Scottish Wildlife Trust

Policy

Sustainable Agriculture

June 2017

Sustainable Agriculture

Policy headlines

1. The Scottish Wildlife Trust recognises the economic and cultural importance of agriculture in Scotland, but also that agriculture has had, and continues to have, profound negative impacts on biodiversity and wider ecosystem health.

2. The Trust calls for the development of a resilient and diverse agricultural sector that enables sustainable food, fibre and fuel production with minimal negative environmental impact.

3. The Trust calls for a more multifunctional agricultural sector that builds healthy stocks of natural capital.[1]

4. The Trust believes that that all public support for agriculture should be linked to maintaining, enhancing, and restoring natural capital and correcting market failures[2]. Well administered public support mechanisms should properly reward groups or individuals for the public benefits they provide e.g. enhancing farm biodiversity, increasing habitat connectivity at the landscape scale, and mitigating and adapting to climate change. These same mechanisms should disincentivise activities that incur unacceptable costs to society e.g. exacerbation of climate change, pollution and destruction of habitat.

5. The Trust believes there needs to be greater alignment and integrated application of relevant land-use policies. Policies related to forestry, agriculture, water management, biodiversity conservation and broader land-use should be pursued in an integrated way. The Trust has published a blueprint specifying how this can be achieved in its Land Stewardship Policy.

6. Post 2020 the Trust believes that we should transition to a system where public money supports the delivery of public goods and services by investing in our natural capital. The Trust believes that extensive livestock grazing systems on High Natural Value farmland should be supported through targeted payments (see Appendix 5 for definition of HNV farming), rather than through a generalised system of support for Less Favoured Areas or livestock headage payments.

7. The Trust believes the adoption of agricultural systems that mitigate and adapt to climate change can increase farm resilience and improve farm profitability and should be a priority for both farmers and government policy and practice.

Scope

8. This policy sets out the Scottish Wildlife Trust's views on how agriculture in Scotland can be more sustainable, and supports the Trust's vision for a 'connected network of healthy, resilient ecosystems supporting expanding populations of native species across large areas'.[3] The policy outlines actions that can be taken by Government, its agencies, farmers and other land managers to deliver a more sustainable agricultural sector in Scotland, with reduced environmental impacts and greater biodiversity value.

9. The policy covers arable, livestock and mixed farming, including crofting and commercial fruit growing. It includes reference to agroforestry and farm woodland but does not cover large-scale commercial forestry. It covers upland livestock grazing but not moorland management for red grouse. These policy areas are both covered in the Trust's 'Living Landscapes in the Scottish Uplands'[4] and 'Land Stewardship'[5] policies. The use of pesticides in Scotland and the Trust's support for reducing usage in farmed systems through integrated pest

management is considered in detail in the Trust's Pesticides policy.[6] The Trust's Land Stewardship Policy sets out a clear framework for ensuring land stewardship is linked to the provision of public goods and the maintenance, enhancement and restoration of natural capital.[5]

Definition

10. There are multiple definitions of sustainable agriculture. The one that most closely matches[7] what the Scottish Wildlife Trust wishes to pursue is "*the management and utilisation of the agricultural ecosystem in a way that maintains its biological diversity, productivity, regeneration capacity, vitality and ability to function, so that it can fulfil – today and in the future – significant ecological, economic and social functions*".[8]

Context

11. Globally, farming has had a greater impact on biological diversity than any other human activity.[9]

12. Since 1945 agricultural intensification, typified by higher inputs and higher yields, has increased in Scotland (for a fuller description of intensification please see Appendix 4).[10,11] Post war agricultural policy focussed on increasing productivity and encouraged the creation of larger, more mechanised farms with fewer semi-natural habitats and higher usage of pesticides and fertilisers. Amalgamation of smaller farms into larger holdings led to the number of agricultural holdings in Scotland reducing by over half between 1950 and 1980. [12] The 'improvement' of grassland by sowing grass and applying fertiliser began in the 18th and 19th centuries but increased rapidly post 1945. However, there still remain large areas of Scotland where this was not undertaken and which today exist as rough grazings, together with smaller areas of species-rich grasslands such as machair.[13]

13. In 2015, c.80% of Scotland's land area (6.2 million hectares) was used for agriculture, of which approximately 60% was rough grazing (including common grazing), 20% grass, 10% crops and fallow and 10% ponds, woodland, yards and other uses.[14] Income from agriculture comprised approximately 0.6% of Scotland's economic output and was responsible for 2.5% of employment (65,000 people). The average farm in Scotland had a net worth of £1.3m. [15] At a national level over the period 2005 to 2015, the net worth of Scottish agriculture more than doubled, from £15.2 billion to £34.1 billion. This is primarily because of a large rise in the value of land and buildings over that period, with most of this rise occurring since 2007.[16] Average prices for the many of the main agricultural commodities are often below the costs of production. This means that in many years, on average, farmers in Scotland do not make a profit from farming without subsidy; and this is the case across most farm types in most years.[17]

14. Scotland has a Land Capability for Agriculture Classification system which was developed by the Macaulay institute in the mid-1960s. The Land Use Capability (LUC) for Agriculture divides Scotland into 13 classes and divisions but broadly these can be can be grouped into 4 categories: [18]

    - Arable Agriculture (LCA 1 -3.1, 8% of Scotland's land area)
    - Mixed Agriculture (LCA 3.2 – 4.2, 20% of Scotland's land area)
    - Improved Grassland (LCA 5.1 – 5.3, 18% of Scotland's land area)
    - Rough Grazing (LCA 6.1 – 7, 51% of Scotland's land area)

15. The majority of Scotland's agricultural area is made up of cattle and sheep farms in Less Favoured Areas / Areas of Natural Constraint.[19] Dairy farms are mainly in lowland areas of the south-west, and cereal farms are mainly located in the east. Mixed farms (with both crops and livestock) tend to occur in the north-east and south-east. Crofting (a uniquely Scottish form of land tenure for small agricultural units) is mainly undertaken on the islands and the north-west of the mainland. Approximately 40% of Scotland's Utilised Agricultural Area (UAA) including

common grazings has been estimated to be High Nature Value (HNV) Farming (see Appendix 5 for definition of HNV farming and appropriate stocking densities, Figure 1 in Appendix 1 shows the distribution of farm types across Scotland, and Figure 2 shows the extent of Less Favoured Areas).

