Yorkshire Wildlife Trust

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Applying a new approach to English Agricultural Policy

Public payments for public goods – an example of how it might work in the River Aire Catchment

A contribution by Yorkshire Wildlife Trust for a better post-Brexit English Agricultural Policy

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Love Yorkshire, Love Wildlife

1 Introduction

This paper is designed as a contribution to an immensely important debate – the development of English Agricultural Policy after the UK leaves the European Union (Brexit). This debate is fundamental to the quality of life of all UK citizens as agriculture is by far the most dominant land-use in the UK – occupying about 80% of England's land surface.

The paper applies some emerging thinking to a practical case study. The wider context for this worked example is described and set within a range of recent policy documents including:

- Future Land Management Policy *(The Wildlife Trusts England, August 2017)*
- Headline Principles for Future Agriculture Land Management *(Greener UK Coalition, April 2017)*
- Agriculture at a Crossroads *(Greener UK Coalition, October 2016)*
- New Markets and Public Goods *(National Trust, 2016)*
- Farming and Land Management Policy *(Wildlife and Countryside Link, September 2017).*

The paper uses the Aire Catchment in Yorkshire as a case-study to examine the impact of changing policy to direct contracting for public benefits and services. It concludes that a move away from subsidy to direct public contracts for identified public goods, if managed well, would be transformational and dramatically secure environmental, quality of life and economic benefit for all, not least the UK's farming industry.

1.1 Yorkshire Wildlife Trust and the Wildlife Trusts

Yorkshire Wildlife Trust is one of the 47 Wildlife Trusts who, with the Royal Society of Wildlife Trusts, make up the Wildlife Trusts partnership. Together, the partnership is the largest UK voluntary organisation dedicated to protecting wildlife and wild places everywhere – on land and at sea, and supported by more than 800,000 members. Nationally, the Wildlife Trusts advise over 3,000 farmers and landowners every year and manage over 200,000 hectares of land directly[1]. Yorkshire Wildlife Trust manages 103 nature reserves totalling 3,000 ha directly and works with many other land managers across a further 6,000 ha per year. The Yorkshire Wildlife Trust estate is characterised by low intensity farming systems – typically grazing – and includes three working farms.

1.2 State of Nature

Wildlife in the UK is in serious trouble. *The State of Nature Report*[2] published in 2016 showed that 56% of all the species studied have declined over the last 50 years and 31% have declined strongly. More than one in ten are thought to be under threat of extinction in the UK.

UK wildlife is in severe decline because of a range of issues of which the most important and systemic issues are intensive agriculture, damaging development, atmospheric nitrogen pollution, resource depletion (especially industrial fishing at sea) and climate change. Well managed conservation projects are successful and can reverse species and habitat decline. For example, red kite have been successfully reintroduced into England whilst the decline of bittern has been arrested and reversed through habitat creation of reed-bed. However, the network of protected areas and nature reserves is inadequate to stem local extinctions that are driven by habitat fragmentation[3].

1.3 Current agricultural systems

By far the biggest cause of wildlife decline is intensive agriculture. This is hardly surprising as intensive

The Cre8 Barn at YWT's Stirley Farm near Huddersfield

Peatland restoration on High West Moor

agriculture, especially arable agriculture, seeks to create monoculture fields that are devoid of all but the crop. Much of lowland arable England is now deeply hostile for wildlife. Even in less intensively farmed areas such as the uplands, agricultural intensification has had a deep impact. For example, most upland hay meadow has been destroyed, leaving less than 1,000 ha remaining[4], largely converted to monoculture (rye grass) grass used to make silage. Moreover, agriculture is by far the biggest land-use in England, with 80% of England given over to agriculture; its intensification has been catastrophic for wildlife. This is, of course, not the fault of individual farmers rather it reflects deliberate public policy to create a more efficient farming industry even at the expense of the environment.

Such intensification is, in part, the result of the European Common Agricultural Policy (CAP). This policy has its origins in post-1945 food security concerns following the Second World War[5]. It is now a remarkably expensive subsidy system consuming 40% of the EU budget and dispensing about £3 billion to land managers and farmers across the UK. The budget is mostly spent on income support – the amount of income is paid in relation to the amount of land owned (or tenanted) – the so called Pillar 1 Basic Payment Scheme. A much smaller amount is paid to Pillar Two reserved for rural development. These are 'co-funded' schemes some of which relate to environmental objectives such as wildlife conservation. The higher level/countryside stewardship scheme, though bureaucratic and poorly targeted, can be effective in conserving wildlife (for example having a very significant impact in restoring damaged blanket bog in the English uplands).

Agriculture also benefits from a range of other indirect subsidies including exemption from inheritance tax, fuel duties, business rate concessions, some planning restrictions and compensation for losses as a result of disease.

Despite such enormous land subsidies and special treatment, agriculture has declined as a proportion of the British economy and now accounts for just 0.37% of GDP employing about 1% of the British workforce. On marginal and wetter soils – the uplands and west of Britain – agriculture is already in crisis with pastoral farms losing money despite subsidy. Many of these farms are characterised by an ageing workforce with the

> "The Common Agricultural Policy is not working for the environment or for the agricultural industry."

[1] http://www.wildlifetrusts.org/sites/default/files/final_pdf.pdf
[2] http://stateofnature.wildlifetrusts.org/
[3] http://archive.defra.gov.uk/environment/biodiversity/documents/201009space-for-nature.pdf
[4] http://www.wildlifetrusts.org/wildlife/habitats/upland-hay-meadows
[5] http://www.dieterhelm.co.uk/natural-capital/environment/agricultural-policy-after-brexit/
[6] http://www.ncl.ac.uk/media/wwwnclacuk/agriculturefoodandruraldevelopment/files/Hill%20Farming%20in%20England%202013_14_V3_final.pdf

average age of upland farmers now at 57[6].
The Common Agricultural Policy is not working for the environment or for the agricultural industry. Brexit gives an opportunity for reform.

1.4 Options for reform

Professor Dieter Helm – an Oxford University economist and Chair of the Natural Capital Committee[7] – considered options available for agricultural policy after Brexit[8]. In this report, he lays bare the effects of the Common Agricultural Policy for both the British countryside and its wildlife and for the agricultural industry.

A distribution of subsidy, mainly based on the amount of land owned, ensures that most of the gains of the Common Agricultural Policy go to bigger and richer landowners, though are largely capitalised through higher land prices. As already noted, despite the largess of the Common Agricultural Policy and the other indirect subsidies applied to farming, upland and marginal soil farmers remain in deep trouble. As such, nearly all interested parties agree that the current Common Agricultural Policy should not simply be replicated into a new devolved English Agricultural Policy. Helm sets out three main options:

1. A continuation of income payments to maintain food security and self-sufficiency, as broadly advocated by the National Farmers Union[9].

2. A move away from Pillar 1 income support payments to just Pillar 2 measures such as environmental stewardship.

3. A very different approach in which identified public goods are simply bought by the tax payer through direct payments to whoever can deliver those public goods in the most cost-effective way.

Helm demolishes arguments for the first two options comprehensively.

Option 1 – income support
A policy of income support (essentially a modification of the current Common Agricultural Policy) cannot help to maintain food security or self-sufficiency as income support simply raises land values making agriculture more expensive. Food security and self-sufficiency are two entirely different policy objectives.

The best route to British food security is through global tariff-free trade ensuring a diverse global food supply. Self-sufficiency requires a ban on exports diverting export consumption to home consumption (and production). This would massively increase food insecurity. Income support does neither, nor is self-sufficiency in any way desirable to British taxpayers.

Option 2 – Environmental Subsidy
The second option is critiqued as it runs counter to the commonly accepted principle that the polluter should pay for the costs of cleaning up the pollution they cause – the 'polluter pays' principle. In any other industry, damage to the environment and pollution would be subject to regulatory restraints and pollution taxes. In farming, it is the other way around as Pillar 2 payments are given to farmers to not damage the environment or pollute water and air. Farmers might rip out hedgerows or apply excessive fertiliser, pesticide and herbicide because it is commercially rational, given that the full costs of doing so fall on others, and not the farmers. For example, if a land manager polluted public water supplies by burning moorland and increasing the brown colour in water (a carcinogen when treated with chlorine), it is water company customers who pay for the treatment through their water bills. It is not part of a farmer's or land manager's profit maximising calculations. As Helm notes "the challenge then is to internalise these external costs, so farmers make their profit maximising decisions in the context of their full costs of production. They should internalise the externalities. Policy should ensure that they face these full costs".

Option 3 – Public Goods Contracting
Instead, Helm argues strongly for all subsidy to be removed, and instead spending is concentrated on directly purchasing public goods that public money is paying for. This approach would determine what the public goods from the land are, and how the natural capital embedded in the landscape could be enhanced. Public goods are things such as carbon storage to reduce climate change impacts, flood storage to prevent settlements from flooding, enhancing biodiversity and improving access to wild places so that people's health and wellbeing is enhanced.

Specific public goods are best defined by those directly responsible for the public (rather than private) interest. There might be one body responsible for these public goods in land use, or perhaps many. They should decide which are the priorities in particular geographical areas and allocate the budgets accordingly. In essence land managers, and especially farmers, become contractors to the state providing a range of public goods that cannot be procured through the market place (in the way that food can). Monies currently allocated to implementing the Common Agricultural Policy can be diverted to the provision of these public goods but may well be supplemented by other public and private mechanisms. For example, Southwest Water is already paying land managers to supply easier and cheaper ways to treat raw water to their treatment works through specific land management practices.

