Woodland Expansion

Alessandro Gimona, Anke Fischer, Justin Irvine, Davy McCracken and others

BioSS
The James Hutton Institute
Science connecting land and people
Moredun Research Institute
Rowett Institute of Nutrition and Health
University of Aberdeen
Royal Botanic Garden Edinburgh
SRUC
Scottish Government
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LUS2 and woodland expansion

Premise: Woodland delivers health and well-being benefits for people and a range of other critical ecosystem services including climate change mitigation and adaptation.

Forestry Grants Scheme to help achieve 100,000 ha of new woodland creation between 2012 – 2022

- Assist in targeting the use of finite financial resources to where they may have most impact.
- Link this to achieving our biodiversity targets and improved ecosystem health and restoration
- Utilise more localised map-based ecosystems assessments to inform funding decisions as appropriate and as these become available across Scotland.

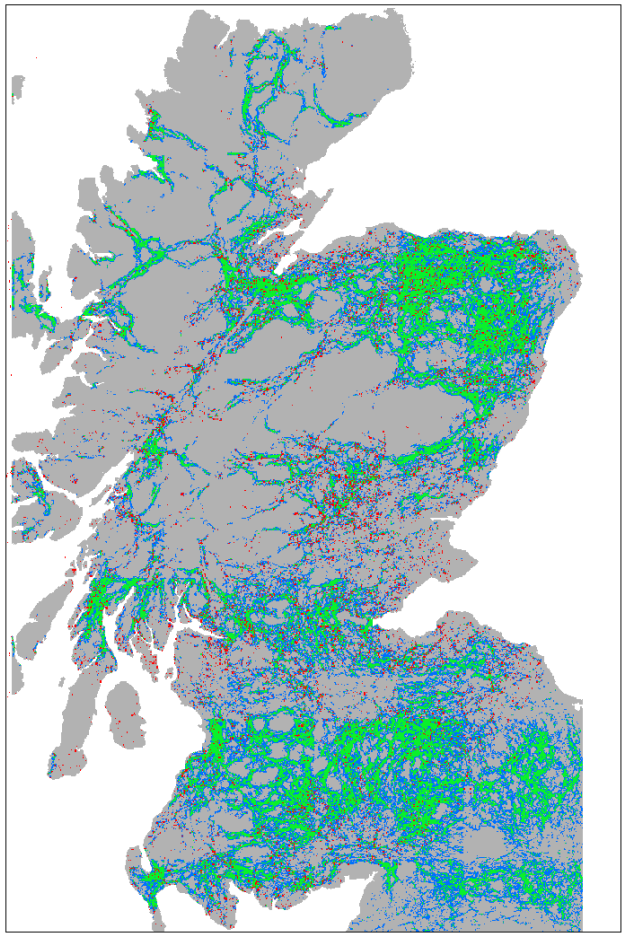
SRP is developing approaches to address these goals

Overarching question

"How can we improve the management of our natural assets to support sustainable land-based industries and vibrant communities, how can we improve existing instruments, and what other instruments could be applied…..?"

- Investigating *multiple benefits* from woodland expansion incentivised by the WGS in both peri-urban contexts (CSGN) and in rural areas (Cairngorms).
- Consider how woodland expansion *constrains or provides opportunities* to enhance well-being, flood risk, water quality, carbon sequestration, biodiversity and local development plans
- Exploring *connectivity* as a mechanism to adapt to environmental change

Corridors in the present landscape



Good permeability

Moderate permeability

See Gimona et al. 2012, *Biol. Cons*.

Land use change and metapopulation dynamics

CONSERVATION CORRIDOR

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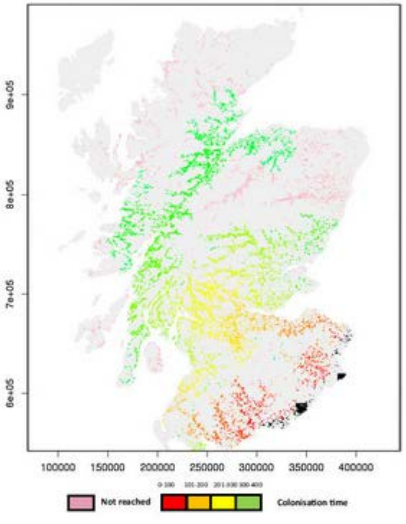
Some species will successfully shift ranges under climate change. Many will not.

Climate change. Forest loss. Agricultural intensification. Urbanization and policy change and international markets. The list of factors that influence ecological networks (i.e. connectivity) over the long-term seems to be growing daily, and parsing out their individual influences on future species' distributions is a complicated task. It's also a crucial one, however, given the need for realistic predictions on population viability for many species, and the need for land managers to make realistic decisions about land use policy.



In their recent paper in *Landscape Ecology*, Gimona et al. build on previous work (Gimona et al. 2012) that examines woodland network response to land use change by specifically considering how woodland networks may facilitate species range shifts under climate change, land use change, and varying dispersal abilities.

They used mainland Scotland as their study region and ran simulations based on four climate scenarios, four hypothetical dispersal distances, and an Agent-Based Model that represented different land managers' behavior. Their methods

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Conservation Corridor Digests

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- Climate Change
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- Digests for Debate

