 66.3t/ha and coniferous forest with 73t/ha)[62,64]. Grasslands can also play an important role in regulating water run-off and diffusing pollution and have an important role in pollination, particularly from flower-rich semi-natural grasslands, but also from improved grassland field margins protected by agri-environment schemes[62,72]. These can be particularly important because they are often situated close to the commercial crops for which pollination is important[62].

Finally, one of the key additional values grasslands hold for society is their cultural and aesthetic value – a value celebrated in the recent opening ceremony to the London Olympic Games which featured the UK's cattle-dominated countryside[73]. A report by Natural England highlighted the value the British public places on 'field systems', which include semi-natural grasslands, hedgerows and traditional farm buildings[74]. Much of this value comes from semi-natural and often protected grasslands, such as the Yorkshire Dales, Pembrokeshire coast and Dartmoor, but significant value was retained by improved grasslands used for dairy farming, through which many of Britain's 190,000km of footpaths and bridleways pass[64].

[e]Sites of Special Scientific Interest

The UK's dairy-reliant industries

Dairy production represents an important and sizeable part of the UK economy.

The 13 billion litres of milk generated by the UK's grassland natural capital plays a significant role in the UK economy. Liquid milk, cream and milk powder demands are all met through domestic production whilst butter and cheese demands are partially met through imports, but overall the UK is a net exporter of dairy products[70, 75]. On average, each person in the UK consumes about 1.5 litres of liquid milk, 200ml of yoghurt, 115g of cheese and 40g of butter a week, with dairy accounting for 16% of average household food expenditure[75]. As dairy products are seen as an essential source of nutrients these demands are fairly insensitive to economic fluctuations compared to other food products[75]. The resulting steady demand is largely met through domestic production by an industry worth over £9 billion. At one end of the value chain lie the industries providing inputs for dairy production, such as fertilizer, seed and feed. These are bought by the producers or farmers, represented by about 15,000 dairy holdings and 1.8 million cows[70]. The vast majority of the milk produced is then sold on to milk purchasers and processors such as First Milk, Dairy Crest and Robert Wiseman. Almost half of the milk purchased is processed into liquid milk for direct consumption, the rest being processed into cheese, powders, condensed milk, butter and cream. Over time there has been a pattern of consolidation and a move towards fewer, larger processing facilities and this looks set to continue. Dairy products are then sold to retailers, with four supermarkets dominating (Tescos, Asda, Sainsburys and Morrisons)[71].

Dairy production strategies vary from low cost, low yield production to high cost, high yield production.

'Milkbench+' divides UK production methods into three main categories, each varying by feeding strategy, level of inputs and output type:[76]. 'Cows at grass' is a relatively low cost, low yield approach where cattle are primarily grazed outside on grassland with few external inputs. Time at grass can be 33 weeks or more, external feed inputs are around 1000kg/cow/year, there is almost no reliance on high yield breeds and yields average 5600 litres per year. Production from cows at grass with strictly limited inputs would include organic dairy production, although organic production only represents about 3% of the market[75]. 'Composite' production represents a higher cost, higher yield approach. Time at grass is around 27 weeks a year, external feed inputs are about 2000kg/cow/year, reliance on high yield genetics is fairly high and yields average around 7500 litres. 'High output' production is a high cost, high yield system involving housed cattle with high levels of external feed inputs. Time at grass is less than half a year, external feed inputs are around 3000 kg per year. Reliance on high yield breeds is high and yields average 8600 litres. The highest output systems are the 'super-dairies', known in the US as Concentrated Animal Feeding Operations (COFA). Herds can number over a thousand, housing is year-round and feed is based on mechanically harvested forage and supplements with little or no reliance on local natural capital and milk yields can reach 10,000 litres per year per cow. The unsuccessful application by Nocton Dairies in 2009 is one of the few examples where a super dairy has been considered in the UK[77].

