

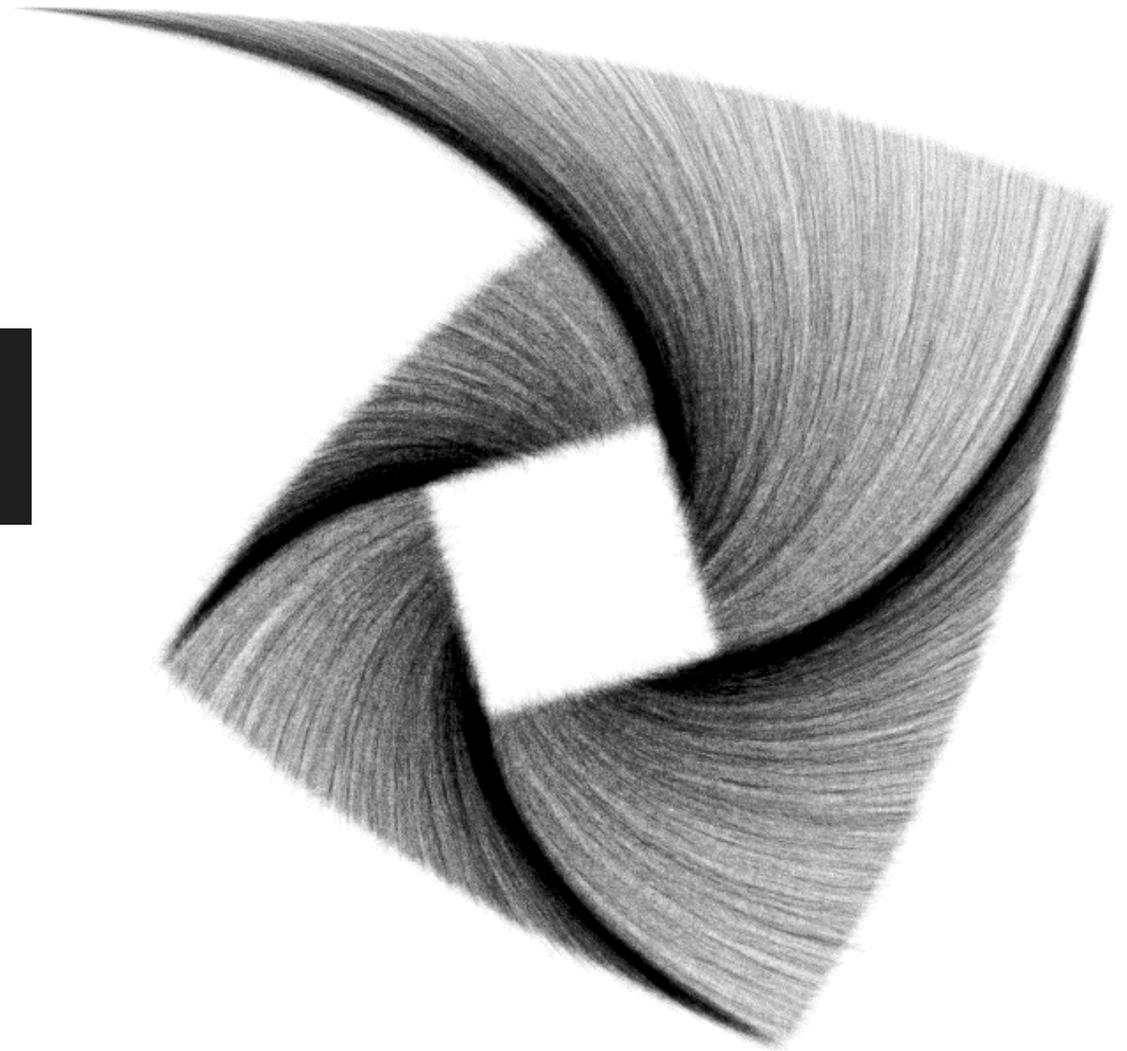


UK Centre for
Ecology & Hydrology

Opportunities and challenges at the frontier of ML and biodiversity

