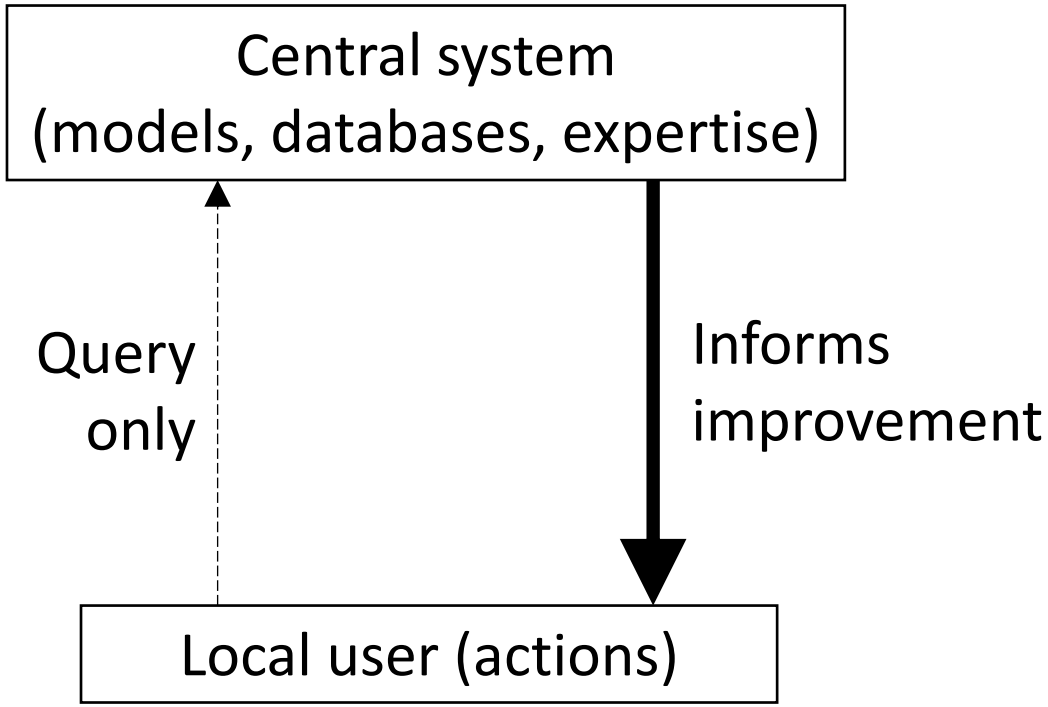
REDS: a key component of CUSP



ESUG

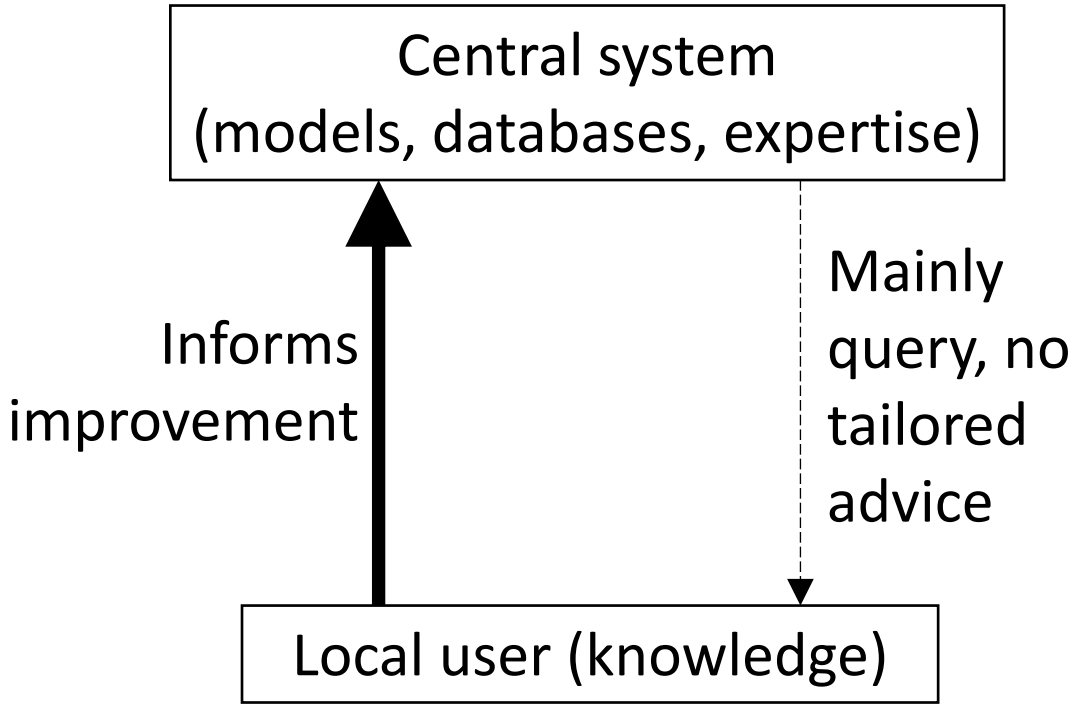
Traditional Environmental Decision Support (EDS)

- Information flow primarily one-way.