Notably, such an approach does not preclude the continuation of farming – food production. Far from it, it frees agriculture to compete effectively securing a competitive agricultural industry. Indeed, part of the provision of public goods will almost certainly require some form of agriculture (e.g. grazing animals might be required to maintain upland heaths) and this can be incorporated into farm businesses. In essence, farmers would manage land to produce food, subject to the marketplace, and contract for the provision of public services where they can be procured.

Appleton Mill Farm in the North York Moors is a pastoral farm supporting a pedigree beef shorthorn herd and is managed to enhance wildlife habitat.

"The best route to British food security is through global tariff-free trade ensuring a diverse global food supply."

[7] http://www.dieterhelm.co.uk/
[8] http://www.dieterhelm.co.uk/natural-capital/environment/agricultural-policy-after-brexit/
[9] https://www.nfuonline.com/assets/94690

2 Public payments for public goods

This paper uses data through a geographical information system (GIS) to examine how Helm's option 3 might work in practice and what impact it would have. The Aire catchment is chosen to assess the impact of such a policy as it provides a useful generalised case-study given the catchment is both urban and rural, upland and lowland, contains some of Britain's best habitat, intensive arable agriculture and is subject to severe flooding in places. In this chapter, general principles of public payments for public goods are considered and the Aire catchment described in more detail.

2.1 Principles

Greener UK set out principles for post Brexit agricultural policy[10] summarised as:

- A shared countryside
- Nature everywhere
- For future generations
- Value for money
- Unacceptable to harm nature
- Easy to help nature
- Fair to farmers
- Built on strong evidence and past success
- Coherent with other policy areas
- The right action at the right scale in the right place

A new approach must be based on some core principles, including[11]:

- **Valued farmers and land managers:** incentives must be provided to make it worthwhile and financially viable for people to work on the land, including in less productive agricultural areas like the uplands where we need the skills and capacity to manage, maintain and improve land assets. Farmers must receive a fair share of the profit generated in the supply chain, creating more resilient farm businesses. We must increase public understanding of where our food comes from, and how it is produced.

- **Value for money:** taxpayers' money should be invested in public benefits that the market cannot provide.

- **Unacceptable to harm nature:** effective rules and regulations are needed to protect the natural environment and properly enforced through a well-resourced public agency.

- **The right action at the right scale:** good quality data and local information is critical to understand the environmental, social and cultural value of different places and to target action in the right place through mapping.

- **No cliff edge:** moving away from the CAP to a domestic policy must be well-managed and well-planned with enough time for farmers and land managers to transition away from the current system of subsidies to one in which they are paid for the public goods they provide.

With this new approach, we seek to achieve the following critical outcomes for economy, society and the environment:

- **Thriving wildlife everywhere:** Wildlife needs to be able to thrive outside protected areas and nature reserves. We need a connected and resilient network of wildlife sites allowing species to move through the wider countryside.

- **More, bigger better natural habitats:** Our peatlands, woodlands, grasslands, heathlands and wetlands should be maintained, restored and expanded so that they are adapted and resilient to climate change.

- **Clean water:** Restoring all water bodies to Good Ecological Status within 10 years.

- **Clean air and climate change mitigation:** Use of non-renewable resources in agriculture should be reduced and Greenhouse Gas Emissions (GHGs) from agriculture lowered.

- **Flood Risk Management:** The scale of use of natural solutions to soak, store and slow the flow of water should be expanded.

- **Healthy soils:** Fertility and health must be restored to our farmland and urban soils.

- **Abundant pollinators:** Wild pollinator populations should be increasing year on year.

Protecting pollinators is vital to biodiversity and a thriving agricultural economy.

- **Healthy people:** More people should be able to enjoy beautiful natural environments rich in wildlife.

These principles are applied in this paper to ensure:

- Farmers and land managers can bid for contracts to manage land to deliver a full range of public goods and services associated with the agricultural landscape, including cultural and social benefits.

- Taxpayers pay for these contracts in return for things that the market is currently not set up to pay for but which are valued and needed by the public, such as flood prevention, carbon storage (climate change), access (health and wellbeing purposes) and wildlife conservation.

- Farmers and land managers are paid in relation to the public benefit they are able or want to deliver; it is an output or results based payment system.

- Locally based commissioning bodies would determine where the money is spent on behalf of the public interest.

- There is ongoing investment in science, new technology and new markets that help nature. There are likely to be new markets to reward land managers for storing carbon, preventing floods and promoting biodiversity, if regulations are designed to create those markets.

We believe that a future land management policy should be driven by these national long-term outcomes, overseen by Defra. Public payments for land management should be spatially targeted and allocated using ecological mapping – a spatial approach to identifying societal and environmental needs, based on local and national data.

Data for each of the national outcomes (e.g. flood risk management, healthy soils, thriving wildlife everywhere) will help identify the key environmental issues which need tackling. The ecological network maps will inform a local environment network plan: a document owned and created by local people, based on locally identified need.

[10] http://greeneruk.org/resources/Greener_UK_Food_%26_Farming.pdf

[11] Based on Greener UK doc – Agriculture at a Crossroads

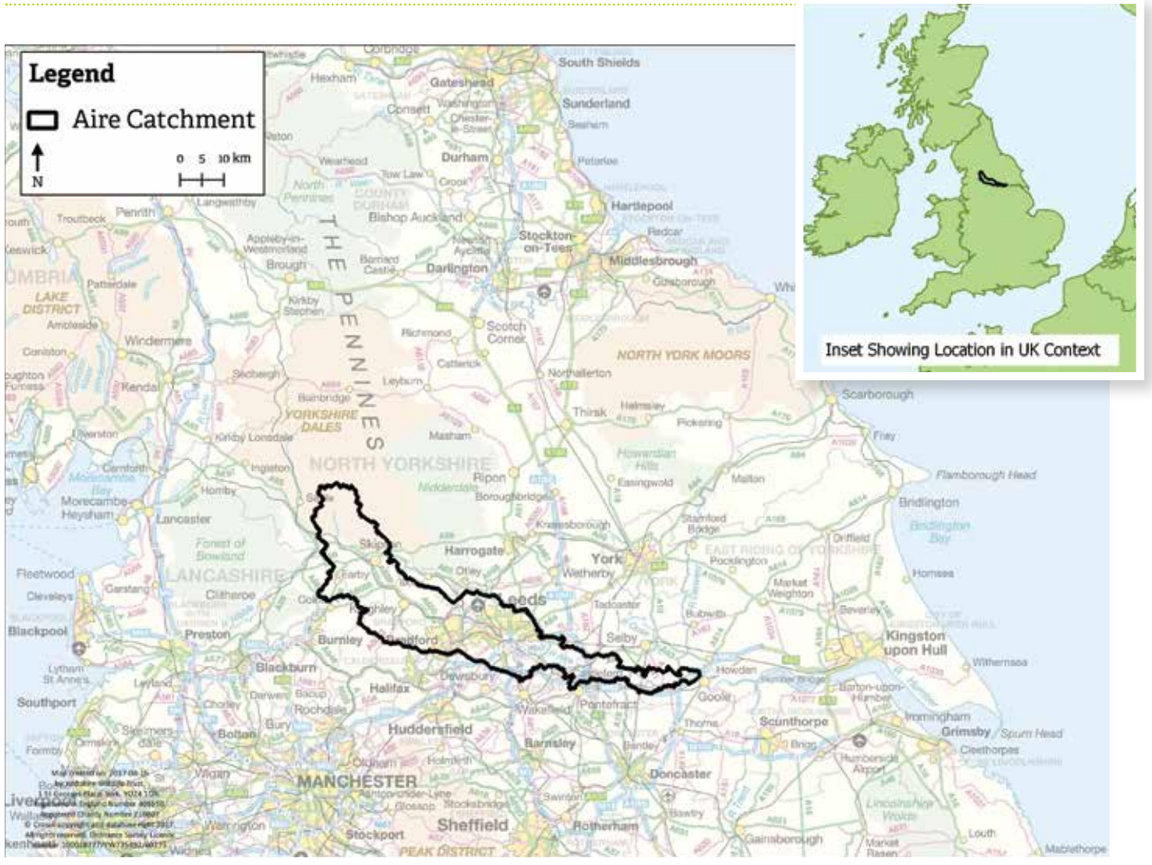
2.2 Aire Catchment

The Aire Valley is a long and thin river catchment starting on the upland moors of the Yorkshire Dales, running through the heart of Leeds and out to the Humber estuary across what was once lowland fen and marsh though now largely converted to intensive arable production. The River Aire flows for 148 kilometres from its source in the Yorkshire Dales near Malham to its confluence with the River Ouse near Goole. The top of the catchment sits in the Yorkshire Dales National Park and is characterised by karst limestone landscapes, including the iconic Malham Cove and its limestone pavements. From Skipton, the valley was heavily industrialised and is increasingly urban, eventually flowing into Leeds. From Castleford, the river runs through a very rural area dominated by intensive arable agriculture.

