

NATURE CONNECTIONS: working together to enhance Scotland's environment, biodiversity and resilience to climate change

Annex 1 and 2: presentations

March 15th 2017, Edinburgh Centre for Carbon Innovation

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Annex 1. Connectivity in context – the need for a new approach Keynote presentations

1. Drivers for change

James Curran

2. Ecological networks: origins and international context

Alessandro Gimona

3. Testing times: testing biodiversity

Deborah Long

4. Ecological connectivity and networks – current SBS activity and next steps Pete Rawcliffe



A couple of quotes to bear in mind during the workshop:

"I don't care whether you're driving a hybrid or an SUV. If you're headed for a cliff, you need to change direction", Barack Obama.

"Look - if you're driving down the highway at 120 miles per hour, I'd rather be behind the wheel than in the backseat", Mark Wahlberg.



The highest level driver is the global nations' commitment to the Sustainable Development Goals.

To today's audience in particular, sustainability means living within environmental limits.

However, we've already broken the planetary limits for climate change, biodiversity, and the nitrogen cycle.

These three elements are, of course, inter-related:

Climate change impacts on biodiversity Emissions of nitrogen create eutrophication which damages biodiversity Some nitrogen emissions are powerful greenhouse gases Biodiversity and healthy ecosystems sequester carbon dioxide from the atmosphere.

So it's a complex world creating "wicked problems" – which require systems solutions that deliver multiple benefits. But we must also avoid multiple dis-benefits. Wicked problems need wicked solutions.

Image taken from Rockstrom *et al.,* 2009, Nature: "A Safe Operating Space for Humanity".



- UN 2030 Sustainability Goals: "halt biodiversity loss"
- Aichi Biodiversity targets: "By 2020 .. fragmentation is significantly reduced"
- "Governments demonstrated their commitment to achieving the Aichi Biodiversity Targets and showed that the biodiversity agenda is central and essential to the global sustainable development and climate change agendas," 13thCoP to the CBD.
- Woods Hole Research Center: "habitat corridors .. are essential for longerterm biodiversity conservation and also provide opportunities for climate change mitigation in the form of carbon sequestration"
- EU Green Infrastructure Strategy "ensure ecosystems are better connected .. in the wider countryside"

In response, a hierarchy of international commitments has been created, many incorporating repeated calls for habitats to be reconnected in order to rebuild biodiversity, ecosystem functions, and carbon sequestration.

Also in the UK, the Lawton Report "Making Space for Nature", 2010, comes to the same conclusions:

"There is compelling evidence that the collection of wildlife sites are generally too small and too isolated, leading to declines in many of the characteristic species. With climate change, the situation is likely to get worse. This is bad news for wildlife but also bad news for us, because the damage to nature also means our natural environment is less able to provide the many services upon which we depend – particularly climate change mitigation. We need more space for nature. This report calls for action which will benefit wildlife and people. It is a repair manual to help re-build nature."

This is pretty much a quote from the Foreword.



But meanwhile biodiversity is rapidly declining worldwide, and it's no different in the UK. This is despite decades of legislative protection of isolated habitats and individual species. It seems something is wrong with our approach.

(1) Global Living Planet Index:

58% decline in population abundance for 14,152 populations of 3706 species monitored globally between 1970 and 2012. Shading is 95% confidence limit.

(2) UK Biodiversity Indicators 2015 Report: Relative abundance of 213 priority species



Furthermore, climate change will only make things worse through increasing damage to habitats and pressures on species. These estimates of extinctions across the world suggest that there is a possibility of extinction of up to 30% of species in some continents by the end of the century.

Taken from Urban *et al.*, 2015, Science, Vol.348, p 571, "Accelerating extinction risk from climate change".



Deterioration in biodiversity is occurring despite increasing efforts globally, nationally and locally from governments, agencies and volunteers.