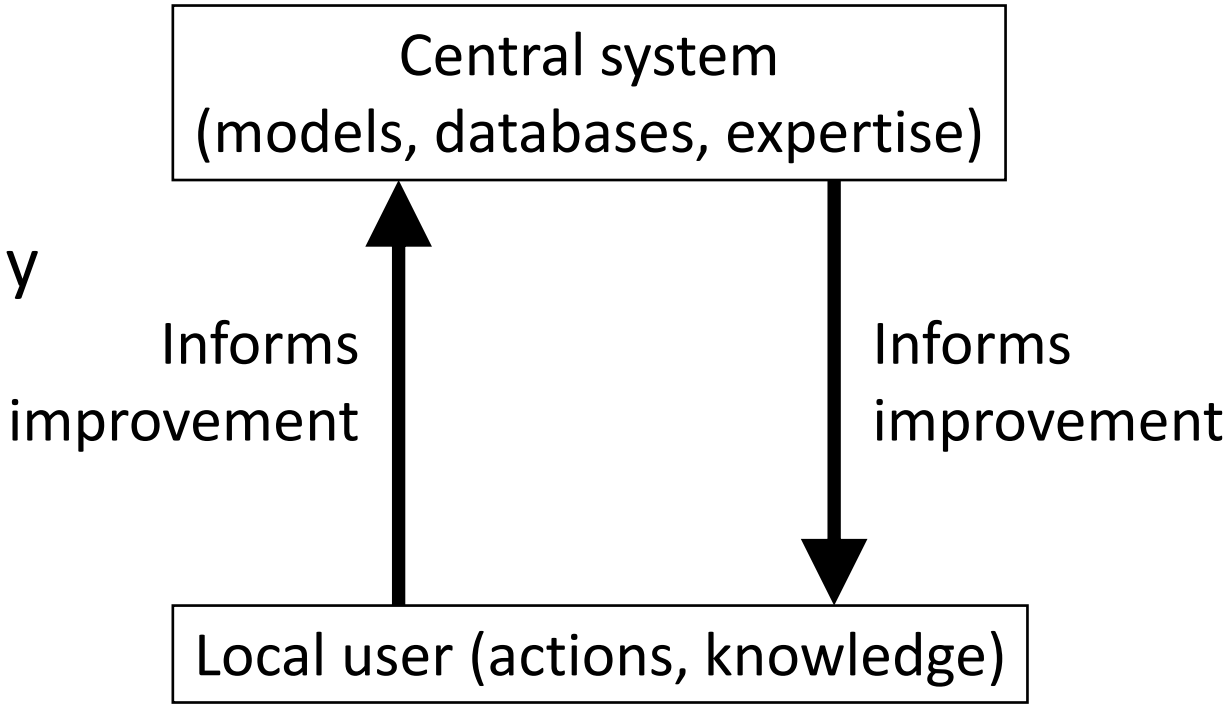
Traditional Citizen Science

- Information flow primarily one-way.



Reciprocal Environmental Decision Support (REDS)

- Information flows *both* ways.
- Information local-to-central not only elicits support but *also updates central database, models and expertise).*



That might sound rather abstract – what's the practical use?

- Consider ordinary citizens (those without conservation-relevant professions)
- Very many (globally) are land managers (e.g., gardeners, smallholders)
- Almost none of them are using EDS
- Very many of them are using species identification and reporting apps
- This is a massive missed but easily exploited opportunity

