



BioDT School

Cultural Ecosystem Services

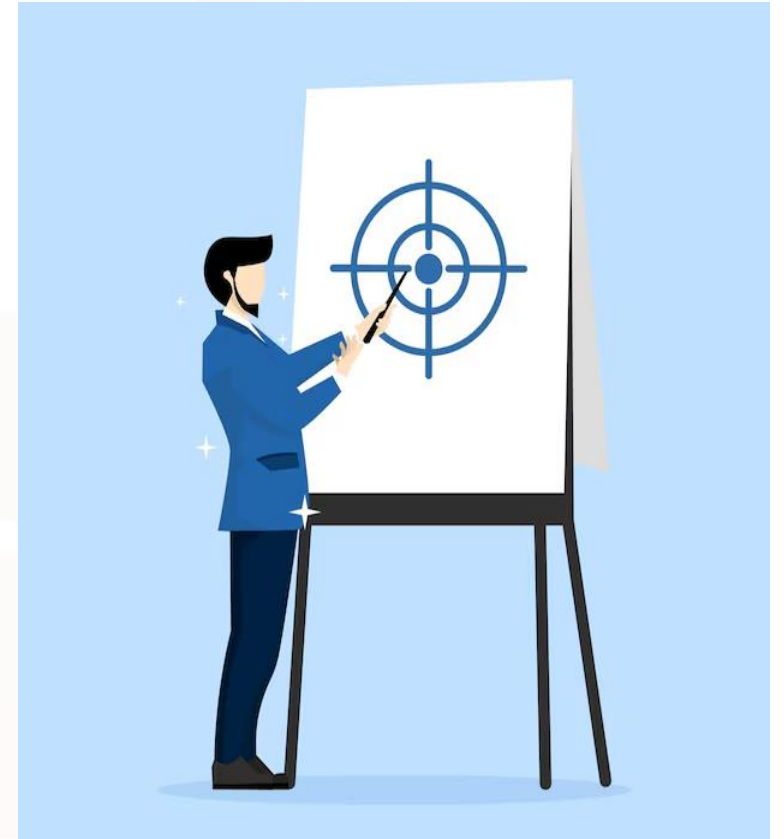
presented by Jan Dick

Core team Simon Rolph, Tomáš Martinovič, Maddalenna Tigli, Christopher Andrews, Joe Marsh Rossney, Dylan Carbone, Megan Williams, Kata Sara-aho



Funded by
the European Union

- 🔥 This session aims to provide the policy and historical background of the BioDT Cultural Ecosystem Service prototype digital twin
- 🔥 Outline:
 - 🔥 Introduction (20 mins)
 - 🔥 Individual assessment of prototype digital twin (30 mins)
 - 🔥 Group discussion of personal assessment (30 mins)
 - 🔥 Updated version of the GUI (10 mins)



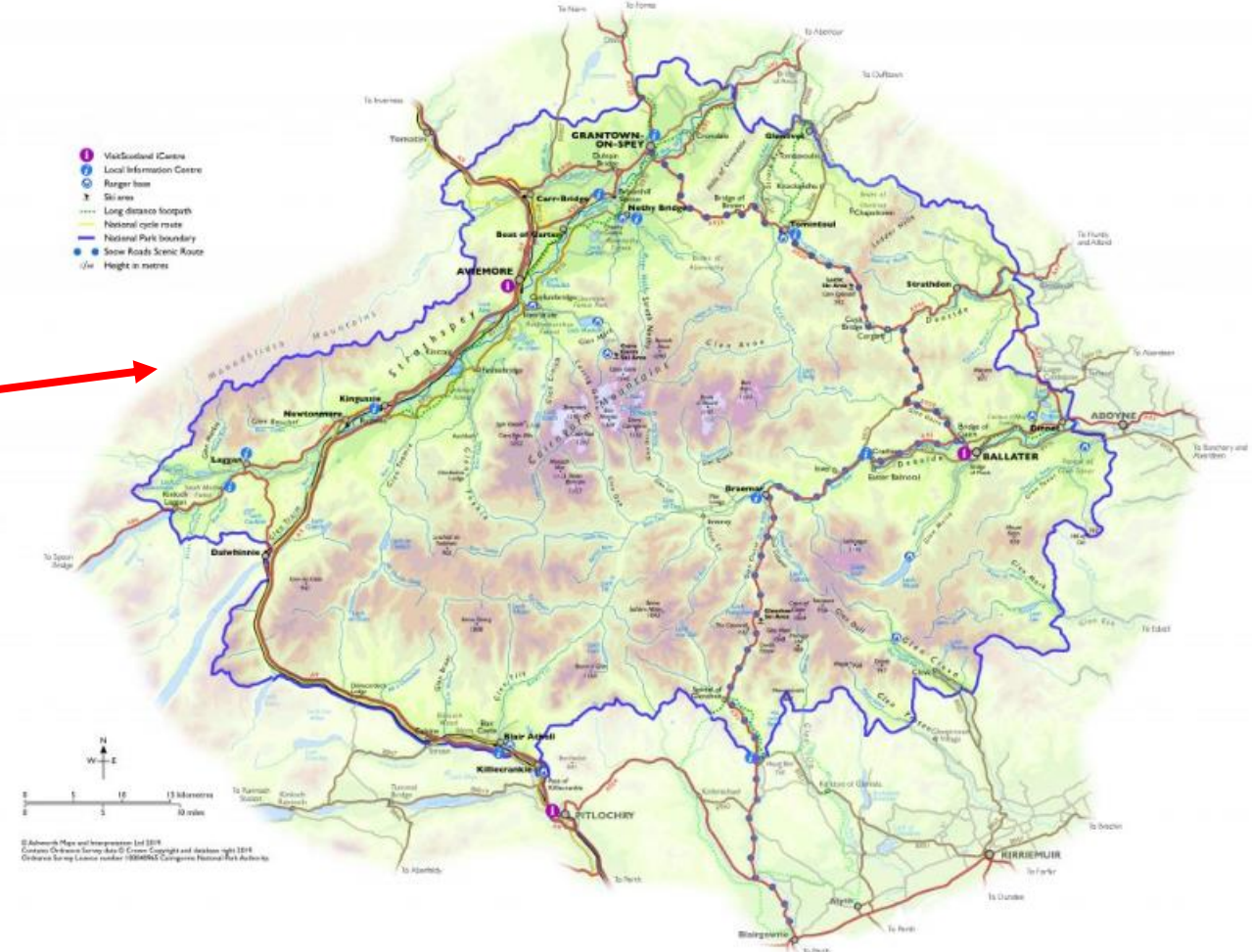
https://www.freepik.com/premium-vector/goals-objectives-concept-scope-work-entrepreneur-project-manager-presenting-scope-work_42188364.htm

Cairngorms National Park Aims:

- To promote sustainable use of the natural resources of the area;
- To promote understanding and enjoyment (including enjoyment in the form of recreation) of the special qualities of the area by the public;
- To promote sustainable economic and social development of the area's communities

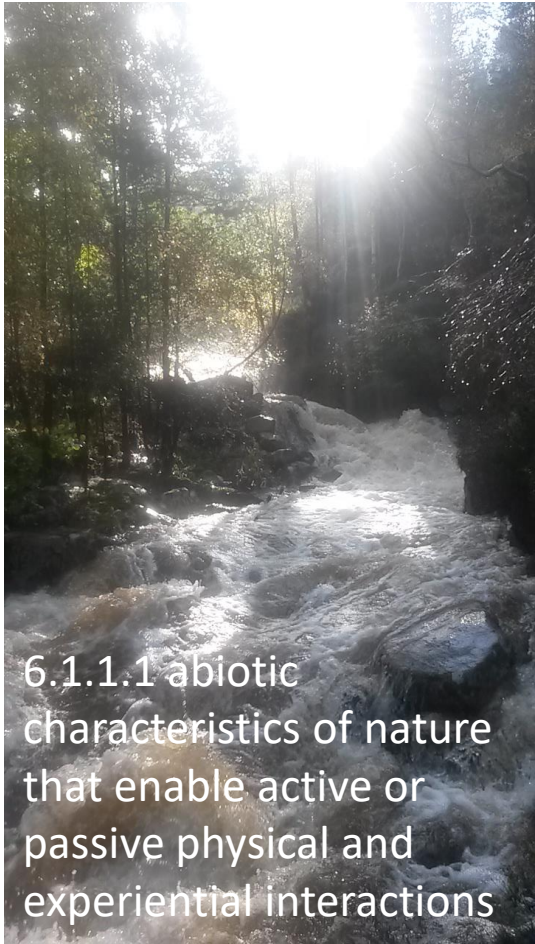


Cairngorms National Park



<https://cairngorms.co.uk/discover-explore/enjoying-the-park/planning-a-visit/>

<https://weareglobaltravellers.com/2020/06/uk-national-parks-guide/>



6.1.1.1 abiotic characteristics of nature that enable active or passive physical and experiential interactions

