Balancing UK Land Use

Friends of the Earth's Illustrative Land Use Scenario

Version 1.1

23 November 2016

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0.2 - Working draft	30 March 2016	Chris Gordon-Smith	Working / snapshot version.
0.3 - Draft	10 April 2016	Chris Gordon-Smith	Updated to incorporate 7 March review comments.
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Contents

1 Introduction

Friends of the Earth has produced a UK Land Use Calculator. The purpose of the Calculator is to illustrate some of the issues that will affect UK land use over the next 15 years, and to encourage discussion and exploration of these issues. Ultimately such discussion should inform important policy decisions that affect land use in the UK.

This document describes an illustrative land use scenario that we have produced for use with the Calculator. The scenario represents a possible way in which land use could change by 2030. We aim to add a range of alternative scenarios from leading opinion formers.

Our scenario reflects our views on a range of issues affecting land use, and we hope it will be a useful starting point for discussion. We recognise that far more work is needed, and support and encourage the development of comprehensive and detailed models and scenarios to be used to help in making policy decisions.

This document should be read in conjunction with the Calculator Guide document [1], which describes the problem of balancing UK land use, and presents a guide to the Calculator.

The Calculator can be accessed at https://www.foe.co.uk/page/uk-land-use-calculator.

We welcome feedback on this document and on the Calculator. Please send any comments to: info@foe.co.uk

2 Document overview

The overall structure and content of this document is as follows:

- Section 1 - *Introduction*: Introduces the illustrative scenario in the context of the UK Land Use Calculator
- Section 2 - *Document overview*: This section - indicates the overall structure and content of this document
- Section 3 - *Summary of scenario principles:* Identifies principles that have been used in making land use choices for the illustrative scenario
- *Section 5 – Scenario choices:* Describes and explains the choices made for the scenario and identifies the principles applied to individual choices
- *Section 6 - Land use principles for the illustrative scenario:* Describes and explains the scenario principles
- Section 7 - *References*

3 Summary of scenario principles

To make the land use choices for our illustrative scenario, we have applied a number of *scenario principles*. These are based on Friends of the Earth position papers and other documents. The principles encapsulate material from these sources that is specifically relevant to land use.

The scenario principles are as follows:

1. No increase in the UK's overseas land footprint
2. Energy and synthetic material production should not be prioritised over food crops
3. Adopt sustainable diets
4. Eliminate avoidable food waste
5. Replace harmful feed imports with UK alternatives
6. Farming should be sustainable and humane
7. Support wildlife, biodiversity and natural systems regulating the environment
8. Towns and cities should be 'compact' places to live
9. Replace fossil fuels with renewable energy
10. Adapt to climate change

The scenario principles are explained in detail in section 5.

4 Scenario choices

The following tables detail the choices made for Friend's of the Earth's illustrative scenario. For each land use type we choose one of three options (Low/Medium/High). An explanation of each choice is given, and the principles applied in each case are identified. See the Calculator Guide [1] for further details of the options. All land areas are in millions of hectares (MhA).

We apply the overarching principle that there should be *No increase in the UK's overseas land footprint (principle 1).*

4.1 Land Demand

Land Demand Type	Our Choice	Explanation of choice and scenario principle(s) applied
Aviation biofuels	Low 0.0 Mha	**Explanation**: Our illustrative scenario assumes that additional UK land will not be used for aviation biofuels. This avoids competition with food production. **Principle applied:** 2 - Energy and synthetic material production should not be prioritised over food crops
Biomass for energy	Low 0.0 Mha	**Explanation**: Our illustrative scenario assumes that additional UK land will not be used for biomass. This avoids competition with food production. **Principle applied:** 2 - Energy and synthetic material production should not be prioritised over food crops
Woodland	High 3.00 Mha	**Explanation:** Environmental services provided by forests and woodlands are important for both biodiversity and carbon capture. Our illustrative scenario meets the Zero Carbon Britain ambition to double UK woodland cover. See Zero Carbon Britain scenario [2] (page 82). **Principle applied:** 7 - Support wildlife, biodiversity and natural systems regulating the environment
Road transport biofuels	Low 0.0 Mha	**Explanation**: Our illustrative scenario assumes that additional UK land will not be used for road transport biofuels. This avoids competition with food production. P**rinciple applied:** 2 - Energy and synthetic material production should not be prioritised over food crops
Food demand from a growing population	Medium 2.00 Mha	**Explanation:** Predicting population growth accurately is very difficult. We have chosen the mid-point (12% increase by 2030) between forecasts from: • The UK government's Office for National Statistics and... • The International Futures model from the Frederick S. Pardee Center. This is a global integrated assessment model designed to help in thinking strategically and systematically about key global systems. See the Calculator Guide [1] for further details and references. **Principle applied:** N/A