Bastide et al., in press, Ecological Modelling

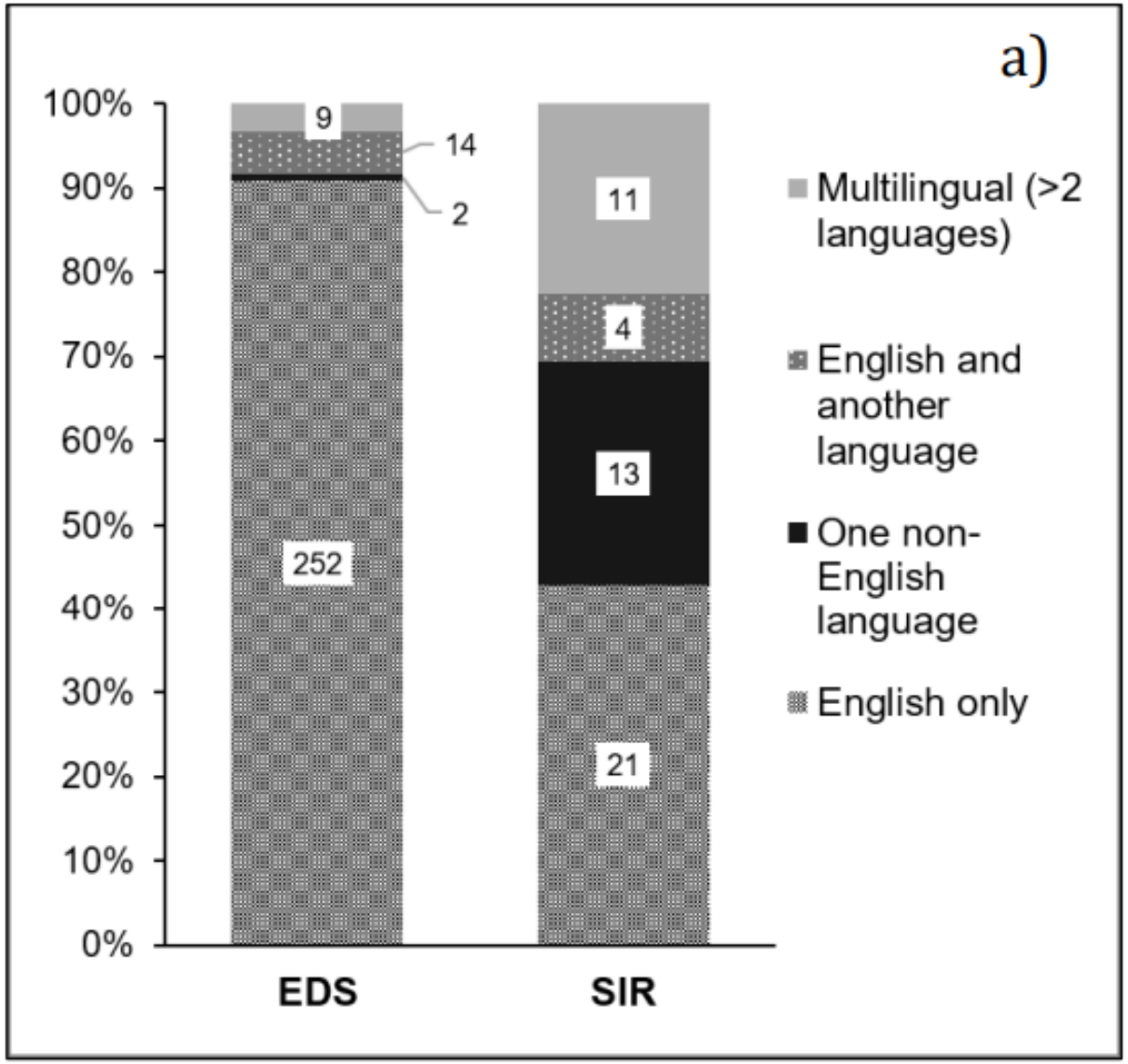


Figure 2a: Multilingual capabilities of Decision Support (EDS) tools (n=277) and Species Identification and Recording (SIR) tools (n=49).