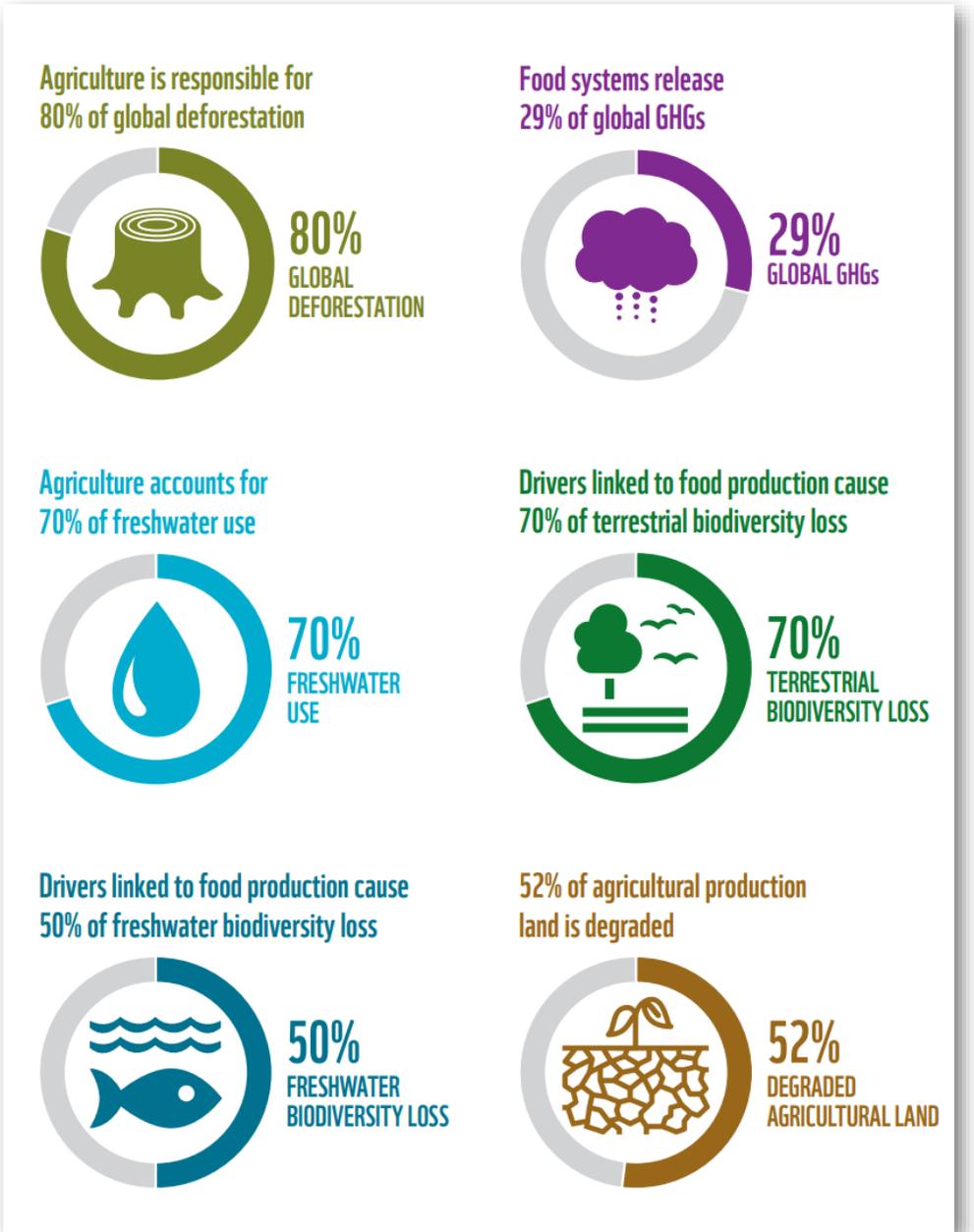
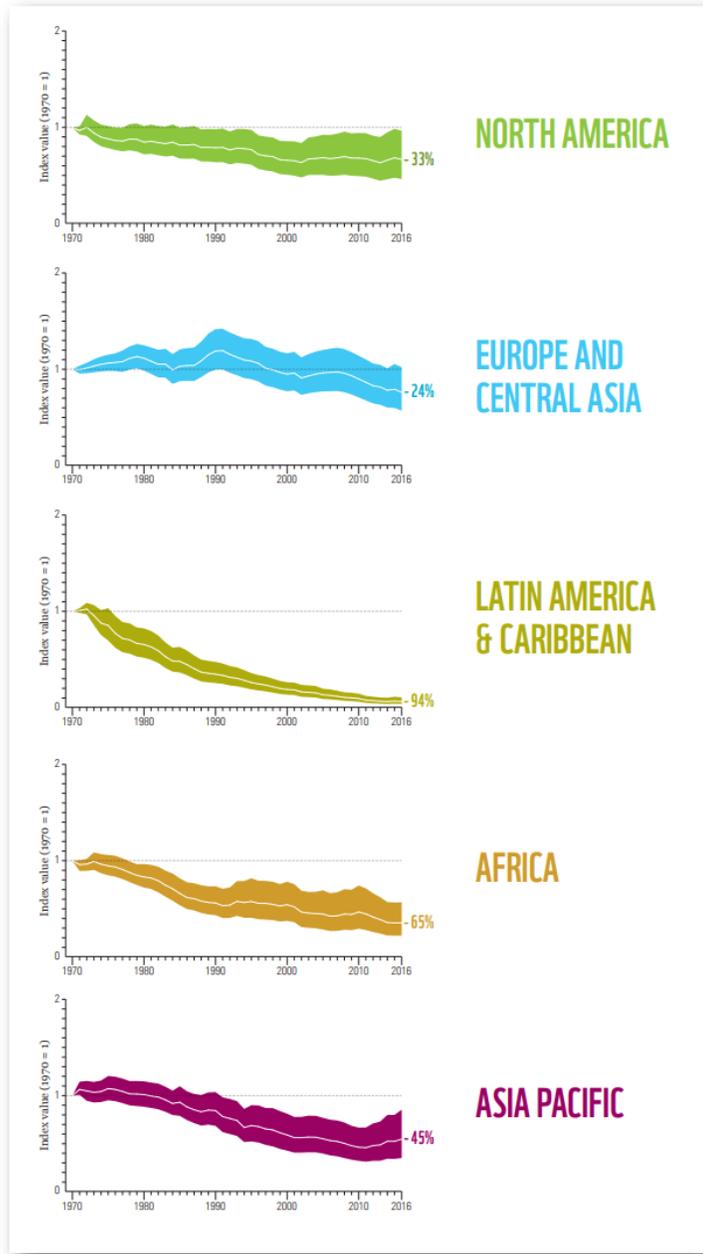
Tom August

Computational Ecologist





LIVING PLANETS?