Increased Domestic Food & Animal Feed Production	Medium 0.29 Mha	**Explanation:** Due to the environmentally harmful effects of some animal feed imports, Friends of the Earth advocates replacing part of our imports (primarily soy from South America) with home-grown alternatives. Our illustrative scenario assumes that 50% of soy imports are replaced. **Principle applied:** 5 - Replace harmful feed imports with UK alternatives
Restoration of peatlands	High 1.00 Mha	**Explanation:** Governments around the world recognise the importance of peatlands for tackling climate change, and for water management and biodiversity conservation. Our illustrative scenario adopts the proposal of the IUCN UK Peatland Programme "1 million hectare challenge" to restore peatlands [3]. **Principle applied:** 7 **-** Support wildlife, biodiversity and natural systems regulating the environment.
Unmanaged/conserved land area for wildlife	High 0.60 Mha	**Explanation:** Increasing unmanaged/conserved land area provides important habitats for biodiversity. Our illustrative scenario uses a figure consistent with the Zero Carbon Britain ambition [2] (page 82). **Principle applied:** 7 - Support wildlife, biodiversity and natural systems regulating the environment**.**
Biological feedstocks for plastics and other synthetic materials	Low 0.0 Mha	**Explanation**: Our illustrative scenario assumes that additional UK land will not be used for biological feedstocks for plastics and other synthetic materials. This avoids competition with food production. **Principle applied:** 2 **-** Energy and synthetic material production should not be prioritised over food crops
Residential and infrastructure	Low 0.0 Mha	**Explanation:** Our illustrative scenario assumes that Friends of the Earth's proposal for 'compact cities' is adopted. This brings environmental and other benefits. **Principle applied:** 8 - Towns and cities should be 'compact' places to live.
Organic target for crop farming	High 0.28 Mha	**Explanation:** Friends of the Earth advocates more planet friendly farming, including a higher percentage of organic farming. The Organic Target Bill that was campaigned for by a coalition of NGOs promoted a target that would ensure that 30% of agricultural land would be organic. See article 'Campaign for Organic Targets Bill' [4]. We adopt this target for our illustrative scenario. **Principles applied:** 6 - Farming should be sustainable and humane 7 - Support wildlife, biodiversity and natural systems regulating the environment

Ecological focus areas (EFA)	High 0.25 Mha	**Explanation:** Because of the benefits for farm wildlife, Friends of the Earth supports a political push to increase EFAs to 10% of cropland (see Friends of the Earth Europe briefing [5] (page 4)). This would result in a demand for 0.25 million hectares of additional cropland. Our illustrative scenario uses this figure. **Principle applied:** 7 - Support wildlife, biodiversity and natural systems regulating the environment
Onshore windpower	Low less than 0.01 Mha	**Explanation:** Friends of the Earth believes that it is reasonable to expect 23 GW of installed onshore wind capacity in the UK by 2030. Our illustrative scenario assumes that this will occur, and that 2.5% (Low option) of the land used for a solar park is unavailable for other production (e.g. livestock grazing). In the High option, 100% of the land would be unavailable. However, we believe this is unduly pessimistic. **Principle applied:** 9 - Replace fossil fuels with renewable energy
Water management	High 0.1 Mha	**Explanation:** There is wide agreement that climate change will lead to a demand for more land being used for such purposes. However, little work seems to have been done to estimate the land demand of this. University of Cambridge research [6] (page 20) estimates 0.1 million hectares. We adopt this figure for our illustrative scenario. **Principle applied:** *10* - Adapt to climate change
Biogas	Low 0.0 Mha	**Explanation**: Our illustrative scenario assumes that additional UK land will not be used for biogas. This avoids competition with food production. There are also biodiversity and flooding issues. See Friends of the Earth's blog on biogas concerns [7], and Defra report 'Controlling soil erosion' [8]. **Principles applied:** 2 - Energy and synthetic material production should not be prioritised over food crops 7 - Support wildlife, biodiversity and natural systems regulating the environment
Improved animal welfare	High 0.08 Mha	**Explanation:** Friends of the Earth advocates improvement of the living conditions of livestock that are currently raised in intensive factory farms. Our illustrative scenario assumes that an additional 30% of all livestock will be reared under humane (e.g. free range) conditions. **Principles applied:** 6 - Farming should be sustainable and humane.
Solar power	Low 0.02 Mha	**Explanation:** Friends of the Earth believes that it is now reasonable to expect 60 GW of installed capacity in the UK by 2030. Our illustrative scenario assumes that a substantial amount of this will be on commercial, domestic and industrial roof space, and that only 33% (Low option) of the land used for a solar parks is unavailable for other production (e.g. livestock grazing). In the High option, 100% of the land would be unavailable. However, we believe this is unduly pessimistic. **Principle applied:** 9 - Replace fossil fuels with renewable energy