Digest Archive

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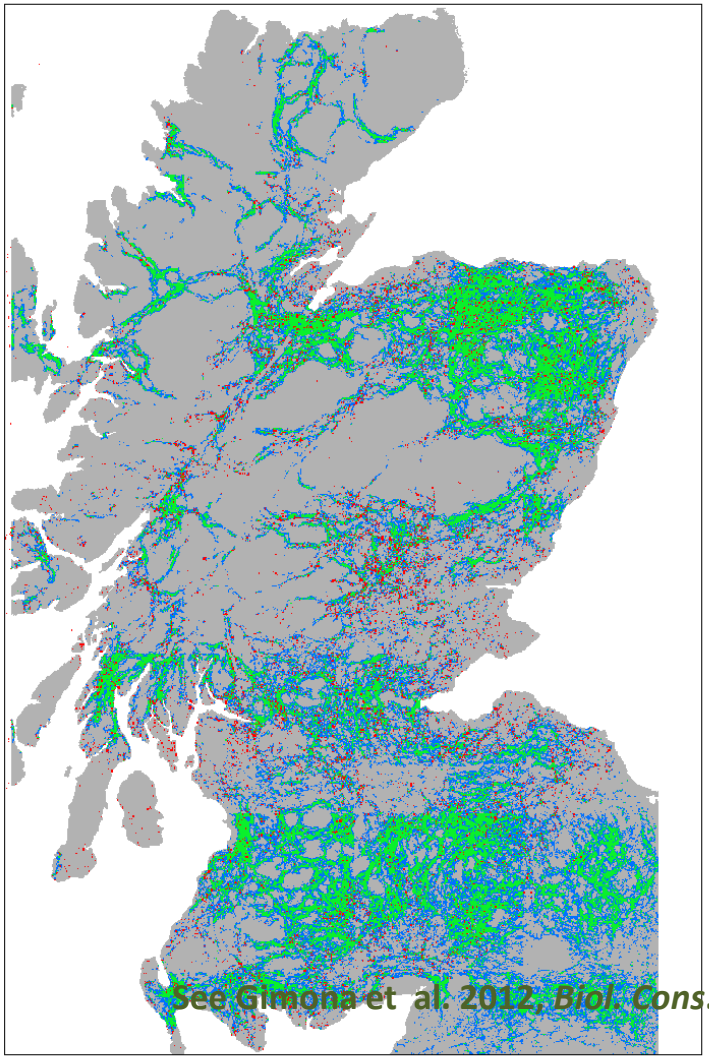
Latest Digests

- The challenges of maintaining aquatic connectivity under climate change October 24, 2016
- Designing corridors with dispersal ecology in mind