16. Approximately 80% of crops grown in Scotland are cereals, with barley the main crop at present.[20] Wheat, oilseeds, potatoes, oats, and fruit and vegetables are also significant crops.[21] The area of arable land in Scotland declined by 30% between 1982 and 2015. [22]

17. Regarding livestock, Scotland's farmers and crofters kept 2.5 million breeding ewes, 437,000 beef cows, and 176,000 dairy cows, and 31,000 breeding pigs in 2015. Beef cow numbers in Scotland fell by 17% between 1982 and 2015, and dairy cow numbers by 37%.[23] After rising significantly until 1990[24], sheep numbers declined by approximately one-third between 1991 and 2015.[25] As of 2010, c. 70% of cattle and c. 90% of sheep in Scotland were in Less Favoured Areas.[26] Pig numbers fell by 31% from 1982 to 2015.

18. Agriculture in Scotland has negatively impacted on biodiversity in many ways for example by causing habitat loss, fragmentation and increased homogenisation. Intensification has led to significant declines in many farmland bird species, as well as profoundly changing vegetation communities and reducing botanical diversity[27], and has led to soil erosion and a reduction in soil organic matter.[28] [29] Agriculture can also negatively affect water and soil quality, and cause significant greenhouse gas emissions. (Changes in agriculture in Scotland since 1945 and key environmental impacts are summarised in Appendix 2.)

Policy statement

Strategic policy interventions

19. The Trust believes that a fundamental change of mindset and action is required among policymakers and practitioners to realise sustainable food systems, restoration and enhancement of biodiversity and ecosystem health, and the maintenance of existing biodiverse farmed habitats. The Trust recognises that the scale of change required is a major challenge, however, it is necessary if we want to meet our international objectives under the United Nation's Sustainable Development Goals[30], the Aichi Targets under the Convention on Biological Diversity[31], national and international climate change targets[32] and for Scotland to become the world's first sustainable economy.

20. The Common Agricultural Policy (CAP) has consistently failed to sufficiently protect and enhance ecosystems and deliver environmental public goods (for a summary of environmental issues regarding the CAP see Appendix 3). The Trust believes that agriculture policy should be reformed to reward land managers for good management of the environment, including biodiversity, soils, water and other ecosystems.

21. To provide the best possible value for public money, agricultural support mechanisms need to incentivise the delivery of a range of ecosystem services which provide public benefit (for a summary of subsidy compared to payment for ecosystem services please see Appendix 3).

22. Over the medium-term we should transition to a system where market intervention should no longer support the production of private goods (i.e. agricultural commodities) and public support should only support public benefits and natural capital investment over and above good agricultural practice. Farmers and land managers should look at all options available on their land, such as diversification into different products and services to realise new income streams. This would make individual farms more resilient to climatic and economic shocks. The Trust believes that high nature value farming systems are best supported by targeted interventions and not through generalised schemes of support such as Less Favoured Area support and headage payments which are not explicitly linked to the provision of environmental public goods.

23. For land management practices that support the environment and to ensure that Scotland has a 'green' agricultural sector which delivers multiple benefits, the Trust believes there must be greater coherence between agricultural policy and other relevant land-use policies: Scotland's Biodiversity Strategy; the Land Use Strategy; Forest Strategy; climate change policy; and river basin management plans.

24. Scotland's Land Use Strategy[33] promotes an ecosystems approach to land management and if widely adopted could help ensure land provides multiple benefits. The Trust believes the Land Use Strategy should inform other policy to help ensure that coordinated actions across multiple landholdings is encouraged through policies, frameworks, advice, funding and demonstration projects in order to realise landscape-scale enhancements to biodiversity, ecological connectivity and wider ecosystem health.

25. The Trust calls for a move towards a model based on regulation and incentive payments linked to maintaining, enhancing and restoring natural capital[34], which takes into account local conditions and requirements. The Trust proposes a model of regulation and incentive with four tiers, as set out in the box below. Appendix 3 describes the way farming in Scotland has been supported through the Common Agricultural Policy and the Trust's proposals for a new system of farm payments in more detail.

Box 1 – A four tier system for regulating and incentivising provision of public goods by farmers

Regulations – retention and implementation of Regulations applying as at 2017, with new soil testing and conservation regulations.
Natural capital maintenance payments: designed to ensure that we maintain, rather than deplete, our stocks of natural capital. These are area-based payments for meeting mandatory criteria which include providing wildlife habitat on at least 12% of the area of every farm.
Natural capital enhancement payments: designed to incentivise actions that will help build our natural capital. These are non-competitive area-based payments available to all farms for carrying out additional optional actions. These include increasing wildlife habitat >12% of farm area; reducing livestock stocking densities on sensitive habitats; conservation grazing; wildlife-friendly cropping practices; mixed farming; and measures to encourage pollinators.
Natural capital restoration payments: designed to enable the delivery of a greater level of public benefits and address societal risks such as resilience to climate change. These are competitive additional payments targeted at specific public good priorities including natural flood management, habitat and species conservation, and support for specific high nature value farming systems

26. The Trust believes that we should transition to this new system of supporting farming over a period of three to five years after 2020. If there is judged to be a significant risk of administrative difficulties with transitioning to a new system, the existing system should be kept in place for a period before this policy comes into effect. This will give farm businesses time to plan.
27. The Trust believes that mitigating and adapting to climate change in agricultural systems can increase farm resilience and improve farm profitability.[35,36] The Trust believes that Government policies to reduce greenhouse gas emissions from agriculture such as the current 'Farming for a Better Climate' initiative[37] should be mandatory (rather than voluntary).[38]

28. Another key priority in mitigating and adapting to climate change is the restoration and management of peatlands to improve and / or maintain their capacity to act as carbon sinks, help slow water movement in a catchment, and provide quality habitats for wildlife. The Trust welcomes the setting by the Government of a target of restoring 300,000 hectares of peatland by 2032-33 and the additional £8m of funding the Government

has provided for peatland restoration in 2017-18.[39] To achieve the Government's target and restore 20,000 ha per year of peatland from 2018-19 the Trust considers £16m of funding will be required (in current prices). The Trust calls on the Government to make this funding available through a dedicated peatland fund, as that will allow the direct economic benefits of peatland restoration to be realised through employment of contractors and purchase of machinery, training and upskilling of peatland consultants. It will also encourage the private sector to invest in peatland restoration through mechanisms such as the Peatland Code.[40] Applicants for restoration funding should demonstrate how the causes of peatland degradation will be addressed and will be managed in future, to ensure that the benefits from restoration works are secured. It is anomalous that while efforts are being made to re-wet peatlands by blocking drainage systems that there is no restriction on installing new land drainage outside designated sites. The Trust therefore calls for the installation of new land drainage on peat soils >50cm deep to be prohibited.

29. The Trust calls for a robust monitoring system to assess and report on the effectiveness of agricultural policy, its integration with other land-based policies, and the success of agri-environment schemes in reversing biodiversity loss and improving ecosystem health. Monitoring should be based on national and regional Ecosystem Health Indicators.[41] If subsidies are found to be leading to clear negative environmental externalities stricter conditions should be attached to them accordingly.