Saline intrusion	High 0.01 Mha (rounded)	**Explanation:** According to the Committee on Climate Change (CCC), 10,000 hectares of agricultural land are at risk of saline intrusion due to climate change. See CCC report [9] (page 102). Our illustrative scenario assumes that all of this land becomes unviable for conventional agricultural production, and so will need to be replaced. **Principle applied:** 10 - Adapt to climate change
Coastal retreat	High 0.01 Mha (rounded)	**Explanation:** The Committee on Climate Change (CCC) identifies a goal of creating 6,200 hectares of coastal habitat by 2030 through a process of managed realignment involving breaching or removing some flood and erosion defences. See CCC report [9] (page 93); the report notes that this could be achieved without losing a single property. Our illustrative scenario assumes that the above goal is adopted. **Principle applied:** 10 - Adapt to climate change

4.2 Land Supply

Land Supply Type	Our Choice	Explanation of choice and scenario principle(s) applied
Sustainable diets	Medium 3.64 Mha	**Explanation:** A change towards healthier diets lower in meat and dairy product content has a huge potential to free up land in the UK. Our illustrative scenario assumes a 30% reduction (Medium alternative) in meat and dairy production. We think that the High alternative (80% reduction) is unlikely to be feasible in the UK by 2030. **Principle applied:** 3 - Adopt sustainable diets
Livestock yield increases	Low 1.38 Mha	**Explanation:** Friends of the Earth believes that factory farming has serious drawbacks, as outlined in section 5.6. Our illustrative scenario therefore assumes that there will be no further increase in factory farming. Under this assumption, land supply from increasing livestock yield is lower than if factory farming continued to increase. **Principle applied:** 6 - Farming should be sustainable and humane
Food waste reduction	High 2.25 Mha	**Explanation:** Our illustrative scenario assumes that all avoidable food waste is eliminated in the UK. This frees up a large amount of land (because if food is not wasted, land is not needed to produce replacement food). **Principle applied:** 4 - Eliminate avoidable food waste
Crop yields	Low 0.0 Mha	**Explanation:** For our illustrative scenario, we assume that previous year-on-year increase in crop yields in the UK will not continue, due to the impact of factors including climate change and air pollution. Under this assumption, there is no land supply from increasing crop yield. See the Calculator Guide [1] for details. **Principle applied:** N/A
Golf courses & horse pastures	Medium 0.25 Mha	**Explanation:** It can be argued that some land currently used for golf courses & horse pastures should be used for more essential purposes. Our illustrative scenario assumes that 25% of the land is converted for other use. **Principle applied:** N/A **-** Friends of the Earth does not have a position on this. Alternative sources of land could be identified if required.

5 Land use principles for the illustrative scenario

This section describes principles that have been used to make the land use choices for our illustrative scenario. The principles are based on Friends of the Earth position papers and other documents published by ourselves and others. The principles focus on material from these sources that is specifically relevant to land use.