The Common International Classification of Ecosystem Services (CICES)

eLTER site looking out across LTSEER Platform



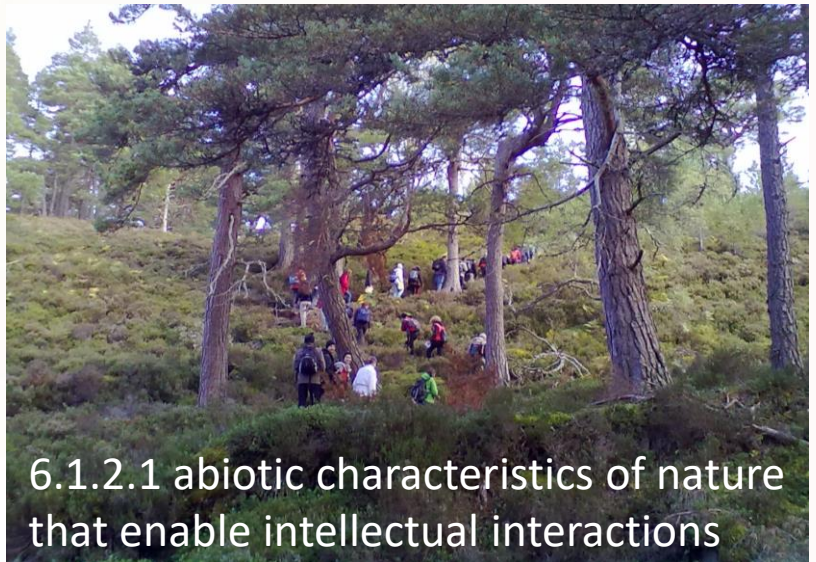
3.1.1.1 active or immersive interactions



3.1.1.2 passive or observational interactions



Bushnell Camera Name 969.6mb↑ 2°C 10-10-2013 11:27:38



6.1.2.1 abiotic characteristics of nature that enable intellectual interactions

Tourism accounts for 30% of the economy (GVA) and 43% of employment.

Visitors and locals appreciate the outstanding landscapes, wildlife and huge range of activities available.



Sustainable Tourism

European Charter for Sustainable Tourism in Protected Areas is a practical management tool that enables national Parks and other protected areas to develop tourism sustainably based on 5 principles:

1. Giving priority to protection;
2. Contributing to sustainable development;
3. Engaging all stakeholders;
4. Planning sustainable tourism effectively;
5. Pursuing continuous improvement.

[Sustainable Tourism - Cairngorms National Park Authority](#)

The park was awarded the EUROPARC Federation charter for Sustainable Tourism in Protected Areas in early 2000's and has used the federation's five principles to practically manage and develop tourism in the area.

The [2017 verifier's evaluation report](#) highlights the positive improvements but also comments on the **need for a deeper knowledge about the recreational potential of the whole Cairngorms National Park to inform visitors and so reduce the high concentration of visitors in certain places and times.**



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The OpenNESS Project

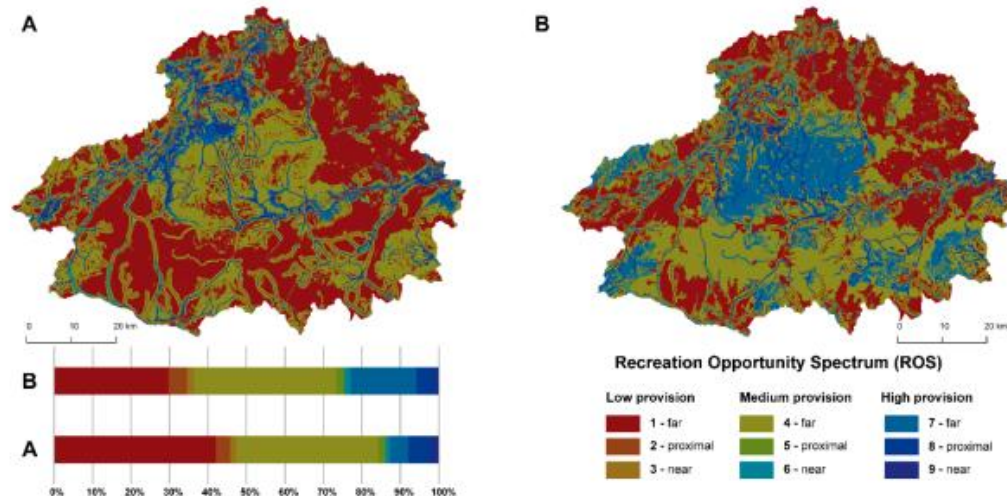
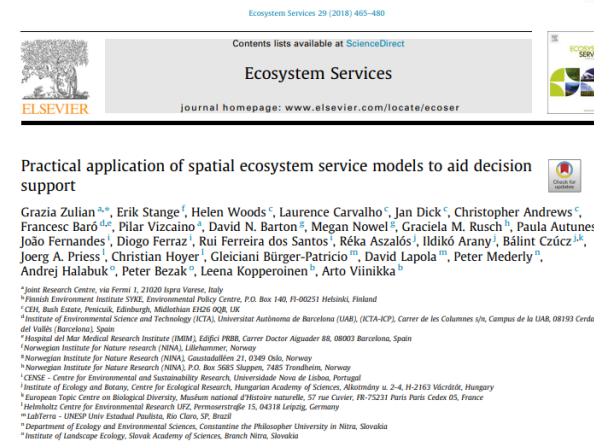
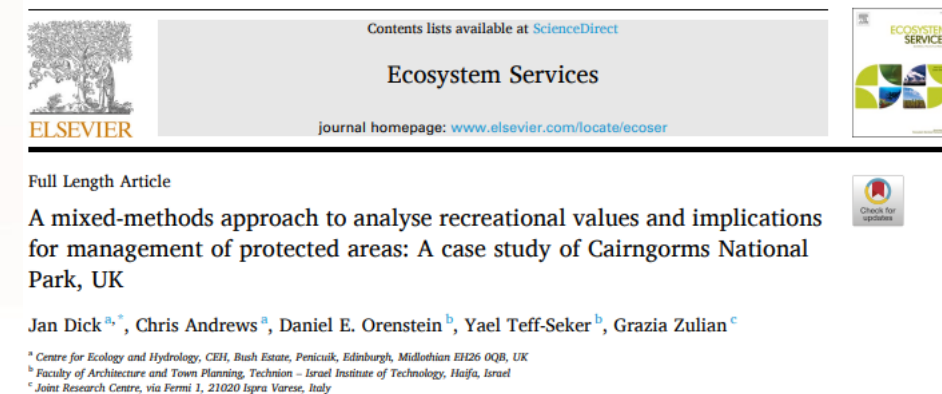
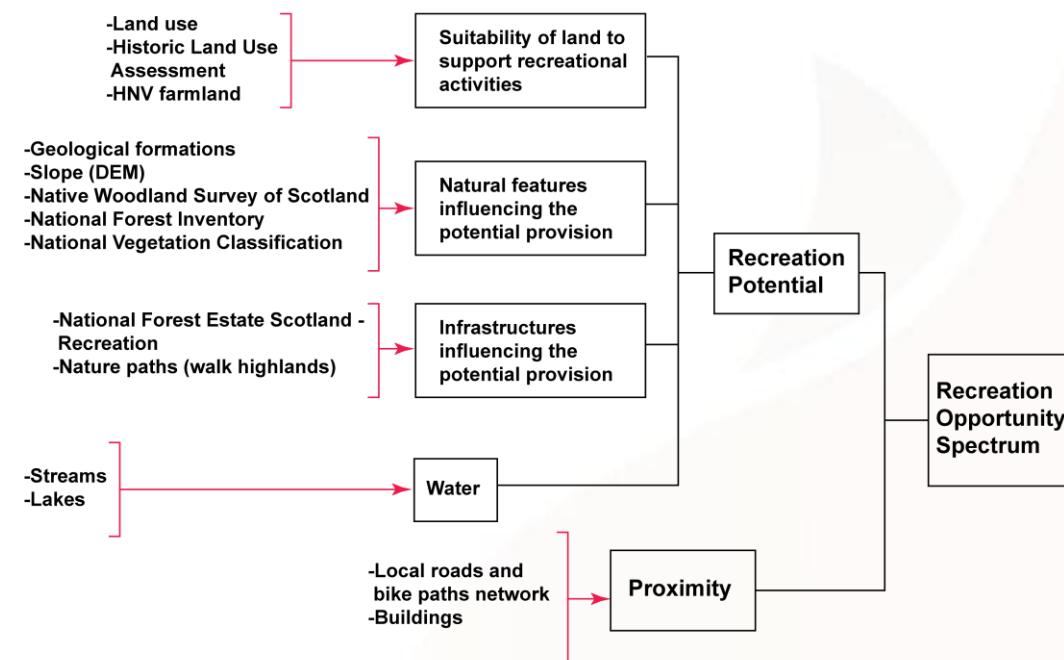