Dairy-reliant industries potentially play a significant role in the provision of other services from grassland capital, but the role can be positive or negative depending on the production methods employed. To a large extent, the existence of grassland capital and the values it generates are largely due to the existence of the dairy industry (and other agricultural industries that rely on grasslands) since grasslands are a transitional habitat and generally require constant human intervention to maintain them. However, the relationship between the production of milk and the production of other ecosystem services varies greatly, with various synergies and trade-offs. Dairy farming on semi-natural grasslands with little or no external inputs (which is now very rare), produces very low yields of milk and other provisioning services but also continues to have a net positive impact on a range of other ecosystem services (*Figure 7* spider diagram)[62]. However, intensification of the production of one service often results in trade-offs with other ecosystem services. Production systems based on improved grasslands produce much larger quantities of better quality forage and thus support much larger herds of high-yield cattle and produce much more milk per unit area as well as continued provision of some cultural and soil regulation services. However, the trade-offs are usually a substantial decrease in local biodiversity as species-rich grassland is replaced by monocultures and a net negative impact on other services such as climate, soil, air and water quality regulation or pollination due to the associated methane emissions from the cattle, nitrous oxide emissions from the fertilizers, soil impaction from the hooves, pollution from run-off and so on. (*Figure 8* spider diagram)[64, 78].

Taking climate regulation as an example, the emissions related to livestock production far outweigh the sequestration achieved by the grasses. Livestock emissions now account for around 18% of all anthropogenic greenhouse gas emissions. Dairy production accounts for about a fifth of this, contributing directly to about 2.7% of anthropogenic greenhouse gas

emissions, or 4% if including the raising of dairy-related culled and fattened livestock[79]. Within the UK the proportion is slightly lower, and emissions have been falling due to reduced fertilizer use and smaller herd size, but dairy production still ends up being a net contributor of around 2% of UK anthropogenic emissions[62, 64, 78]. Furthermore, this report only considers the impacts of local or 'first order' impacts. It is also important to note that the introduction of external inputs into production, such as cattle feed or fertilizer, potentially causes even more serious 'second order' impacts on international natural capital, many of which have been poorly quantified. For instance, reliance on cattle-feed based on soy or palm oil can have major impacts on tropical land use change and thus greenhouse gas emissions and biodiversity whilst the production process for inorganic fertiliser also results in significant greenhouse gas emissions[80]. Other production systems, such as COFA dairies will be characterised by different spider diagrams again. By housing cattle year-round there are major opportunities for methane capture and even energy generation which can potentially negate the impacts on climate regulation, but by relying entirely on external feed they would lose the cultural and regulating services provided by grass-based systems and potentially cause much larger second order impacts. The exact form of these relationships will also vary greatly within a given production system depending on location, management techniques employed

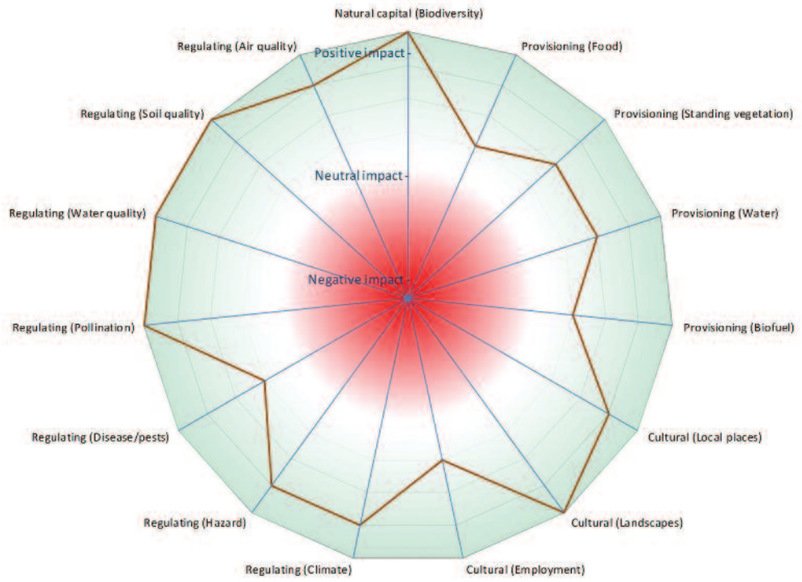


Figure 8 –Impacts of low yield, low input agricultural production for food on semi-natural grasslands on biodiversity and ecosystem services. Units are arbitrary but represent whether there is a positive (green) or negative (red) impact on the service (adapted from the UK National Ecosystem Assessment Synthesis and chapter on semi-natural grasslands[8,62])