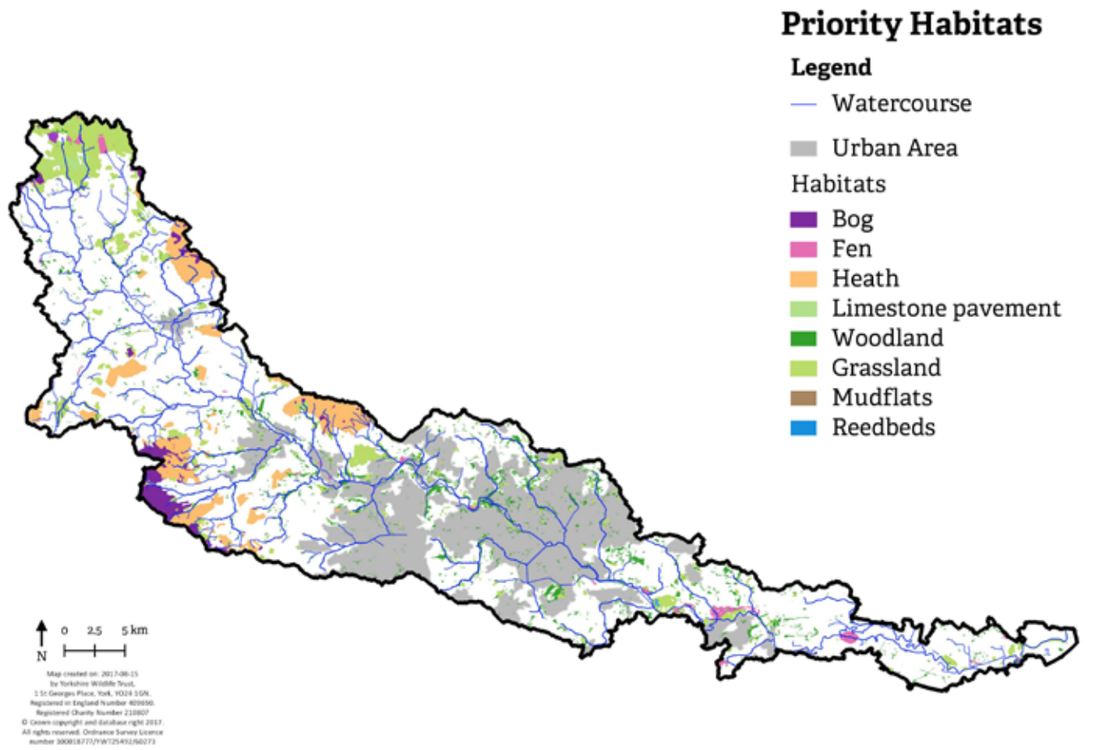
The catchment includes fine scenery and sites of very high environmental quality including 22 Sites of Special Scientific Interest (SSSIs), four Special Areas of Conservation (SACs) and two Special Protection Areas (SPAs). There are 219 Scheduled Ancient Monuments and one World Heritage Site, at Saltaire, in the catchment.

The catchment has a wide variety of habitats and agricultural soils as shown in the following maps:

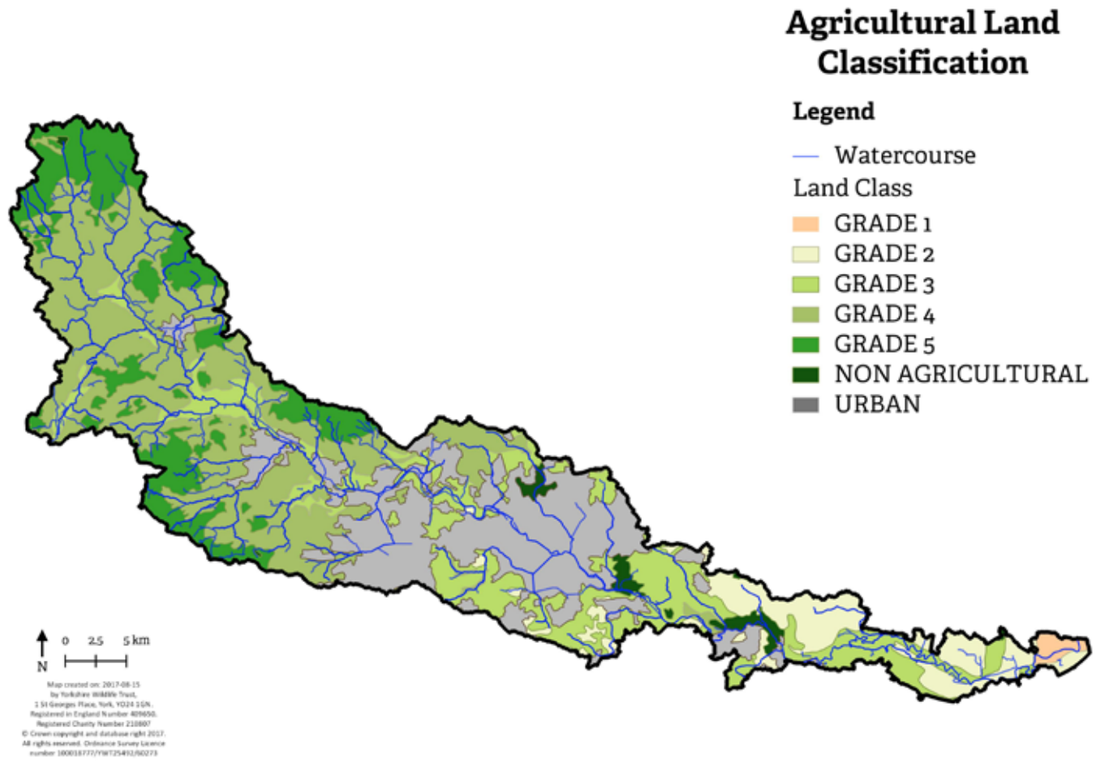
Map 1: Location of the Aire catchment



Map 2: Habitats map



Map 3: Land classification map



3 Public goods and services from land

3.1 Current land subsidy system

Map 4 shows the distribution of land subsidies through the Aire Catchment in 2015. Taken together, i.e. adding together Basic Payment Scheme, Entry Level Scheme, Higher Level Scheme, Countryside Stewardship and Organic Scheme, shows that the Aire catchment is currently in receipt of around £16 million per year in 2015. Pillar 2 (rural development) payments are concentrated in the upper catchment – those areas with the greatest proportion of semi-natural habitat and of the highest scenic and environmental value. Pillar 1 payments are spread more evenly, though urban greenspace is excluded from agricultural subsidy as it is not farmed.

3.2 Public goods from land management

Land management within the Aire catchment does, to an extent, and certainly could deliver a range of services that are important to society. Here, those public goods are identified in relation to the Aire catchment and a notional figure devised for capital investment and revenue payments for the provision of the service. **These figures are speculative and warrant considerable further analysis and debate but are used here simply for illustration**.

The figures used approximate to the levels of subsidy currently received by farmers and other land managers. For this exercise, six non-marketable public goods are identified for public support – maintenance and creation of biodiversity; flood risk management; improving water quality; access; carbon storage; and heritage and geological site conservation. These are chosen because they are fundamental to people's quality of life and there are few other market or non-market mechanisms to secure these benefits in the absence of new regulations.

By assessing the provision through analysis within a Geographical Information System it is easier to understand the total costs of such an approach, which can then be compared to the current levels of subsidy. The methodology behind each calculation is set out in Section 4.

3.2.1 Biodiversity

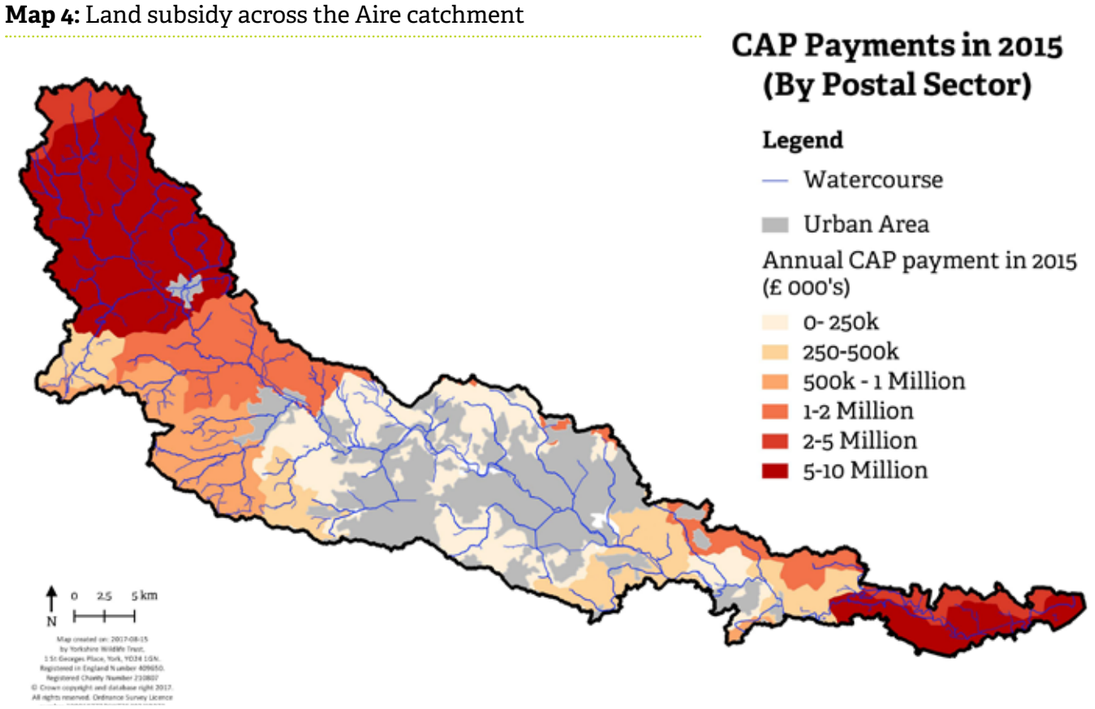
Wildlife in the Aire catchment faces similar threats and issues as elsewhere in England. At the top of the catchment, small areas of blanket bog suffer from over-drainage, over-burning and over-grazing that has resulted in hagging and blanket bog erosion. Upland heaths are often over-burnt and eroded whilst upland pasture and hay meadows have often been substantially modified through fertiliser application and, in some cases, re-seeding to mono-culture ryegrass meadows.