Opportunities and challenges

Harnessing unintended data streams



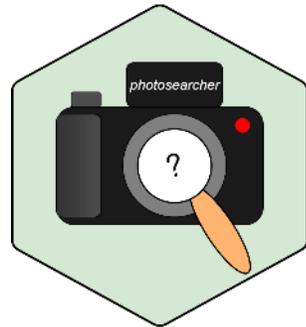
The idea

An AI naturalist workflow

flickr

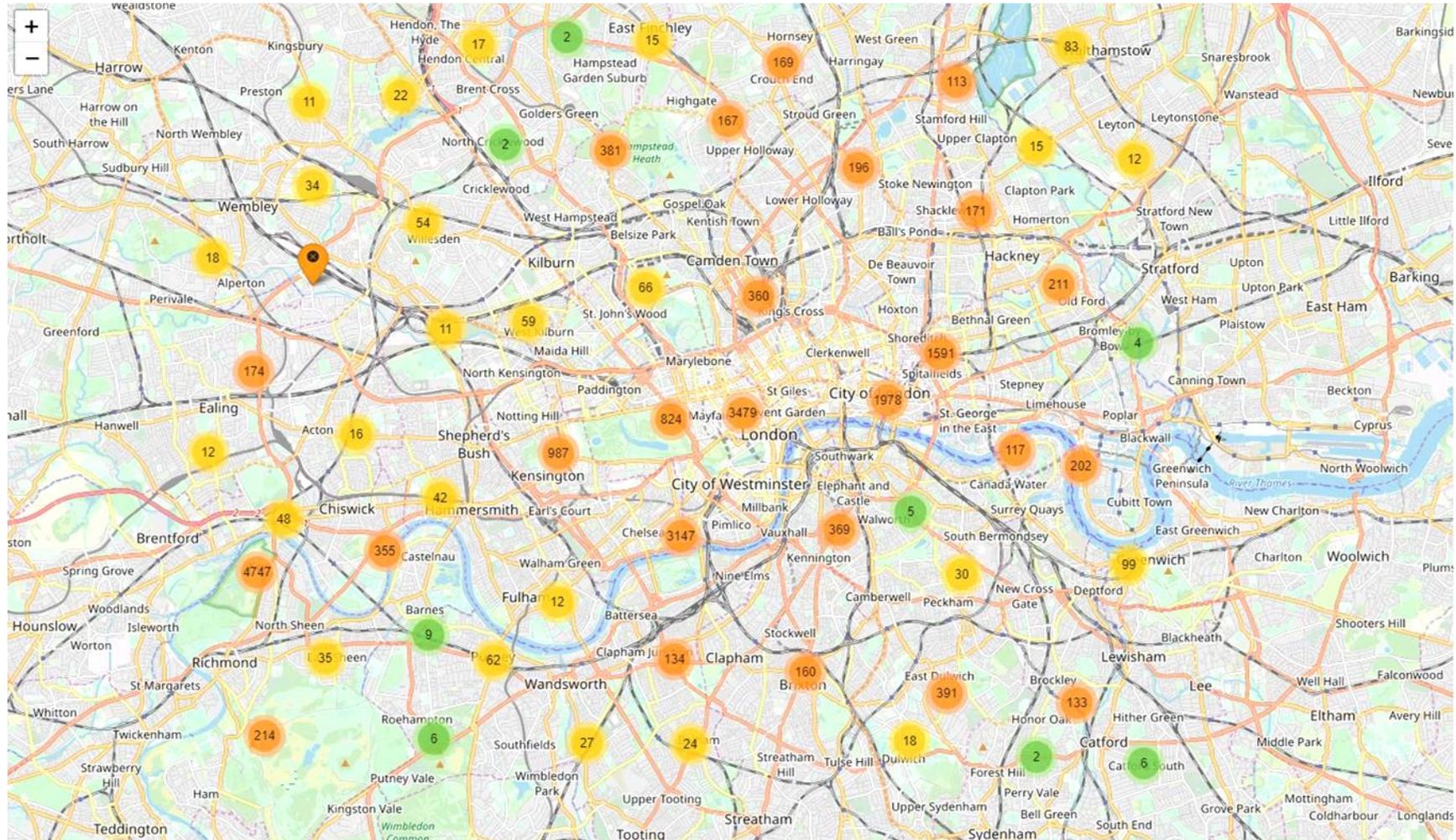


 Pl@ntNet



plantnet

AI Naturalist: Day Out in London



August, et al. 2019. Zenodo. <http://doi.org/10.5281/zenodo.3514685>



Helianthus annuus
Score: 0.23

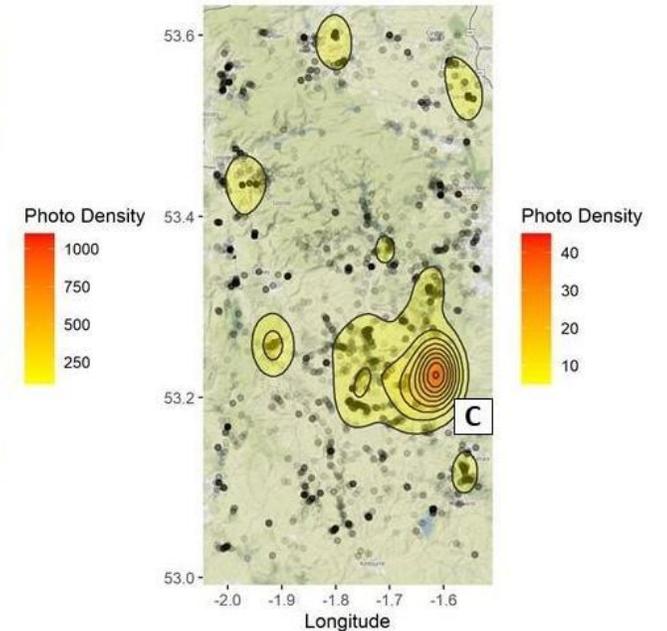
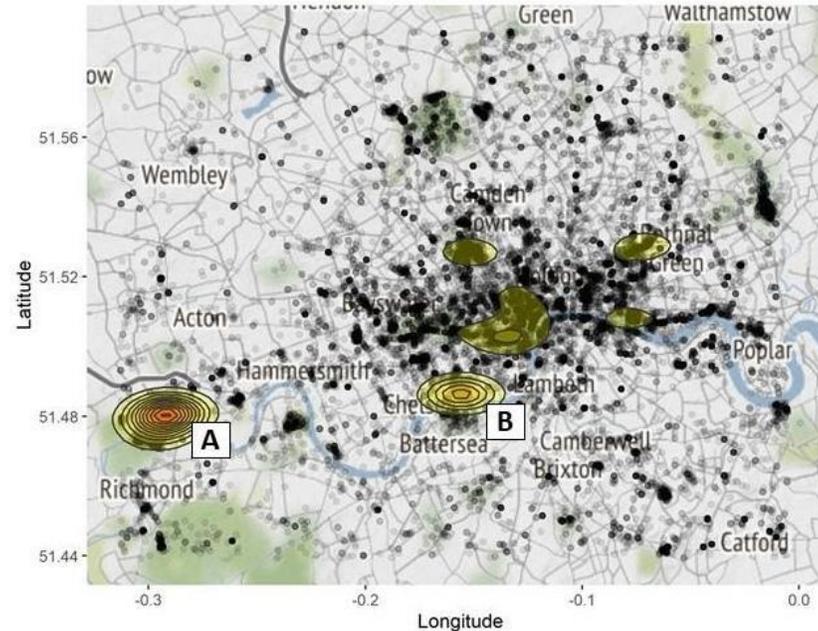
Challenges