Fig. 5. ESTIMAP-Recreation opportunity spectrum map for the CNP parameterised by (A) soft and (B) hard recreationalist (Table A13 and A14 of the SI provides the parameters used).

A recreational potential model ESTIMAP-Recreation (Zulian et al., 2013) was further developed for the Cairngorms (Zulian et al. 2018) providing a practical example of coproduction and collaboration (Dick et al., 2022).



- ESTIMAP is a multiple look up model, which in this case, depends on expert opinion.
- Each input data is scored according to its suitability to provide opportunities for outdoor recreation.
- The parameters are scored individually using a scale from 0 to 10.
- ✓ 0 = absence of availability of recreation potential
- ✓ 10 = maximum potential.



Slope (Digital Elevation Model)

Slope %	Description	Soft recreationalist	Hard recreationalist
<3	easy	8	5
"3-5"	gentle slope	8	6
"5-10"	medium slope	8	6
"10-20"	steep slope	6	7
"20-30"		5	7
>30	extremely steep slope	4	8

For example a 10 percent slope means that, for every 100 feet of horizontal distance, the altitude changes by 10 feet:

Dick, J., Andrews, C., Orenstein, D., Teff-Seker, Y. and Zulian, G.
 2022 A mixed-methods approach to analyse recreational values and implications for management of protected areas: a case study of Cairngorms National Park, UK. *Ecosystem Services* 56
<http://dx.doi.org/10.1016/j.ecoser.2022.101460>

The DECIDE Tool



1 Do you want to discover new places to record wildlife?



2 Explore the DECIDE Tool. It shows places with high priority for recording.



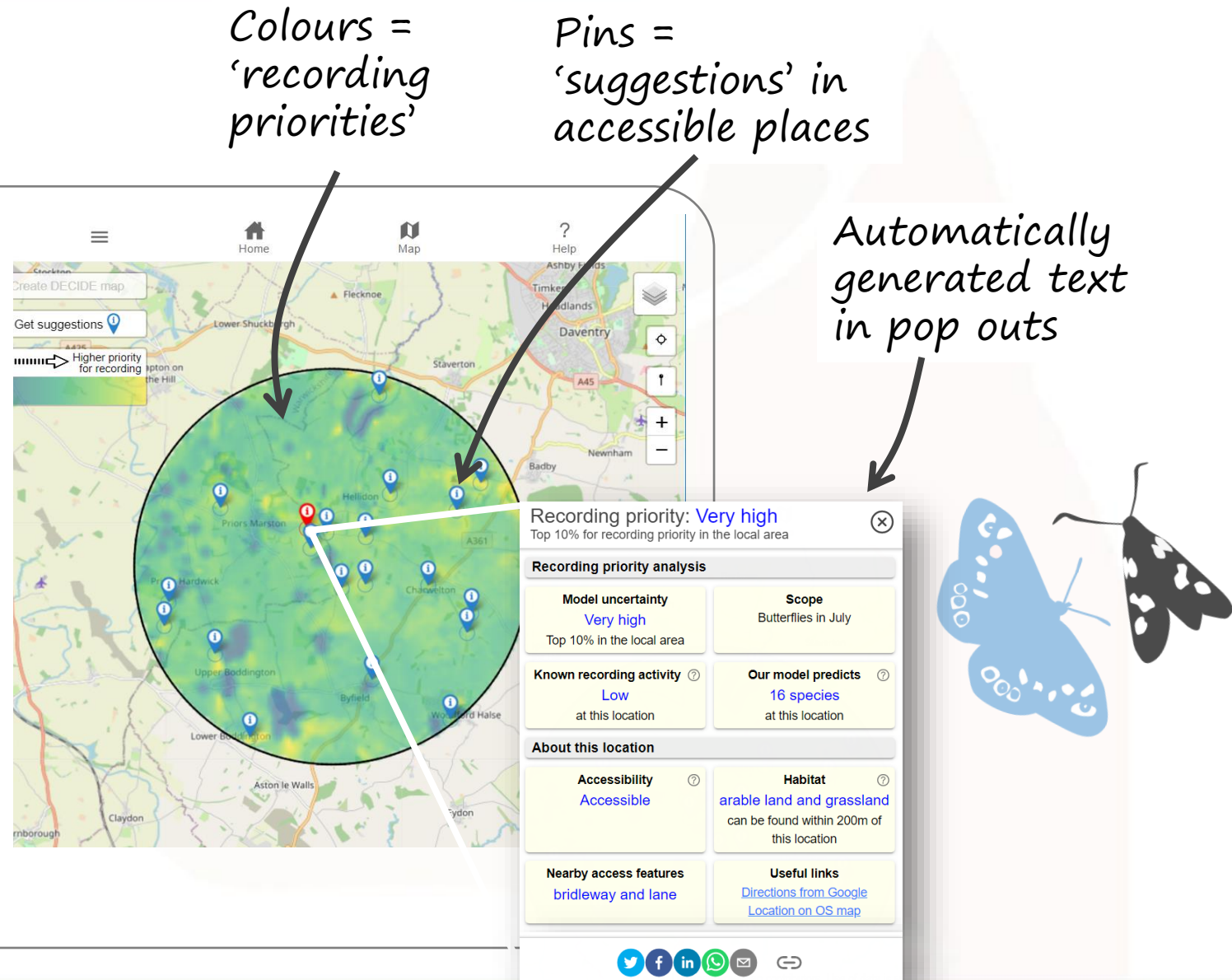
3 Choose a location to visit. Record all species seen using existing apps and websites.



[Find out more](#)



[Go to map](#)



Base map is ESTIMAP - Recreational Potential model with location of rare biodiversity overlain