In the mid Aire, the floodplain is now mostly disconnected from the river (due to flood banks) concentrating the flow into the main channel and exacerbating flooding further downstream. This disconnection of the river from its floodplain has allowed significant intensification of land-use – with fertilised pasture or arable as the dominant land-use. In places, there are remnants of herb-rich floodplain grassland or wet woodland. On the valley sides, the mid Aire is characterised by extensive woodlands, some of which are ancient and many now plantations over ancient woodlands. Urban and industrial areas contain some encapsulated countryside of high environmental value and post-industrial brownfield sites that can be remarkably rich in biodiversity, especially invertebrate diversity. Likewise, former open cast mines and pit head slag heaps (e.g. Rothwell Country Park) are now rich in wildlife with rich wetlands (St Aidens and Fairbairn Ings).

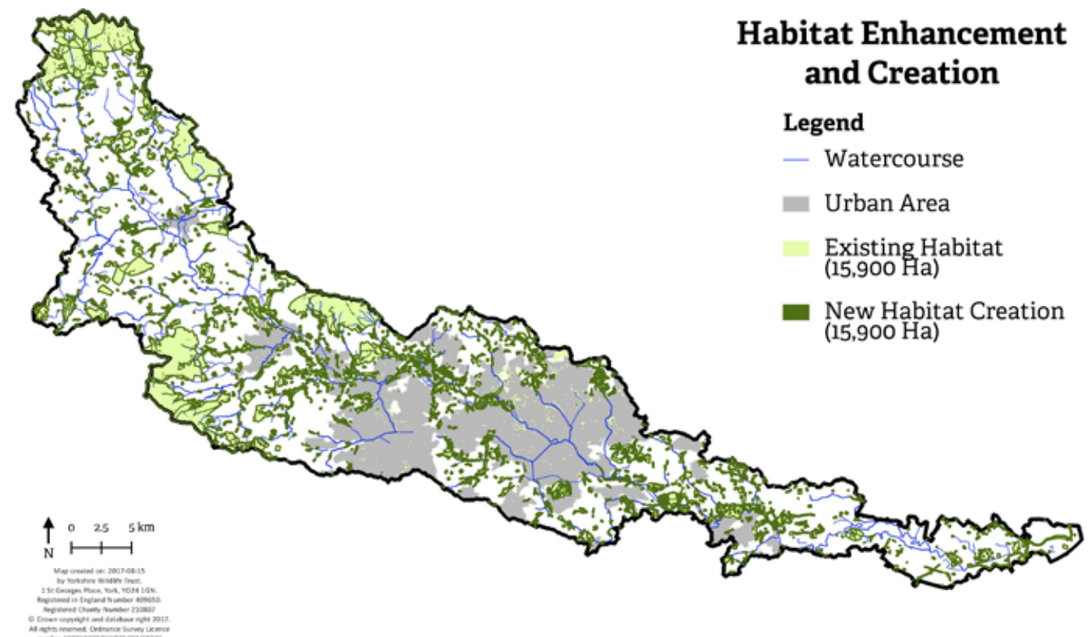
In the lowest reaches of the Aire, the fens and marshes that once characterised the Humberhead Levels (former lake bed of glacial Lake Humber) have been drained and are now intensive grade 1 arable land.

In summary, the Aire catchment is very mixed. It certainly has a rich suite of wildlife habitats that need on-going management and care to maintain and enhance; for this, direct payments from the tax-payer are proposed to stop and reverse wildlife decline. The catchment also has very significant areas of wildlife-poor land and is now (as with much of England) too fragmented to cope with the onset of climate change and the impact that will have in driving local species extinctions. As such, capital

Map 4: Land subsidy across the Aire catchment



Map 5: Habitat creation



payments are proposed to create new habitat. Where and what type of habitat should be created requires more detailed analysis but for the sake of this theoretical exercise, good quality habitat area is doubled over 10 years by focusing on the buffer around each patch of semi-natural habitat (see map 5). The costs of land management of existing habitat for wildlife and habitat creation are based on previous and published knowledge and equate to a capital cost of **£48.8 million** or **£4.8 million** per year over 10 years.

The revenue cost of managing habitat is well known and for the Aire catchment would cost **£4 million** in Year 1, rising to **£8.1 million** per year by Year 10, as new habitat is created.

One of the more important habitats and landscape characteristics of the catchment are hedgerows and walls. A capital scheme is proposed to create new field boundaries and a revenue scheme to maintain them. Understanding the overall cost of this part of the proposed scheme is assessed by dip sampling different areas to assess overall length of boundaries. It was then assumed that we would like to ambitiously increase the length of boundary features by 50% by the end of the 10 year period, increasing it from 1,700 km to 2,600 km across the catchment.

The capital cost of this doubling of boundary features amounts to **£17.5 million** equating to **£1.7 million** per year over **10 years**.

The revenue cost of managing existing or newly created boundaries amounts to **£1.7 million** per year in Year 1 rising to £2.6 million per year by Year 10 as new boundaries are created.

3.2.2 Flood Risk Management

As a result of increased storminess due to climate change and changing land-use, flooding is more likely. On Boxing Day 2015, the Aire valley was subject to severe flooding. Over 4,000 homes and almost 2,000 businesses were flooded with an economic cost to the Leeds City Region of over half a billion pounds, £100 million of which was damage to key infrastructure such as bridges, roads and Yorkshire Water assets[12]. In the aftermath of this major flooding event, an increased emphasis on natural flood management is evident within Government[13] with, for example, the Department for Environment, Food and Rural Affairs announcing £15 million of new funding to take forward natural flood management schemes[14]. In Leeds, the second flood alleviation scheme is also considering significant investment in managing land to reduce flooding rather than build expensive hard flood defences[15].

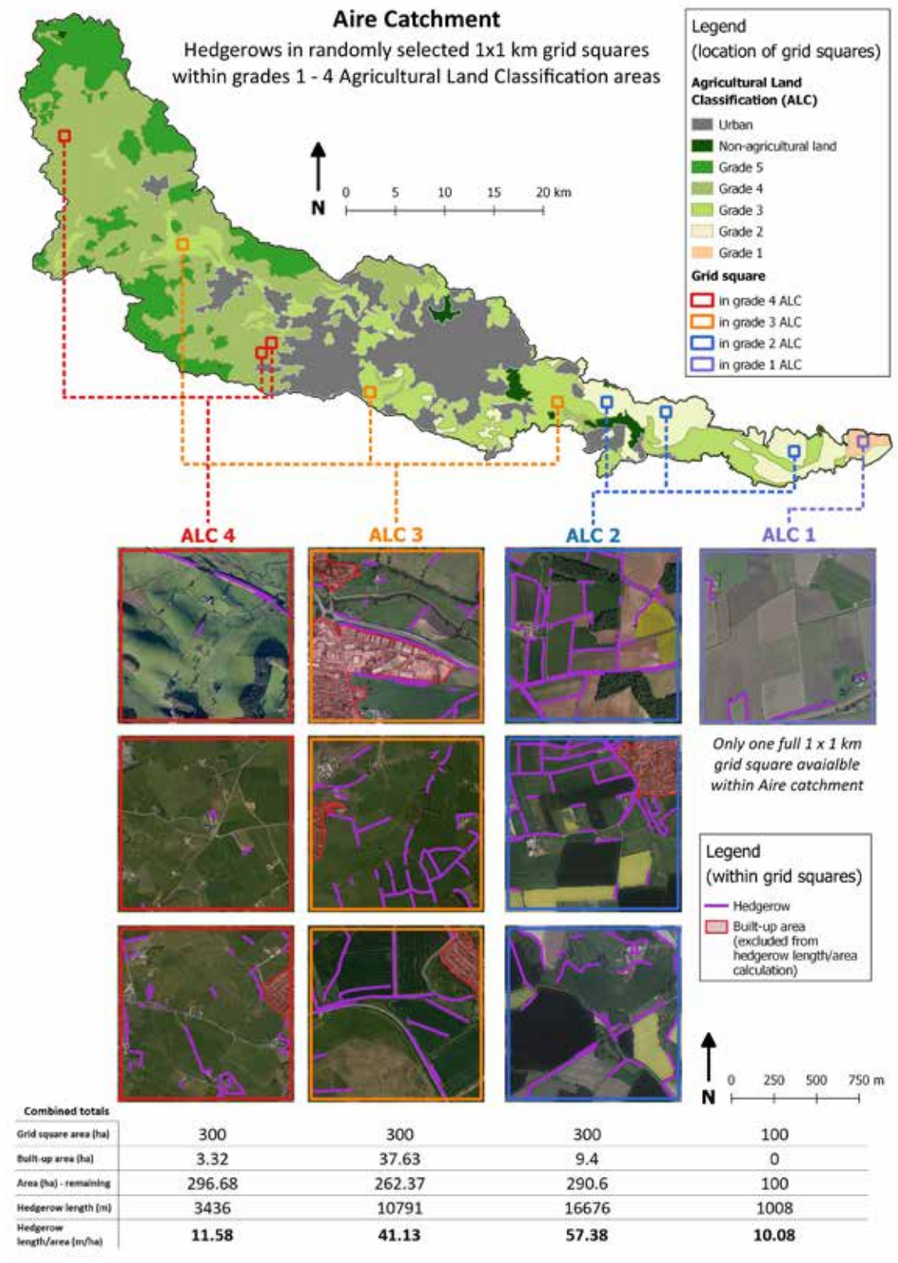
Currently though, land managers are not paid directly to reduce flooding and are simply the recipient of an occasional capital projects to install natural flood management on their land. Moreover, if land is taken out of production (for example through fencing off a riverbank to create a vegetated streamside buffer), the land manager is penalised through a reduction in their basic payment scheme. Here we argue for a targeted approach, paying for both capital works and revenue payments to actively manage natural flood management measures. The maps below shows where such payments would be targeted. Natural flood risk management is targeted in those sub-catchments that are naturally 'flashy', i.e. river levels respond quickly to rainfall. These are known as rapid response catchments and are dangerous because flood peaks can combine to cause more severe flood peaks on the main river that overwhelm existing flood defences. Natural flood management measures include:

- Slowing the flow of rainwater across the land by increasing surface roughness (through tree planting, peat bog restoration, installation of in-field small scale leaky dams and fencing off streamsides to allow vegetation growth).
- Slowing the flow of water within the stream by installing leaky dams, woody debris dams, encouraging meandering and planting wet woodlands along the bank side.
- Storing water both in-field (leaky dams) and on river floodplains by allowing the floodplain to operate naturally where rivers spill out onto the floodplain to substantially reduce flood peak.

Capital payments: Set at £200,000 per sub-catchment over 10 years. This equates to £20,000 per year, installing natural flood management measures across 35 catchments (as shown on the map below) – approximately an average capital payment of £1,300 per km of watercourse (based on the average length of watercourse in each catchment). Such capital schemes are likely to be supplemented by other schemes to reduce flood risk, such as the local levy that are raised by Regional Flood and Coastal Committee or specific flood alleviation schemes.

Revenue payments: Based on £50 per ha of floodplain where the floodplain is reconnected to the river and allowed to flood creating flood storage.

Map 6: Hedgerow dip sampling methodology and calculations

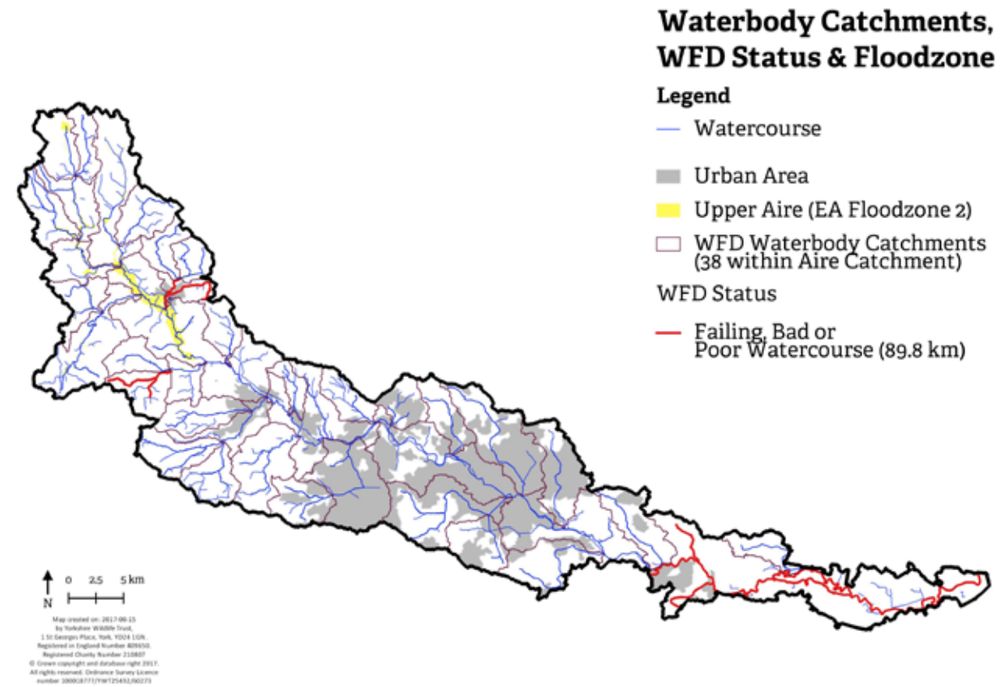


Combined totals				
Grid square area (ha)	300	300	300	100
Built-up area (ha)	3.32	37.63	9.4	0
Area (ha) - remaining	296.68	262.37	290.6	100
Hedgerow length (m)	3436	10791	16676	1008
Hedgerow length/area (m/ha)	**11.58**	**41.13**	**57.38**	**10.08**

This would equate to a maximum of £365,000 per year, based on the current floodplain area of the Upper Aire. Additionally, where natural flood management measures have been installed along watercourses, land managers would receive a revenue payment of £500 per km of watercourse per year, equating to a maximum of £335,000 per year, based on the total length of watercourse across the 35 sub-catchments above Castleford.

[12] https://www.westyorks-ca.gov.uk/uploadedFiles/Content/News/Leeds%20City%20Region%20Flood%20Review%20Report%20-%20Executive%20Summary%20FINAL.pdf
[13] https://publications.parliament.uk/pa/cm201617/cmselect/cmenvfru/926/92605.htm
[14] https://www.gov.uk/government/news/schemes-across-the-country-to-receive-15-million-of-natural-flood-management-funding
[15] http://www.leeds.gov.uk/residents/Pages/Leeds-Flood-Alleviation-Scheme-Phase-2.aspx

Map 7: Map of the 38 Aire Waterbody Catchments.



3.2.3 Water Quality

From the 19th Century to the 1970s, the Aire was grossly polluted but this has significantly improved over the last few decades[16] due to de-industrialisation, sewage treatment works investment and stronger enforcement to stop point source pollution by industry. Today, the Aire suffers mainly from diffuse pollution – small scale pollution from a variety of sources, principally urban run-off and agricultural run-off. Under the terms of the Water Framework Directive (WFD), the UK has to bring its water courses into 'good ecological condition'. Mapping of water quality by the Environment Agency identifies those parts of the Aire river system that are failing (see map 7 below).

Reducing diffuse pollution on the farmed environment is mostly about talking to farmers and encouraging a range of practices that stop any small-scale point source pollution (e.g. slurry pollution) and reducing sediment getting into rivers. In practice, the sort of measures used for natural flood management, especially field buffers, river-side tree planting and fencing off, and woody debris dams within the river are effective.

Under the 'polluter pays' principle, polluters should be regulated to stop pollution using fines if necessary. Here, direct payments are only considered for maintenance of measures within failing watercourse catchments that help to reduce diffuse pollution and have other benefits. In practice, these measures are usually beneficial for wildlife and natural flood management. Target areas are shown in map 7 above (watercourses classified as failing, bad or poor under the WFD) with the capital costs to put measures in place to improve these calculated.

Capital payments: Set at **£1.2 million** over the 10 years.

Revenue payments: £50 per ha where diffuse pollution reduction measures are in place in those sub-catchments that are currently failing. These payments are not additional to natural flood management revenue payments rather part of them.