Data are spatially biased

Images are biased by population density

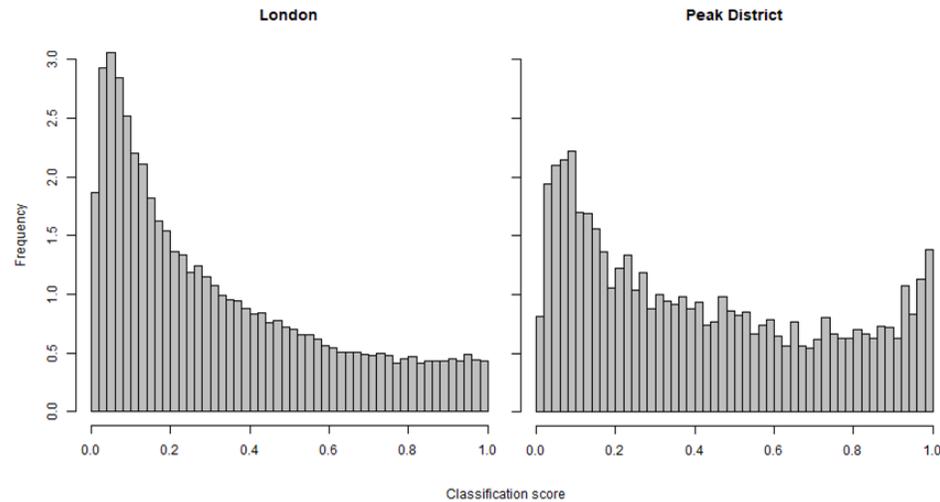
Images are biased by sites of interest

Both biases exist in existing natural history data



Challenges

Images are sub-optimal



Many of the images collected are not of a single species

Many images are of ornamental species

A mismatch results between model train data, and these data



Challenges

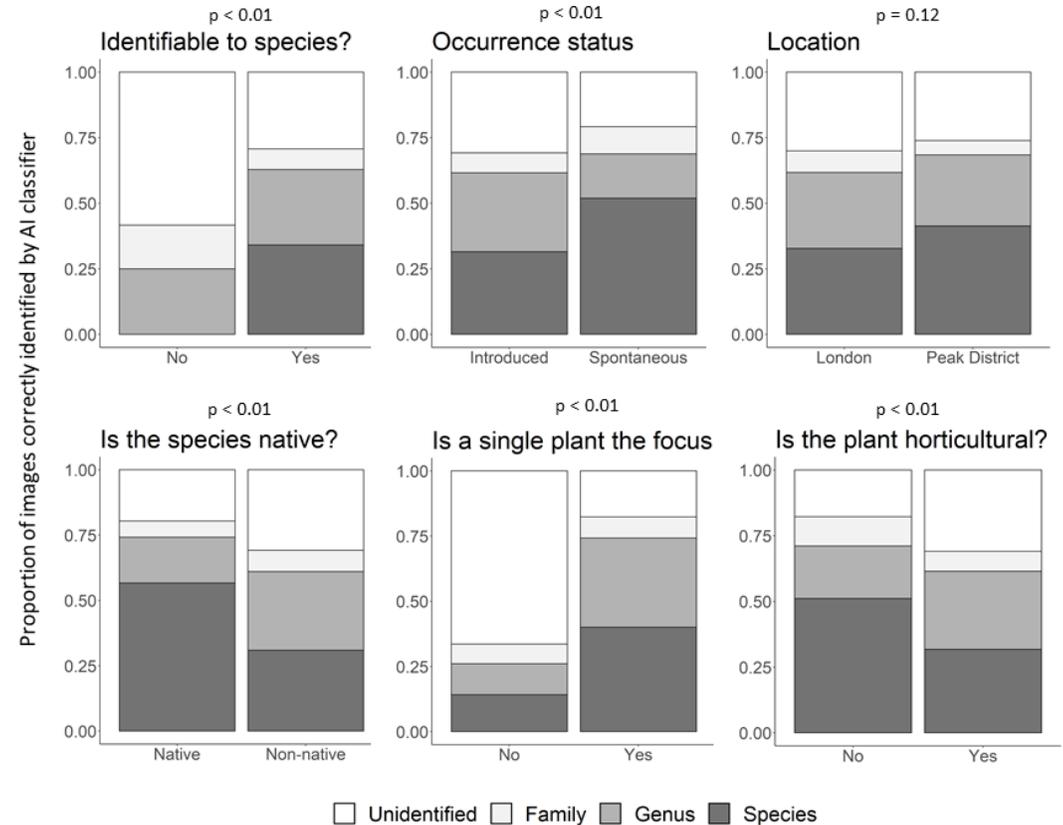
Task does not match training data

Performance is best for:

Naturally occurring

Native plants

Where a single plant is the
focus of the image

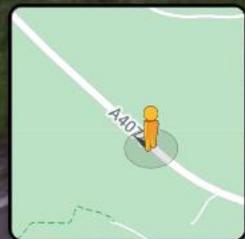


Red Ln

England



Street View - Jun 2017



Red Ln

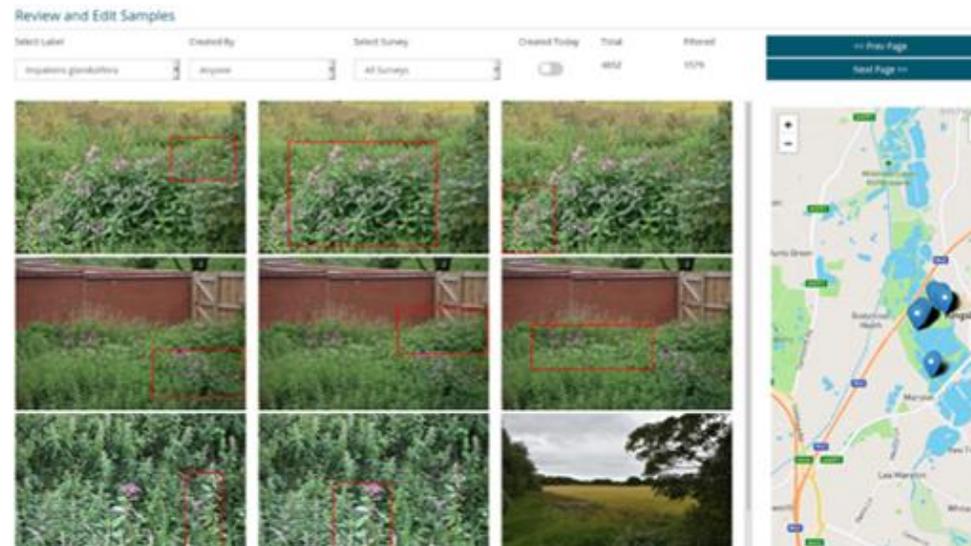
Google

Large scale assessments

Collect images using
a car-mounted
camera

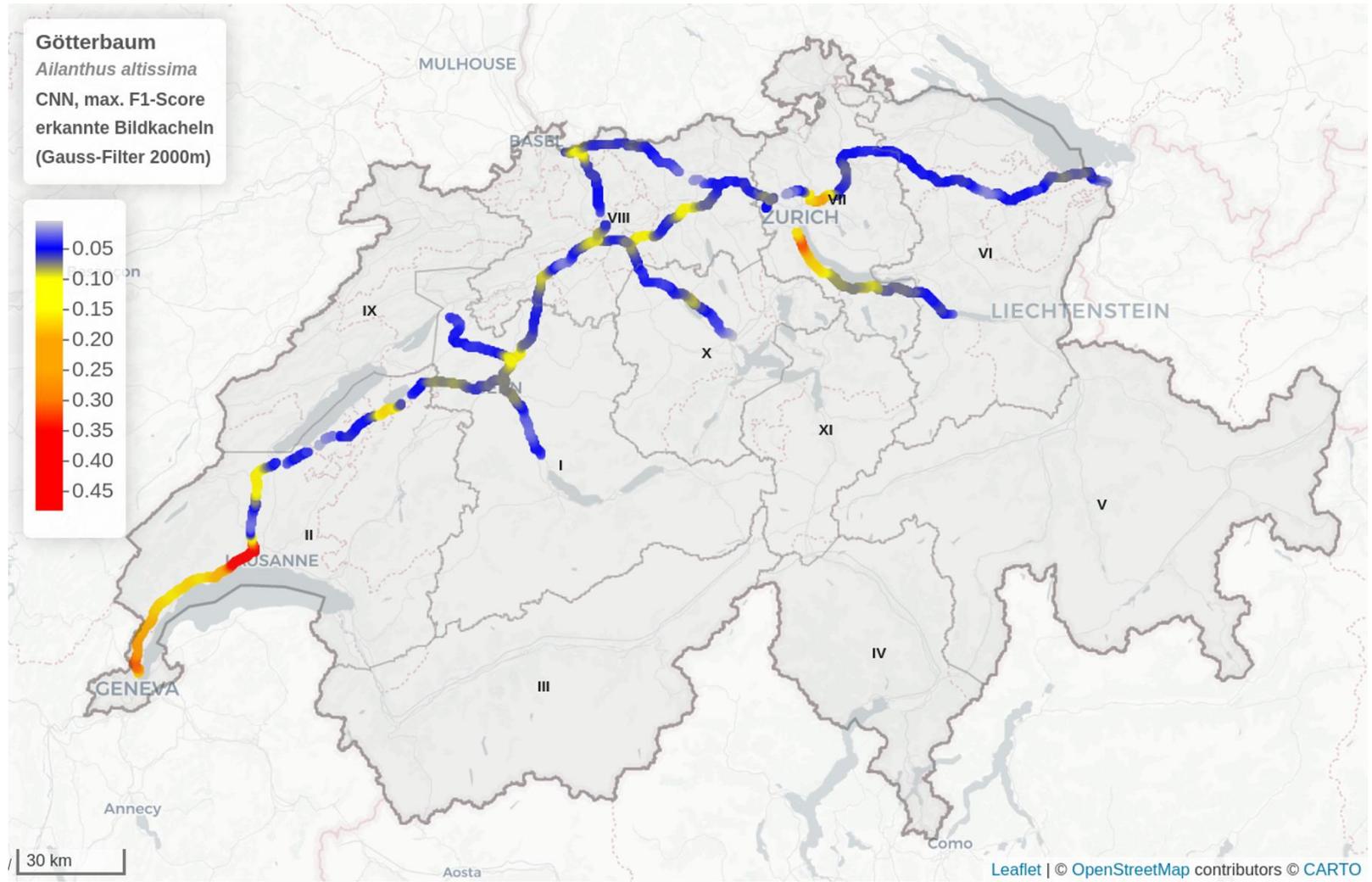


Create a tool for reviewing
and labelling images



Train AI to find
interesting images
including invasive
species

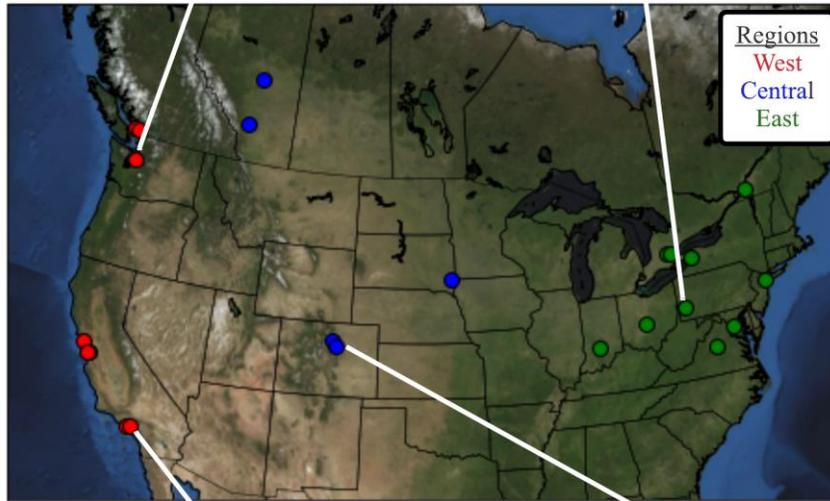




City: Seattle, Genus: Malus



City: Pittsburgh, Genus: Platanus

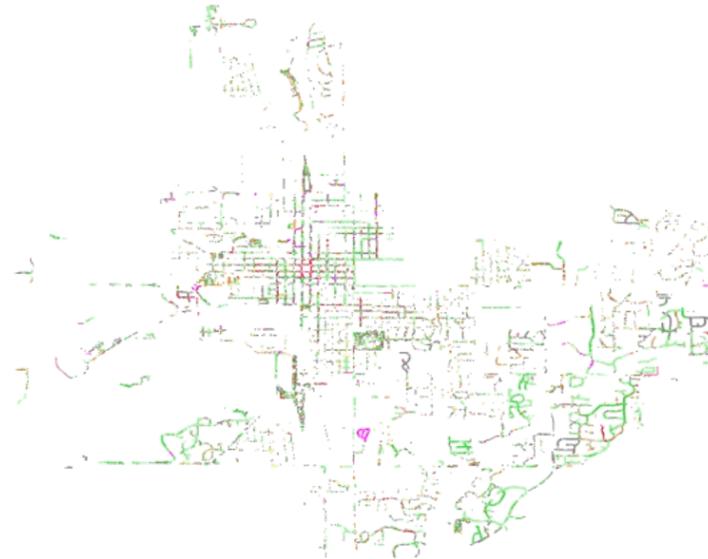