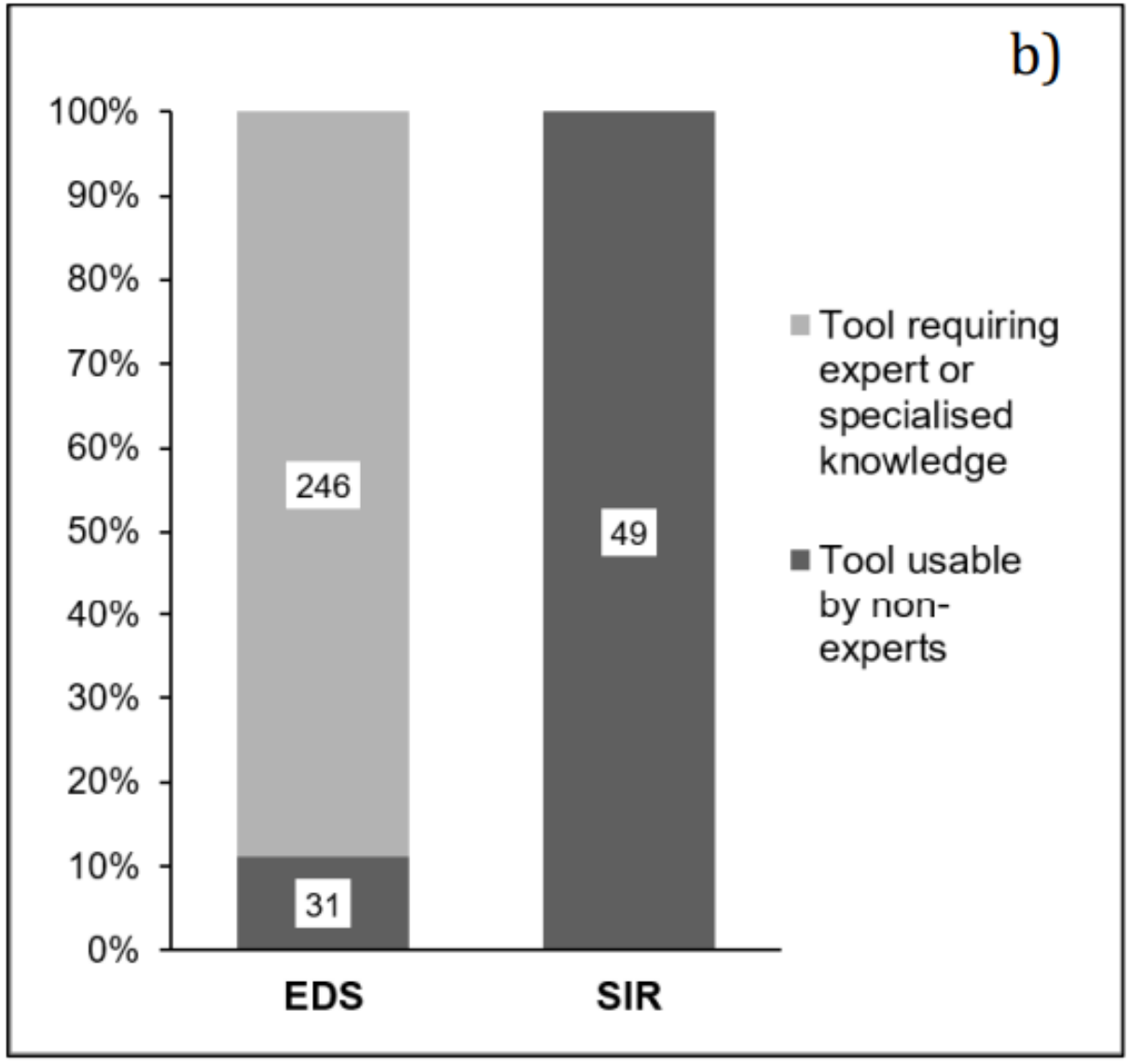


Figure 2b: Usability for non-experts of Decision Support (EDS) tools (n=277) and Species Identification and Recording (SIR) tools (n=49).

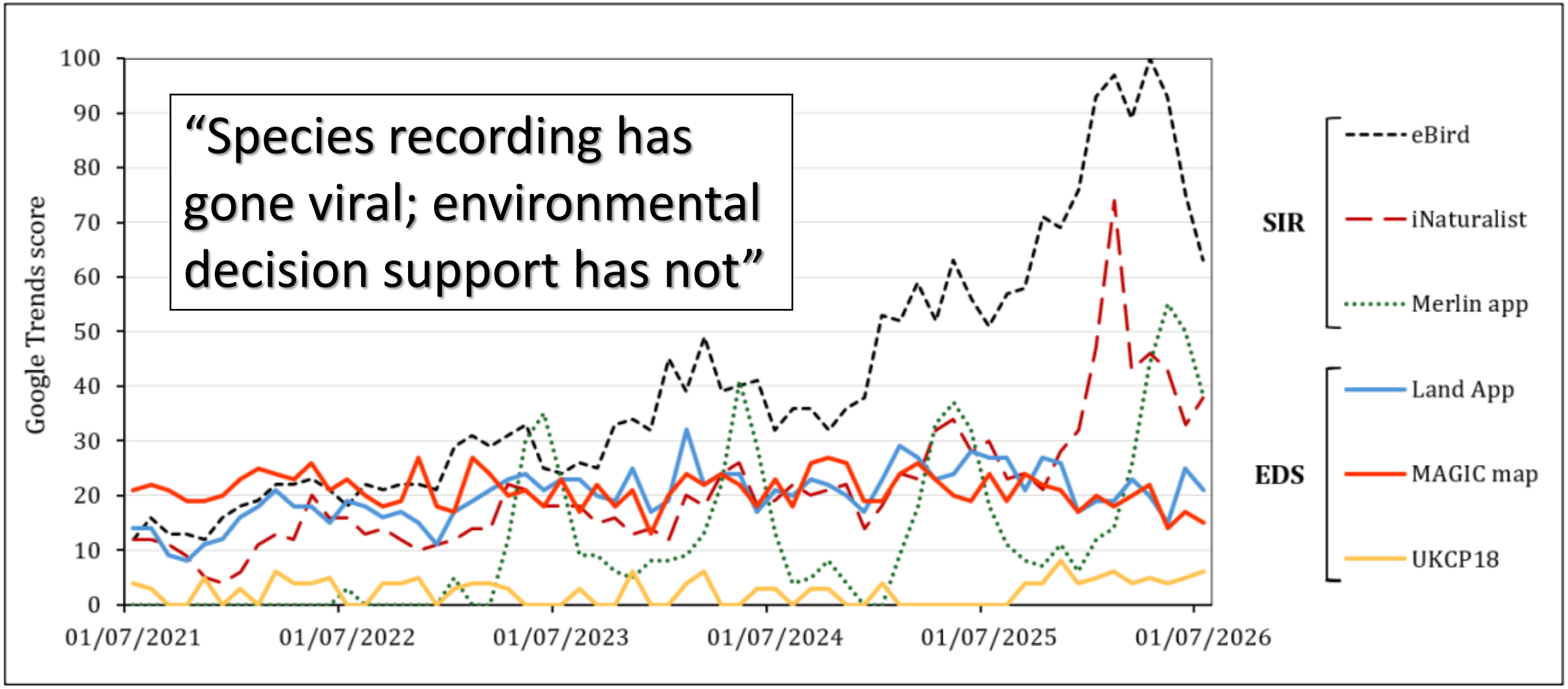


Figure 1: Google search trends in the UK (2016-2026) for 3 key Environmental Decision Support (EDS) tools and 3 Species Identification and Recognition (SIR) tools: Merlin app (Merlin Bird ID by Cornell Lab), iNaturalist, eBird, Land App, Magic Maps, and UKCP18 (UK Climate Projections 2018). Values are normalized by Google Trends on a 0–100 scale, with 100 indicating the highest relative search interest during the study period [31].