For each principle, the following are given:

- Statement of the principle
- Explanation, including relevant background and rationale
- Other references and relevant extracts

5.1 No increase in the UK's overseas land footprint

Principle

There should be no increase in the UK's overseas land footprint in the period to 2030.

Explanation

This is an overarching principle underpinning all of the choices for our scenario.

Many of the products consumed in the UK (e.g. paper, food, cars, electrical goods, steel) are produced elsewhere. Much of the land used in production is therefore outside the UK. Such land is referred to as *imported land*. With 80 million hectares of imported land, the UK is the second highest land importer in Europe, after Germany.

There are a number of risks associated with this, including:

- Economic risk: An increasingly populated world means land is more valuable – the more we are reliant on other countries' land the greater the risk from price increases or volatility
- Environmental risk: The UK is already disproportionately responsible for the constant pressure on habitats and ecosystems that comes with our ever greater use of land
- Social risk: More pressure on land means more chance of communities being forced off their land. See European Parliament briefing [10] (section 3) regarding related concerns over large-scale acquisitions of land in the developing world.

See the Calculator Guide [1] for further details.

Other references and relevant extracts

- Friends of the Earth Europe - Europe's land import dependency [11]:
  - "It will not be possible for people around the world to have a fair share of the world's land resources, without a considerable reduction in Europe's land footprint"
  - "Europe's land footprint also has major economic impacts. Products that require land are likely to see this portion of their production cost increase – as is already visible in price increases for basic foods. The increased need for land is driving land grabbing, which will also have impacts on the cost of Europe's land imports, not to mention massive economic, social and environmental impacts in affected countries"
- Arnold Tukker and others - The Global Resource Footprint of Nations [12] (page 71):
  - UK per capita footprint relative to world average: 1.7

5.2 Energy and synthetic material production should not be prioritised over food crops

Principle

Land should not be used to grow feedstocks for energy or for plastics and other synthetic materials if this would be detrimental to the needs of food crops grown to eat.

Explanation

Non-fossil energy derived from biological sources can be provided in a number of different forms, including biomass, biogas and biofuels (for both road transport and aviation). In addition, plastics and other synthetic materials can be produced from biological materials without the use for fossil based inputs.

This can have advantages, for example in dealing with climate change and pollution. However, it should not be to the detriment of crops grown for people to eat. Where possible, alternatives should be found that do not place heavy demands on agricultural land.

Other references and relevant extracts

- Friends of the Earth's position paper on feeding the world [13]:
  - "Limit bioenergy crops – these shouldn't get priority over crops grown to eat"
- Friends of the Earth's position paper on bioenergy [14]:
  - "Growing crop-based biofuels can push food production out to previously uncultivated areas, such as forests, and increase carbon emissions. We should introduce penalties for cultivation of biofuel that harms the environment."
- Friends of the Earth Europe and others, "Driving to destruction" [15]:
  - "National plans for energy and transport show Europe is set to increase significantly biofuel use. By 2020, biofuels will provide 9.5% of total energy in transport; 92% of these fuels will come from food crops (such as oil seeds, palm oil, sugar cane, sugar beet, wheat)."
  - "This will require an expansion of cultivated agricultural land globally, converting forests, grasslands and peat lands into crop fields. Up to 69 000 km^2 will be affected – an area over twice the size of Belgium."
  - "Total net GHG emissions from biofuels could be as much as 56 million tonnes of extra CO^2 per year, the equivalent of an extra 12 to 26 million cars on Europe's roads by 2020. This means that instead of being 35 to 50% less polluting than fossil fuels (as required by the Renewable Energy Directive (RED)), once land use impacts are included, the extra biofuels that will come to the EU market will be on average 81% to 167% worse for the climate than fossil fuels."
- Institute for European Environmental Policy (IEEP) - report on expanded use of biofuels and bioliquids in the EU [16]:
  - "The expansion in the area of cultivation leads to land use change, which is associated with significant GHG emissions as a consequence of the release of carbon locked up in soils and biomass. Moreover the expansion in cultivated area and more intensive use of agricultural land can pose a potentially significant threat to biodiversity globally."
- J.A Colwill and others writing in the International Journal of Sustainable Engineering [17]

- "In terms of the BDP [bio-derived plastics] industry, continued emphasis should be placed on the exploration and development of alternative feed stocks for plastics, which do not compete with food production, for example, algae and waste. In addition, improvements in resource efficiency, achieved through the development of efficient recycling processes, innovative design and changed consumer behaviour, will continue to be essential for sustainable development."