LC and MD
decrease landscape permeability

See Gimona et al.,2015, *Landscape Ecology*

Revised permeability



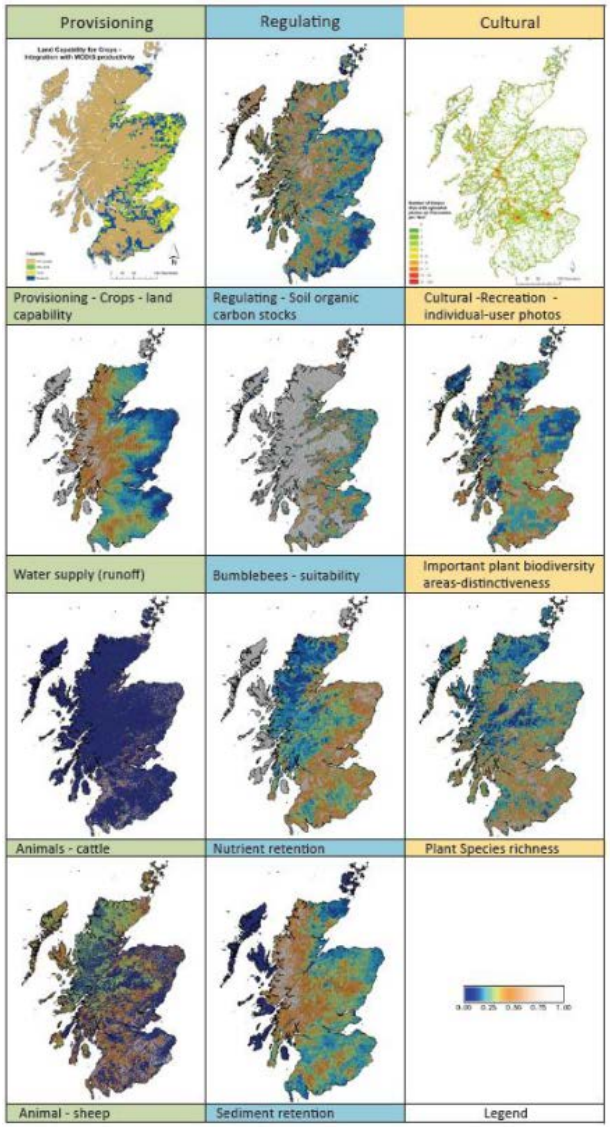
See Gimona et al. 2012, *Biol. Cons.*

Moderate permeability

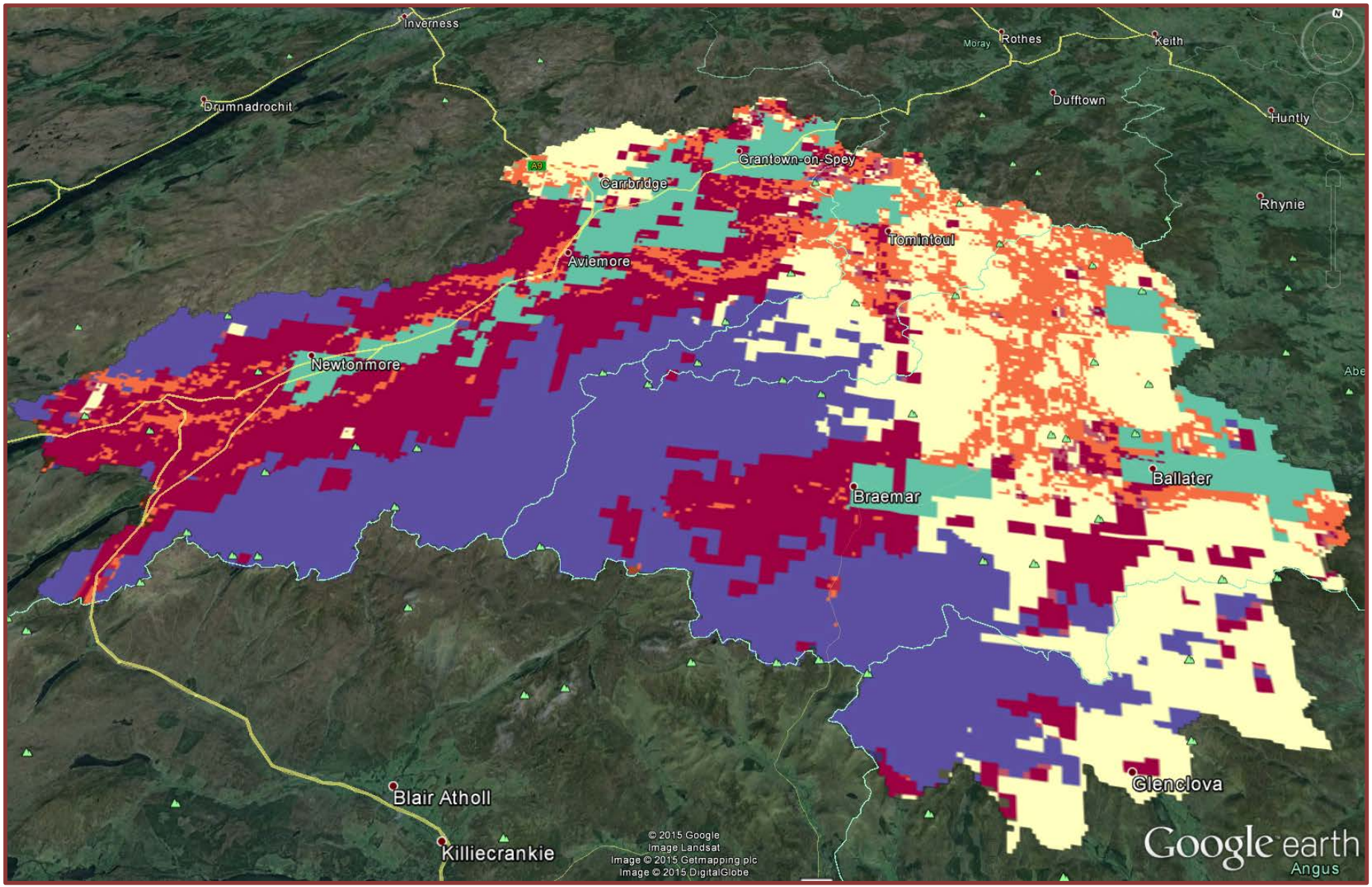
Low permeability

Where should we plant new trees?

- Connectivity can be considered at regional scale
- Consider other factors such as ESS to have multiple benefits



ESS areas


Inverness
Drumnadrochit
Moray
Rothes
Keith
Dufftown
Huntly
Grantown-on-Spey
A9
Carrbridge
Rhynie
Tomintoul
Aviemore
Newtonmore
Abe
Ballater
Braemar
Blair Atholl
Killiecrankie
Glenclova
© 2015 Google
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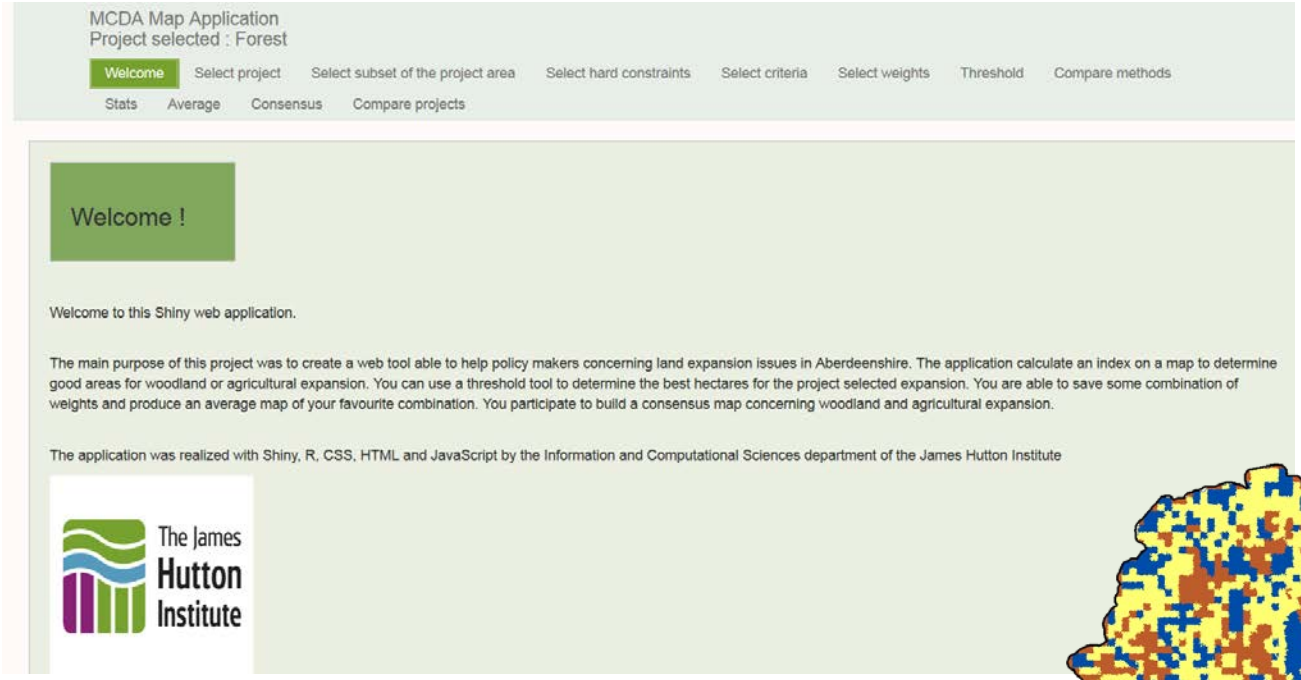
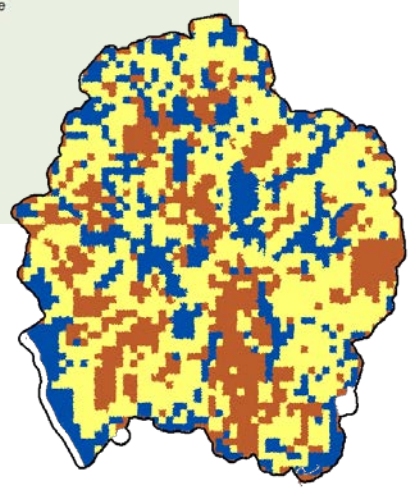
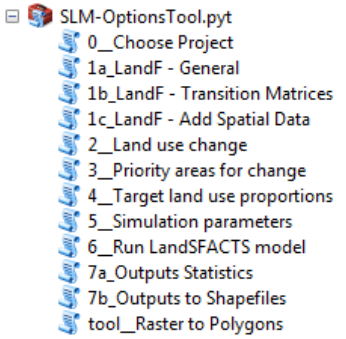
Angus