Conclusion of this review

- If Environmental Decision Support was made much more accessible, it could be:
  - taken up by the very many land managers who we know already have an affinity for nature and for technological tools (because they use SIRS)
  - incorporated into existing SIR tools
  - combined with the citizen-science aspect of SIR tools to allows reciprocal model updating, which could quickly bootstrap major improvements in quality of decision support

REDS proof of concept: the Garden Advice app

1. UK residents mapped their garden microhabitats.
2. A pre-existing model[1] of house sparrow habitat-association provides sparrow scores.
3. The system reports how sparrow scores could improve or worsen with garden changes.
4. Users also reported sparrow observations.
5. Over time, the model is automatically updated with these new observations.
6. Future advice about sparrows is improved by information from previous users.

[1]Matthiopoulos, J., Field, C., & MacLeod, R. (2019). Predicting population change from models based on habitat availability and utilization. *Proceedings of the Royal Society B*, 286(1901), 20182911.

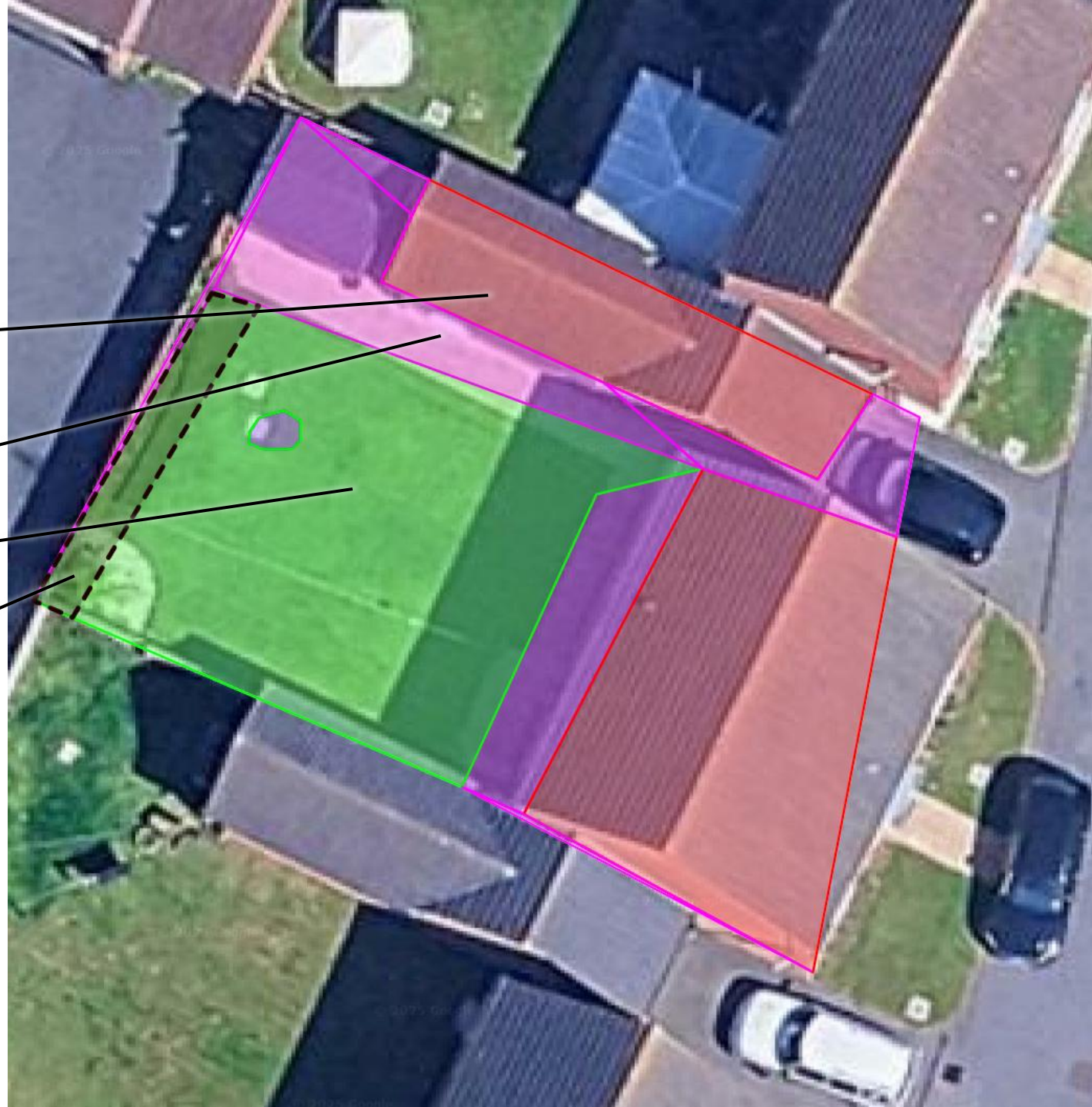
A garden mapped by a UK resident

Buildings
(important for house sparrows)