City: Los Angeles, Genus: Washingtonia



City: Denver, Genus: Quercus

Bloomington

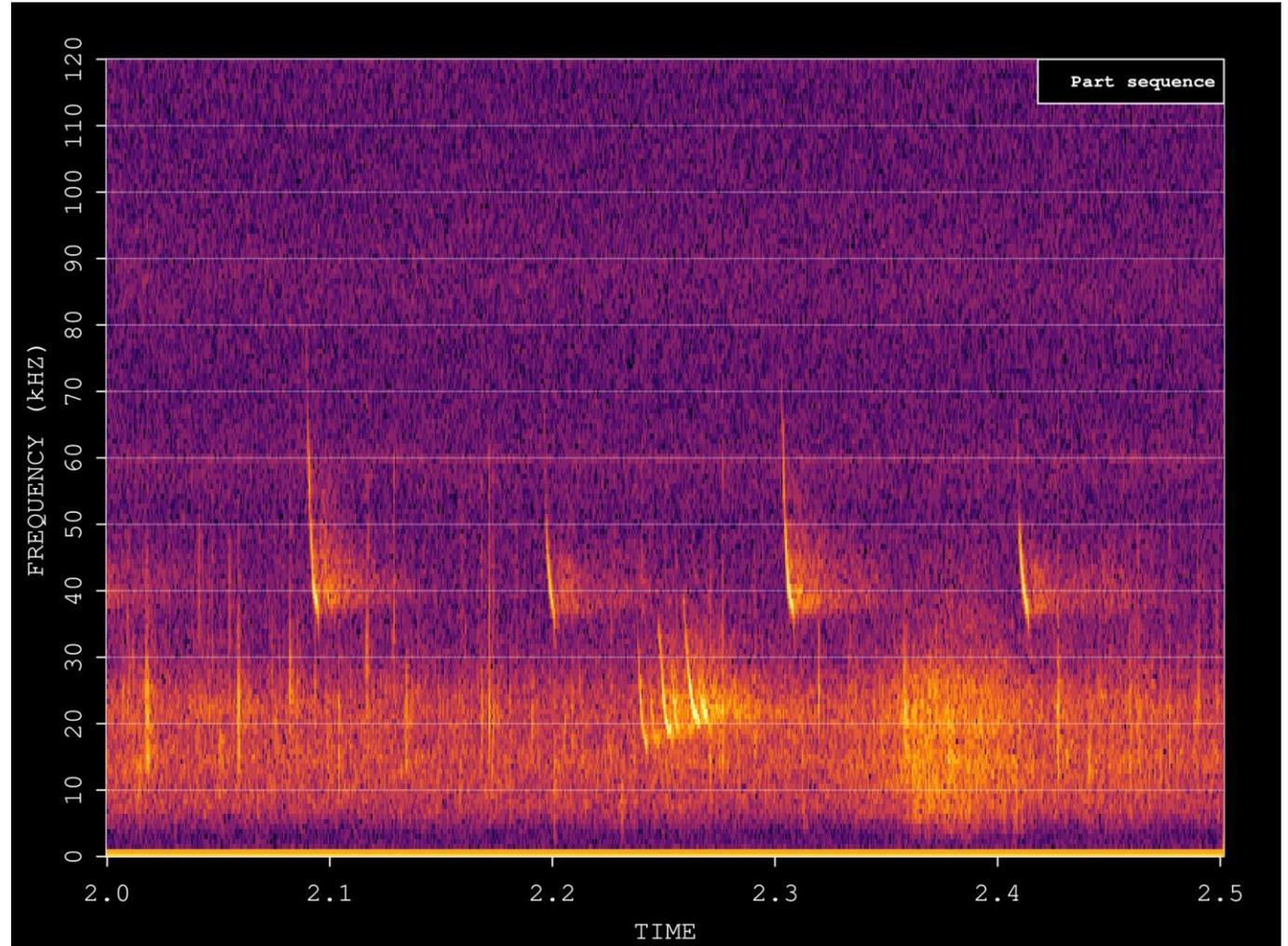


- Acer (Maple)
- Fraxinus (Ash)
- Ulmus (Elm)
- Quercus (Oak)
- Picea (Spruce)
- Prunus (Plum)
- Tilia
- Platanus
- Gleditsia
- Populus
- Pinus (Pine)
- Liquidambar
- Lagerstroemia
- Washingtonia
- Ficus
- Afrocarpus
- Other

Using ecologist's insights to design better AI

Species identification can be a high dimensional problem

- Habitat
- Season
- Time of day
- Weather
- Temperature
- Habitat structure
- Lure
- Sight/sound/smell/texture