[16] http://aireriverstrust.org.uk/a-brief-history-of-the-river-aire/

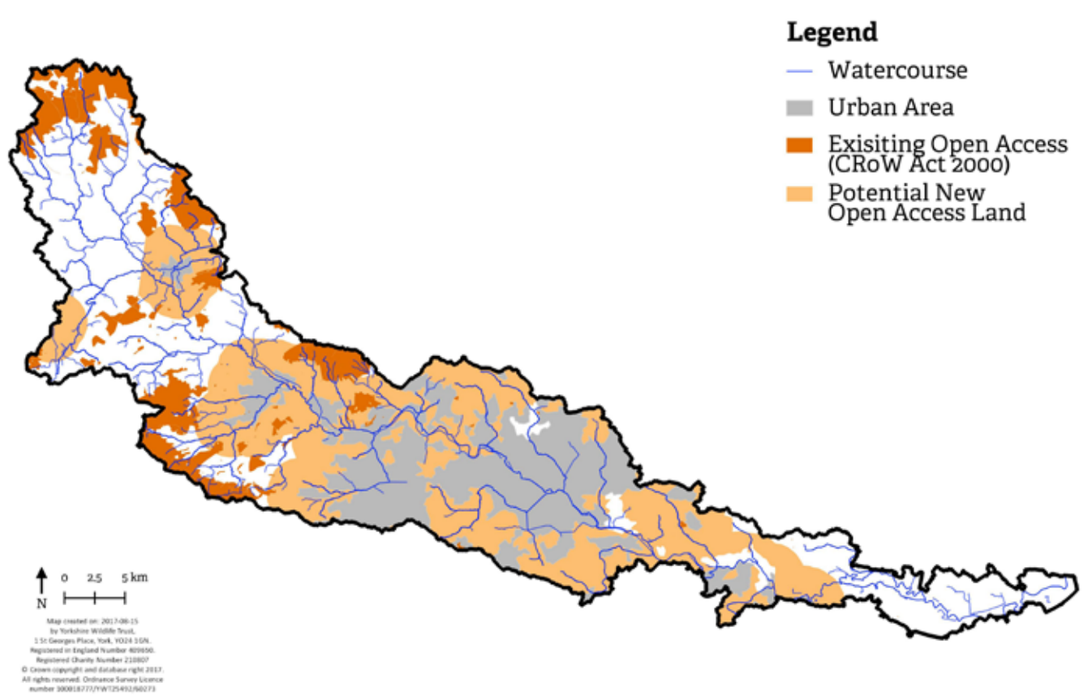
3.2.4 Access

*"Physical inactivity is a global health crisis, responsible for an estimated 5 million deaths worldwide... Around 20 million adults in the UK are insufficiently active, putting them at a significantly greater risk of heart and circulatory disease, and premature death. Levels of sedentary behaviour also remain stubbornly high in the UK, and evidence is growing that shows a sedentary lifestyle, irrespective of your level of physical activity, is strongly associated with poor cardiovascular health. Combined these two risk factors present a considerable threat to people's individual risk of heart and circulatory disease. The impact of physical inactivity and sedentary lifestyles also weighs heavily on UK healthcare, estimated to cost as much as £1.2 billion a year. Making physical activity easier and **more accessible** for all is of paramount importance if we are to reduce the burden of inactivity-related ill health and improve the future cardiovascular health of our population."*

British Heart Foundation (2017)[17]

There is a large body of evidence showing that contact with a wide range of natural environments can provide multiple benefits for health and wellbeing[18]. Benefits include improvements to physical health (through increased physical activity); and improvements to psychological and social wellbeing in a number of ways, including: reductions in stress and anxiety, increased positive mood, self-esteem and resilience, improvements in social functioning and in social inclusion.

Map 8: Current Open Access Land (CRoW Act 2000) & Potential Additional Open Access Land within a 2.5 km Urban Buffer Zone



[17] https://www.bhf.org.uk/publications/statistics/physical-inactivity-report-2017

[18] http://www.wildlifetrusts.org/sites/default/files/wellbeing-benefits-fr-nat-env-report-290915-final-lo_0.pdf

One of the most obvious barriers to physical activity is lack of access to open space – parks, countryside and urban fringe greenspace. In the Aire Catchment, the vast majority of people live in towns and cities with immediately accessible greenspace restricted to urban parks and gardens. Footpaths and open access land in the neighbouring upland areas provide further opportunities for physical activity though paths are often poorly maintained (or made deliberately inaccessible) whilst upland areas are only really accessible to most people by car.

A very simple and effective way to radically increase open access land would be to pay farmers and land managers to open up their land for responsible access. Here, we propose offering land managers a capital programme to install gates, stiles or simply hedgerow/fence gaps in field corners and leave a field margin for responsible public access. Opening access is targeted at land adjacent to towns and cities using a 2.5 km buffer margin.

Capital cost for gate/stile/fence gap installation of £1,000 per field, assuming an average field size of 2 ha, would equate to **£18 million** - to open up access within the whole urban buffer zone.

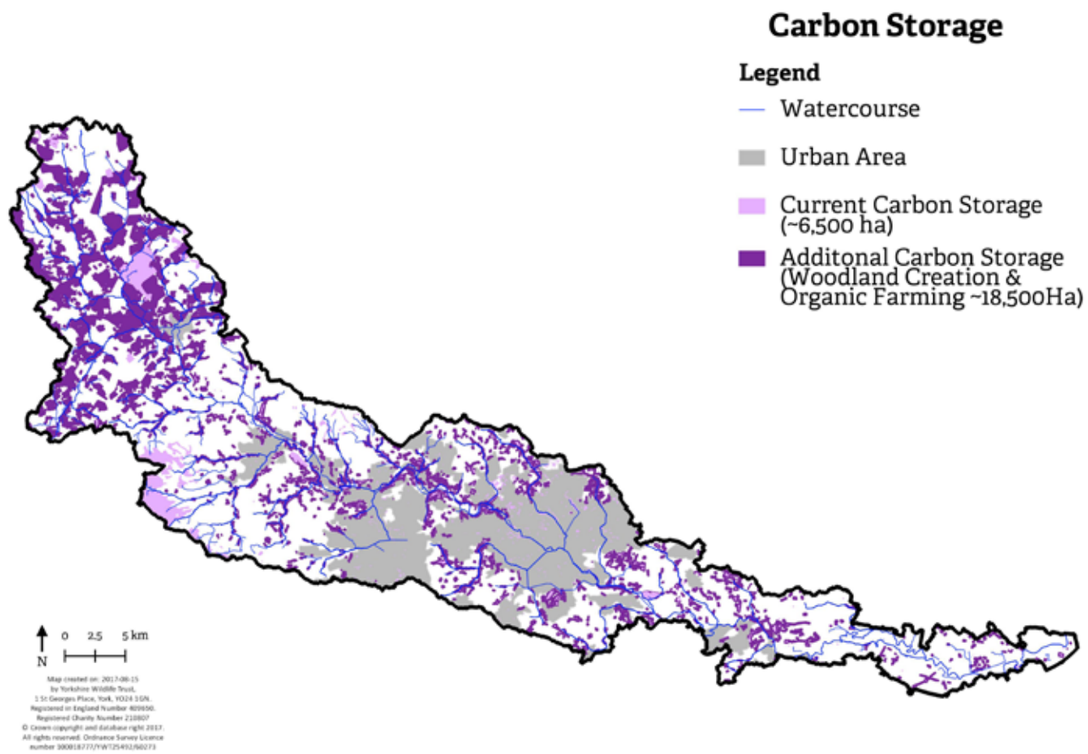
Revenue cost for allowing ongoing responsible public access within this urban buffer zone would be an additional **£16.2 million** over the 10 year period.

3.2.5 Carbon Storage

By far the biggest long term threat to wildlife and, indeed to society, is climate change. It is vital that human society moves to zero carbon emissions in line with the Paris Agreement on climate change[19]. Achieving net zero emissions will not be easy but one of the simpler mechanisms is to reduce emissions of carbon from land-use – the 'land use and land use change and forestry' provision within the Kyoto Protocol of the Climate Change Convention. For example, the densest store of terrestrial carbon is peatlands, storing twice as much carbon as the world's forests on just 3% of the land surface compared to forest land on 20% of the land surface[20]. Yet, damage to peatlands, means that they are currently contributing carbon to the atmosphere (acting as a source) rather than absorbing carbon from the atmosphere and laying it down as peat (acting as a sink). However, peatland restoration is relatively cheap – a matter of keeping the bog wet (often as simple as drain blocking) and restoring the right sort of vegetation.

In the Aire catchment, the three most important carbon stores are peatlands, woodlands and allowing carbon to build up in pastoral soils. Here we propose capital programmes of peatland restoration and woodland planting as part of the biodiversity enhancements set out above. Improving pastoral soils to increase carbon storage can be achieved by switching to organic agriculture. Organic management of pastoral soils are nominally given a revenue payment of £50 per ha limited to £500k in any one year. Land that is currently storing a high density of carbon and potential carbon storage areas is shown in map 9 opposite.

Map 9: Current and Potential Carbon Storage in the Aire Valley



3.3 Heritage sites and geologically important sites

The landscape also contains many heritage sites and regionally important geological sites. Heritage sites are designated as listed buildings, conservation areas, battlefields, parks and gardens or national monuments. Important rock exposures that are particularly interesting for geological study have a non-statutory designation of local/regional geological or geomorphological site. Land-use can affect all these sites and ideally land-uses are designed that are appropriate to the heritage or geological site/feature. It is likely that the management regime to conserve these features are so different for each site, a site-by-site contract should be set up. Here we assume a total budget for this work of £1 million per year and use the Natural England figure of £90 per ha currently used in Environmental Stewardship schemes.


Round-leaved sundew


Hetchell Wood, Leeds


Cattle at Ledsham Bank, Leeds

[19] https://www.carbonbrief.org/iea-world-can-reach-net-zero-emissions-by-2060-meet-paris-climate-goals
Joosten, H., Sirin, A., Couwenberg, J., Laine, J. and Smith, P. The role of peatlands in climate regulation. In: Bonn, A., Allott, T., Evans, M., Joosten, H. and Stoneman, R. (2016) Peatland Restoration and Ecosystem Services: Science, Policy and Practice. pp. 63-76. Cambridge University Press.