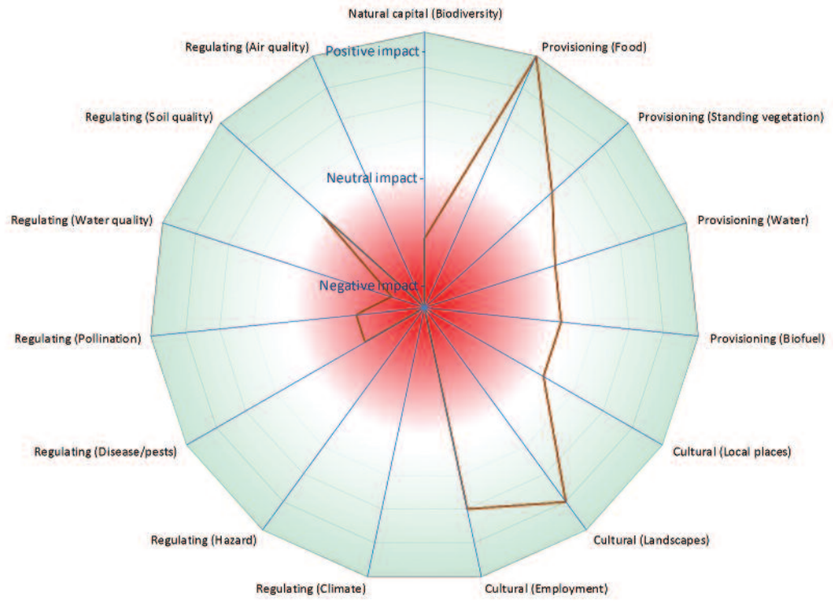
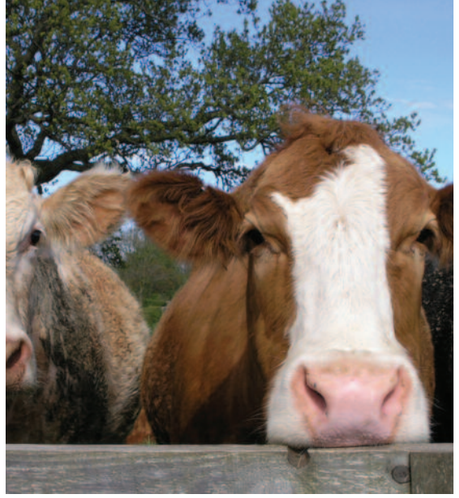


Figure 9 - Impacts of high yield, high input agricultural production on improved grasslands on biodiversity and ecosystem services. Units are arbitrary but represent whether there is a positive (green) or negative (red) impact on the service (adapted from the UK National Ecosystem Assessment synthesis and chapter on Improved Grasslands[8,64])

and other factors. Better run, more efficient farms will have lower impacts on air, water and soil quality through pollution. Farmers adopting agri-environment schemes will have lower impacts on biodiversity and related services, others focussing on their carbon footprint will have lower impacts on climate regulation services. The trade-offs between milk production and impacts on other ecosystem services is therefore not a simple linear relationship and various dairy-environment initiatives have already identified a number of win-wins – usually based on efficiency - whereby milk productivity can be increased at the same time as reducing the impacts on other ecosystem services[8,17,19–21]. However, by increasing the production of milk most dairy systems cause a net-negative impact on ecosystem services somewhere else.

Various initiatives exist with the aim of reconciling milk production with environmental impacts but most focus primarily on minimizing existing impacts.

The impacts of dairy production on natural capital have long been recognised and a number of initiatives launched to address them. Many of these specifically highlight a pro-active role for the industry. One of the key initiatives in the UK is the Milk Roadmap, specifically developed in 2008 to address the environmental impacts of milk production on the environment and subsequently developed into the Dairy Roadmap to cover the wider dairy industry[8,23,24]. The vision presented in the Roadmap is for 'achieving sustainability by working to improve the environment…'[8]. Progress against the targets of the road map have been good, with 61% of dairy farmers now engaged with some sort of environmental stewardship scheme, 58% implementing measures to make better use of water, 97% implementing manure management plans and 39% trialling new technologies to reduce emissions. Similar improvements were made by processors, with more recycled materials being used for bottling and better sustainability reporting[23]. More recently the industry-led Dairy 2020 initiative has been



outlining a vision for the dairy sector in 2020, describing 'an industry that takes seriously its role in protecting the natural resources that we all depend on, from soil to water to animals'[20].