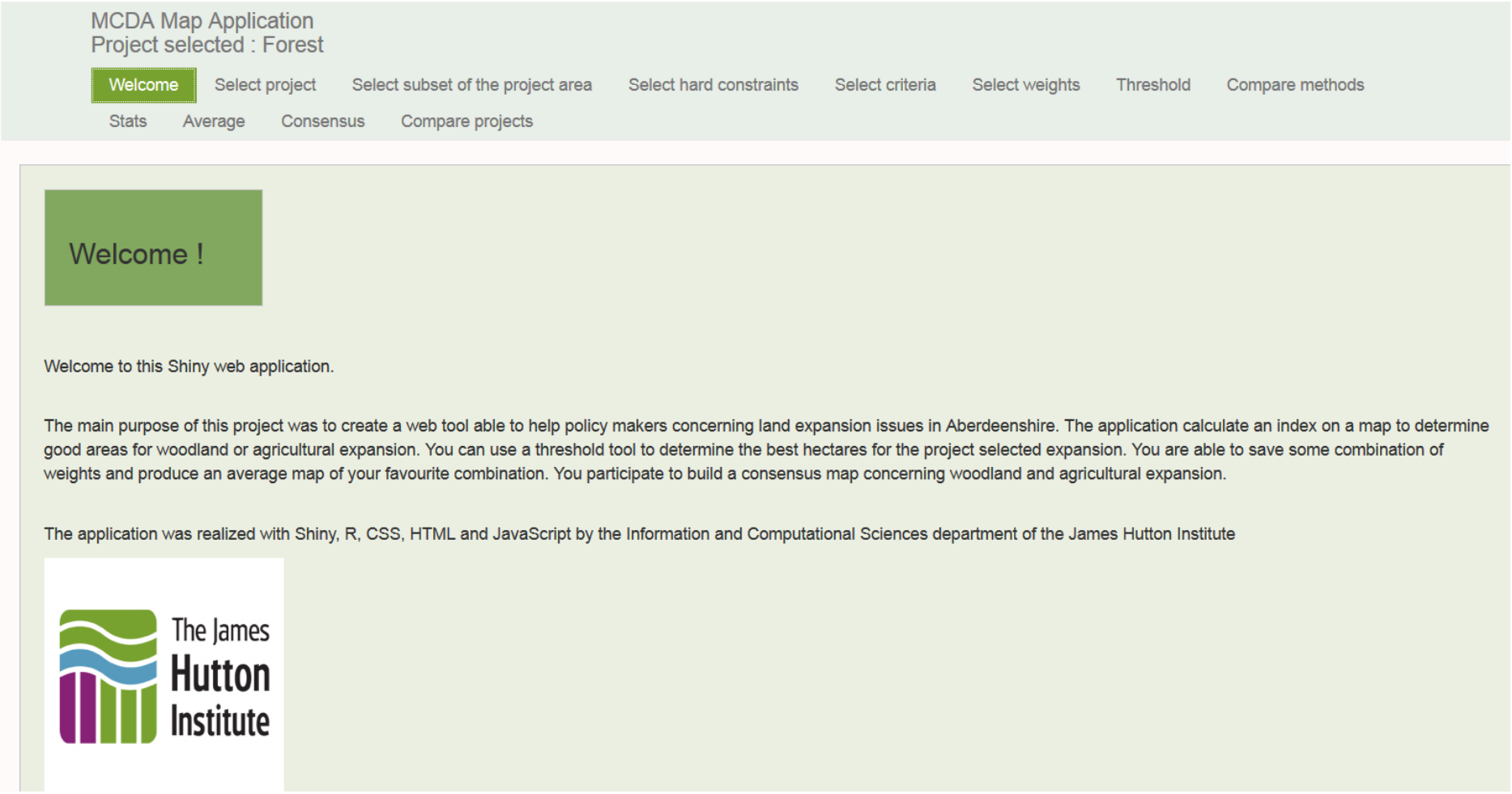
Tools


MCDA Map Application
Project selected : Forest
Welcome
Select project
Select subset of the project area
Select hard constraints
Select criteria
Select weights
Threshold
Compare methods
Stats
Average
Consensus
Compare projects
Welcome !
Welcome to this Shiny web application.
The main purpose of this project was to create a web tool able to help policy makers concerning land expansion issues in Aberdeenshire. The application calculate an index on a map to determine good areas for woodland or agricultural expansion. You can use a threshold tool to determine the best hectares for the project selected expansion. You are able to save some combination of weights and produce an average map of your favourite combination. You participate to build a consensus map concerning woodland and agricultural expansion.
The application was realized with Shiny, R, CSS, HTML and JavaScript by the Information and Computational Sciences department of the James Hutton Institute
The James Hutton Institute