5.3 Adopt sustainable diets

Principle

Adopt healthier diets with lower environmental impact.

Explanation

A typical diet in the UK is high in meat and dairy products, as well as sugar, fats and salt. Such a diet causes illness, including heart disease, diabetes and obesity. Dietary demands have resulted in intensive meat and dairy production that pollutes, is wasteful, uses massive amounts of water and contributes towards climate change (See our position paper on Sustainable Diets [18]).

Such a change towards diets lower in meat and dairy product content has a huge potential to free up land in the UK. This is because livestock requires, very approximately, 10 times as much land as arable crops to produce protein for human consumption. See University of Cambridge report [6] (page 21), which also notes that a reduction in meat and dairy consumption is in line with the UK Government's healthy eating advice.

Other references and relevant extracts

- Friends of the Earth's position paper: Sustainable Diets [18]:
  - "We need to embrace healthier and sustainable diets, and cut global meat consumption by half by 2050."
  - "Producing meat and dairy to eat has an enormous environmental impact – at least 14.5 per cent of global greenhouse gas emissions come from livestock production alone"

5.4 Eliminate avoidable food waste

Principle

Food waste should be eliminated wherever possible.

Explanation

Food waste increases pressure on farming systems. When combined with unsustainable farming practices, it is associated with climate change and other environmental degradation.

Other references and relevant extracts

- WRAP - Estimates of Food and Packaging Waste in the UK Grocery Retail and Hospitality Supply Chains [19]:
  - "Three major WRAP studies carried out in 2013 estimated annual food waste arisings within UK households, hospitality and food service, food manufacture, retail and wholesale sectors at around 12 million tonnes, 75% of which could have been

avoided. This had a value of over £19 billion a year, and was associated with at least 20 million tonnes of greenhouse gas (GHG) emissions. Around 90% (by weight) of the avoidable food waste arises in households and food manufacture, although waste arising in one part of the supply chain is certainly influenced by other parts of the chain."

- Friends of the Earth's position paper on feeding the world [13]:
    - "Nature can provide us with all the food we need, but we're damaging its ability to do so by changing the climate, degrading soil, reducing biodiversity and over-using water. To make sure everyone has enough food, we need to waste less, eat less meat and farm in ways more sympathetic to the environment."

5.5 Replace harmful feed imports with UK alternatives

Principle

Replace animal feed imports produced in an environmentally harmful way with sustainable UK alternatives.

Explanation

Due to the environmentally harmful effects of some animal feed imports, Friends of the Earth advocates replacing part of our imports (primarily soy from South America) with home-grown alternatives.

Here we assume that 50% of soy imports are replaced. According to calculations for Friends of the Earth, replacing 50% of soy animal feed imports with a range of UK grown crops would require 285,000 hectares. See Friends of the Earth briefing 'Pastures New - A Sustainable Future for Meat and Dairy Farming' [20] (page 10)

Other references and relevant extracts

- Pastures New - A Sustainable Future for Meat and Dairy Farming [20]:
    - "Livestock farming is one of the most significant contributors to global environmental damage – yet in the UK we are doing little about it.
      Central to the problem is our reliance on imported soy for animal feeds. This comes mostly from South America, where rainforests and grasslands are being ripped up to make way for soy plantations or for beef ranching which has been displaced by soy plantations."

5.6 Farming should be sustainable and humane

Principle

Farming must be sustainable in the long term. It must not damage wildlife, natural systems or put our health at risk, and must treat livestock humanely.

Explanation

Intensive use of crop fertilisers and pesticides can damage wildlife, biodiversity and natural systems.

Drawbacks of intensive livestock farming include:

- Use of antibiotics and pesticides to mitigate the spread of disease exacerbated by crowded living conditions for livestock. The large amount of antibiotics used in factory farming is a significant cause of the resistance of many common pathogens to the antibiotics used to treat infections in humans [21] [22].
- The crowded living livestock conditions of intensive factory farming also exacerbate the dangers of manure pollution of the environment [22] [23].