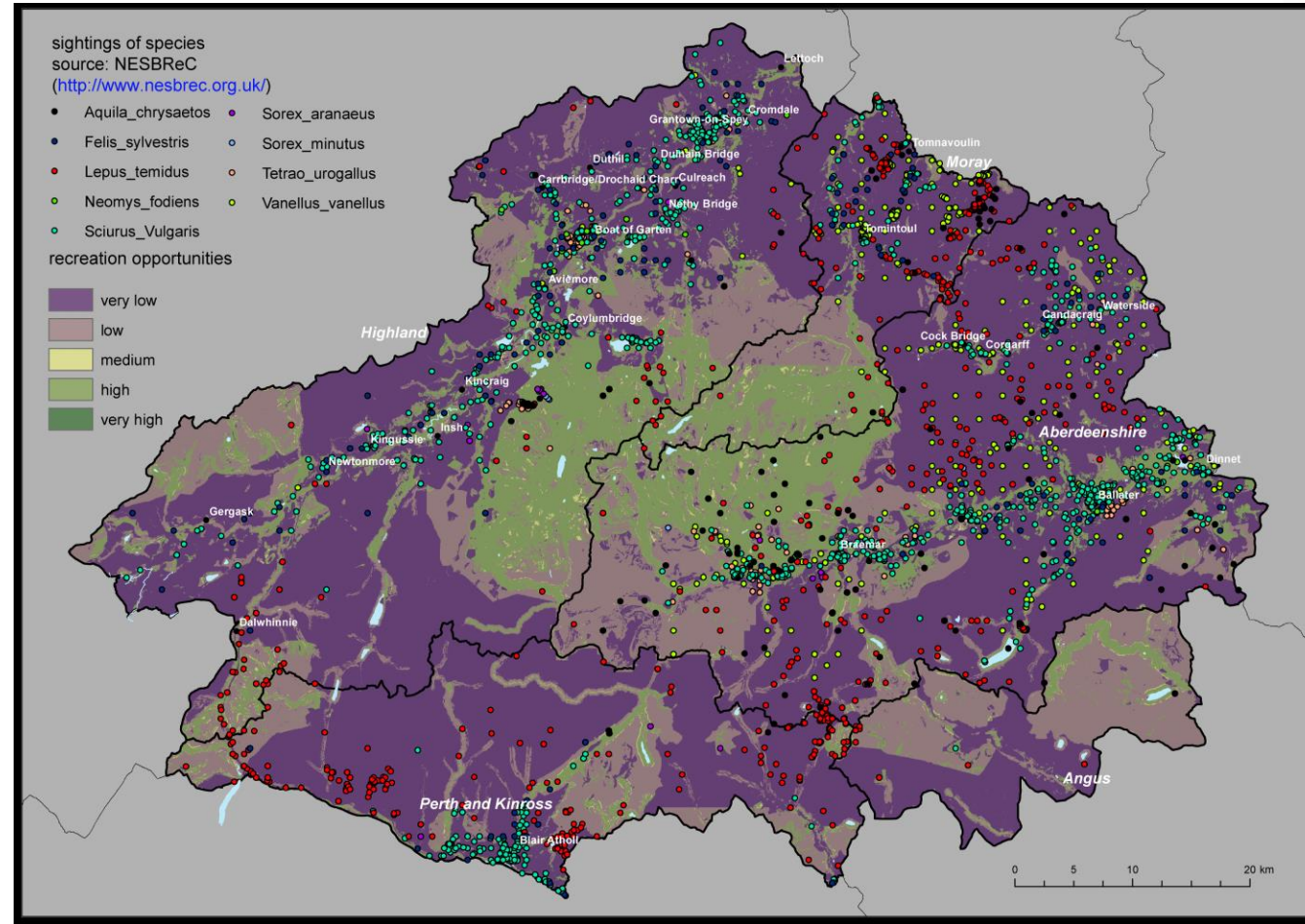
Aquila chrysaetos
Golden eagle



Sciurus vulgaris
Red Squirrel



Sorex minutus
Eurasian pygmy shrew



Felis silvestris
Wild cat



Lepus timidus–
Mountain hare

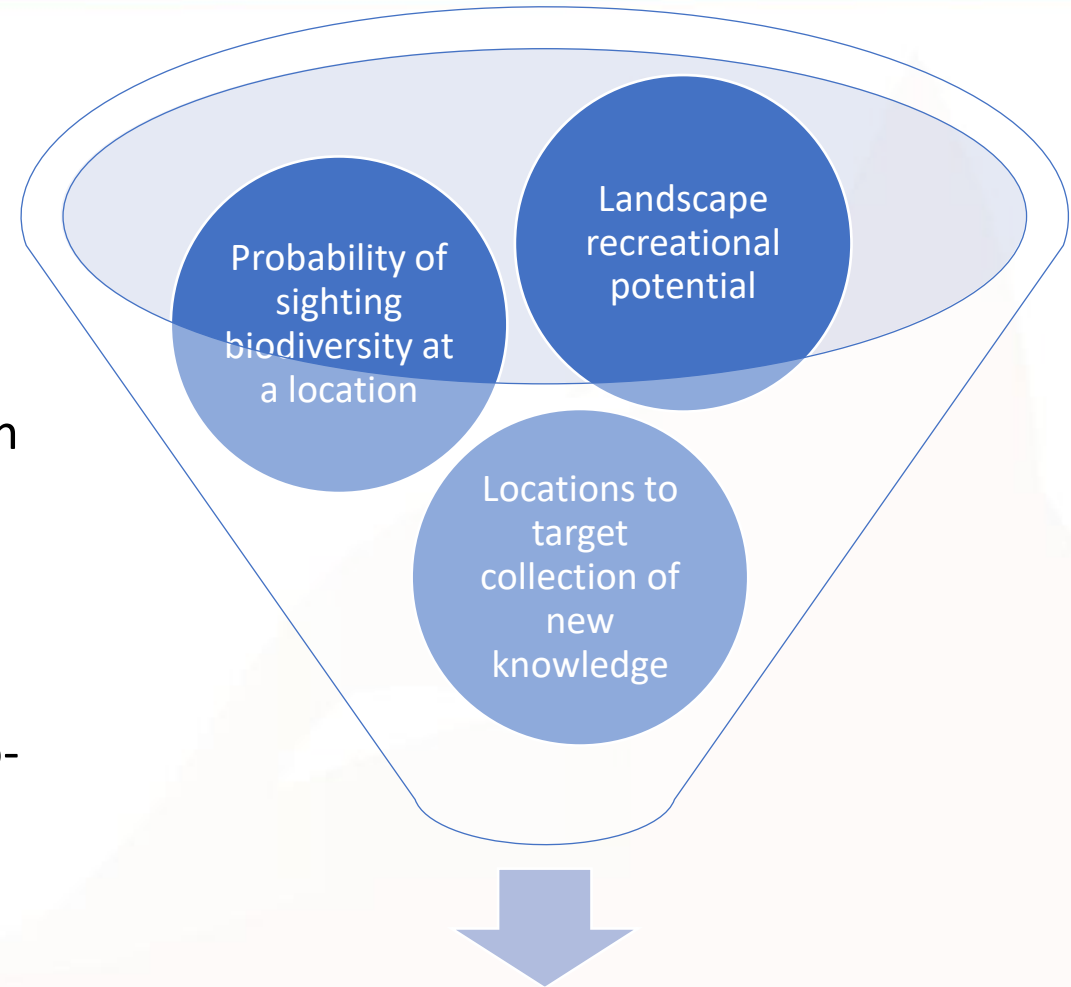


Tetrao urogallus –
Western capercaillie

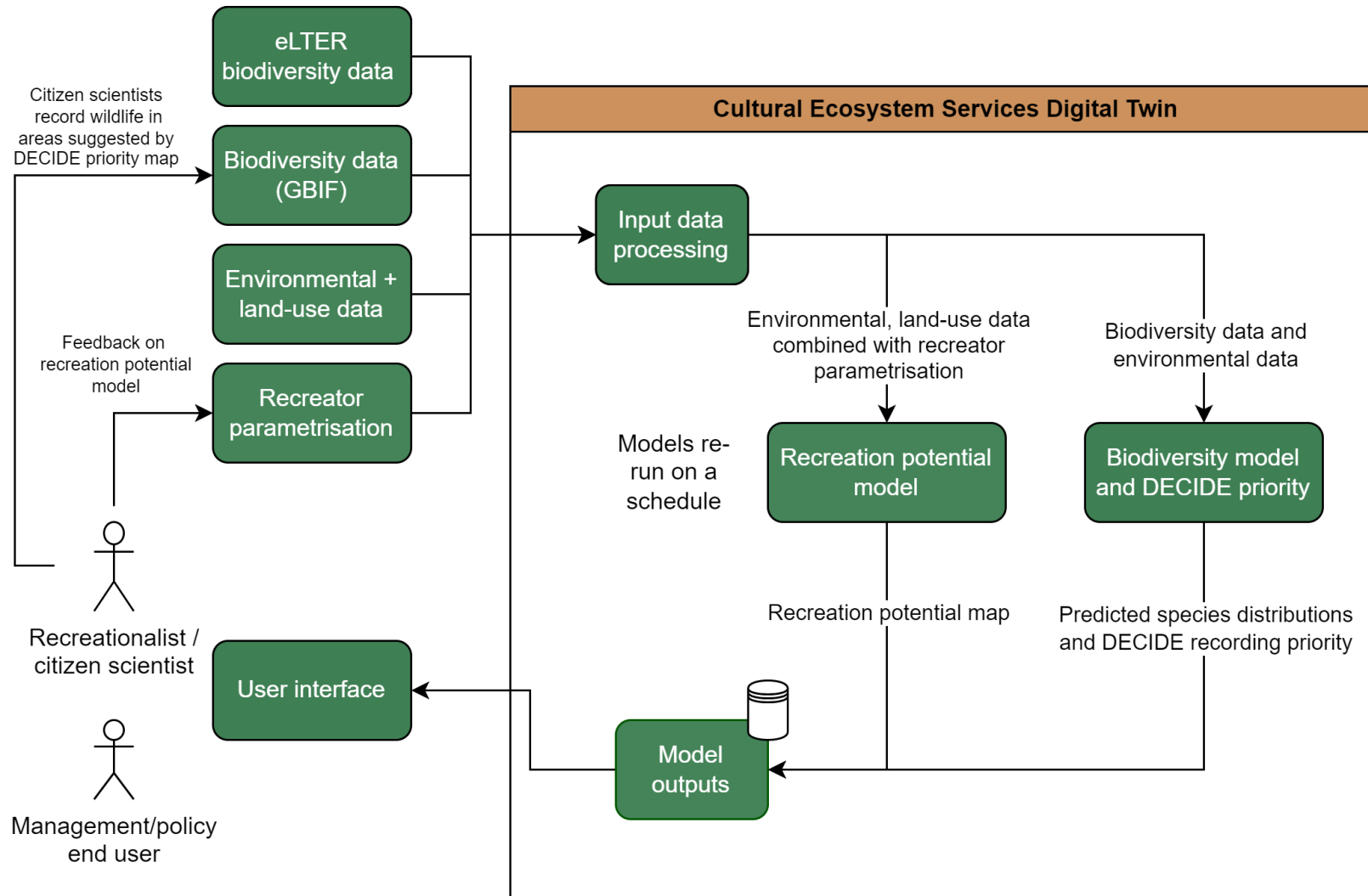
Zulian, G. et al, 2018. The practical application of spatial ecosystem service models to aid management of nature-based resources. *Ecosyst. Serv.* 29 (Part C):465-480