Many initiatives take a more specific focus. The Global Dairy Agenda for Action for example, signed in Berlin in 2009, focuses on greenhouse gas emissions alone. But the Agenda recognises both the dairy sector's reliance on natural resources and its history of stewardship over them and commits to a 'positive contribution to global action to address climate change'[25]. Whilst laudable, in practice all of these initiatives focus on minimising the impacts of dairy production rather than maximising the potentially positive role dairy production could have on natural capital. Few go so far as to recognise the extent to which impacts need to be reduced to address a net negative impact on the environment and thus become truly sustainable – they simply describe how to improve on the current state. The most recent initiative - the UK Government's Green Food Project – does look at some of these issues more critically, investigating how to maximise efficiency and improve environmental impacts. The group concluded that substantial increases in production were possible by bringing the poorest performers up to the level of the top performers but tackling the environmental impacts required 'large scale system change' to a more integrated and mixed approach to farming. A number of win-wins were identified which increased productivity and decreased impacts on natural capital but the report also served to highlight the limitations of expecting the dairy industry to both increase production and fulfil a role in natural capital stewardship and noted that general agreements on how to balance these were not reached[19].

The challenges facing grassland capital and the UK dairy industry

Over time, economic pressures are pushing the UK dairy industry towards larger scale, higher yield and higher input consolidated models of production.

The economic pressures on the UK dairy industry and their impacts on dairy farmers have been well reported in recent months. One trend that has been clearly documented is the rising costs of milk production, a local reflection of the global challenges facing natural capital outlined in the introduction to this report. UK dairy farmers have seen prices of feed, fertilizer, oil, land and rent rise significantly in the last few years[70]. Usually, market forces would mean this would be reflected in the retail price of milk, but many farmers have seen falls in the price of milk over the same period.

Average retail prices for milk 2011/12 were the lowest they have been for seven years, nearly 5% lower than the year before, with some retail pricing strategies an important factor[86, 87].

Individual purchasing contracts between producers and processors vary, so not all farmers are impacted by the price in the same way, but those that are have been making headlines. In July 2012 the latest announcement of planned cuts to be paid by processors to farmers was met by demonstrations by hundreds of farmers around the country, with the National Farmers Union claiming that the average cost of producing a litre of milk was now 30 pence per litre (ppl) whilst the new prices to be paid were closer to 25ppl[88]. One of the consequences of this has been the number of smaller operators that have been forced out of business as a result, with an average of six farmers leaving the industry every month in the south west[89].

Remaining in business now means consolidating and producing low margin milk at increasing yields and volumes. Production methods are increasingly shifting towards large scale, high yield, high input systems. Currently there are about 15,000 dairy farms and about 1.8 million cattle in the UK. This is a 45% decline from the number of farms and a 21% decline in the number of cattle from 2000. At the same time, average herd sizes rose from 84 to 117 and milk yields from 6000 litres/cow/year to 7300 litres[70]. These trends show little sign of changing.

According to Dairy UK, whose members represent 85% of UK milk processing, developing economies of scale is essential: 'from 1000 plus cow farms to the commissioning of dairies processing up to one billion litres of milk per year, this trend is vital if the industry is to remain competitive'[71].

Modern methods of dairy production and the economics driving them are now extremely difficult to reconcile with a natural capital stewardship role.

The impacts of a transition in dairy production do not only impact dairy farmers but have also altered the relationship between dairy and natural capital. In the past, dairy farmers played a key role in the provision and stewardship of ecosystem services beyond milk because they relied on them too. Many in the industry still want to play a role over and above milk production, as evidenced by Dairy 2020 and other industry-led initiatives with similarly ambitious goals.