Artificial surface

Grass

Sparrow observation area

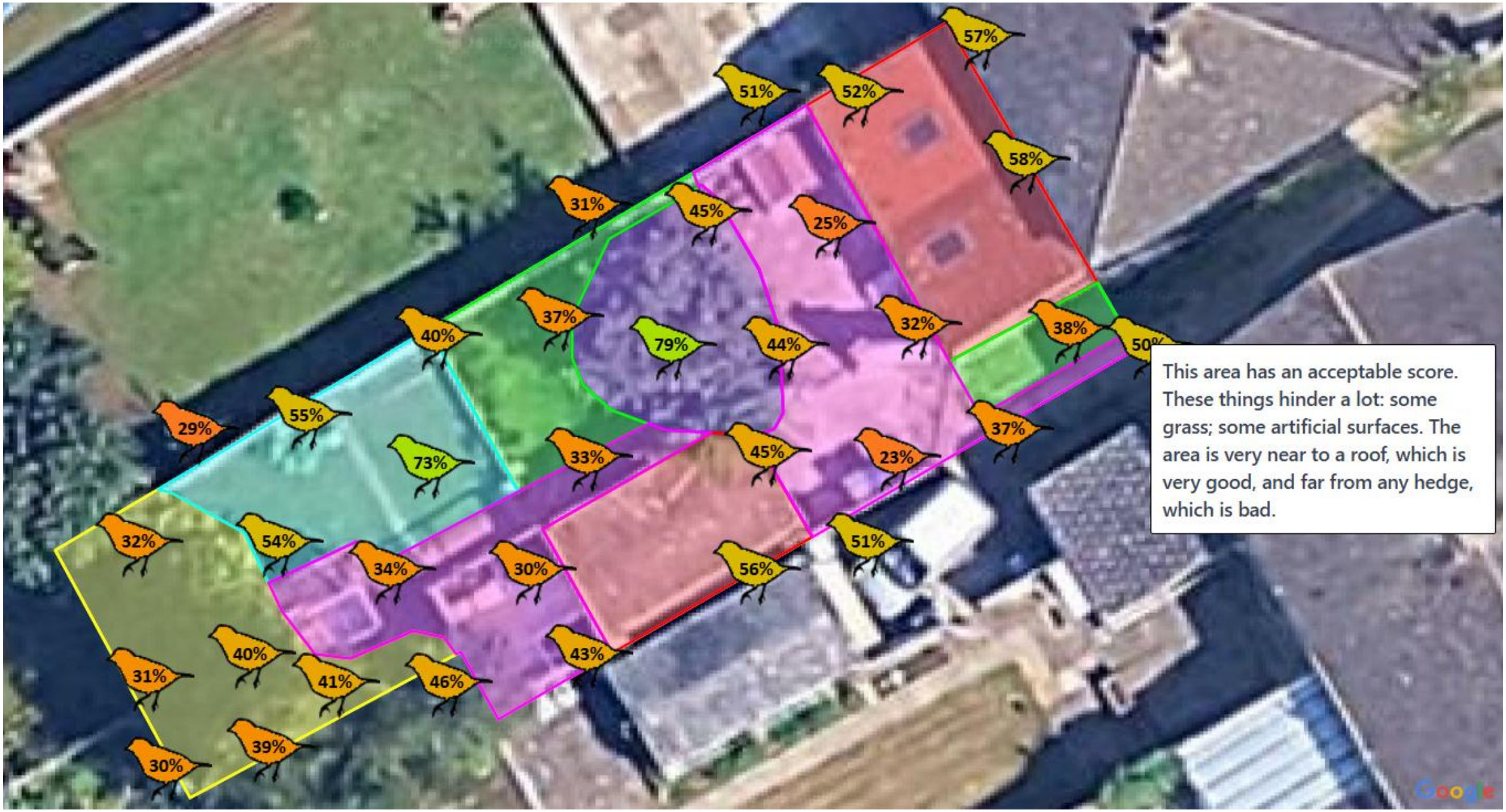


More example gardens from users (we used 71 to update our model)