Target audience:

- Citizens wishing to spend time in nature at locations with specific attributes
- Land managers wishing to manage recreationalists in their area
- Policymakers wishing to balance the trade-offs between space for development and space for nature, and
- Inter and transdisciplinary researchers seeking socio-ecological knowledge specific to a place

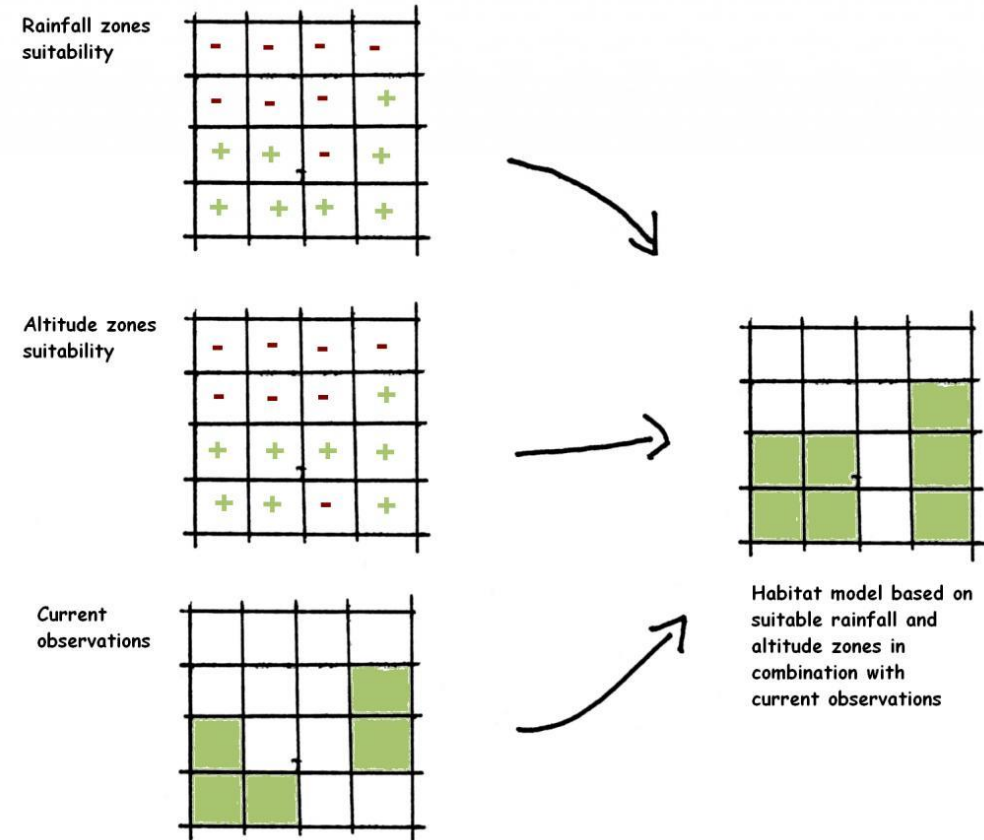


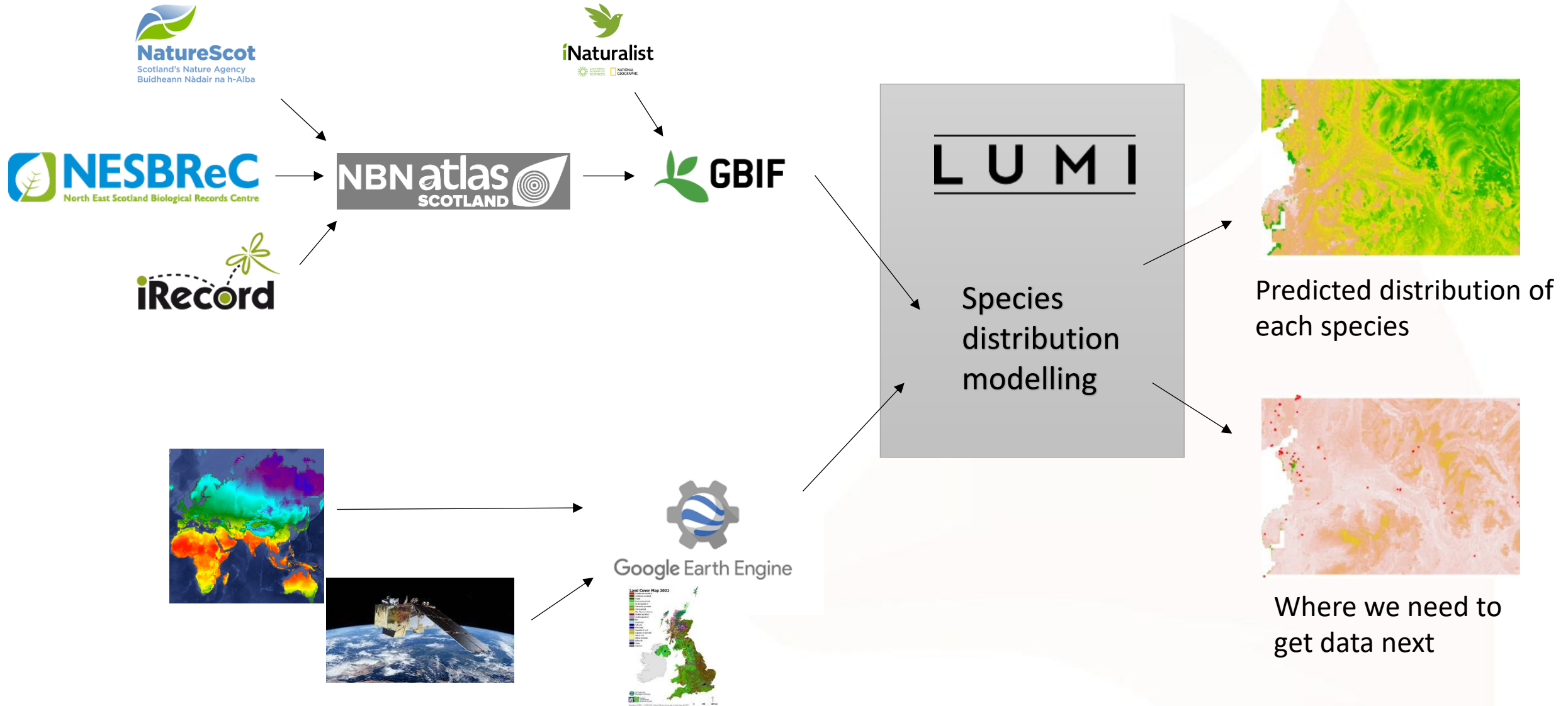
**BioDT Recreation Ecosystem
Services Digital Twin**



