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CC: Richard Plant, Defra.

Dear Sir

Natural England Response to the Airports Commission Aviation and Climate Change Discussion Paper.

Natural England welcomes the opportunity to provide the Airports Commission with comments and evidence on its Aviation and Climate Change discussion paper.

As the Government's advisor on the natural environment, our purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

Climate change caused by greenhouse gas emissions, including from the aviation industry, is having direct impacts on the natural environment. These impacts are already being observed through changes in wildlife and habitats, the landscapes we enjoy and the ecosystem services they provide, including flood risk management, water and air quality regulation and local climate regulation. These are services on which airports depend for their efficient operation. Any change in these services, as a result of climate change, pose threats as well as present potential opportunities for airports.

Our response focuses on the main climate risks and adaptation challenges that the Commission needs to consider. It recommends that when making its assessment of the UK's overall aviation capacity and connectivity need and in considering site specific options to meet those needs, the Commission should consider:

- aviation's role in exacerbating the local effects of climate change on the natural environment, particularly where biodiversity and landscape is most vulnerable to climate change;
- those impacts arising from climate change, such as flood risk, coastal change, water supply and changes to biodiversity and landscape, that could significantly affect the operational viability of airports;
- the adoption of an ecosystems approach when appraising site specific options for aviation capacity enhancement so that the interactions between climate change, the aviation sector and the natural environment can be explored as part of any appraisal;
- the potential for airport climate change adaptation plans to give greater consideration to green infrastructure and ecosystem services-based adaptation measures;

In preparing this response we have had discussions with the Environment Agency to ensure that we provide you with consistent messages on the environment.

Our detailed response is attached in the annex to this letter. If you have further questions regarding our response to this consultation, please contact Clare Warburton, Senior Environmental Specialist on 07917 643593 or at clare.warburton@naturalengland.org.uk.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Rob Cooke', written in a cursive style.

Rob Cooke
Director, Land Use

Annex

Climate Change, Aviation and the Natural Environment

Background

1. Natural England has already provided suggestions to the Airports Commission for the development of sifting criteria. We will also be providing a response on the short and medium term measures and the long term measures.

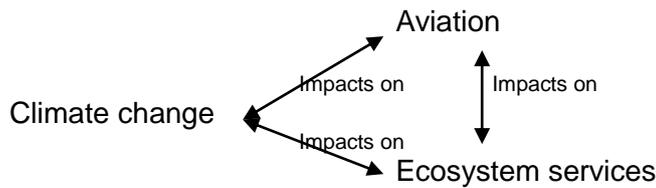
Introduction

2. As discussed in the Commission's paper, aviation contributes significantly to global climate change, *'with UK domestic and international aviation being responsible for around 6% of national Greenhouse Gas emissions, and whilst this is currently smaller than for road transport, it is likely to make up an increasing proportion of total emissions over time'*.
3. Whilst the issues of GHG emissions are covered in detail within the Commission's paper, aviation's role in exacerbating the local effects of climate change on the natural environment, is not explored. We consider that suitable approaches are needed to address these more localised effects. In this response we discuss how consideration of location specific issues in relation to airport development, as well as ecosystem services-based adaptation plans at airports, can both play a part in addressing the more localised effects of climate change.
4. Our response to specific questions raised by the consultation focuses on the climate risks and adaptation challenges that the Commission will need to consider. However we would emphasise that a reduction in emissions from the aviation sector is crucial, as adaptation measures are only able to deal with locked in climate change.

Detailed Response

What do you consider to be the main climate risks and adaptation challenges that the Commission will need to consider a) in making its assessment of the UK's overall aviation capacity and connectivity needs:

5. It is essential to have a picture of the UK-wide climate risks and adaptation challenges when assessing the UK's overall aviation capacity and connectivity needs because of the potentially significant effects that climate change could have on the operations of airports, and the exacerbating effects that aviation can have on the local effects of climate change on the natural environment. In gaining this UK-wide picture we consider it is important to take an Ecosystem Approach, considering the full range of ecosystem services a healthy natural environment provides to people, and the complex interactions between climate change and the provision of these services and the aviation sector.
6. The relationship between climate change, ecosystem services and aviation is summarised below:



7. Ecosystem services can be defined as the outputs from ecosystems from which human's derive benefits (UKNEA, 2011)¹. There are recognised to be four categories of ecosystem services: provisioning services, regulating services, cultural services, and supporting services. Regulating ecosystem services such as water quality, air quality, flood risk and climate regulation, and provisioning ecosystem services such as supply of water will be particularly important in the context of aviation operations. Climate change caused by greenhouse gas emissions, including from the aviation industry, will affect the functioning of these key ecosystem services which could have direct or indirect effects on aviation operations. Some effects are specific to a particular habitat or ecosystem, other effects are more generic and will be felt across a range of habitat types or ecosystems.
8. It is clear from recent reports produced by Natural England ^{2a} and Living With Environmental Change (LWEC) Partnership ^{2b} that there is strong evidence that climate change is already affecting UK biodiversity. Natural England's research reports that *'wetland, montane and coastal systems appear particularly vulnerable (to climate change) in the short term'*, and suggests that *'that climate risks will not be spread evenly across the country; there are likely to be 'hotspots' in which a number of important natural features, ecosystems and services are likely to be affected by multiple direct and indirect interacting threats. It might be necessary to focus particular attention on these and similarly vulnerable places'*.
9. Impacts from airports located in these areas may exacerbate localised climate change effects and contribute further to adverse effects on habitats and ecosystems. It could also mean that airports in these locations are more susceptible to changes in key ecosystem services such as air quality regulation, water supply, flood risk management, climate regulation, and water quality.
10. The spatial nature of the risks that climate change poses are in the process of being assessed and will inform the guidance and advice provided by Natural England ^{3a}. We are developing a climate change vulnerability model that will help to assess the vulnerability of biodiversity to climate change ^{3b}.
11. Natural England is also developing a set of aviation sensitivity maps for 33 major airports (see our submission on short and medium term measures for further information). The sensitivity maps are designed to function as a high level strategic planning tool that can be used to identify nationally and internationally designated nature conservation sites and protected landscapes that are likely to have the highest levels of sensitivity to aviation impacts.
12. These tools could help inform the Airports Commission on those locations that are most vulnerable to climate change and where further exacerbating impacts on biodiversity need to be avoided.

What do you consider to be the main climate risks and adaptation challenges that the Commission will need to consider b) in considering site specific options to meet those needs?

Ecosystems Approach

13. In our response on sifting criteria we suggested that the criteria take account of ecosystem services. The Treasury's Green Book Supplementary Guidance 'Accounting for Environmental Impacts' ^{4a} advises that the UK National Ecosystem Assessment (NEA) has provided a robust case for accounting for the environment in decision making. It recommends that the starting point when designing policies should be to identify the full range of effects on the environment/ecosystem services, so that these can be taken into account when comparing different options. By taking this approach it would be possible to factor in the effects of climate change and aviation operations and the resulting effects on ecosystem services at individual airports.
14. Government's Webtag transport appraisal process provides a method for options testing transport policies and projects, looking at economic, social and environmental impacts. It provides a basis for appraising new airport capacity options and a Webtag appraisal of each potential option could be undertaken to inform the Airports Commission's final report once specific proposals have been identified. However Webtag does not currently include an appraisal of ecosystems services, and we would expect any longer term options on airport capacity to incorporate more rigorous approaches to ecosystem services than are currently set out in Webtag ^{4b}.

Climate risks and adaptation challenges in considering site specific options

15. All airports, whether expanding or not, need to consider how to adapt to climate change. Impacts arising from climate change, such as flood risk, coastal change, water supply and changes to biodiversity and landscape, could significantly affect the operational viability of airports.
16. Airports also need to consider how to avoid impacts on other sectors trying to adapt to climate change, such as the natural environment. Expansion at existing airports or the development of new airports could significantly affect biodiversity, landscape, flood risk and coastal change and exacerbate the effects of climate change.
17. The risks associated with climate change will vary depending on location of the airport. UK airports that are located near the coast may be vulnerable to sea level rise. Others may be susceptible to flooding occurring as a result of increased rainfall. Conversely airports may constrain the ability of other sectors to adapt to the effects of climate change e.g. sea level rise and increased flood risk. Assessments at individual airports will be important to assess their vulnerability and/or contribution to these potentially significant effects.
18. The following issues in relation to climate change and ecosystems and will need to be considered for each site specific airport option:

Increased frequency of extreme weather events

19. More severe cold weather in the winter is likely to lead to increases in the use of de-icer. Balancing ponds may not be designed to deal with such large quantities of chemicals from de-icing fluids and this can lead to polluted water being discharged to local rivers. The cold winters of 2009/10 and 2010/11 produced large volumes of de-icer contaminated surface water run-off, exceeding the storage / treatment capacity available at Gatwick Airport (Gatwick Airport Master Plan 2012 ⁵)
20. The chemicals used in de-icers and anti-freeze, such as glycol, have a serious effect on the environment ⁶. In 2010 Heathrow Airport was fined £13,000, ordered to pay court costs of £15,000 and compensation of £195,000 to a local lake owner. This was due to the release of glycol, causing a large number of fish deaths, relocation of others and loss of business ⁷

Increased Rainfall and Flood Risk

21. More frequent and severe weather events are predicted to occur as a result of climate change. Increases in average annual rainfall or the size of peak rainfall events at many locations will mean that flood risk management will be a key issue for major airports to address and may affect the sizing and design of stormwater detention facilities and lead changes to maintenance programs, with potential effects on bird activity and safeguarding. ⁸. Airports often have large areas of hard standing that can contribute to local flooding downstream of storm discharges.
22. Increasing flood risk is likely to raise the importance of wetlands as a natural defence from flooding. If airport safeguarding measures were to prevent the creation, restoration or management of wetlands because of bird hazard issues, this could represent a barrier to climate change adaptation for the natural environment and other sectors dependent on flood risk management.

Increased Temperatures/Heat Waves

23. As temperatures rise and populations increase, many towns and cities anticipate that air quality in some locations will exceed the air quality standards, or that the frequency and duration of such exceedances will increase.
24. Aircraft emit a wide variety of pollutants including oxides of nitrogen (NO_x), volatile organic compounds (VOCs), heavy metals, particulates and ammonia. Pollution can arise not only from aircraft but from associated vehicle movements at the airport (passenger-related vehicle trips, maintenance vehicles, fuel tankers) and from road traffic to and from the airport (traffic associated with air passengers and airport employees). Airport expansion may be accompanied by significant new road development or increased traffic on existing roads, and this may act as a greater source than the emissions from the on-site activities.
25. Air dispersion modelling ⁹ for a number of airports in England suggested that they may contribute an additional 2.9 - 20 ug/m³ of nitrogen dioxide (nb. the NO₂ contributions from airport-related sources, such as car parks, access roads, and the local road network are not included in these data, so the contributions are likely to be much higher). Elevated concentrations of NO_x are toxic to vegetation. Emissions of NO_x and the secondary compounds formed from these also contribute to nitrogen deposition, which can harm sensitive habitats through nutrient enrichment and acidification. Critical loads for acidity and the fertilising effects of atmospheric

nitrogen are already exceeded in 54% and 75% of the area of sensitive UK natural and semi-natural habitats, respectively ¹⁰ .

26. Higher temperatures have already resulted in changes to wildlife activity and species found at airports and surrounding areas. Luton Airport's Climate Change Adaptation Report 2011¹¹ identifies that higher numbers of migrating birds were observed in October 2010 and links this to optimum conditions for insects and changing migration patterns for birds and other wildlife. With these changes come potentially higher costs arising from bird hazard management activities, as well as impacts on wildlife trying to adapt.
27. Higher average temperatures could affect material specifications, require longer runway lengths or reduced take-off weights due to compromised aircraft performance. Some terminals currently experience raised internal temperatures during peak summer and predicted temperature increases is leading to concerns that existing terminal building infrastructure may not be able to withstand peaks in increased temperatures (Luton Airport 2011 ¹¹). The Urban heat island effect describes the increased temperature of urban air compared to its rural surroundings. As temperatures increase the UHI effect is likely to become more pronounced and airports will contribute to this effect.
28. Ecosystem services can potentially be used to manage some of these risks and the following section explores this further.