This measure is based on the aggregate of 6 global indicators of: protected area extent and biodiversity coverage, sustainable forest management, policy on alien invasive species, and biodiversity-related aid. Shading is 95% confidence.

This plot is from:

Butchart *et al.*, 2010, Science, Vol 328, p.1164, "Global Biodiversity: Indicators of Recent Declines"

However, 8 out of 10 global biodiversity indicators are declining.

Specifically, global trends on fragmentation are unavailable but believed to be worsening.

eg 80% of remaining Atlantic Forest fragments are <0.5km² in size

59% of large river systems are moderately/strongly fragmented by dams/reservoirs



There is recent very disturbing evidence of the role of declining biodiversity in further aggravating climate change.

Mauna Loa Observatory (monitoring of atmospheric CO_2 concentrations since 1957) provides the longest, high-quality, and most representative global record.

Data provide a saw-tooth plot with an in-year cycle: CO_2 declines during N. Hemisphere early-summer (4 months) as terrestrial ecosystems soak up CO_2 through leaf and plant growth, followed by 8 months of release of around half of the CO_2 back into the atmosphere through biodegradation of fallen leaves etc.

The intra-annual drop, "a" in the diagram, is a measure of how good the ecosystem is at sequestering CO₂.

For reference, the intra-annual drop is around 7.5 ppm, but the rebound is about 9.6 ppm. So the increase each year is about 2.1 ppm (2012 figures).



By plotting the value of "a" over the years, it is found that the ecosystem was increasing its sequestration ability up until 2006. This has been predicted as northern latitudes warm and become greener, and because CO_2 is also recognised as a plant fertiliser.

However, it has also been predicted (IPPC Assessment Reports 4 and 5) that climate change itself would begin to sufficiently damage ecosystems (through heat, drought, floods, wildfires, pests/diseases, permafrost gassing) that they would decrease in sequestration activity and, at some point, actually turn into sources of CO_2 . The IPCC Reports both suggest this turning point might be around 2030. Worryingly, it seems to be much earlier (ie 2006).

This plot taken from Curran & Curran, 2016, Weather Vol.71, p226, "An estimate of the climate change significance of the decline in the Northern Hemisphere's uptake of carbon dioxide in biomass".



The effect is very large.

The annual increase in CO_2 each year in the atmosphere in 2012 was 2.1ppm. But if the Earth had not lost its ability to sequester (upper extrapolation) then the annual increase would have been 1.5 ppm. So 30% less. This is equivalent to having added another China to the emissions inventory – without declaring it. [see Curran & Curran, 2016, Weather, Vol. 71, p.226]

Note that this effect is NOT incorporated into current climate change models - since they assume future emissions trajectories and resultant atmospheric concentrations. It looks like emissions trajectories will be much steeper than anticipated.

It is no surprise then that atmospheric CO_2 is rising faster than ever, while global emissions have flat-lined over the past 3 years.

This is the beginning of positive feedback – potentially leading to runaway or irreversible climate change.

It is very urgent that ecosystems are rebuilt.

One of the top 5 actions in the UK Climate Change Risk assessment 2017 (UK Climate Change Committee)

Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity

MEDIUM MAGNITUDE NOW (medium confidence)

HIGH MAGNITUDE IN FUTURE (medium confidence)

MORE ACTION NEEDED

Climate change presents a substantial risk to the UK's native wildlife and to the vital goods and services provided by natural capital, including food, timber and fibre, clean water, carbon storage, and the cultural benefits derived from landscapes. Projected increases in soil aridity and wildfire risks, changes in the availability and temperature of freshwater, and the acidification and warming of UK seas, will exacerbate existing pressures including pollution, habitat loss, invasive species, and the over-exploitation of natural resources. Significant and potentially far-reaching changes are already underway, such as the observed shift from cold to warm water plankton species in the North Sea, which could have implications for the entire marine food chain.

Here in the UK there is a simple national and strategic message "MORE ACTION NEEDED".