Species distribution models

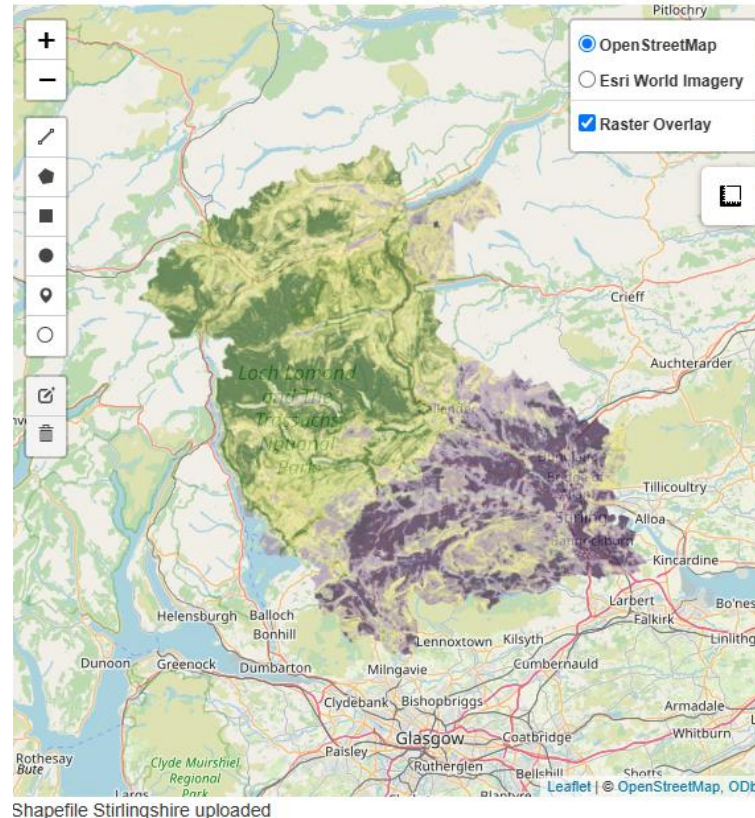
- Definition: Predict species distribution from environmental data.
- Purpose: Understand, predict, and manage species habitats.
- Components:
 - Environmental data
 - Species data
 - Models
 - Predictions



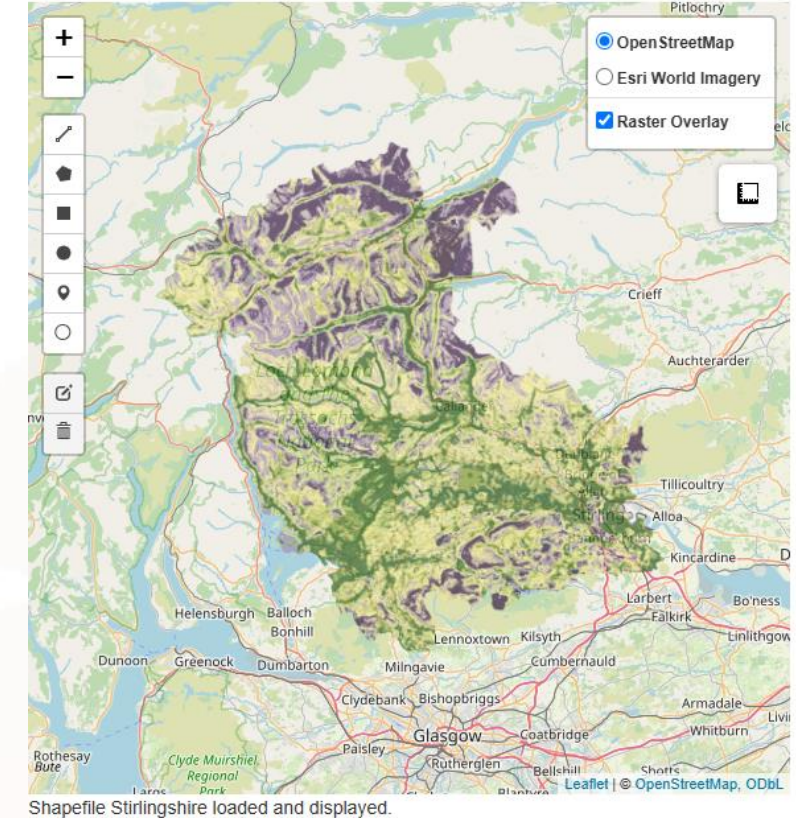


- Only recreational potential model used (dropped the proximity aspect)
- Key provided on simple linear scale rather than quartiles
- Datasets changed to be whole of Scotland
- All containerised and available to run on Lumi

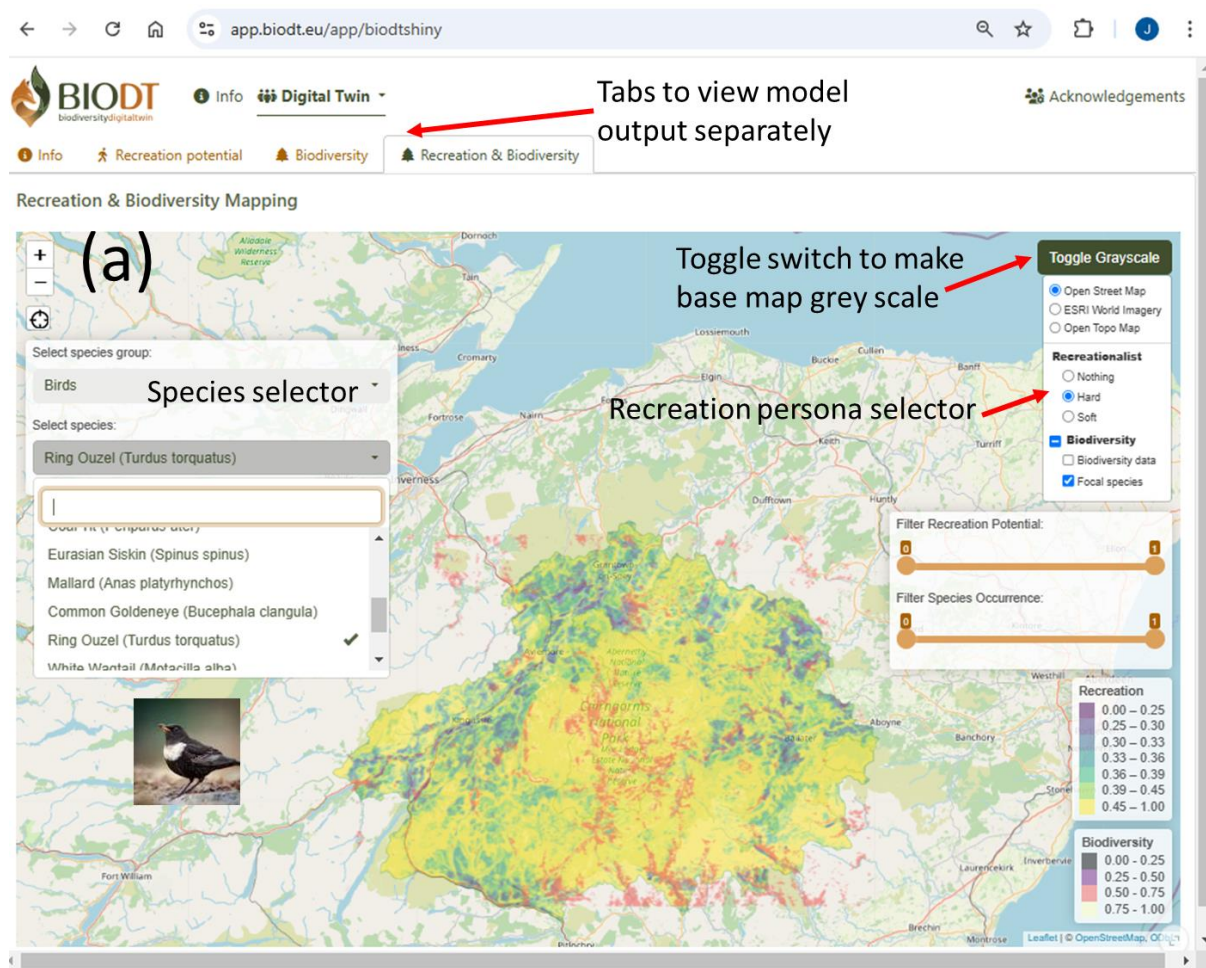
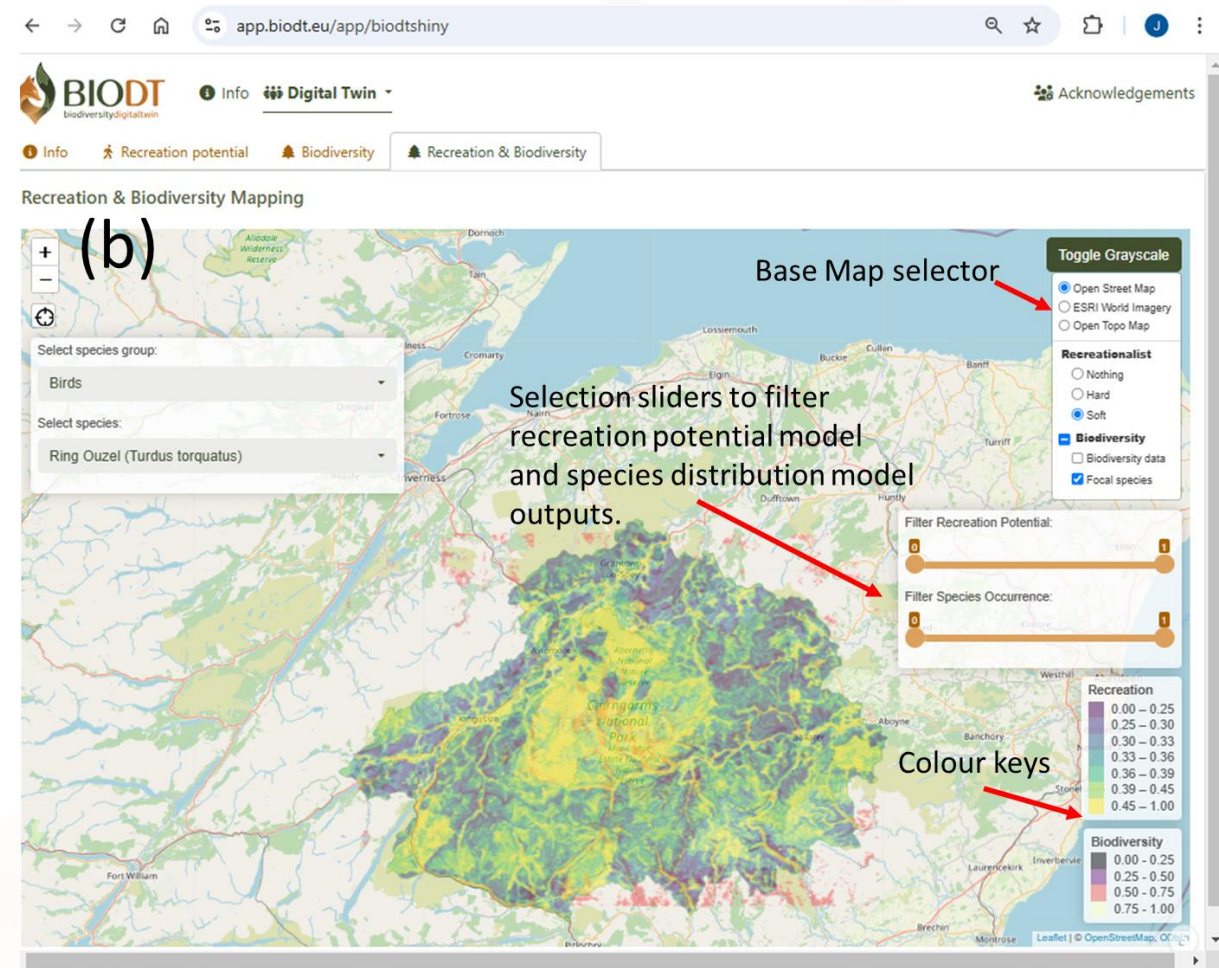
Hard Recreationalist Stirlingshire