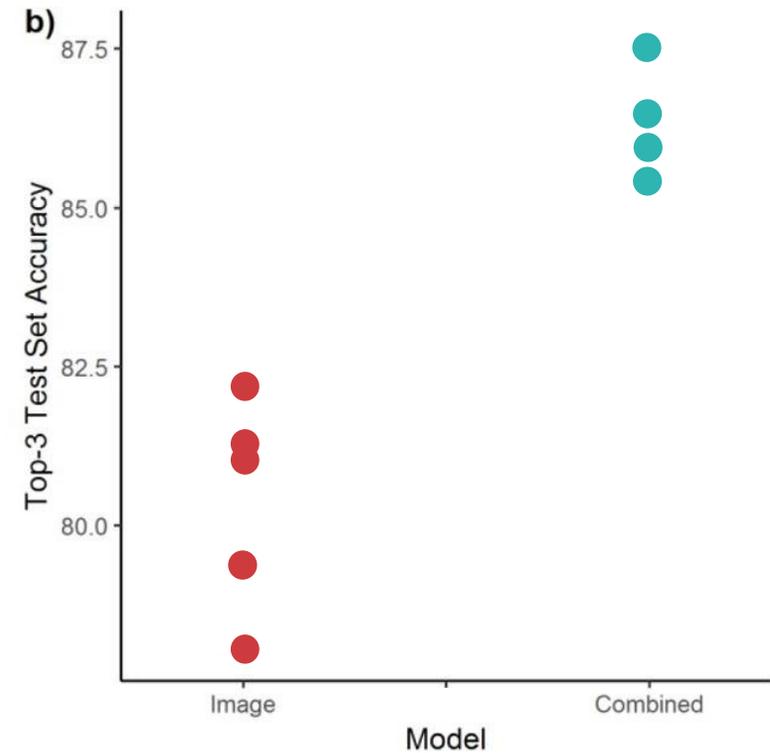
AI #1: Trained on ladybird images

- Learns what ladybirds looks like



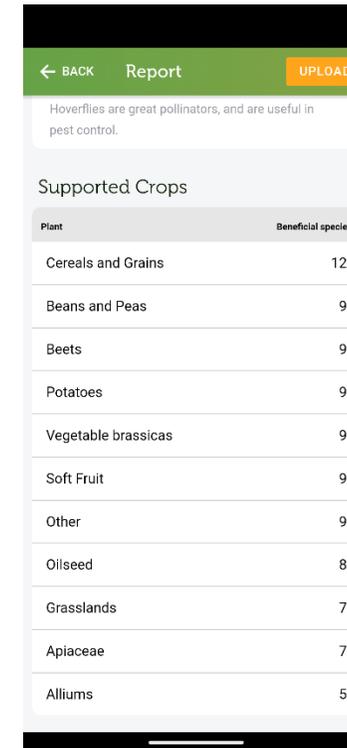
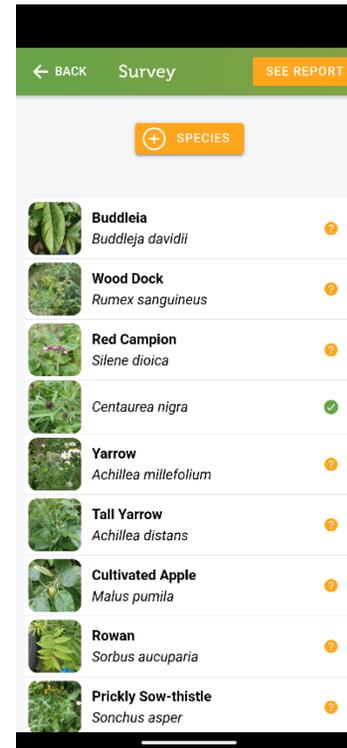
AI #2: Trained on ladybird images and environmental context

- Learns what ladybirds look like and their ecological niche



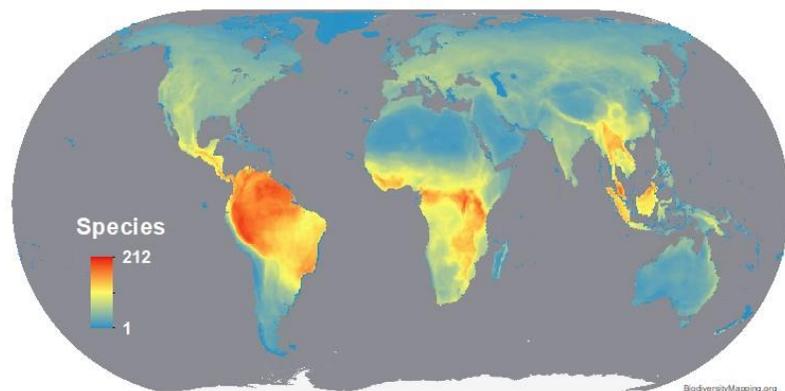
Reversing the vacuum cleaner

- Traditionally we have focussed on citizen science as a data collection method
- Using AI assisted ID can help provide actionable information
- We need to empower people to make a change, in addition to driving policy change

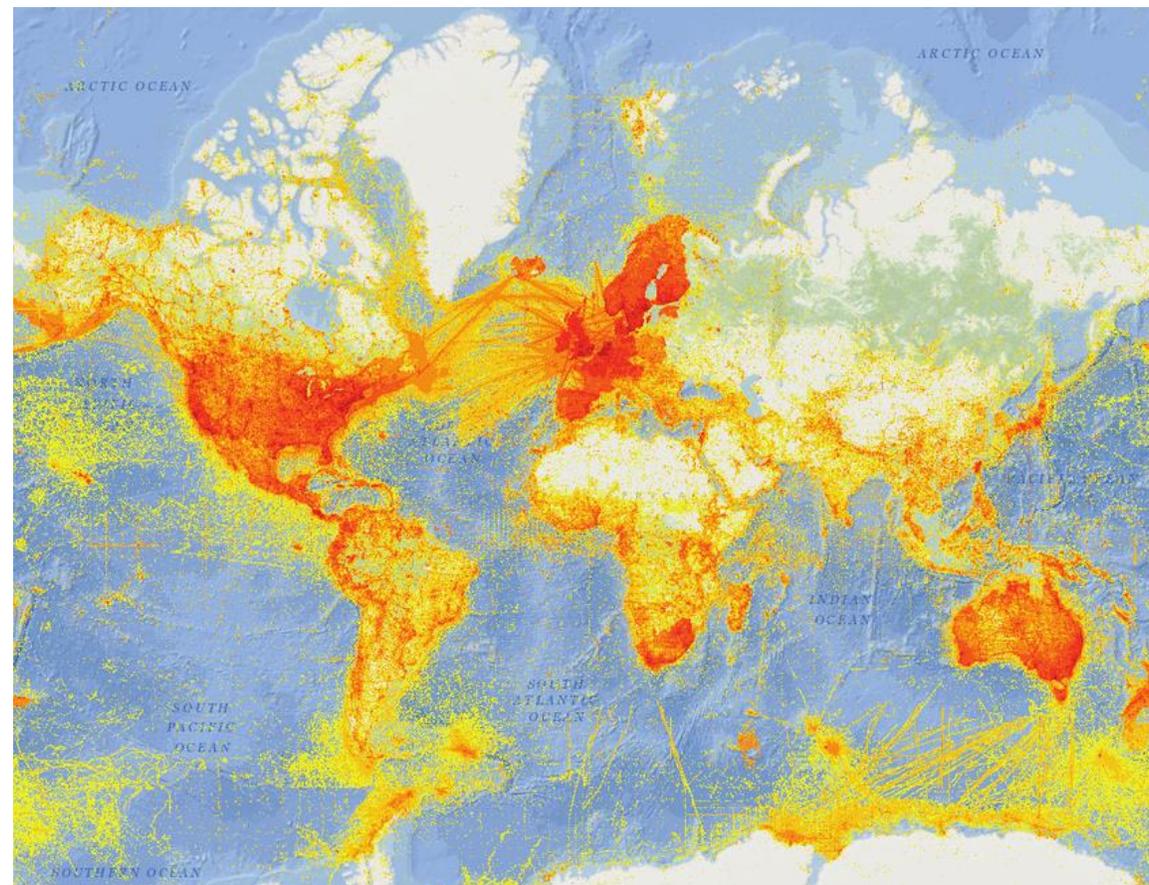
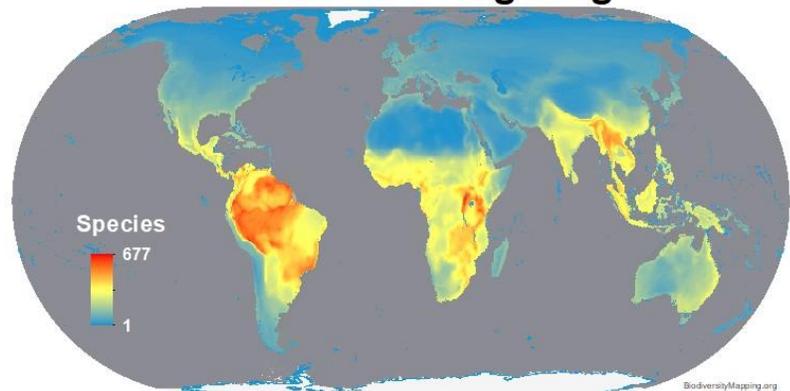