30. The Trust strongly supports the principles of High Nature Value Farming (HNVF).[42,43] HNVF systems are agricultural systems that provide important environmental benefits, such as soil biodiversity, and support for populations of threatened species. Approximately 40% of Scotland's Utilised Agricultural Area (UAA) including common grazings has been estimated to be HNVF. Incentivising the adoption of HNVF through subsidies and other measures will provide benefits for biodiversity and the rural economy. (Further details of HNVF are given in Appendix 5)

Farmed landscapes

Landscape Scale Management

31. One of the criteria for receipt of public support payments post 2020 should be that at least 12% of land on every farm be devoted to conservation objectives.[44] Flower-rich habitats, such as conservation headlands (utilising crop margins), have been shown to increase the abundance and species richness of pollinating insects.[45,46] Biodiverse areas of farms can provide vital corridors for wildlife and could contribute significantly towards a national ecological network.[47]

32. The Trust believes that there is significant potential for greater integration of woodland into farmed landscapes. Agroforestry systems (which include silvopastoral e.g. trees and pasture for livestock and silvoarable systems) provide shelter for livestock, windbreaks for crops, a local source of fuel and / or a commercial wood crop and can be of benefit to wildlife. Targeted establishment of agroforestry systems, and greater woodland planting on farms in general, offers a means of increasing ecological connectivity at the landscape scale, improving ecosystem resilience and increasing the range of ecosystems services that are delivered.

33. The Trust calls for more research into the role of agroforestry in Scotland's farming systems. This will help to identify where such approaches are most appropriate, to compare costs and benefits (of traditional farmed systems versus agroforestry) and to determine the best way to incentivise farmers to adopt this approach. Such studies should take account of the existing patterns of land ownership, tenancy and crofting in Scotland. (A definition and summary of agroforestry can be found in Appendix 4).

34. Options for Natural Capital Enhancement payments would encourage the restoration of mixed farming systems, and the cultivation of a wider range of a diversity of crops. The habitat heterogeneity created by such systems is of key importance for farmland biodiversity and can provide ecosystem services that benefit farmers directly, e.g. increases in arthropods important for pest control.[48]

35. In some upland areas, where the land is no longer actively managed for sheep farming, the Trust sees potential for allowing the widespread natural regeneration of scrub and woodland for biodiversity and flood mitigation purposes (for more details on farming in the uplands see the Trust's 'Living Landscapes in the Scottish Uplands' Policy[49]). This would be an option for Natural Capital Enhancement payments.

36. The Trust believes that reducing soil erosion and conserving and increasing soil organic matter, especially in arable areas, should be priorities for Government policy. Standardised protocols for monitoring soil structure, fertility and compaction should be developed, in order to identify areas where remedial and preventative action is required. Regulations to set minimum standards for preventing soil erosion and conserving soil organic matter should be developed and implemented (management practices that the Trust supports to aid soil conservation are listed in Appendix 7).

37. The Trust generally supports a land sharing approach to Scotland's agriculture but recognises that land sparing may be an appropriate model in some circumstances. (Definitions and summaries of land sharing and land sparing concepts can be found in Appendix 4).

38. In more intensively farmed areas (e.g. coastal East Lothian or Aberdeenshire) it is important that ecological standards are developed and applied to protect ecosystem health and habitat connectivity. Otherwise, the negative environmental externalities generated by intensive monocultural farming practices could result in significantly more costs than benefits to society and, in the longer term, farmers themselves.

39. Although inputs of fertilisers from farmland into the aquatic environment have declined in many parts of Scotland, the Trust believes that inputs of nitrogen and phosphorus should be reduced further in order to improve water quality for human use and to benefit biodiversity. The Trust believes that more 'priority catchments'[50] should be identified to ensure the most effective reductions in nitrogen inputs (see Appendix 6 for examples of management practices to reduce impacts on the aquatic environment).

Sustainable farming

40. The Trust believes that permanent grassland should be protected from ploughing both within and outwith designated sites.

41. The Trust recognises that both organic and conventional farming systems have a role to play in the agricultural landscape of Scotland. Notwithstanding this, the Trust would support an increase in the number of certified organic farms in Scotland where this will deliver better environmental outcomes than conventional systems. This aligns with the Trust's belief that all farming systemsshould deliver public goods, such as biodiversity and other ecosystem services, as well as food production. (A definition and summary of organic farming in Scotland can be found in Appendix 4).

42. The Trust recognises that grazing is an important tool in the maintenance of some habitats and notes that sustainable stocking densities are location-specific. However, stocking densities should follow the HNVF guidelines[51] and be set at levels that will achieve improvements in soil, plant productivity and diversity, as well as co-benefits such as water quality improvement (See Appendix 5 for details on stocking density and HNVF). Low-intensity, mixed livestock farming should be encouraged where it is ecologically appropriate. Options for Natural Capital Enhancement payments should include reducing stocking densities on sensitive habitats e.g. to prevent heather loss; and setting maximum stocking densities for improved and unimproved grasslands and rough grazing. Targeted support for High Nature Value extensive livestock grazing systems should be available as Natural Capital Restoration options.

43. There should be greater support for on farm advice which helps farmers and land managers deliver environmental benefits, and identifies potential "win, win" solutions to problems and collaborative projects that can be undertaken with other land managers. This advice should also promote practices that reduce water pollution (see Appendix 6) and support soil conservation (please see Appendix 7).

Priorities for action

44. The Scottish Wildlife Trust will advocate the principles outlined in this policy to the EU, Government, the farming sector, the wider public and other key stakeholders.
45. The Scottish Wildlife Trust will demonstrate the principles of sustainable agriculture on Trust reserves where appropriate, using the Trust's own 'flying flock', tenancy agreements and by working with neighbouring farmers to achieve the best conservation outcomes at the landscape scale.

Cross reference to other Scottish Wildlife Trust policies:

Policy Futures 1: Living Landscapes
Policy Futures 3: Climate Connections
Land Stewardship
Living Landscapes in the Scottish Uplands
Forestry and woodland
Lowland peat and horticulture
Pesticides
Integrated Catchment Management
Economics of ecosystem goods and services

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Appendices

Appendix 1: Distribution of farm types in Scotland and Less Favoured Areas.