  See the Calculator Guide [1] for further details.

Other references and relevant extracts

- Friends of the Earth's position paper on feeding the world [13]:
  - **"**Use ecological farming practices – Farming should be rich in diversity, protect soils, manage water sustainably and use natural fertiliser and pest control before chemical solutions. Farms must treat livestock humanely – intensive meat production is cruel and relies on using antibiotics that endanger our health."
- Friends of the Earth's position paper on sustainable diets [18]
  - [The food industry should] "Promote food products which have a lower environmental impact, such as organic, beyond niche markets."
  - [The food industry should] "Support farmers who produce grass-fed or waste-fed meat and dairy products - By using and promoting high-quality produce from farms that protect the environment and animals' welfare, the food industry can encourage better farming practices.
- Johns Hopkins Bloomberg School of Public Health report on Industrial Farm Animal Production in America [23] (page 9):
  - "Both animals and their waste are concentrated and usually exceed the capacity of the land to produce feed or absorb the waste. Consequently, the rapid ascendance of IFAP [factory farming] has produced an expanding array of deleterious environmental effects on local and regional water, air, and soil resources"
- Friends of the Earth Europe briefing: Green farming for Europe: Is the European Parliament losing the plot? [5]
  - "as a minimum, mandatory greening with strong measures including crop rotation with leguminous crops, ecological focus areas covering 10% of the land on all farms, and an immediate end to the ploughing-up of natural grasslands and pastures"

5.7 Support wildlife, biodiversity and natural systems regulating the environment

Principle

Land should be used in a way that supports wildlife, biodiversity and natural systems.

Explanation

A healthy natural world underpins our economy, is necessary for our wellbeing, and should be valued in its own right. Natural systems such as woodlands and peatlands play an important role in capturing carbon which is important for tackling climate change.

Other references and relevant extracts

- Friends of the Earth's position paper on nature [24]:
  - "**Nature provides us with many vital services.** It regulates processes such as erosion, flooding, and climate. It underpins photosynthesis and the formation of soil that we rely on for food production. We can put monetary value on some of the ways nature provides for us, such as pollination of food crops, but other cultural, aesthetic, psychological and spiritual benefits are incalculable."
  - "**Protect wildlife** – It is crucial we protect areas that are rich in wildlife in the UK and overseas from further development and damaging activities. This requires strong laws at national, EU and international level, together with a commitment to enforcing them."
  - "**Enhance nature in farming and fishing** – Our food production methods and pest management systems must change to be more innovative, diverse and respectful of natural systems. Landscapes destroyed by intensive farming must be restored to boost declining populations of species such as bees and butterflies and to facilitate migration."
  - "**Value nature's worth** – We must start to value nature for all its benefits, recognise its worth in its own right, and reflect this in our decision-making. Economists have a role but must accept that nature's value is more fundamental and complex than purely monetary calculations allow for."
- Rewilding Britain – Proposal to Make Britain a Wilder Place [25]:
  - "Within our long-term vision, by 2030 Rewilding Britain's Goal is:

    300,000 hectares of core land areas and three marine areas established where nature is starting to take care of itself and key species are starting to be re-established. These areas will be: i) ecologically connected into a more wildlife-permeable landscape; ii) supported by an engaged, enthused and educated public."

5.8 Towns and cities should be 'compact' places to live

Principle

Towns and cities should be 'compact' places to live, with walking, cycling and public transport prioritised. See Friends of the Earth's position paper on housing [26].

Explanation

Compact housing is necessary for addressing climate change. If well designed, they can:

- Be more resource efficient
- Help build communities and social inclusion
- Include thriving biodiversity
- Enable wellbeing

Other references and relevant extracts

- Friends of the Earth's briefing on housing [27] (pages 3 and 4):
  - "at least over the next 10-15 years, the vast majority of new homes should be within existing towns and cities, but to high design standard ... not shoddy urban cramming."
  - "It is essential that we avoid urban sprawl to accommodate a rising population as this would lock-in higher carbon emissions. Compact cities and towns designed for walking, cycling and public transport, with easy access to amenities, services and jobs are internationally recognised as necessary for addressing climate change. They can also be more liveable. Cities and towns designed for sharing of resources such as books, bikes, green spaces, tools, meeting places, food growing, etc. are more resource efficient, help build communities and are better for social inclusion. Accessible and nearby quality green spaces, allotments and streets designed for playing, relaxation and thriving biodiversity are critical for wellbeing. Higher density locations work better with reduced car ownership, and people will choose to be car-free if there is quality and affordable public transport, quality cycling and walking routes, and accessible car clubs for when a car is needed."
  - "A detailed report by the former Commission for Architecture and the Built Environment (CABE) showcases numerous case studies from around Europe of where high density housing works, at densities that are significantly higher than is the norm in the UK"