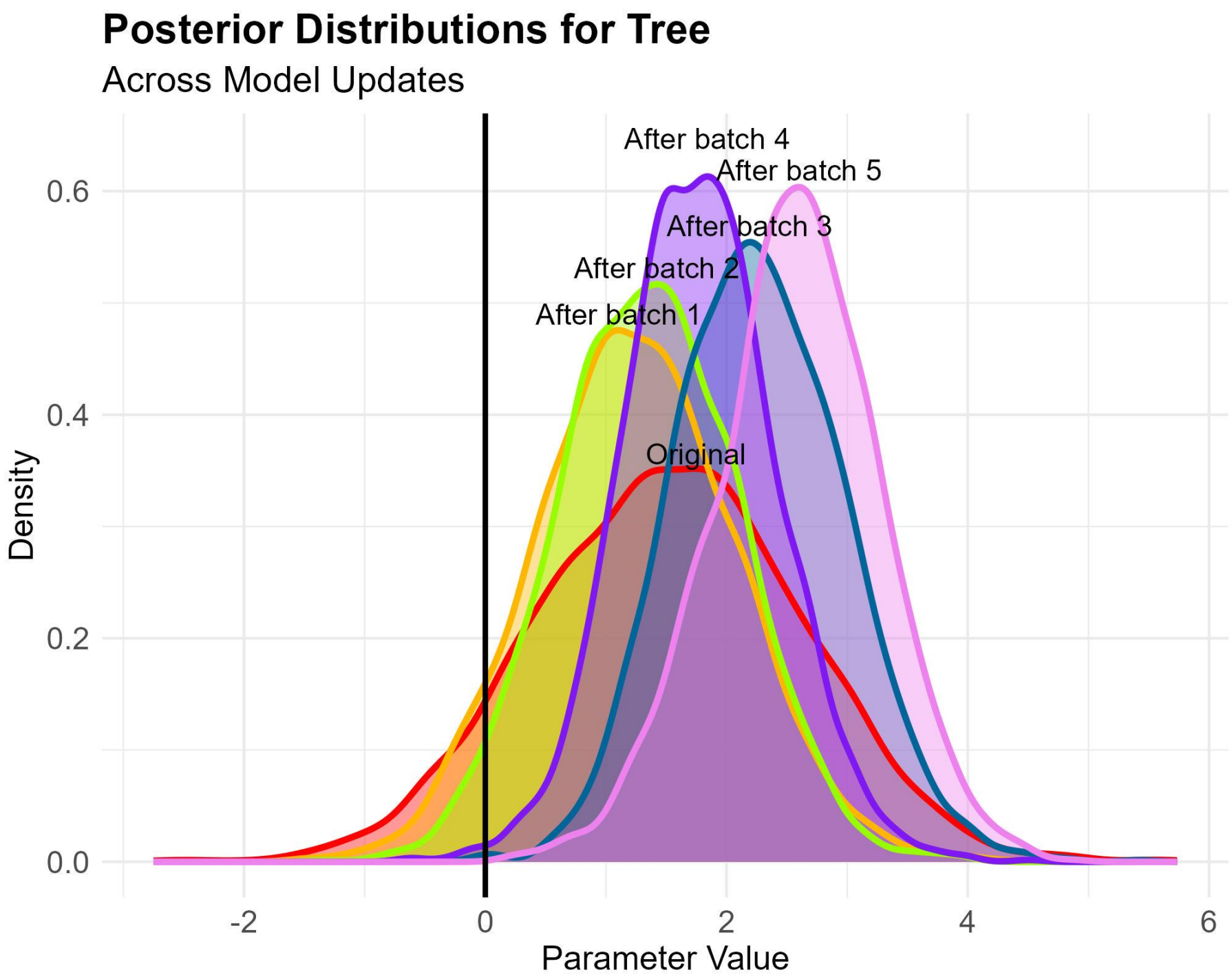


Sparrow scores (with a sparrow score explainer)



The sparrow observations improved the model's ability to predict sparrows

- With all this new data, model coefficient estimates became clearer.
- NB! Any data can reflect observation bias as well as reality!