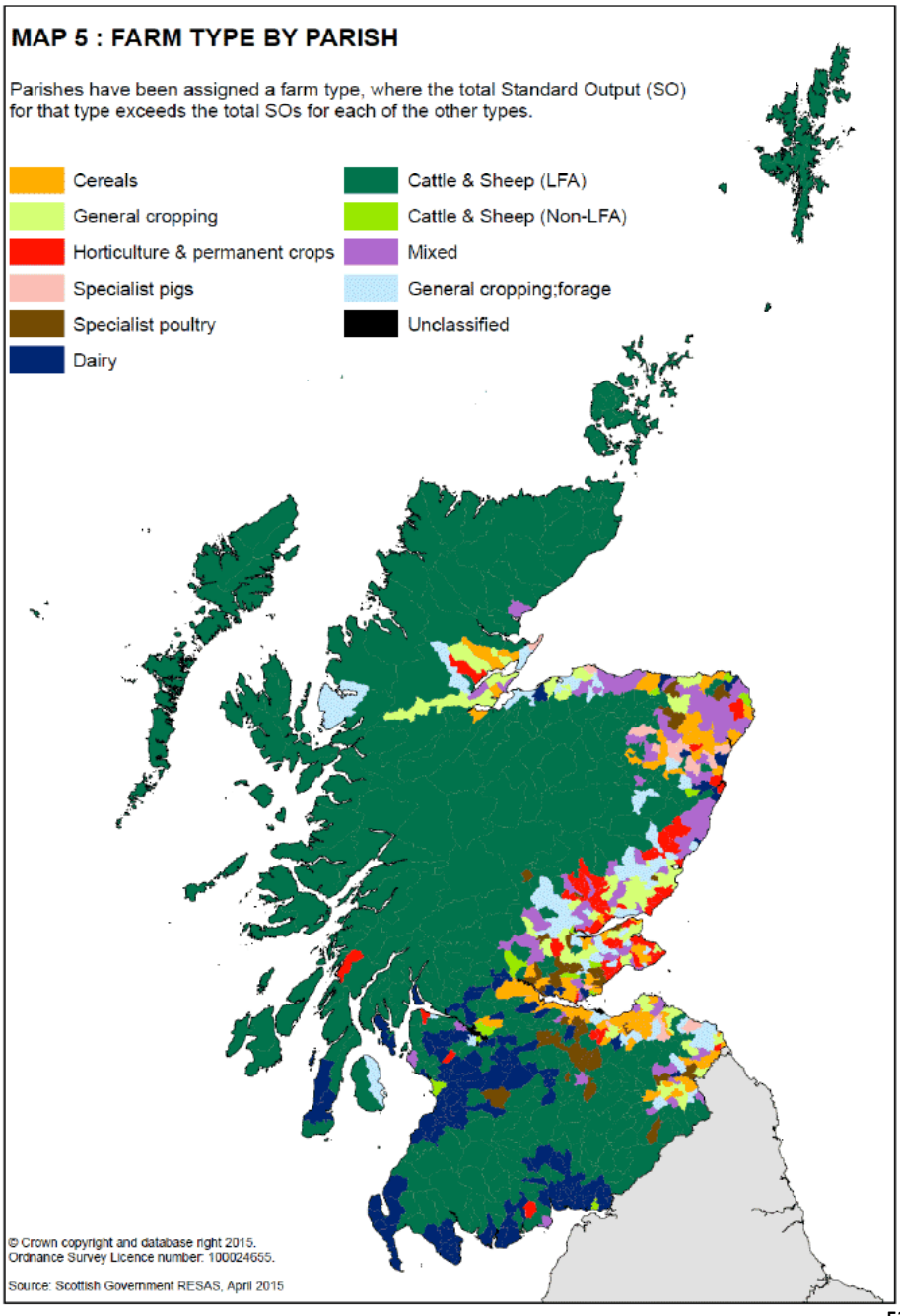

Figure 1: Distribution of farm types across Scotland by parish (2015)[52]

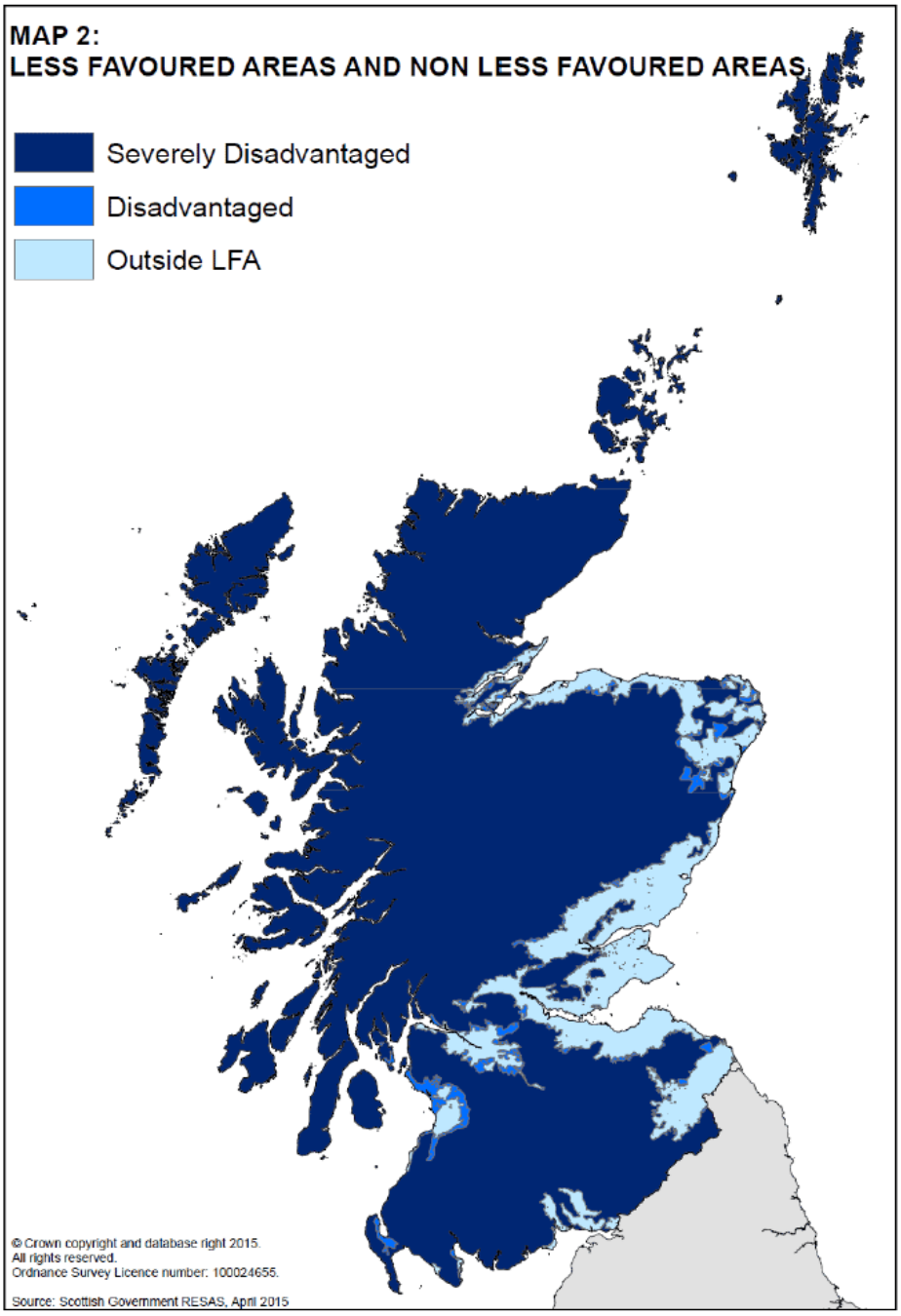

Figure 2: Extent of Less Favoured Areas in Scotland (2015)[53]