Using Ecosystem Services to Manage Climate Change Risk at Airports

29. Green infrastructure that enhances the delivery of ecosystem services and provides multi functional solutions to climate change adaptation and mitigation can be used to manage some of the above risks e.g. reducing air pollution, reducing storm water runoff and reducing the urban heat island effect.
30. Airports have recently produced Climate Change Adaptation Reports to assess the risks and identify priority actions for adaptation. From our analysis of these documents we note that there is a focus on hard engineering solutions. The importance of using green infrastructure in adapting to climate change is recognised in the National Planning Policy Framework (NPPF), paragraph 99: *'New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure'* and we would like to see greater inclusion of this as the approach in the discussion paper.
31. Natural England has recently undertaken a critical review of literature about the environmental and economic benefits of investment in Green Infrastructure (GI)¹². It focuses on GI interventions and is structured using the Ecosystem Approach. It provides a critical review of the use of GI for flood control (freshwater), flood risk management at the coast, water purification and treatment, local climate regulation (including the urban heat island effect), air-quality and noise reduction and its conclusions could be usefully applied at airports.
32. Greenroofs are an example of a GI intervention that has been implemented at many European Airports. Natural England's report on greenroofs (2003) ¹³ identifies that they have a range of environmental benefits such as:

- Absorption of air pollution and dust
 - Attenuation of storm water runoff
 - Reduction in the urban heat island effect
 - Provision of wildlife habitat
 - Health benefits
 - Protecting building fabric from sunlight and temperature fluctuations
 - Reducing costs including drainage, heating and cooling
 - Reducing airport noise
 - Providing a visual feature of interest
33. Within Germany there are airport greenroofs at Stuttgart, München, Bremen and Düsseldorf. France has green roofs at Charles de Gaulle in Paris, Paris' Orly International Airport and Bordeaux Airport. The Schiphol airport in Amsterdam has greenroofs totalling 13,730 m².
34. Germany and Europe's largest airport, Frankfurt International (FRA) has installed green roofs on the two terminal buildings, the tower office building, maintenance, cargo and other office buildings. The total estimated greenroof space is 40,000m². FRA does not scare birds but relies on biotope management, which focuses on designing the airport grounds in such a way that birds are not attracted in the first place. The bird strike count at FRA averages 3 to 5 per 10,000 aircraft movements and is at the top in terms of international comparison, equal to the annual strikes at Schiphol International Airport. Management techniques include developing part of the area as heath because it works well in minimising the bird strike danger. ¹⁴
35. In some parts of the UK there are issues with birds, especially gulls, nesting on flat roofs ¹⁵ and further research may be needed on the use of green roofs as nesting sites. However if green roofs are successful in reducing the roof run-off at airports (via transpiration and respiration by roof vegetation), then there could potentially be less demand for stormwater detention facilities, balancing ponds and ditches that are attractive to birds.
36. All GI measures at airports would need to consider bird-strike hazard, and to this end we would encourage early dialogue between airports and conservation bodies to maximise the potential benefits and minimise risk through appropriate planning and management techniques.

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2. 2a Natural England. 2012. *Natural England's climate change risk assessment and adaptation plan*. Natural England General Publication, Number 318. <http://publications.naturalengland.org.uk/publication/216300>
2b The Terrestrial Biodiversity Climate Change Impacts Report Card: <http://www.lwec.org.uk/resources/report-cards/biodiversity>
3. 3a The NCA Climate Change Adaptation Reports (the phase 2 reports are in the process of being published): <http://www.naturalengland.org.uk/ourwork/climateandenergy/climatechange/adaptation/naturalengland.aspx>

- 3b The Natural England National Biodiversity Climate Change Vulnerability Model:
<http://www.naturalengland.org.uk/ourwork/climateandenergy/climatechange/vulnerability/nationalvulnerabilityassessment.aspx>
4. 4a The Treasury's Green Book Supplementary Guidance 'Accounting for Environmental Impacts' (Dunn, 2012)

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 6. [Airport Watch](#) reporting on Aviation and the Environment (2003)
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 13. Green Roofs: their existing status and potential for conserving biodiversity in urban areas, English Nature Research Reports number 498, 2003
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 15. Potential Bird Hazards from Sustainable Urban Drainage Schemes , Advice Note 6, August 2006 <http://www.aoa.org.uk/media/5442/AN06-Birds-SUDS-August-2006.pdf>