Soft Recreationalist Stirlingshire



"AREA shape km2:2254.816"



Consultation focused on:

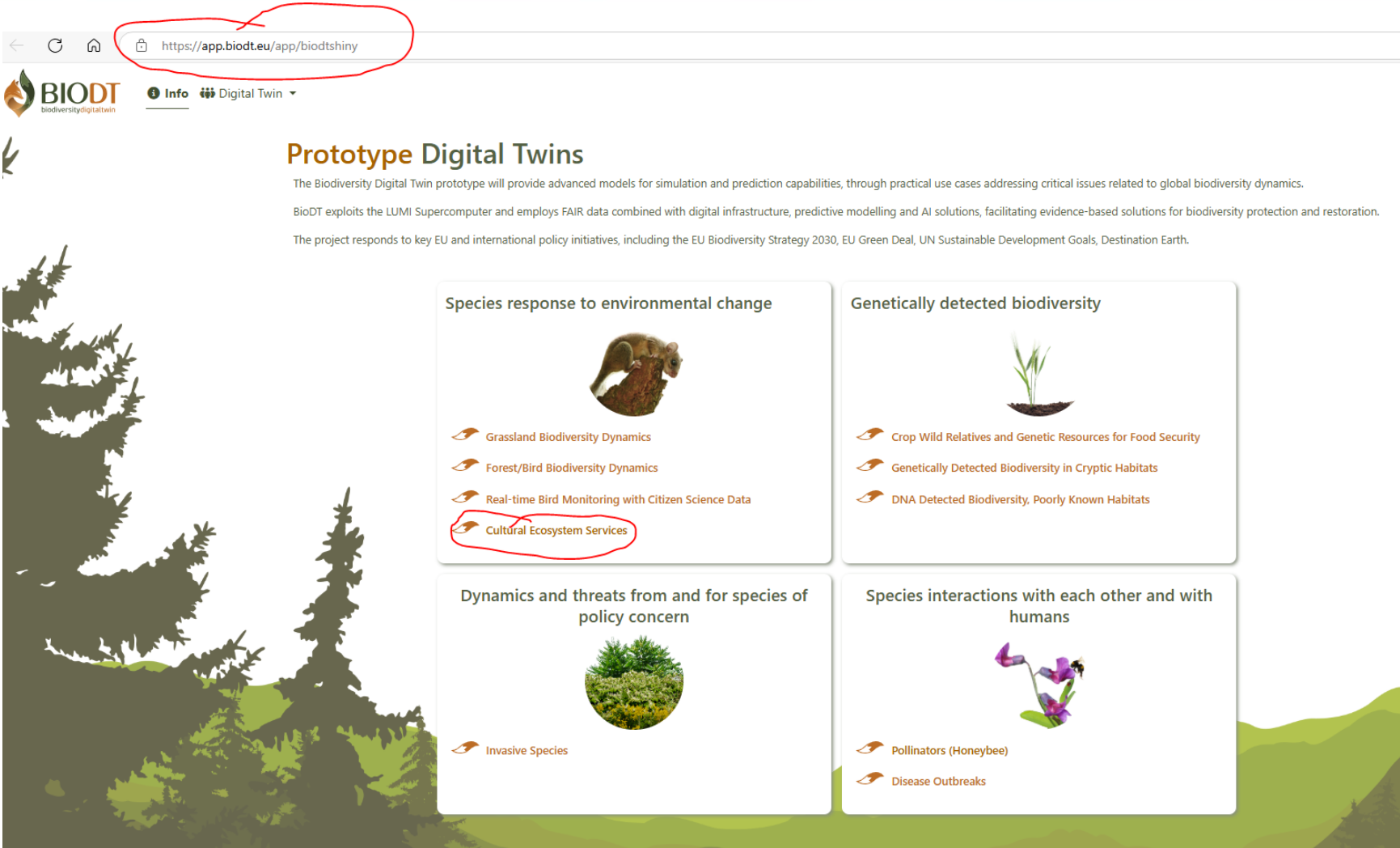
- (i) the graphical user interface,
the components of both the
- (ii) recreational and
- (iii) species distribution models and
- (iv) the sustainability of the digital twin following the completion of the BioDT research project.



<https://app.onlinesurveys.jisc.ac.uk/s/ceh-online-surveys/biodt-bes-2024-biodt-school>



Participants offering their opinions in the survey tool on their mobile phones after trailing the prototype digital twin at the British Ecological Society meetings December 2024 $n=58$.



Prototype Digital Twins

The Biodiversity Digital Twin prototype will provide advanced models for simulation and prediction capabilities, through practical use cases addressing critical issues related to global biodiversity dynamics.