Appendix 2: A summary of key agricultural changes in Scotland since 1945 and their environmental impacts

(i) Agricultural changes in Scotland since 1945

Significant changes to agriculture in Scotland since 1945 have included:

a) Increased mechanisation and efficiency of machinery (resulting in less waste crop and weed seeds after harvest).[54]
b) Increased field size.[55]
c) Increased fertiliser usage.[56]
d) Increased pesticide usage.[57]
e) Changes in timing of farming operations, e.g. introduction of autumn-sown cereals reducing winter and spring fallow periods and crop stubbles.[58]
f) Losses of semi-natural habitats such as scrub, field trees, field margins, banks.[59,60,61]
g) Long term, and ongoing, loss of hedgerows. There was a 50% reduction in hedgerows between 1947 and 1988. Between 1998 and 2007 there was a further 7.4% decline.[62,63,64]
h) Changes in stocking densities.[65]
i) Reduction of mixed farming systems.[66]
j) Reduction of mixed cropping and fallow rotations.[67]
k) Habitat conversion (e.g. hay meadows converted to silage systems with repeated cutting).[68]
l) Improvement of grasslands. Unimproved grasslands are now rare in the lowlands and less than 1% of grassland in Scotland is classed as semi-natural grassland.[69] The area of improved grassland is still increasing – there was a 9% increase in Scotland between 1998 and 2007.[70]
m) Drainage and resulting loss of wet grasslands, lowland raised bogs (44% loss between 1947 – 1988), farm ponds and other wetlands.[71,72]

(ii) Environmental impacts

Biodiversity

Impacts on biodiversity from one or more of these changes have included:

a) A 63% decline of priority habitats associated with lowland and farmland habitats (2008 figures).[73]
b) Reduction in habitat heterogeneity within farmed landscapes.[74]
c) Fragmentation of habitats, e.g. through removal of linear features such as hedgerows.[75]
d) Decline in soil biodiversity. [76,77]
e) Profound changes in vegetation communities, e.g. declines in species richness of improved grasslands, declines in species richness of acid and neutral grasslands comprising rough grazings, damage to upland habitats through overgrazing, reduction in woodland regeneration due to overgrazing, declines in species richness of hedgerows and associated ground flora.[78,79,80,81]
f) Long term declines in bird species associated with farmland (both passerines and waders) e.g. lapwing, chough, corncrake, grey partridge, corn bunting. Targeted conservation efforts have achieved gains for some species, e.g. corncrake, but nine of 61 farmland bird species experienced significant declines between 1995 and 2011.[82,83,84,,85]
g) Declines in small mammal diversity and abundance in farmed landscapes.[86]
h) Declines in abundance and/or species richness of some groups of invertebrates (e.g. spiders, bumblebees) as well as sub-lethal effects from pesticides on pollinating insects such as bumblebees.[87,88,89,90]

Climate change

Approximately one fifth of Scotland's greenhouse gas emissions come from agriculture. Just over half of the emissions from agriculture comprise nitrous oxide N_2O (mainly from artificial fertiliser usage) and just over one third is methane CH_4 (from soil, livestock and manure management), with the remainder comprising carbon dioxide CO_2 (from energy used for fuel and heating as well as emitted from soils). A total of 49% of agricultural greenhouse gas emissions are from soil, 34% from livestock digestion, 9% from fuel usage and 8% from manure management.[91]

Many vehicles used on farms are entitled to use "red diesel" which is subject to a lower rate of fuel duty than normal diesel.[92] Rather than incentivising fuel use, tax breaks should be used as a tool to encourage best practice i.e. for technologies that reduce climate change impact. Therefore, farmers should be encouraged to use as little fuel as possible, to reduce greenhouse gas outputs, reduce farming's overall carbon footprint and to make farm business more resilient.

Changes in climate will determine what can be grown commercially in different regions of Scotland. Climate change will directly affect farming operations in terms of: water availability, increased risk of flooding, changing temperatures, increased pressure from pests and disease, and changes in the habitats and species found on farmland (e.g. types of grassland, tree species).

Aquatic environment and water flow

Negative impacts from agriculture on the aquatic environment arise from diffuse pollution, and from abstractions of water for irrigation. The major sources of diffuse pollution are:

a) artificial fertilisers[93]
b) farm effluents (especially livestock waste)[94]
c) soil erosion[95]
d) pesticide application.[96]

Excess nitrogen and phosphorus from agriculture can cause eutrophication of surface waters, and can affect species diversity and abundance by changing the water chemistry. Leaching of nitrates into groundwater can also occur[97]

Riparian buffer strips of semi-natural habitat adjacent to watercourses are a widely used tool to reduce diffusion pollution by trapping sediment. They may also have the co-benefit of enhancing biodiversity. However, if buffer strips are too narrow, this can lead to poor quality habitat, with low invertebrate diversity and poor foraging habitat for birds.[98]

Inadvertent soil compaction from machinery, and attempts to increase farm productivity through drainage of wetlands, and the removal of trees and hedgerows can increase flooding, particularly if these practices are common across a catchment.[99]

Soil

Healthy soils with high biodiversity are the foundation of many food webs, and play a vital role in delivering ecosystem goods and services.[100] However agricultural intensification and changing agricultural practices have led to losses of soil biodiversity across Europe, e.g. through declines in crop rotation and increased ploughing.[101]

Arable soils in the east of Scotland are eroding at twice the acceptable background rate.[102]
Soil compaction can also increase run-off of water and chemicals into the aquatic environment, although this is a localised rather than national problem.[103]

Scotland's soils, including its peatlands and peaty soils, store huge amounts of carbon that may be released through inappropriate land management practices, such as ploughing or overgrazing of moorland.[104]

Appendix 3: Agricultural subsidies through the Common Agricultural Policy and proposals for Natural Capital Payments

At present, more than a third of the European Union's budget is spent on the Common Agricultural Policy (CAP).[105] Scottish agriculture currently (2014 – 2020 period) receives c. £590 million of support through CAP payments each year.[106] The majority of CAP allocation is based on land holdings, with only a small proportion supporting ecosystem goods and services (including biodiversity[107]). The implementation of 'greening'[108] as part of direct payments to farmers is welcome, but it does not go far enough to address the multiple benefits that agriculture should provide.