5.9 Replace fossil fuels with renewable energy

Principle

Energy should be produced from renewable sources, replacing fossil fuel energy.

Explanation

Fossil fuel emissions are the primary cause of damaging climate change.

References and key quotes:

- Friends of the Earth renewable energy web page [28]:
  - "A 100% renewable future is possible, and it should be a goal for all Governments. The exact mix of renewables will vary from country to country, but renewable energy is vital in order to avoid catastrophic climate change.

    Here in the UK, we are lucky to have colossal renewable energy resources from wind, wave and sun. Other sources such as tidal energy, hydro and geothermal also have huge potential."

5.10 Adapt to climate change

Principle

Measures must be taken to limit the impact of climate change.

Explanation

We need to adapt to the effects of climate change, for example by:

- Increasing wetlands and reservoirs (fresh water management)
- Managing coastal land in a in a way that helps adaptation to rising sea levels
- Recognising that some coastal land will become unviable for conventional agriculture due to the movement of saline water into freshwater aquifers, and planning accordingly

References and key quotes

- Friends of the Earth's position paper on climate change adaptation [29]:
    - "Climate change is causing more flooding, typhoons and heat waves. This damages lives and food production, and hits the poorest people in the UK and overseas the hardest. To limit the impact we must adapt. By funding climate change adaptation, the Government can protect vulnerable communities and nature."

6 References

[1] Friends of the Earth, “Balancing UK Land Use - A Guide to Friends of the Earth’s UK Land Calculator,” April 2016. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/uk-land-use-calculator-guide-99953.pdf. [Accessed 10 April 2016].

[2] Zero Carbon Britain, “Rethinking the Future,” 2014. [Online]. Available: http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf. [Accessed 12 August 2015].

[3] IUCN UK Peatland Programme, “Pilot UK Peatland Code,” 2013. [Online]. Available: http://www.iucn-uk-peatlandprogramme.org/peatland-gateway/uk/peatland-code. [Accessed 13 August 2015].

[4] Pesticide Action Network International, “Campaign for Organic Targets Bill,” 1999. [Online]. Available: http://www.pan-uk.org/pestnews/Issue/pn46/pn46p11a.htm. [Accessed 18 July 2015].

[5] Friends of the Earth Europe, “Green farming for Europe: Is the European Parliament losing the plot?,” 2013. [Online]. Available: https://www.foeeurope.org/sites/default/files/press_releases/foee_briefing_losing_the_plot_jan2013_0.pdf. [Accessed 19 August 2015].

[6] University of Cambridge, Institute for Sustainability Leadership, “The best use of agricultural land,” 2014. [Online]. Available: http://www.cisl.cam.ac.uk/business-action/natural-resource-security/natural-capital-leaders-platform/news/best-use-agricultural-land. [Accessed 12 August 2015].

[7] Friends of the Earth, “Biogas concerns: more than hot air?,” May 2014. [Online]. Available: https://www.foe.co.uk/blog/biogas-concerns-more-hot-air. [Accessed 30 March 2016].

[8] DEFRA, “Controlling soil erosion,” September 2005. [Online]. Available: http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/environment/quality/land/soil/documents/soilerosion-lowlandmanual.pdf. [Accessed 30 March 2016].

[9] Committee on Climate Change, “Managing the land in a changing climate,” 2013. [Online]. Available: http://www.theccc.org.uk/wp-content/uploads/2013/07/ASC-2013-Book-singles_2.pdf. [Accessed 9 April 2016].

[10] European Parliament, “An Assessment of the Effects of Land Ownership and Land Grab on Development - With a Particular Focus on Small Holdings and Rural Areas,” 2011. [Online]. Available: http://ecologic.eu/sites/files/project/2013/lot5_13_land_grabbing_en.pdf. [Accessed 23 December 2015].