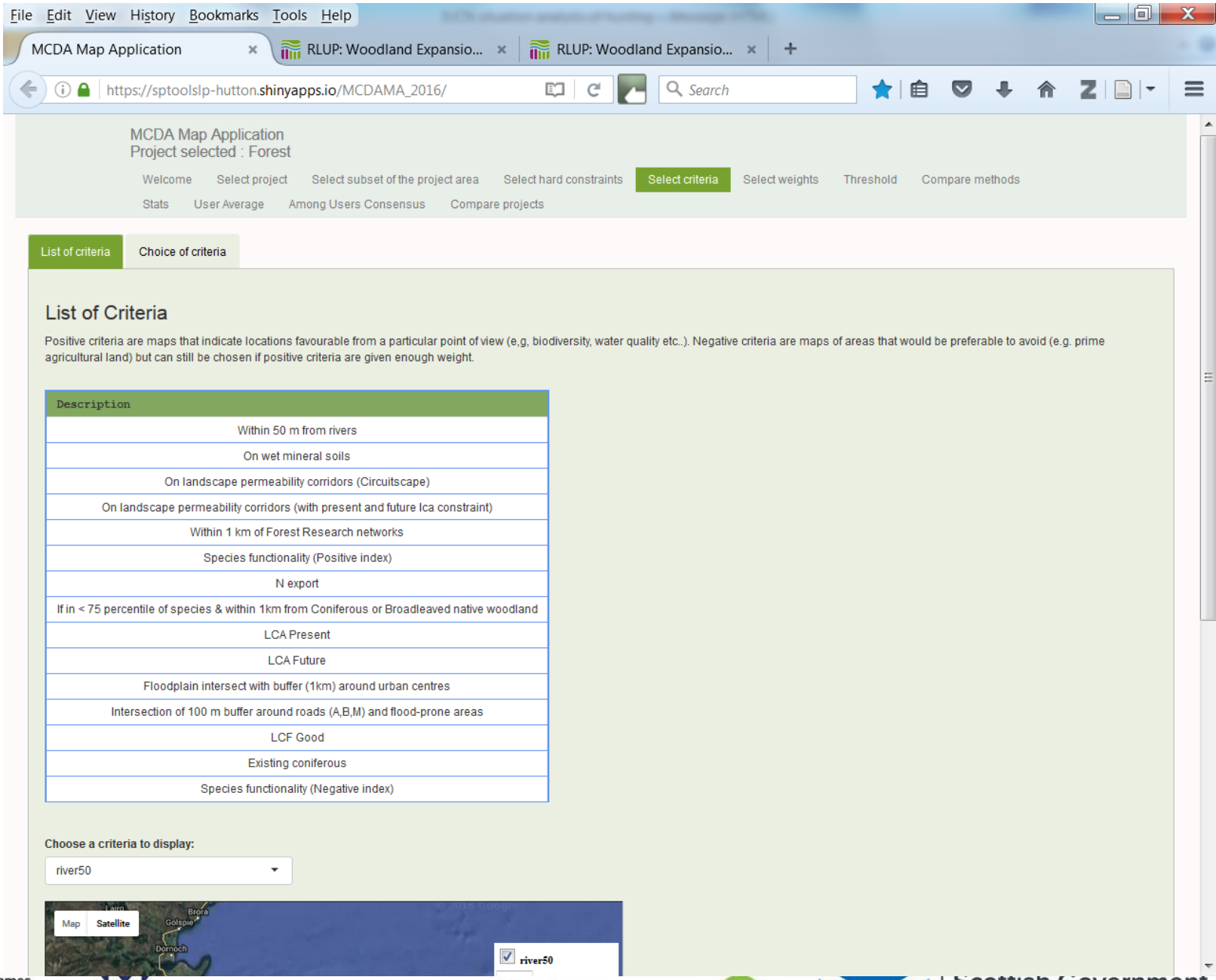



SLM-OptionsTool.pyt
0__Choose Project
1a_LandF - General
1b_LandF - Transition Matrices
1c_LandF - Add Spatial Data
2__Land use change
3__Priority areas for change
4__Target land use proportions
5__Simulation parameters
6__Run LandSFACTS model
7a_Outputs Statistics
7b_Outputs to Shapefiles
tool__Raster to Polygons

Multi-criteria interactive web tool



Melodic 2



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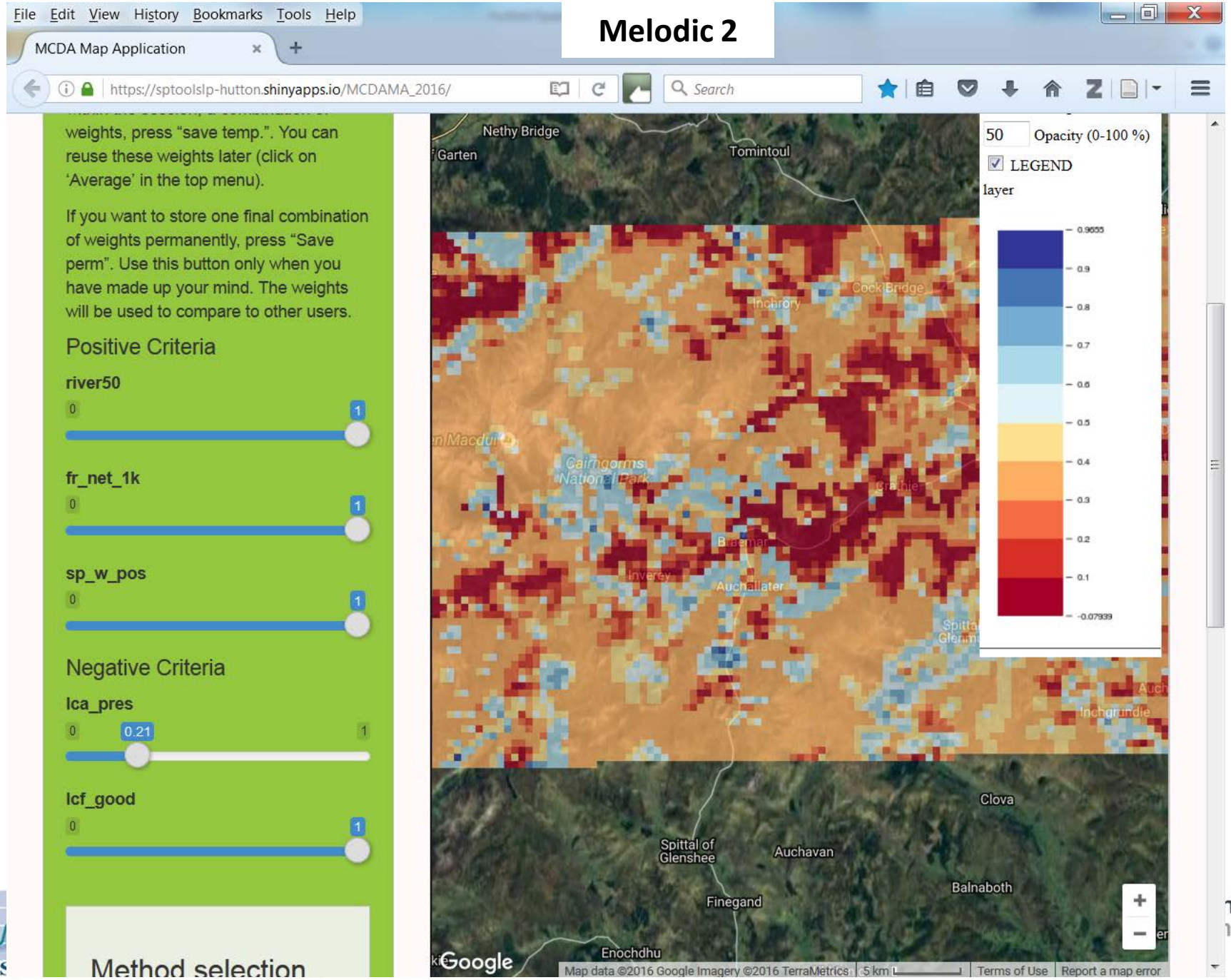
Melodic 2