BioDT exploits the LUMI Supercomputer and employs FAIR data combined with digital infrastructure, predictive modelling and AI solutions, facilitating evidence-based solutions for biodiversity protection and restoration.

The project responds to key EU and international policy initiatives, including the EU Biodiversity Strategy 2030, EU Green Deal, UN Sustainable Development Goals, Destination Earth.

- Species response to environmental change**
 - Grassland Biodiversity Dynamics
 - Forest/Bird Biodiversity Dynamics
 - Real-time Bird Monitoring with Citizen Science Data
 - Cultural Ecosystem Services**
- Genetically detected biodiversity**
 - Crop Wild Relatives and Genetic Resources for Food Security
 - Genetically Detected Biodiversity in Cryptic Habitats
 - DNA Detected Biodiversity, Poorly Known Habitats
- Dynamics and threats from and for species of policy concern**
 - Invasive Species
- Species interactions with each other and with humans**
 - Pollinators (Honeybee)
 - Disease Outbreaks

<https://app.biodt.eu/app/biodtshiny>

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Sharing results of feedback and discuss solutions



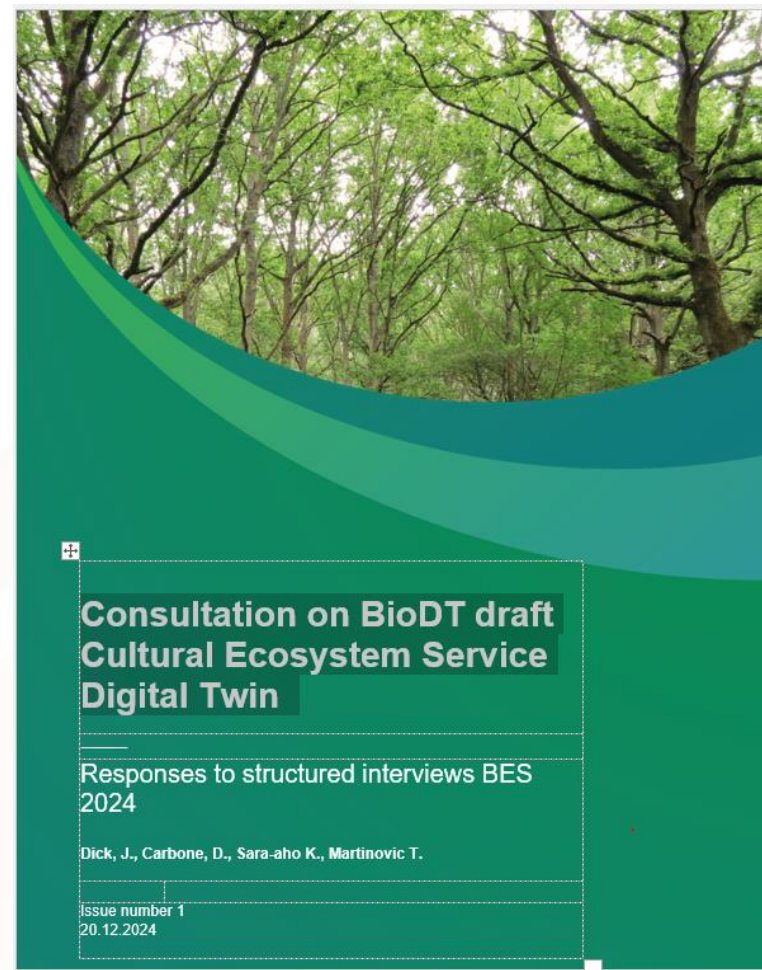
<https://www.alamy.com/stock-photo-feedback-concept-the-meeting-at-the-white-office-table-128390426.html>



<https://www.soniagartside.com/womenleaders/tag/Giving+Feedback>

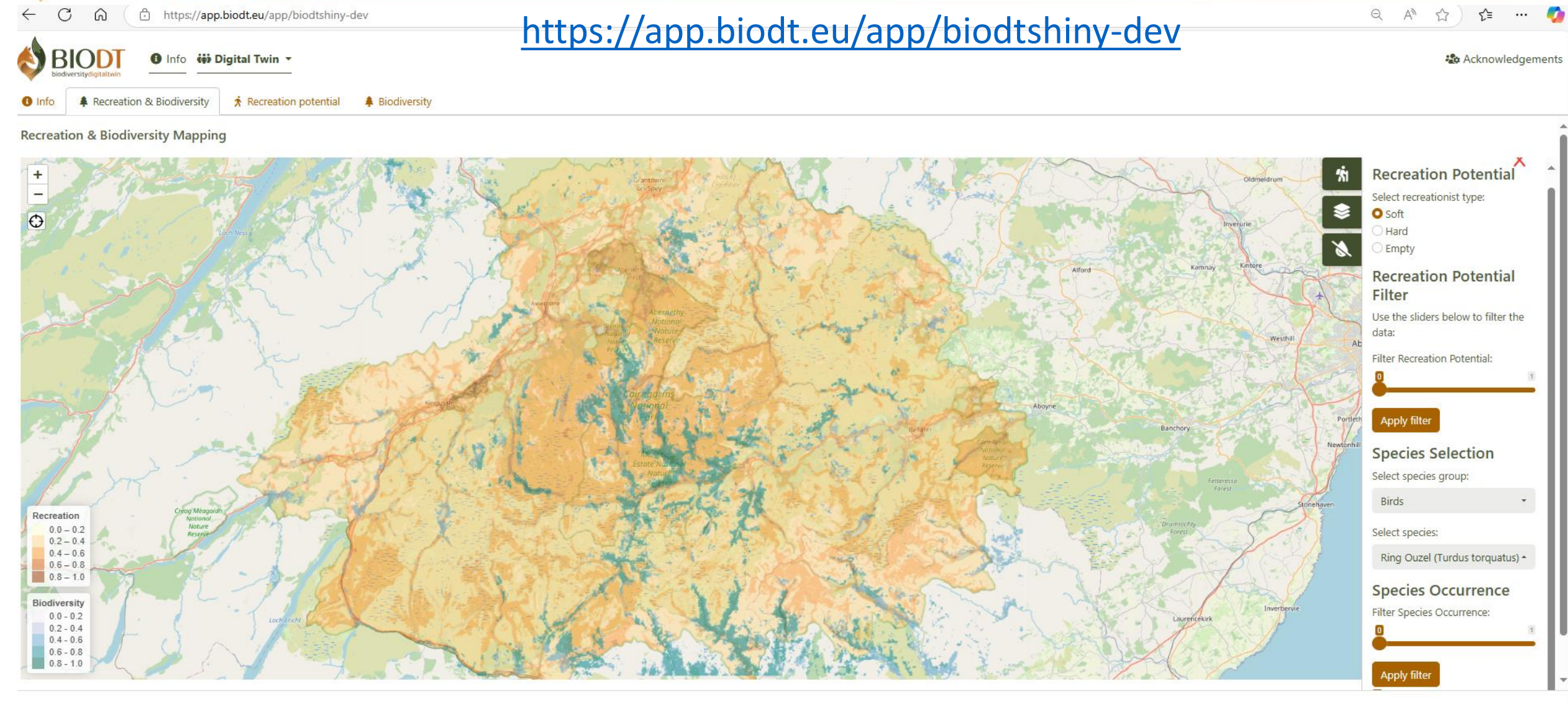
The overall conclusions where:

- 74% considered the three base maps sufficient
- Most respondents agreed that the filters were useful (78% recreational potential 93% species occurrence) but questioned why it was possible to move the slider in both directions.
- The use of additional tabs viewing supplementary information on other web sites or apps was welcomed with suggestions to include route planners, public transport, and weather apps
- There was general agreement that the recreational potential model incorporated the main elements (72%) but concern that the user may need to parameterise the model with 87 parameters
- Species distribution models considered a sensible approach, but it was recommended to include other biodiversity datasets not just citizen science
- Many recommended both the recreational potential and biodiversity data should be seasonally adjusted not only annually updated
- The colour scheme was questioned by many respondents even when they scored the question positively. Many recognised that there was a lot of information to impart but considered the present colour scheme unclear



Dick, J. ; **Carbone, D.** ; Sara-aho, K.; **Andrews, C.** ; Martinovic, T..
2025 [Consultation on BioDT draft Cultural Ecosystem Service Digital Twin: responses to structured interviews BES 2024](#). UK Centre for Ecology & Hydrology, 72pp.

<https://app.biodt.eu/app/biodtshiny-dev>





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