Marketing campaigns continue to promote the idea of milk production as part of an archetypal British countryside and it makes sense for society that an industry that manages such a large proportion of national natural capital plays a central role in its stewardship. However, as the dairy industry responds to global economic forces with a move towards higher yield, higher input production methods there is an increasing decoupling of milk production from local natural capital[64]. In one study of interactions between agricultural productivity and eight other ecosystem services provided by grasslands there were only two services (erosion regulation and nutrient cycling) that had a positive impact on agricultural production. There is therefore decreasing incentive to maintain local ecosystem services, since they have decreasing relevance for production. In contrast, there were six areas where agricultural production had a direct negative impact on other ecosystem services (air quality, water quality, erosion regulation, nutrient cycling, biodiversity and landscape quality)[90].

There are a number of clear business cases for dealing with negative impacts, from efficiency to regulatory risk to subsidies and social responsibility and these are generally the focus of most dairy environmental initiatives, although it is important to remember that there is a difference between mitigation and resolution; reducing an impact on species richness through field margin management or reducing emissions through improved manure management will still likely result in a net negative impact on climate regulation or biodiversity. In many cases such initiatives will represent win-wins, increasing productivity or profit as well as reducing impacts on natural capital such as more efficient use of fertilizer[80]. Other actions might be 'win-no loss', with no clear productivity benefits but clear benefits for natural capital at little or no cost such as switching to grass species with root systems which are better for managing water flow[91].

However, there is very rarely a strong business case for active stewardship of natural capital under current economic frameworks. Maintaining, managing and enhancing ecosystem services that do not have direct relevance to business for the benefit of society will cost money. Production systems that produce milk and generate other ecosystem services are currently economically inviable. With milk production increasingly running on razor-thin margins and almost no economic incentive to perform any function beyond milk production it is increasingly unrealistic for the dairy sector to adopt a net-positive, stewardship role over UK grassland capital.

Commitments to action

The companies in this collaboratory recognise a role and responsibility for business in the management, maintenance and enhancement of natural capital relevant to the dairy industry.

The companies in this collaboratory recognise a shared dependence on a single ecosystem service, agree on the challenges facing the dairy sector, accept they have a pivotal role in addressing them. They believe that business has a responsibility to take the lead for recognising the extent of its impacts on natural capital and ecosystem services and then working to negate these impacts as far as is possible. They also have a desire to go beyond damage minimisation and risk management and towards a vision of a UK dairy industry with a net positive impact on the natural capital it influences.

The companies of this collaboratory now set out a set of commitments outlining what is required to move towards this vision.

At the moment, neither the information nor the economic and regulatory frameworks required to achieve this vision exist at present. To address the information shortage, the companies commit to the following actions, and recommend fellow businesses in the dairy value chain follow suit:

1. To continue to strive towards addressing the impacts of dairy production on ecosystem services:

The companies in this collaboratory commit to continued and improved engagement with natural capital impact mitigation initiatives to work towards a goal of dairy production with zero negative impacts on ecosystem services. These include implementation of identified 'win-win' solutions as well as 'win-no loss' solutions.

2. To commission, support, exchange and contribute to research:

Lack of data was identified as one of the key barriers to progress with regards to natural capital. The member companies commit to supporting research for identifying the exact relationships between all economically feasible methods of milk production and ecosystem services; the options available to address the negative impacts; what they would cost to implement and the options available for how to pay for these changes. This research would need to include the relationships with international natural capital not covered in this report.

2. To consolidate the natural capital targets across initiatives:

With numerous dairy initiatives relating to environmental goals the member companies commit to working together to consolidate all of the targets addressing natural capital together with economic and social targets into a single manifesto for the development of UK dairy

3. To be open to a variety of potential changes:

The member companies recognise the scale of the challenge facing dairy with respect to natural capital and commit to considering the full range of evidence-based solutions, even if some of these potentially take the industry in significantly different directions to current practices.

At the same time, the companies request that the Government take a clearer position on the UK's natural capital as a whole, identifying the natural capital outcomes that are required, implementing the economic, regulatory and incentivising frameworks required to support them and allowing market forces to determine the optimal way for businesses to achieve them. Specifically the companies request:

1. Support for their quest for additional data:

Whilst the companies recognise a central role in addressing the lack of data available regarding the relationships between dairy and natural capital they also call for support from Government where possible, both in terms of extending the work of the National Ecosystem Assessment and in terms of setting standards for the metrics required for businesses wishing to assess their own impacts on natural capital

2. Clearer policy frameworks for ecosystem services:

The externalisation of many grassland ecosystem services from the economic decisions governing grassland management is key to the impacts of dairy on natural capital. The Government has taken steps towards developing additional markets for ecosystem services and various payment for ecosystem service systems are developing in other sectors such as water provision and flood management.