Previous iterations of CAP payments, such as headage payments (based on the number of head of a specific type of livestock) leading to severe overgrazing, encouraged farming practices that led to significant environmental damage in Scotland. (See also the Biodiversity section of Appendix 2 above – the CAP was a driver for many of these changes in farming practices).

Changes such as the 'decoupling' of direct payments from production, a move away from headage payments and the introduction of obligatory minimum environmental standards have improved the situation somewhat, but have not reversed biodiversity declines and the other environmental impacts of farming in Scotland. From 2014-20 c.£45m a year is being spent on two headage schemes, the Scottish Suckler Beef Support Scheme and the Scottish Upland Sheep Support Scheme.[109] The Trust believes that such supports should be withdrawn, and the budget reallocated to measures that explicitly support the provision of non-market goods and which restore and enhance the natural capital of farming systems.

The CAP has consistently failed to sufficiently protect and enhance ecosystems and deliver environmental public goods. Scotland's Natural Capital Asset Index found that the three broad habitat types associated with agriculture (cropland, moorland and grassland) all experienced declines in their natural capital (and therefore capacity for providing ecosystem service) between 2000 and 2010.[110]

The UK National Ecosystem Assessment notes that while food production has increased significantly in Scotland since the introduction of the CAP, many other ecosystem services have declined, especially those related to air, water and soil. It concluded that "*agriculture needs to better provide ecosystem services other than production*".[111]

Common Agricultural Policy and Payment for Ecosystem Services

Payments for ecosystem services (PES) compensate for the cost of activities carried out to increase the quantity/quality of an ecosystem service or services. These schemes are market based approaches which aim to link those who benefit from ecosystem services with those who are most closely associated with supplying them.

A subsidy is "a sum of money granted by the state or a public body to help an industry or business keep the price of a commodity or service low"[112]. However, it can be argued that tax reduction is also a form of subsidy as the end result is the same i.e. the beneficiary is better off.

The vast majority of public money given to land managers under the CAP in Scotland is a subsidy (in the form of the Basic Payment, Greening Payment, and headage paymments). Despite recent greening measures, the Basic Payment Scheme is poorly targeted at delivering environmental and societal benefit because only very basic requirements need to be met in order to receive it. Some elements of the CAP provided for under the Rural Development Programme, such as the Scottish Governments Agri-Environment Climate Scheme, are a form of PES.[113]

Natural Capital Payments

The box below gives details of the system of payments proposed to incentivise the maintenance, enhancement and restoration of natural capital.

Natural Capital Maintenance – mandatory measures

This is an area-based payment available to all farmers (owner-occupiers and tenants[114]) for meeting mandatory criteria. These are:

Compliance with Statutory Management Requirements under the Basic Payment Scheme for 2017, [115] with addition of:

Compliance with species protection requirements of Birds and Habitats Directives, and the Habitats Regulations 1994 (as amended in Scotland); Wildlife and Countryside Act 1981 (as amended); Part 2 of the Animal Health and Welfare (Scotland) Act 2006, and with codes made under the Act; Controlled Activities Regulations; and the Sludge (Use in Agriculture) Regulations 1989.

Comply with regulations on soil conservation.

Comply with Good Agricultural and Environmental Condition (GAEC) requirements under the Basic Payment Scheme for 2017. [116] Amend GAEC 1 on buffer strips to state the uncultivated area must be at least 6 m wide. Add requirement to GAEC 4 on minimum soil cover that winter stubbles must be left unsprayed, to improve value for wildlife.

Reinstate GAEC requirements to prevent wind erosion and soil capping; use break crops in arable rotations; manage use of manures and slurries to meet crop needs; use machinery on land appropriately (e.g. not when water standing on surface or soil saturated); avoid overgrazing and overburning; and no liming of rough grazing or semi-natural habitats.

Comply with the Prevention of Environmental Pollution from Agricultural Activity (PEPFAA) Code[117] and the Code of Practice on the Use of Plant Protection Products. [118]

A minimum of 12% of the farm to provide wildlife habitat. [119]

Whole farm reviews to include financial performance and efficiency, soil, water, energy, greenhouse gas emissions and biodiversity.

Natural Capital Enhancement – regional options

This is a non-competitive additional area-based payment available to all farms for additional actions to provide public goods. Applicants can choose from a range of options, each of which attracts different point scores towards a target total to trigger the payment. Measures include:

Measures to optimise fertiliser & pesticide use.

Reducing stocking densities on sensitive habitats e.g. to prevent heather loss.

Maximum stocking densities for improved and unimproved grasslands and rough grazing.

Increasing wildlife habitat above >12% of farm area on a graduated scale.

Reintroduction of mixed farming (cropping on livestock farms and livestock on currently all arable farms), and reintroduction of a greater range of crop types (e.g. use of legumes and protein crops in arable rotations).

Allowing colonisation of native woodland and scrub onto rough grazings.

Creation of varied swards (e.g. areas where plants are allowed to flower and seed; leaving small areas unmown) and reinstating hay production on proportion of conserved forage area

Wildlife-friendly cropping and mowing techniques.

Measures to encourage pollinators; e.g. increasing legume content of temporary and permanent grassland mixes.

Leaving hedgerows uncut (e.g. on a 3-year rotation rather than every year, and not cutting hedgerow trees).

Conversion to organic farming.

Improving public access e.g. stiles, gates, footpaths, parking areas, signage, facilities.

Natural Capital Restoration

This is a competitive additional payment designed to deliver specific public good priorities. Measures include:

Natural flood management measures. [120]

Measures targeted at particular farmland types; e.g. machair, wood pasture, upland hay meadows.

Measures targeted at particular species; e.g. brown hare, black grouse, farmland waders and passerines.

Support for targeted livestock grazing on qualifying High Nature Value farmland.

Measures to create and restore non-woodland habitats to contribute to a National Ecological Network. Priority non-woodland habitats will be identified at local level as part of the process of catchment scale opportunity mapping.

Appendix 4: Summary of farming models, systems and concepts

Organic agriculture

Organic agriculture is governed by an EU regulatory framework that defines it as a farming system where artificial chemical fertilisers are prohibited, use of pesticides is restricted, genetically modified crops are banned and animal welfare is prioritised; routine use of drugs such as antibiotics is prohibited. In the UK, organic agriculture businesses are inspected by control bodies approved by the Department for Environment Food & Rural Affairs (Defra).