File Edit View History Bookmarks Tools Help
MCDA Map Application
https://sptoolslp-hutton.shinyapps.io/MCDAMA_2016/
Search
weights, press “save temp.”. You can reuse these weights later (click on ‘Average’ in the top menu).
If you want to store one final combination of weights permanently, press “Save perm”. Use this button only when you have made up your mind. The weights will be used to compare to other users.
Positive Criteria
river50
0
1
fr_net_1k
0
1
sp_w_pos
0
1
Negative Criteria
lca_pres
0
0.21
1
lcf_good
0
1
Method selection
Nethy Bridge
Garten
Tomintoul
Inchrory
Cock Bridge
Cairngorms National Park
Braemar
Inverey
Auchallater
Clova
Spittal of Glenshee
Auchavan
Balnaboth
Finegand
Enochdhu
50
Opacity (0-100 %)
LEGEND
layer
0.9655
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-0.07939
Google
Map data ©2016 Google Imagery ©2016 TerraMetrics
5 km
Terms of Use
Report a map error

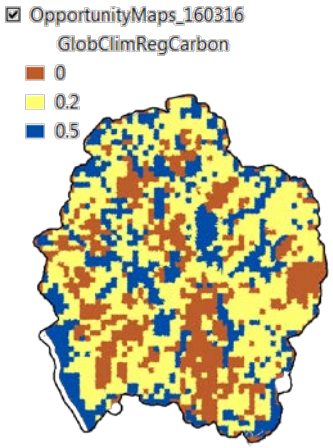
Sustainable Land Management – Options Tool

Input :
ESS-derived opportunity maps
Stakeholders define ESS priorities for improvement

Output: land use/management change advice (where & what to change)

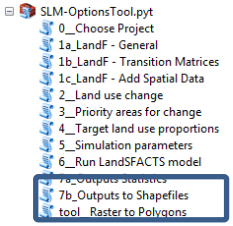
- Options that can satisfy multiple objectives