The companies in this collaboratory see development of markets for ecosystem services as crucial if the dairy sector is to build a natural capital stewardship role and urge the Government to develop clear policy frameworks that drive the creation of such markets and allow the linking of initiatives across sectors.

3. More targeted use of national and European subsidies:

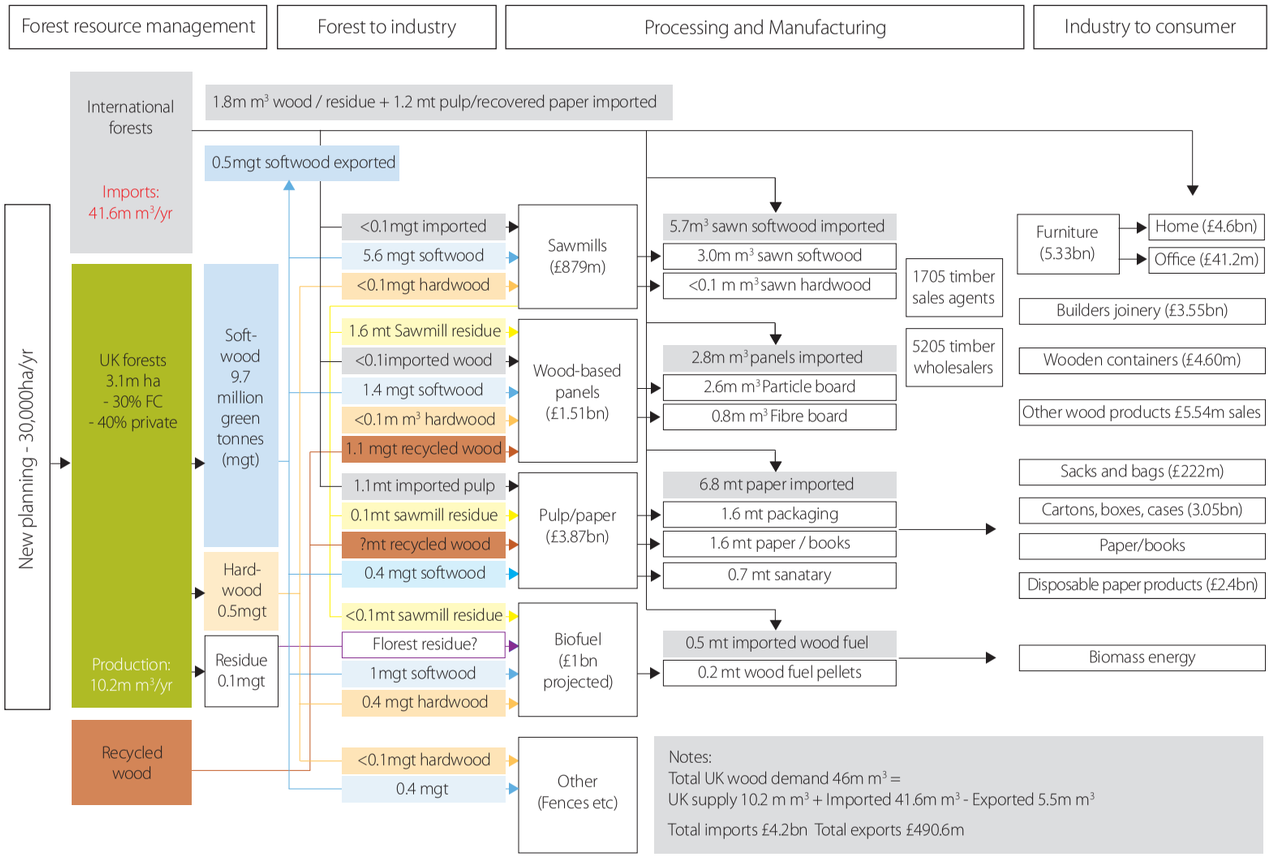
The companies recognise the current pressures on Government spending and highlight the reform of national and European subsidies as the key way Government can provide economic incentives for positive change. They urge reform to focus on providing the economic incentives for implementing proven natural capital management techniques.