[20] Joosten, H., Sirin, A., Couwenberg, J., Laine, J. and Smith, P. The role of peatlands in climate regulation. In: Bonn, A., Allott, T., Evans, M., Joosten, H. and Stoneman, R. (2016) Peatland Restoration and Ecosystem Services: Science, Policy and Practice. pp. 63-76. Cambridge University Press

4 Applying the strategy across the Aire Catchment

4.1 Methodology

4.1.1 *Biodiversity*

The primary source for the biodiversity calculation was Natural England's Priority Habitat Inventory (PHI) dataset[21]. This allowed a reasonable estimate to be made with regards to the current resource within the catchment to be able to quantify the costs of maintaining this current resource using existing data for the costs for maintaining each of the habitat types[22].

There are over 15,900 ha of priority habitat within the Aire Catchment and, for the purposes of this paper, the capital and ongoing maintenance costs were modelled to double the good quality habitat area. This is illustrated in map 5, where a doubling of habitat area is modelled by using a 45m buffer around existing good quality habitat.

BIODIVERSITY	Maintenance cost per unit	Creation/Restoration cost per unit	units
Blanket bog			ha
Calaminarian grassland	£200	£8,250	ha
Coastal and floodplain grazing marsh	£335	£1,504	ha
Deciduous woodland	£100	£2,126	ha
Fragmented heath	£200	£1,304	ha
Good quality semi-improved grassland	£200	£1,500	ha
Grass moorland	£200	£1,500	ha
Limestone pavement	£200	£0	ha
Lowland calcareous grassland	£200	£2,408	ha
Lowland dry acid grassland	£200	£1,714	ha
Lowland fens	£60	£674	ha
Lowland heathland	£200	£1,304	ha
Lowland meadows	£200	£1,498	ha
Lowland raised bog	£150	£4,975	ha
Mudflats	£60	£15,000	ha
Purple moor grass and rush pastures	£200	£1,500	ha
Reedbeds	£60	£1,486	ha
Traditional orchard	£250	£1,123	ha
Upland calcareous grassland	£200	£1,500	ha
Upland flushes, fens and swamps	£60	£674	ha
Upland hay meadow	£200	£1,500	ha
Upland heathland	£200	£1,304	ha
Hedgerows	£1	£20	m

4.1.2 *Flooding*

Three main calculations were made in relation to flood storage and Natural Flood Management (NFM) payments:

- £200,000 per catchment for capital schemes related to 'slow the flow' principles - which was based on existing schemes within the Otterburn catchment (a tributary of the Aire) where YWT are currently installing natural flood management features. The length of watercourses in each catchment were calculated and an average capital spend per km of watercourse (~£1,300) was extrapolated to apply to each farm case study.
- £500 per km of watercourse was applied as a revenue payment to maintain natural flood management measures, paying for both ongoing maintenance and associated costs to keep them functioning and in place.
- £200 per ha revenue payment where a floodplain is reconnected to the river allowing regular flooding (and therefore flood storage), proposed here as the land would no longer be able to be used for arable farming. Only land upstream of the main urban areas is eligible as downstream flood storage would have minimal impact.

The Environment Agency Flood Zone 2 data layer[23] was used for this calculation for floodplain above Skipton. This covered 1,800 ha equating to £367,584.

4.1.3 *Water Quality*

Water quality payments were only deemed to be available to those farmers who had responsibility over failing waterbodies as identified by the Environment Agency[24] and equating to 90km. Capital payments are used to reduce diffuse pollution such as streamside fencing, pasture pumps/drinking bays, buffer strips etc, costed at £10,000 per km (fencing), £1,000 per km for pasture pumps/drinking bays and £225 per km for a 5m buffer strip along streamsides.

4.1.4 *Access*

Access payments are based on initial capital costs for installing pedestrian gates and stiles (2 of each per field at £200 and £100 each respectively plus installation costs: £1,000 per field). Once a field is brought into open access, a maintenance payment of £50 per ha is used. The public benefit is restricted to land within 2.5km of urban areas, equating to 36,000 ha (see map 8 above). Average field size is assessed through dip sampling random 1 km squares and measuring field sizes directly and then using this data to extrapolate across the urban buffer zone within the Aire catchment – yielding around 18,000 2ha fields.

4.1.5 *Carbon Storage*

The Natural England priority habitat layer, used for the biodiversity calculations, was also used for carbon storage calculations to estimate the area of woodland and blanket bog habitats as the two habitats that are naturally carbon-rich. Increasing carbon in pastoral soils is achieved through organic pastoral agriculture. Natural England environmental stewardship (ES) data shows current farmland within organic stewardship schemes (750 ha).

Here, a 10,250 ha (a quarter of all farms currently in Entry Level Stewardship or Higher Level Stewardship) increase in organic pastoral farming is used hypothetically. Revenue payments for land management for carbon are based on notional figures of £50 per ha for deciduous woodland (leave deadwood), £100 per ha for peatland management (wet and Sphagnum rich habitats) and £50 per ha for organic pastoral farming (non-silage) which are additional to biodiversity payments above.

4.2 Impact

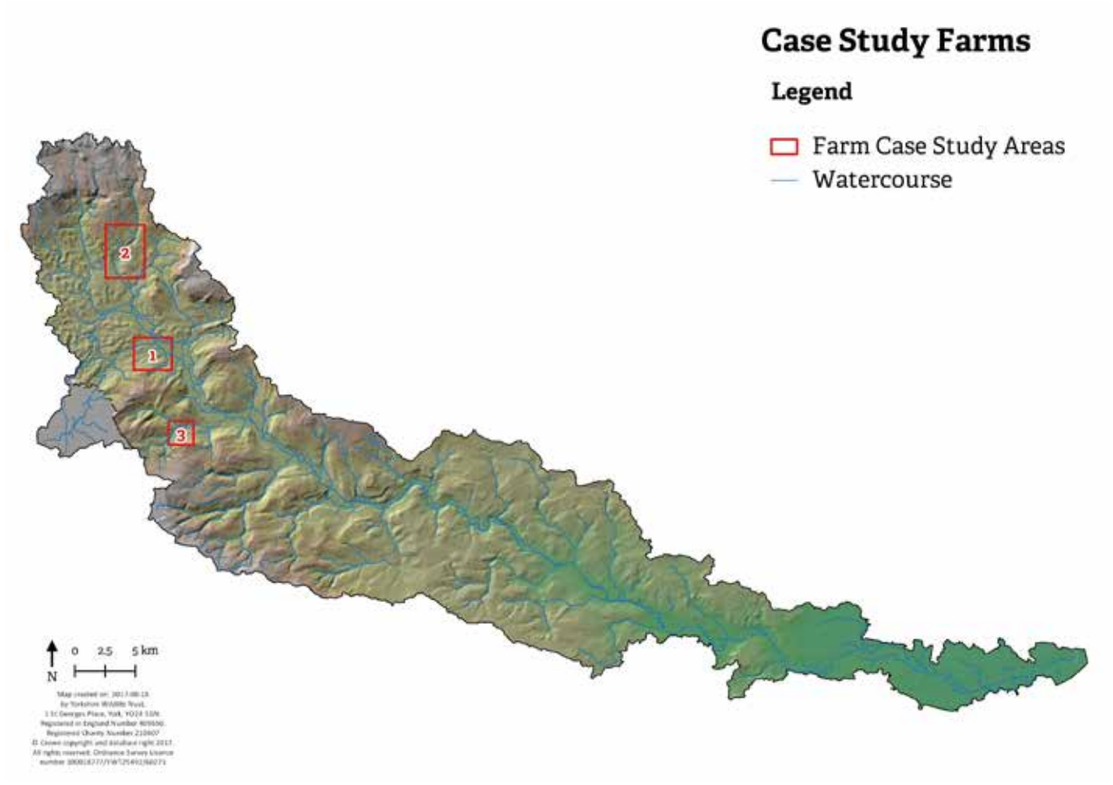
4.2.1 *Approach*

To assess the impact of this theoretical scheme on typical farms within the catchment a simple modelled spreadsheet was created allowing variables to be added in providing a payment/cost calculation on an area basis.

Three farms were selected, using the Natural England Environmental Stewardship data[25], which typified the types of farm found within the catchment. An urban fringe farm, upper catchment farm and a mid-catchment farm were chosen and the farm boundaries were simplified to anonymise the actual farms chosen. Current agricultural payments (environmental stewardship and estimated basic payment scheme) could then be

[21] https://data.gov.uk/dataset/priority-habitat-inventory-england2
[22] https://www.rugby.gov.uk/download/downloads/id/168/habitat_target_costings_to_2026.pdf WCS LBAP - Broad costings for estimating the total cost of delivering habitat targets in Warwickshire, Coventry and Solihull
[23] https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-flood-zone-2
[24] https://data.gov.uk/dataset/wfd-classification-status-cycle-2
[25] https://data.gov.uk/dataset/environmental-stewardship-scheme-agreements2

Map 10: Farm Case Study Areas (Red Rectangles) shown against relief map of the catchment



compared with payments under this scheme.

4.2.2 *Case study 1 – urban fringe*

Located within an urban buffer, this 200 ha farm straddles over 4km of the River Aire and its tributaries. Currently, it receives basic payment scheme and is part of the rural development fund entry level scheme such that the current annual subsidy is about £40,000 per year, delivering very little non-market public benefit.