Multi-functionality



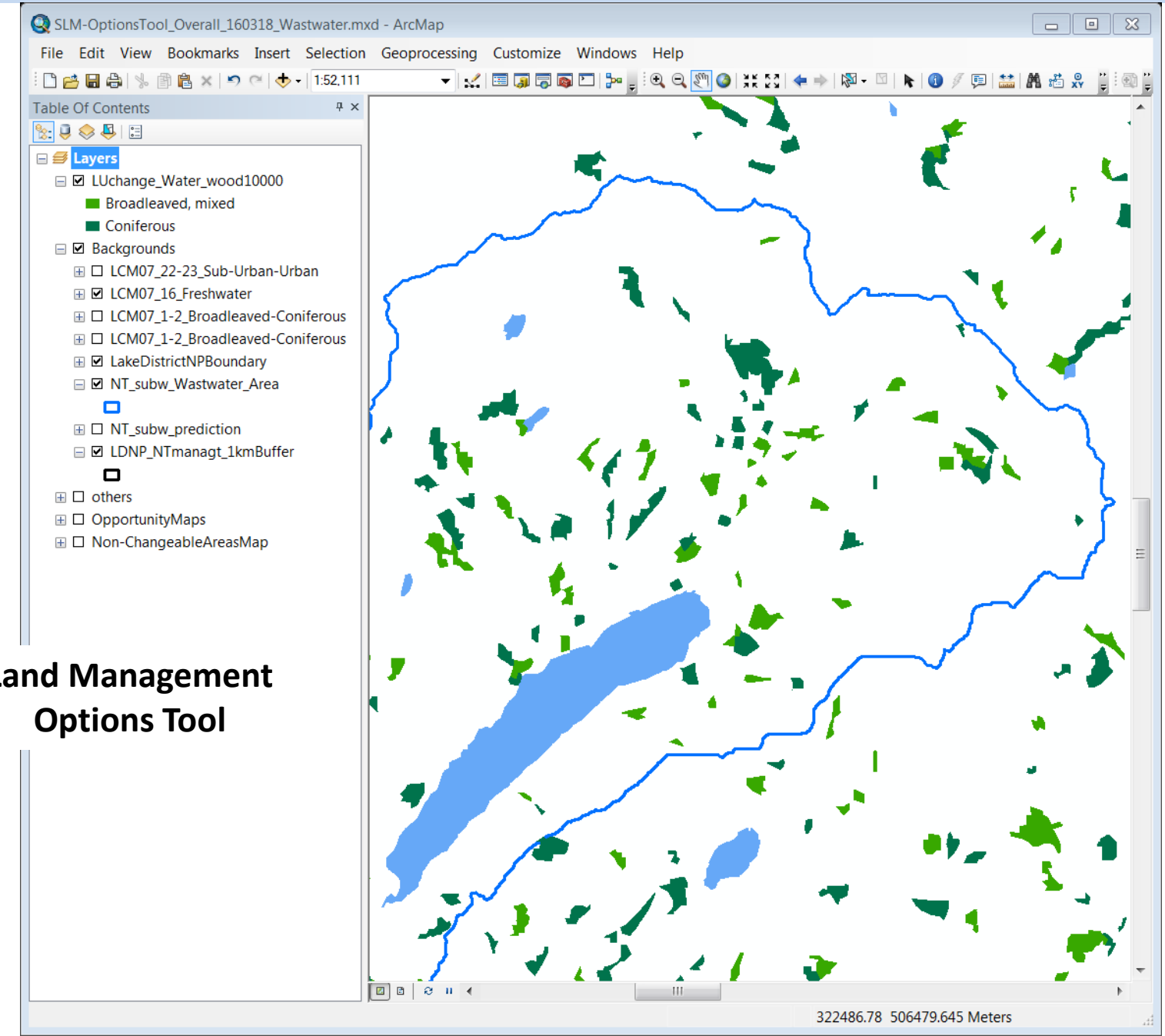
Opportunity map

SLM-OptionsTool



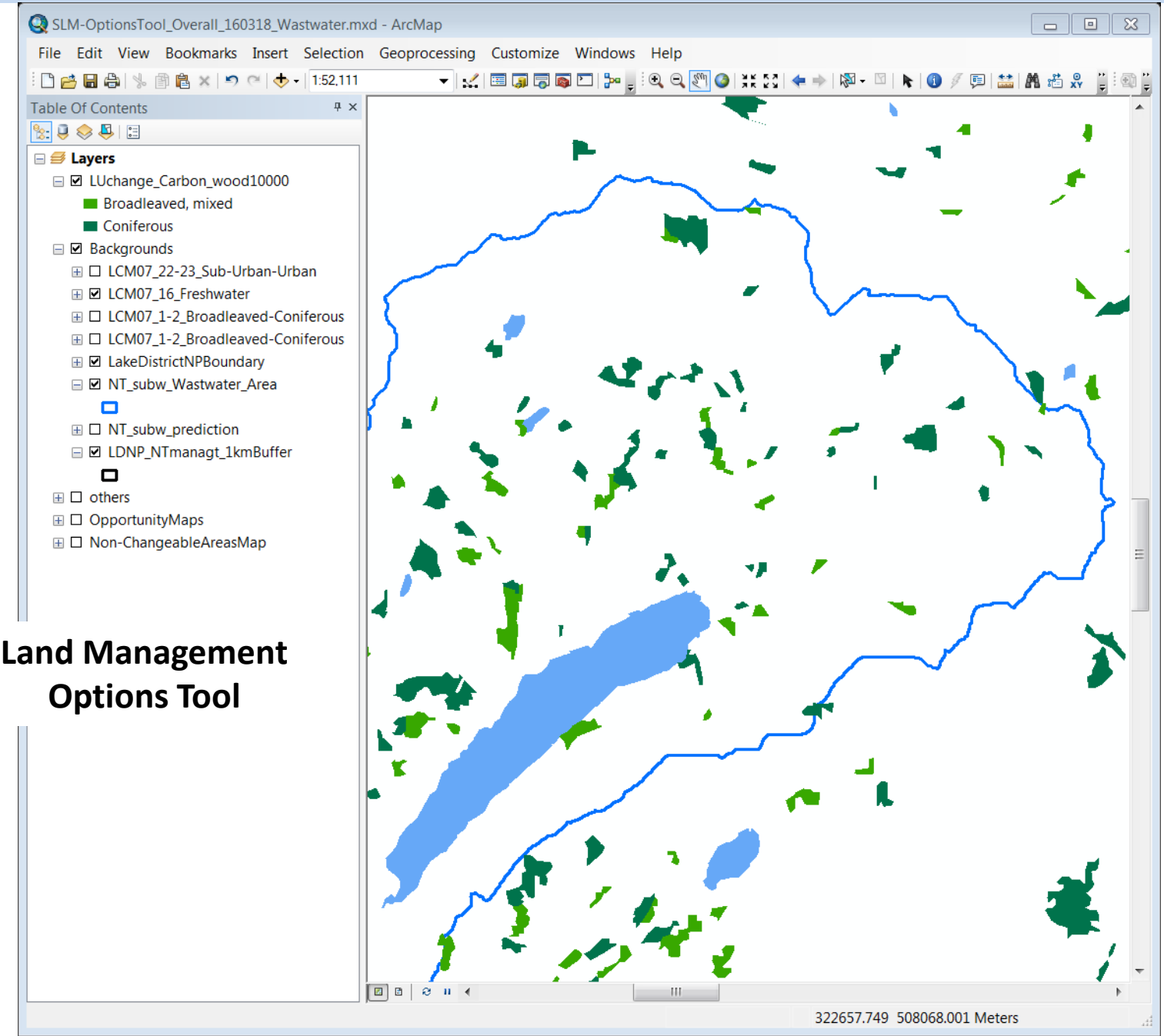
National Trust

Land sub-functions: Water Cycling – Purif., Nutrient & Erosion Reg.