Sir Robert Watson, Chair of IPBES and former Chair of the IPCC, said: "Successful climate action can never be at the expense of biodiversity, because stabilising the climate is only possible over the long-term by ensuring the health and protection of biodiversity and ecosystems. (5th Plenary of the UN International Platform for Biodiversity & Ecosystem Services, Bonn, 2017).

It is great that the ESCom, LINK and the James Hutton Institute have called this workshop to discuss what experience we have in Scotland of taking more and different actions, and to assess whether there is a common view of a new and collaborative direction we perhaps need to take, and how research and evidence-gathering can potentially support our efforts.

In conclusion, the debate on biodiversity still lies in the hands of environmentalists (that is the experts in this room); it hasn't yet been usurped by political, financial and business interests – as with climate change. And yet we are failing. We, the experts, must get behind the wheel rather than being in the backseat. We **must deliver clarity, purpose and unified commitment** to the way forward. If we don't, who will?

There's a lot to do, and very little time.













- Core area(s): securely protected sites for conserving biological diversity, with limited low impact human activities
- Buffer zone: surrounds or adjoins the core areas,. More human activities; connectivity function
- Transition area: area with a variety of land uses and human settlements; sustainable development activities

















Convention on Biological Diversity Recognition

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The CBDs 2011-2020 Strategic Plan Target 11 requires that systems of protected areas and other effective, area based conservation measures are "well connected" and "integrated"

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"A recognised, large and/or significant spatially defined geographical space of one or more tenures that is actively, effectively and equitably governed and managed to ensure that viable populations of species are able to survive, evolve, move and interconnect within and between systems of protected areas and other effective area based conservation areas"

Essentially: Multifunctional large corridors, sustainably managed, with, also, a Climate Change adaptation function.

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The James Hutton Institute





Testing times: testing biodiversity

Dr Deborah Long Programme Director, GROW Observatory LINK Honorary Fellow

Environment, Climate Change and Land Reform Committee Inquiry into Biodiversity Progress to 2020: letter to Cabinet Secretary 25 November 2016

• The Committee heard that the number of strategies and their lack of "join up" has resulted in a lack of clarity over the strategic purpose and therefore in a lack of clarity in the approach for those tasked with delivering a "step change" for biodiversity in Scotland.



























Scottish Natural Heritage Dualchas Nàdair na h-Alba

Next steps?

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- SBS working groups discussion – 8th March
- Quick review of existing activity
- Development of NEN statement and action plan

N.B Cabsec/ECLR keen to see progress!





Annex 2. Short showcase-talks – existing initiatives

- 1. Irina Birnie (Aberdeenshire Council)
- 2. Louise Bond (SEPA)
- 3. Vanessa Burton (Edinburgh University)
- 4. Jan Dick (Centre for Ecology and Hydrology)
- 5. Chris Ellis (Royal Botanic Gardens Edinburgh)
- 6. Justin Irvine (James Hutton Institute)
- 7. Derek Robeson (Tweed Forum)
- 8. Paul Sizeland (Scottish Natural Heritage)
- 9. Andy Tharme (Borders Council)
- 10. Kevin Watts (Forest Research)
- 11. Bruce Wilson (Scottish Wildlife Trust)
- 12. 'Data and tools' breakout presentation Marie Castellazi (James Hutton Institute)


















Connectivity @

- Innovative, explorative MSc projects
- Welcome collaboration with outside partners
- Recent dissertations have worked with Forest Research and Scottish Natural Heritage
- Yearly 'mixers' aim to link up MSc students with organisations
- PhD research biodiversity and ecosystem services (including connectivity) under alternative 'visions' for woodland expansion

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EcoCo Life Project Ecological coherence in practice models, maps and matrices

NATURE CONNECTIONS: A scoping workshop for new collaborative action 15 March 2017

(RAAR)

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"NATURE CONNECTIONS: working together to enhance Scotland's environment, biodiversity and resilience to climate change"

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