Addressing global challenges

Mammal Richness



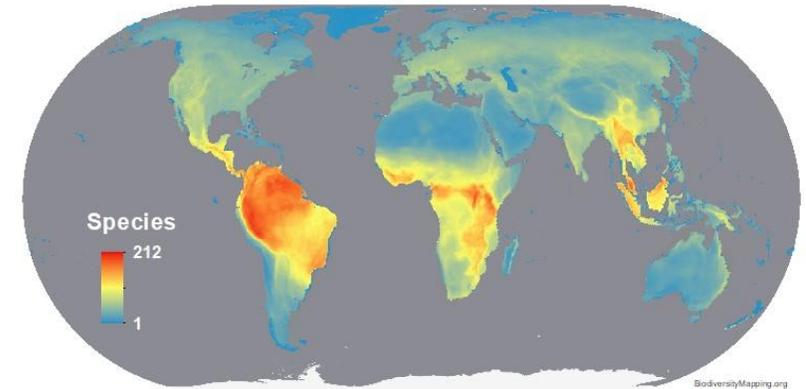
Birds - nonbreeding ranges



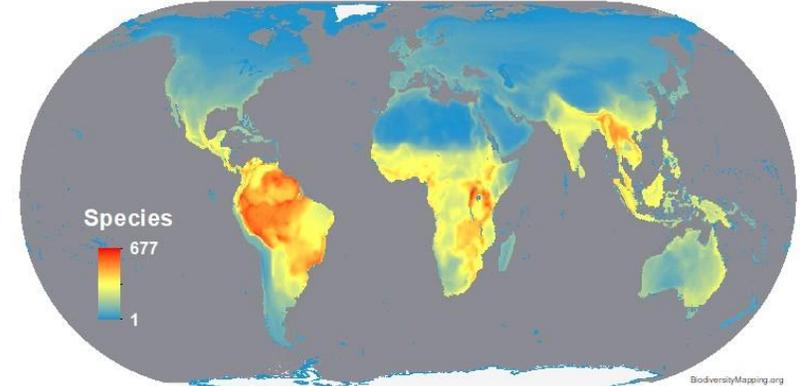
Addressing global challenges

1. Needs to be generalisable
2. Needs to be tackling the long-tail in training data
3. Needs to work with unknown classes
4. Needs to be inclusive/co-designed

Mammal Richness

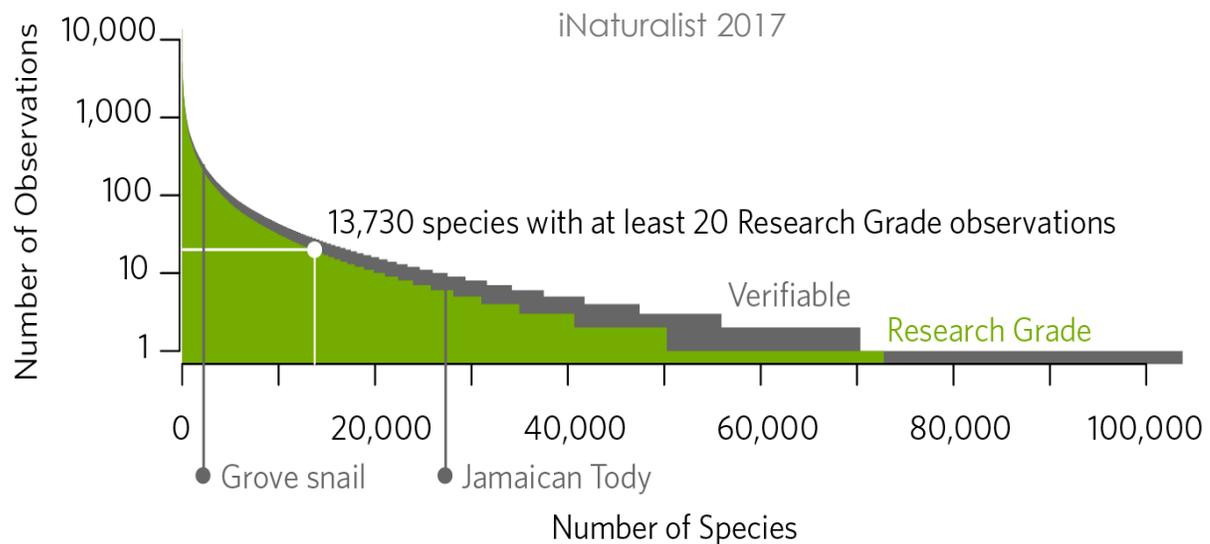


Birds - nonbreeding ranges



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Easy RIDER Real-time IDentification for Ecological Research and Monitoring

"Bring together complementary expertise to develop automated sensors using computer vision and deep learning to monitor insects."

Establish a community of practise



Knowledge exchange



Field trials



Best practise guides



Conclusions

1. We are in a biodiversity crisis and need access to the right tools to address it
2. There are new methods and applications that show promise
3. We need to ensure we are applying the technology where it is needed most, and working with local communities

Thanks to:

David Roy, Alba Gomez-Segura, Simon Teagle, Toke Høye, Maxim Larrivé, Keen-Al, Chris Terry, Pierre Bonnet, Alexis Joly, Antoine Affouard, Richard Pywell