Organic farming in Scotland has declined from approximately 8% of agricultural land in 2002 to 2.4% in 2014. By contrast, in Europe as a whole, the area of organic farmland has risen steadily to almost 6% in 2012.[121]

Numerous studies have identified biodiversity gains associated with organic farming. They include increases in species richness and abundance for taxa including bats, birds, mammals and plants.[122, 123, 124] However, the extent of these benefits varies among taxa and crops, and can depend on surrounding land-use. Debate continues as to whether a whole-farm organic approach benefits biodiversity more than carefully targeted actions on smaller areas within conventional agriculture.[125]

Organic farming can achieve carbon gains of approximately 0.5 tonnes per hectare per year more than in conventional farming systems through carbon sequestration in soils. [126, 127] This may be due to increased usage of livestock slurry as fertiliser in organic systems.[128]

Comparisons of the global warming potential of organic beef and dairy production with their conventional equivalents have yielded conflicting results. [129, 130, 131]

Land sharing versus land sparing

With a growing human population, agricultural activity is likely to increase substantially over the next 50 years on a global scale.[132] Two approaches that may mitigate the environmental effects of this expansion have been proposed.

Land sharing is an approach where conservation objectives and food production are integrated by making existing farmland as hospitable to biodiversity as possible.[133] This approach underpins much current European agri-environment policy (although it is a moot point whether the policy objective is being achieved across Europe). In contrast, land sparing, involves maximising production on existing farmland with the aim of dramatically reducing the need to convert unfarmed habitats to agricultural land.[134] There is ongoing debate about the relative benefits of these two approaches.[135]

The separation of nature and agriculture in the land sparing model can lead to local and regional scale losses of habitats, and their associated suites of specialist species, that co-occur with agriculture. Land sparing may also lead to increased habitat fragmentation if agricultural land covers large areas. In addition, communities living in land sparing farmed areas will not accrue the benefits associated with systems where farming and environmental objectives are integrated. However, it has been estimated that a land sparing approach could lead to reductions in greenhouse gas emissions from agriculture.[136]

Given that 80% of Scotland's land area is used for agriculture, and the majority of the small remaining area of semi-natural habitats in Scotland are not suitable for farming, the emphasis here will be on land-sharing, and also on restoring and rewilding of some of our most marginal agricultural land (reverse land-sparing).

Agroforestry

Agroforestry has been defined as "a dynamic, ecologically based, natural resource management system that, through the integration of trees in farms and in the landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels".[137]

In the UK, the two major types of agroforestry are silvopastoral (trees and pasture for livestock) and silvoarable (trees and arable crops).[138] There has been little research on the benefits of trees to crops or pasture in Scotland but the following below summarise what is known.

A study of a silvoarable system in England found reductions in yield of approximately 7% at the edge of cereal crops due to shading by trees[139], although the trees themselves were typically a commercial crop, therefore reducing the economic impact of this shading.

A European analysis found that increases in yield away from trees compensated for yield reduction close to trees, and that potato yields increased by c. 30% in the presence of shelter from trees.[140]

Another study in England found higher pollinator abundance (hoverflies) and bumblebee species richness in silvoarable systems than typical arable land.[141]

An experiment in Scotland found that tree shelterbelts increased grass yield, most likely through protecting grasses from wind damage.[142] A study of silvopastoral farms in England, Wales and Scotland found that shading from trees did not affect the carrying capacity of the pasture.[143] A study in Wales found that shelterbelts of trees in pastoral land reduced flood risk.[144]

Silvoarable systems have been shown to increase floral diversity, the diversity of some invertebrates (e.g. butterflies), and the diversity and abundance of mammals and birds, including some species useful for invertebrate pest control.[145] Silvopastoral systems can be suited to both lowland and upland areas, and have been shown to quickly enhance the diversity of invertebrates and birds. [146]

Intensification

The United Nations Food and Agriculture Organisation defines Agricultural intensification as:

"*an increase in agricultural production per unit of inputs (which may be labour, land, time, fertilizer, seed, feed or cash). For practical purposes, intensification occurs when there is an increase in the total volume of agricultural production that results from a higher productivity of inputs, or agricultural production is maintained while certain inputs are decreased (such as by more effective delivery of smaller amounts of fertilizer, better targeting of plant or animal protection, and mixed or relay cropping on smaller fields).* "

In this document intensification tends to refer to the overall trend for the agricultural industry as a whole in Scotland over the long term and not to individual farm units. The Trust recognises that some farms in Scotland are reducing inputs and indeed outputs. Nevertheless, this on its own is not having a beneficial impact on biodiversity as the habitat loss associated with the previous intensification is still a factor in these farmed landscapes. Hence additional habitat management or restoration would be required in addition to reduced inputs in order to reverse previous biodiversity losses.

Appendix 5: A summary of High Nature Value Farming and sustainable stocking densities

High nature value farming (HNV farming) refers to agricultural systems that are important for environmental benefits they provide, such as soil biodiversity, or supporting populations of threatened species. HNV farming looks at farm-level management to ensure that the farm as a whole has a high nature conservation value, with constraints on areas of the farm at certain times of year being balanced out by other management of other areas. There are broadly three types of HNV farming:

a) Type 1: land with a high proportion of semi-natural vegetation.

b) Type 2: land with a mosaic of low intensity agriculture and natural and structural elements (field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc).
c) Type 3: land supporting rare species or a high proportion of European or world populations.

In Scotland, the presence of semi-natural vegetation is a common feature of HNV farming, so that essentially, types 2 and 3 are subtypes of type 1.

Approximately 40% of Scotland's Utilised Agricultural Area (UAA) including common grazings has been estimated to be HNV farming.

Livestock-dominated systems in Scotland are considered to be HNV systems when rough grazing makes up more than 70% of the UAA and where livestock units per available forage hectare are less than 0.44 livestock units (LU) per hectare at the whole farm holding level. As an example, a farm may be classed as HNV farming when rough grazing comprises >70% of the UAA, and stocking densities are <0.2 LU/ha on rough grazing and <1.0 LU/ha on in-bye land, therefore <0.44 LU/ha at the farm scale.