Under this hypothetical scheme the farm would receive about £16,500 direct payments for: maintenance of hedgerows (9km – £4,500); deciduous woodland management (10 ha - £1,000); deciduous woodland carbon storage (10 ha - £500) and flood storage on floodplain (£10,500). More active involvement could increase that considerably. A modest 20 ha increase in woodland and similar amount of heathland, along with an increase in boundary features with 1.5 km of hedgerow planting, would generate capital investment of £97,500 with additional annual income for maintenance of £6,700. Additionally, restoration of half of the floodplain to grazing marsh would generate capital investment of £37,600 and annual maintenance payments of £8,375. There would also be additional monies available for natural flood management measures generating a capital investment of £55,000 and annual maintenance payments of £2,100. Opening access to the farm (given its urban fringe location) creates a capital investment of £20,000 and access annual payments of £10,000 per year.

With these measures in place, annual payments increase to about £45,000 per year (i.e. equivalent to current subsidy levels) with a capital investment of £210,500. Of course, the public benefits are massively increased: good quality habitat is doubled and managed better, the floodplain is partly converted into new habitat, boundaries are increased and better managed and over 200 ha of land is opened for public access. Little of this precludes food production though clearly the farm business would change, accommodating habitat management as well as food production.
With better and more attractive habitat and open access, nature tourism related business ventures are likely to be more successful.

4.2.3 *Case study 2 – upper catchment*

This upland 665 ha farm includes open access land and is outside urban buffer areas. Currently, the farm receives basic payment scheme (estimated), entry level scheme and higher level scheme – about £136,000 per year.

Under this hypothetical scheme the farm would be eligible for payments relating to: boundary features and existing habitat management (£56,000 per year); woodland carbon storage (30 ha: £1,500 per year); floodplain storage (35 ha: £7,100 per year) and archaeological features (6.3 ha - £570) totalling about £85,500 per year.

More positive engagement could significantly increase this payment:

- Habitat creation to double good quality habitat and increase field boundaries (by 6km) (capital investment of £296,500 and new annual revenue income of £75,500)
- Creation of 30 ha of floodplain grazing marsh (capital investment of £45,000; revenue payment of £10,000 per year)
- Adoption of natural flood management measures across the 6.6 km of watercourse over the farm (capital investment of £86,000 and annual revenue income of £3,300)
- Organic conversion of pastoral land across the land-holding (665 ha) (revenue payment of £33,250 per year for water quality related payments and a further £33,250 for carbon storage payments)

With these measures in place, a total capital investment of £427,800 and annual revenue payments of ca. £166,000 per year would flow, though this could be further increased through increased habitat creation. This would transform the farm to a wildlife-rich, open access farm delivering a high level of public benefit that powers rural tourism in upland Yorkshire. Opportunities for the farm to diversify to niche local food production and nature tourism would be considerably enhanced. None of the measures proposed here precludes food production; indeed grazing is integral to much of the habitat management proposed.

4.2.4 *Case study 3 – mid catchment*

Outside the urban buffer, the case study is modelled on a 64 ha dairy farm that includes a small (2.4km) tributary of the Aire that is classified as 'failing' under the terms of the Water Framework Directive definitions of ecological condition. Currently, the farm receives about £10,000 (estimated) basic payment scheme with a further £2,400 a year through the entry level scheme, totalling £12,400 per year agricultural subsidy. Under this hypothetical scheme, the farm would be eligible for payments allowing the flood plain to flood (5.2 ha – ca. £1,000 a year); deciduous woodland management (2 ha - £200 per year); boundary maintenance (£7,300 per year) totalling £8,500 a year.

More positive engagement would significantly increase capital investment and revenue payments. These include: restoration of the flood plain to grazing marsh (capital investment of £7,250; maintenance payment of £1,675 per year); doubling the woodland area (capital investment of £4,250; maintenance payment of £200 a year); increasing boundary features (500m – capital investment of £10,000; further maintenance payment of £250 per year); addressing the failing watercourse (capital investment of £28,700); adopting natural flood management measures across the watercourse (capital investment of £32,000; maintenance payment of £1,200 per year) new and existing woodland carbon management (£200 per year); and organic conversion for a quarter of the farm (£1,500 per year).

With these measures in place, a capital investment of £75,000 and annual revenue payments of ca. £13,600 per year would flow (cf. current agricultural

subsidy), though this could be increased through organic conversion of the whole farm and increasing habitat creation. None of the measures proposed here precludes food production; indeed grazing is integral to much of the habitat management proposed, though the farm business may switch away from diary to beef production as a result of these changes. The landscape would transform – good quality habitat would double in area, carbon would be sequestered from the atmosphere in organic pastoral soils and through new woodland planting, flood storage would protect towns and cities downstream whilst poor ecological quality of the stream would be remediated.

5 Implications

Dieter Helm sets out a radical departure from the current European Common Agricultural Policy (CAP) arguing that public payments should only ever be used for the public interest. This seems obvious, yet the CAP invests mostly in favour of private interest – distributing very large sums of taxpayer monies through the basic payment scheme to support private income, rather than public benefit. The effect is higher agricultural land prices leading to more expensive food. Worse, the CAP drives environmental degradation everywhere, leading to less wildlife, polluted water courses and high carbon and nitrogen emissions from land. Moreover, the agricultural industry, especially on the marginal upland or wetter soils, is in crisis – with a depleting and ageing workforce and very low incomes for those farming marginal soils.

Departure from the European Union and thus the Common Agricultural Policy offers the Government a clear opportunity to develop public policy and public fiscal intervention to resolve some of these issues; a far more coherent and effective agricultural policy could emerge from the Brexit process.

Here, we provide a practical examination of how Dieter Helm's third option (public payments for direct public benefits that is fully uncoupled from food production) might work. Capital payment costs are based on realistic current costs. Revenue payments are more notional and certainly would require finessing to set at the right level, but do approximate to current levels of subsidy. On this basis, and including £580,000 per year for catchment-based governance and facilitation of the programme, the total cost of the scheme for the Aire Catchment amounts to £163.5 million over 10 years or £16.3 million per year – the same cost as the current agricultural subsidy applied through Common Agricultural Policy.

The difference between the two approaches are profound. In terms of public benefit, the current CAP-based system provides remarkably few benefits given its cost. In the upper catchment, stewardship/ higher level scheme is undoubtedly making a substantial impact – protecting and maintaining habitat in particular. In places, these schemes are also helpful maintaining, for example, the last remaining patches of limestone grassland or the wetlands in the Lower Aire valley. Generally, though, these public benefits are extremely modest. In terms of public benefit, the current CAP-based system provides very poor value for money.

Under this hypothetical scheme, public benefit is massively increased. Governance of such public benefit would be developed locally and be publically, not privately, accountable through for example public agencies (e.g. Natural England). Here, a catchment scale is used employing 10 catchment advisors working with land managers to develop farm-scale programmes for the public benefit.

For the first time, all good quality habitat would be well managed. This would include all Sites of Special Scientific Interest, all Local Wildlife Sites and all undesignated good quality habitat. The UK would, under this scheme, finally arrest the decline of biodiversity meeting its commitments under the United Nations Biodiversity Convention. Better still, the scheme could double the area of good quality habitat, for example planting 4,200 ha of new deciduous woodland (8.4% of the England woodland creation target on just 1% of England's land-surface); creating 4,400 ha of upland heath (three times England's total Biodiversity 2020 target) or 600 ha of new grazing marsh (4% of England's Biodiversity 2020 target).

The programme would invest £14 million in natural flood management over 10 years (cf. the current £15 million all-England DEFRA programme) significantly reducing the impact of flooding in flood vulnerable urban areas such as Leeds and Castleford. It would help to address climate change by sequestering carbon from the atmosphere, laying down peat and soil organic matter as a permanent carbon store, switching land use from a source to a sink for carbon, and helping the UK meet its international climate change commitments under the Paris Agreement.

Accessibility to the countryside would transform under the scheme with a potential addition of 36,000 ha of responsible access to farmland around towns and cities substantially adding to the current area of open access land in the remoter uplands. These are huge public benefits reflecting significant investment in the land through a redirection of the current CAP budget. Yet, it also frees agriculture to adapt to market based food production without the hindrance of agricultural subsidy. Here, farmers would manage land for food production and public benefit building far more sustainable farm businesses based on multiple outcomes. Under current arrangements, farmers can be penalised for providing public benefit if land is deemed to have come out of agricultural production – utterly perverse public policy. Here non-monetised public benefits are paid for by the state as a common benefit for society. The farm case studies show that such a system would at least maintain current farm incomes. Refining farm businesses to make the most of opportunities from food production, tourism and public benefits could see farm income rising and attract younger farmers back revitalising farming. Instead of constantly fighting for environmental degradation (i.e. neonicotinoids, land drainage, burning, excessive fertiliser application etc.), the farming industry could lead the way to better, healthier and more locally produced food through a land management system that delivers a higher quality of life for everyone.

This represents a radical departure from the current system delivering huge public benefit at the same cost as the current CAP. Value for money is assured through local delivery of public benefit and direct payments for output based measures. And what value – wildlife, flood prevention, better health, climate change mitigation, new woodlands, well managed archaeological sites... A sensibly designed English Agricultural Policy could transform the countryside to the benefit of all.

Malham, Yorkshire Dales

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