[11] Friends of the Earth Europe, “Europe’s land import dependency,” October 2011. [Online]. Available: http://www.foeeurope.org/sites/default/files/resource_use/2015/5_-

_briefing_europe_global_land_demand_7_october.pdf. [Accessed 7 April 2016].

[12] A.Tukker and others, “The Global Resource Footprint of Nations,” Netherlands Organisation for Applied Scientific Research, 2014. [Online]. Available: http://exiobase.eu/index.php/publications/creea-booklet/72-creea-booklet-high-resolution. [Accessed 23 December 2015].

[13] Friends of the Earth, “Position paper: Feeding the world,” April 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-feeding-world-76595.pdf. [Accessed 8 April 2016].

[14] Friends of the Earth, “Position Paper on Bioenergy,” May 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-bioenergy-79907.pdf. [Accessed 30 March 2016].

[15] Joint Report, “Driving to Destruction,” [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/driving_to_destruction.pdf. [Accessed 30 March 2016].

[16] IEEP, “Anticipated Indirect Land Use Change Associated with Expanded Use,” March 2011. [Online]. Available: http://www.ieep.eu/assets/786/Analysis_of_ILUC_Based_on_the_National_Renewable_Energy_Action_Plans.pdf. [Accessed 30 March 2016].

[17] J. A. Colwill and others, “Bio-plastics in the context of competing demands on agricultural land in 2050,” International Journal of Sustainable Engineering, 2011. [Online]. Available: http://www.tandfonline.com/doi/abs/10.1080/19397038.2011.602439. [Accessed 6 April 2016].

[18] Friends of the Earth, “Position paper: Sustainable diets,” April 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-sustainable-diets-76594.pdf. [Accessed 6 April 2016].

[19] WRAP, “Estimates of Food and Packaging Waste in the UK Grocery Retail and Hospitality Supply Chains,” 2015. [Online]. Available: http://www.wrap.org.uk/content/uk-handy-waste-facts-and-figures-retail-sector. [Accessed 9 April 2016].

[20] Friends of the Earth, “Patures New - A Sustainable Future for Meat and Dairy Farming,” 2010. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/pastures_new.pdf. [Accessed 10 April 2016].

[21] “The Poultry Site,” 24 September 2010. [Online]. Available: http://www.thepoultrysite.com/poultrynews/20967/conference-hears-of-antibioticresistant-superbugs/. [Accessed 2015 November 18].

[22] Friends of the Earth, “Factory farming’s hidden impacts,” October 2010. [Online]. Available: http://www.foe.co.uk/sites/default/files/downloads/factory_farming.pdf. [Accessed 18 November 2015].

[23] Johns Hopkins Bloomberg School of Public Health, “Environmental Impact of Industrial Farm Animal Production,” Pew Commission on Industrial Farm Animal Production, [Online]. Available: http://www.ncifap.org/_images/PCIFAPSmry.pdf.

[24] Friends of the Earth, “Position Paper: Nature,” November 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-nature-91977.pdf. [Accessed 8 April 2015].

[25] Rewilding Britain, “Proposal to Make Britain a Wilder Place,” [Online]. Available: http://www.rewildingbritain.org.uk/assets/uploads/files/publications/Vision%20for%20Rewilding%20Britain%20-%20Aug%202014.pdf. [Accessed 11 April 2016].

[26] Friends of the Earth, “Position Paper: Housing,” January 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-paper-housing-75190.pdf. [Accessed 9 April 2016].

[27] Friends of the Earth, “Briefing: An environmental and socially just agenda for housing,” October 2014. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/environmental-socially-just-agenda-housing-48776.pdf. [Accessed 9 April 2016].

[28] Friends of the Earth, “Renewable energy,” [Online]. Available: https://www.foe.co.uk/page/renewable-energy. [Accessed 9 April 2016].

[29] Friends of the Earth, “Position Paper: Climate change adaptation,” May 2015. [Online]. Available: https://www.foe.co.uk/sites/default/files/downloads/policy-position-climate-change-adaptation-82393.pdf. [Accessed 9 April 2016].