The great flexibility of the REDS idea and system

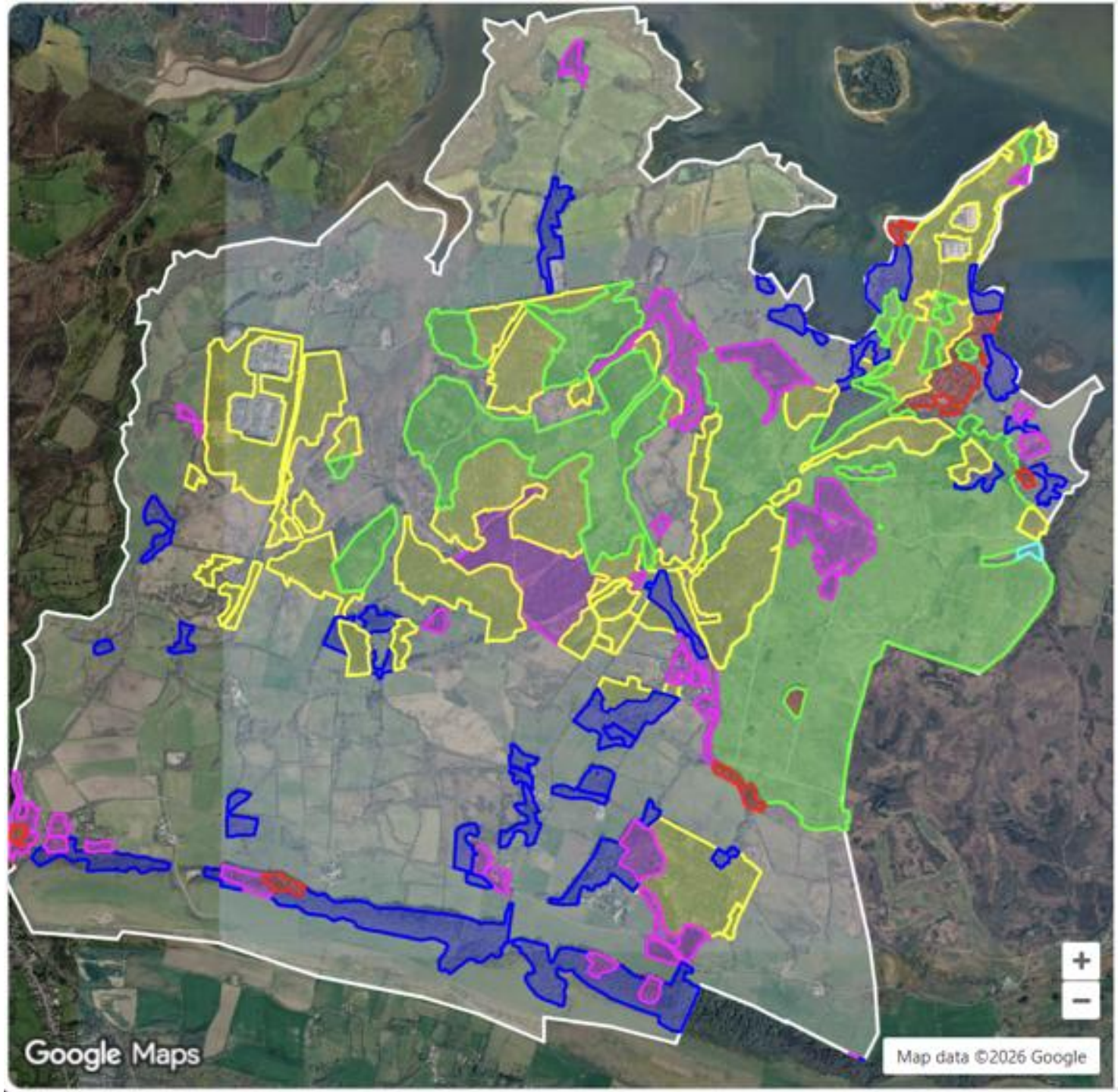
- The system could be used to create and improve models of any spatial associations.
  - Many types of habitat association or utilisation model.
  - This could also go well beyond habitats and species – for example, human behaviour could be included.
- Even if you don’t need to improve a model, the system is a convenient way for users to report spatial information and receive advice in return.





REDS in the PRO-COAST Arne case study

- Native red squirrels could be reintroduced to the Purbeck coastal region, replacing the invasive and damaging grey squirrels.
- To assist, residents would use a REDS system to report sightings of both species, along with local habitat descriptions, so that population dynamics and habitat association models can be built up to:
  - Inform experts about the reintroduction progress.
  - Inform residents about how to support red squirrels.



Find your area, then describe it. Then, you can see predicted squirrel populations.

Find | Describe | Predicted squirrels | What-if

Now you have a boundary, you can add compartments and map squirrel sightings.

Boundary | Compartments | Sightings

Add a compartment, change or delete one, tidy them (grow them or fill empty space), or get help.

Add | Subtract | Change | Delete | Tidy | Help

How will you draw the compartment? Clicking is easiest for straight lines, tracing or dragging for curves.

Click | Trace | Drag | Walk | Import

Select a data source to import from

NFI

Register | Retrieve | About | Privacy

Future versions – the sky's the limit

- Flexible architecture ('model boxes') to incorporate all models
- Most models are poor, all models can get better – iterative reciprocal improvement will be powerful ('co-creation' with practitioners)
- Open source and non-profit but sustainable freemium business model after current public-funded initiation.
- Additional larger land-owners next for greater impact
  - We also have a version that models partridges on farmland, based on a model from the Game & Wildlife Conservation Trust (Aebischer & Ewald, 2010).

REDS Resources

Bastid, P., Ewald, J., Gardashuk, T., Jaeckel, Y., Kenward, R., & Kenward, B. (*in press*). Species recording has gone viral; environmental decision support has not: the difference matters. ***Ecological Modelling***. https://doi.org/10.5281/zenodo.21807702

Kenward, B., Casey, N., Bastid, P., Buner, F., Buffam, I., Ewald, J., & Kenward, R. (*under review*). Reciprocal Environmental Decision Support (REDS): better tailored advice in return for data. https://doi.org/10.64898/2026.01.08.697712

Kenward, B., Ewald, J., Kenward, R., Casey, N., Bastid, P., Buner, F., & Buffam, I. (*simple brochure*) Better citizen observations in return for better conservation advice: Introducing REDS. https://earthadvice.org/documents/better_citizen_observations_in_return_for_better_conservation_advice_introducing_reds.pdf

Garden Advice app: https://garden.earthadvice.org/