Appendix 6: Examples of management practices to reduce impacts on the aquatic environment

a) Livestock should be kept away from watercourses to reduce the release of sediment through trampling.
b) Manure and fertiliser applications should be targeted, and their quantities calculated, to reduce leaching and run-off. This will also reduce greenhouse gas emissions and save money. The timing of slurry, manure and inorganic fertiliser application should be controlled, to increase the efficiency of nutrient usage and minimise the potential for leaching.
c) Riparian buffer strips can be an effective means of reducing diffuse pollution from agriculture. Buffer strips should be as wide as possible, ideally at least 6 metres, and grass/herb buffers should be managed by occasional cutting or grazing to benefit biodiversity.[147] Forested riparian buffer strips have been shown to have potential for slowing and storing flood waters, acting as a buffer to agricultural run-off and enhancing habitat connectivity.[148],[149] It has been found that riparian woodland usually needs to be 25-30 metres wide to preserve ecological integrity, but that 5-10 metre strips can preserve the chemical and physical attributes of the watercourse.[150] Existing riparian woodland should be sensitively managed for biodiversity.
d) Increasing the amount of native, broadleaved woodland in farmed landscapes will have multiple benefits, including providing a source of fuel, shelter for livestock, reducing flooding, increasing biodiversity, aiding soil conservation, acting as a windbreak and protecting watercourses from run-off. Broadleaved woodland is on average 67 times more effective than grazed improved grassland at absorbing surface water run-off and research has shown that even small, carefully sited woodland strips can reduce the magnitude of flood peaks by 40%. [151]

Appendix 7: Examples of management practices to support soil conservation

a) Reduced tillage should be encouraged where possible, in addition to the ploughing-in of stubbles and other crop residues.
b) Winter stubbles should be retained where possible, to reduce soil erosion and support biodiversity, especially as a food source for birds[152]
c) Crop rotations should be encouraged, as this has been shown to increase soil biodiversity, soil aggregation and organic carbon content.[153]

d) Retaining and increasing organic matter in soils through incorporation of crop residue, farmyard manure/slurry and the use of cover crops, to reduce inorganic fertiliser input.
e) Inorganic fertilisers should be used only when necessary, at optimum rates for the crop and not at the same time as the application of manure or slurry.

[1] *Natural Capital can be defined as the stocks of natural assets which include geology, soil, air, water and all living things*
[2] Market failure occurs when the market fails to allocate resources efficiently and does not generate the greatest social benefit i.e. it is not efficient. Externalities from farming are a good example of market failure. An business may produce a product such as chicken and neighbouring populations may be impacted by airborne pollution without this being factored into the "cost" to wider society, this pollution would be at a "socially inefficient" level as the wider costs hadn't been factored in and thus a market failure.
[3] Scottish Wildlife Trust (undated) Natural connections: a vision for re-building Scotland's wildlife. Available at http://scottishwildlifetrust.org.uk/docs/002__003__general__NaturalConnections__1259853885.pdf
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[6] Scottish Wildlife Trust (undated) Pesticides Policy. Available at http://scottishwildlifetrust.org.uk/docs/002_293__pesticidespolicy_1396267439.pdf
[7] See also paragraph 16; the Trust believes that sustainable agriculture should also lead to the *restoration* and *enhancement* of biodiversity and ecosystems where appropriate as well as *maintenance* of healthy ecosystems
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[17] Scottish Government. Economic Report on Scottish Agriculture, publication series. Available at: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/PubEconomicReport
[18] Land Capability for Agriculture in Scotland, Available from http://www.hutton.ac.uk/sites/default/files/files/soils/lca_leaflet_hutton.pdf
[19] Less Favoured Areas are a long standing designation under the Common Agricultural Policy they are classified as such due to natural impediments to agriculture such as steep slopes, difficult climatic conditions or low soil productivity. Areas of Natural Constraint will likely replace less Favoured Areas in the European Commission's Rural Development Regulation, they will have similar biophysical parameters. Currently 84% of farm land in Scotland is designated as LFA
[20] Until the 1950s, oats were the dominant crop in Scotland.
[21] Scottish Government (2016) Agriculture Facts And Figures, Saughton House, Edinburgh. Available at: http://www.gov.scot/Resource/0050/00501331.pdf

[23] Scottish Government (2015) Abstract of Scottish Agricultural Statistics 1982 to 2015. Available at: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/PubAbstract/Abstract2015 [Note to allow comparison of Cattle Tracing Service figures from 2015 with data pre-2006 percentages are calculated for all female beef cattle and dairy cattle aged over one year]
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[27] *Critchlow-Watton, N., Dobbie, K.E., Bell, R., Campbell, S.D.G., Hinze, D., Motion, A., Robertson, K., Russell, M., Simpson, J., Thomson, D. and Towers, W. (eds) 2014. Scotland's State of the Environment Report, 2014. Scotland's Environment Web. http://www.environment.scotland.gov.uk/*
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[30] Please see: http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda.html
[31] Please see: https://www.cbd.int/sp/targets/

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[37] See http://www.sruc.ac.uk/info/120175/farming_for_a_better_climate
[38] Cross Compliance is a mandatory set of requirements and standards that land managers have to meet in order to receive support scheme payments see: http://www.gov.scot/Topics/farmingrural/Agriculture/grants/Schemes/Crosscompliancesection/ccompliance
[39] Scottish Government. (2017) Draft Climate Change Plan: 3rd Report on Policies and Proposals 2017-32 available at: http://www.gov.scot/Publications/2017/01/2768
[40] IUCN UK Peatland Programme. The Peatland Code: http://www.iucn-uk-peatlandprogramme.org/peatland-code
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[44] Scottish Wildlife Trust (2015) 50 For the Future. Available at http://scottishwildlifetrust.org.uk/docs/002_433__201508_50forthefuture_10_onlinespreads_1443171929.pdf The 12% area would be calculated as a proportion of the whole farm area. As with Ecological Focus Areas, different coefficients will apply to different habitat types. Habitats which deliver connectivity beyond the landholding would have a coefficient >1. Habitats such as retained winter stubbles would be eligible but would have a coefficient <1. Semi-natural grasslands and grazed wet meadows would qualify as wildlife habitats.
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[114] In contract farming arrangements provision would be made to ensure criteria were met by the contractor carrying out the farming, where they were not the party receiving subsidy under the agreement.
[115] Statutory Management Rules for the Basic Payment Scheme 2017 are listed here: https://www.ruralpayments.org/publicsite/futures/topics/inspections/all-inspections/cross-compliance/detailed-guidance/statutory-management-requirements/
[116] Good Agricultural and Environmental Condition requirements for the 2017 Basic Payment Scheme are listed here: https://www.ruralpayments.org/publicsite/futures/topics/inspections/all-inspections/cross-compliance/detailed-guidance/good-agricultural-and-environmental-conditions/ previous requirements are listed here: http://www.gov.scot/Publications/2005/12/0990918/09207#smr3
[117] http://www.gov.scot/Topics/farmingrural/Agriculture/Environment/PEPFAA/Overview
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[119] Eligible land would include the features currently eligible for Ecological Focus Area, with additional features added to reflect the extension of this requirement to all farm types. Collective applications from neighbouring farms would receives higher point weightings. Creation of linked habitats e.g. hedgerows for nesting cover and winter stubbles and sacrificial cereal plots for feeding for farmland birds would also be incentivised.
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