Land Management Options Tool

Land sub-function: Global Climate Regulation Carbon



Land Management Options Tool

Spatial tools to explore land use change options and ES provision

Web based tools through the *lens of woodland expansion*:

- *Melodic*: Aberdeenshire Regional Land Use Pilot http://rlup.hutton.ac.uk
- *Melodic 2*: more flexible version

- *Sustainable Land Management – Options Tool* (NT): solutions for land use change to achieve multiple objectives

Research (drawing on these tools)

1. Decision making: reconcile woodland expansion with other land use priorities

a. The barriers and opportunities for achieving collaborative decision making over woodland expansion and

b. The social and institutional circumstances under which collaborative decision making can be supported

- Adaptive Management as an evaluation framework

Adaptive Management in decision making: applying tools in case studies

1. Park scale land use change: Woodland Expansion opportunities and trade-offs

2. Regional land use change: consequences of woodland expansion e.g.:

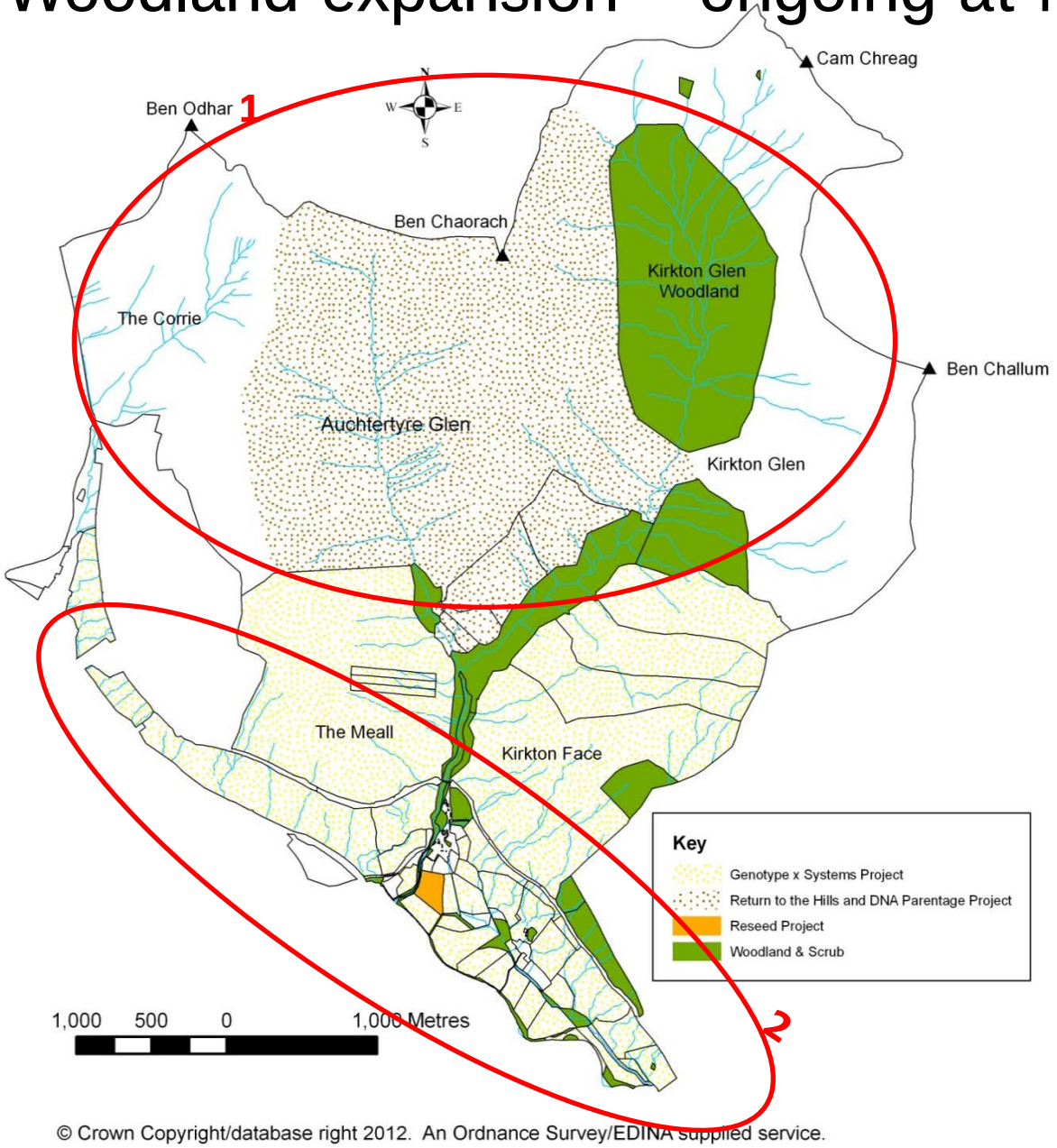
- Moving the treeline, landscape character & water management (Cairngorms Connect?)
- Woodland connectivity and grouse moor management (ECMP?)

3. Local community engagement in land use change: interaction with biodiversity: Capercaillie framework (& CSGN)

2. Impacts of potential changes (decisions) on ecosystem services

- Sites within CNP: part of a set of study areas from the peri-urban to the remote
- Aim: investigate changes in ecosystem services (ES) in response to management interventions
  - Woodland expansion and restoration
- Ecology and social sciences
- Study core: 9 focal ES; additional work possible
- Currently identifying study sites

Woodland expansion – ongoing at Kirkton/Auchentyre



2016-21

(1) Ecosystem services stocks and flows – compare and contrast '17 year rewilded' (200 ha montane woodland, surrounding 200 ha moorland ungrazed) area with 450 ha continuous grazed upland moorland pastures (with Moredun Research Institute & University of Stirling).

(2) In discussion with FCS re: potential to test productive agro-forestry establishment on part of 150 ha semi-improved lower land and small part of 70 ha inbye land

Wider issues

- Developing spatial tools to understand where our natural capital is, what state it is in and opportunities for improving the benefits we derive from it
- Understanding the trade-offs involved from different land uses and management options
- Exploring how this knowledge can be used to inform practical interventions using an adaptive management approach