Appendix 1:
List of organisations involved in the report

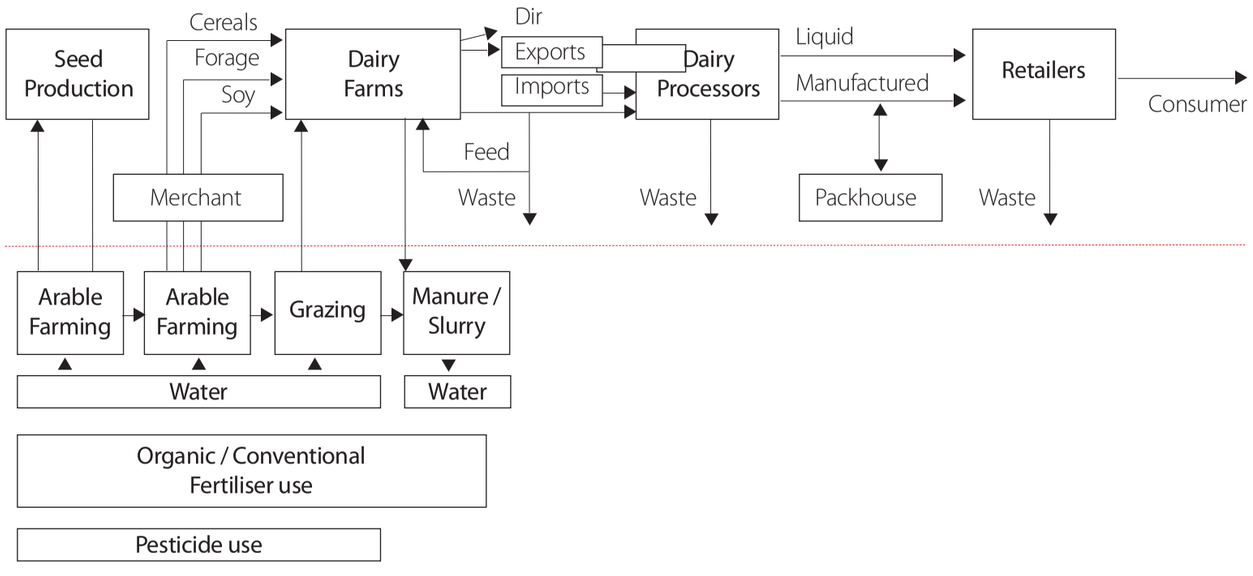
Organisation	Collaboratory	Sector
AB Agri	Dairy	Seed production
Asda	Dairy	Retail
B&Q PLC	Timber	Retail
Bayer CropScience	Dairy	Crop protection
Confederation of Forest Industries (CONFOR)	Timber	Trade body
Department for Energy and Climate Change (DECC)	Timber	Government
Department for Environment, Food and Rural Affairs (DEFRA)	Dairy	Government
Department for Environment, Food and Rural Affairs (DEFRA)	Timber	Government
Drax Power	Timber	Bioenergy
DS Smith Packaging	Timber	Paper
Egger UK	Timber	Wood particle board
Firbank Ecosystems Ltd / School of Biological Sciences, University of Leeds	Dairy	Academia
First Milk	Dairy	Farming Cooperative
Forestry Commission (England)	Timber	Forest management
Grupo Andre Maggi	Timber	Commodities
Iggesund	Timber	Paper
Independent Panel on Forestry	Timber	Independent
Kingfisher PLC	Timber	Retail
Lloyds	Dairy	Finance
Nestle	Dairy	General processor
Norbord Europe	Timber	Wood particle board
OMSCo	Dairy	Farming cooperative
Taylor Metcalf Ltd,	Dairy,	Independent
UK Woodland Assurance Scheme (UKWAS)	Timber	Certification
Unilever PLC	Dairy	General processor
University of Cambridge	Dairy / Timber	Academia
Volac	Dairy	Milk Processor
Yeo Valley	Dairy	Farming / processing

Appendix 2: Industry value chain diagrams

Wood-reliant industries



Dairy-reliant industries



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