



SCIENCE AND EDUCATION  
FOR SUSTAINABLE LIFE

# Project LIFEPLAN as a case in point

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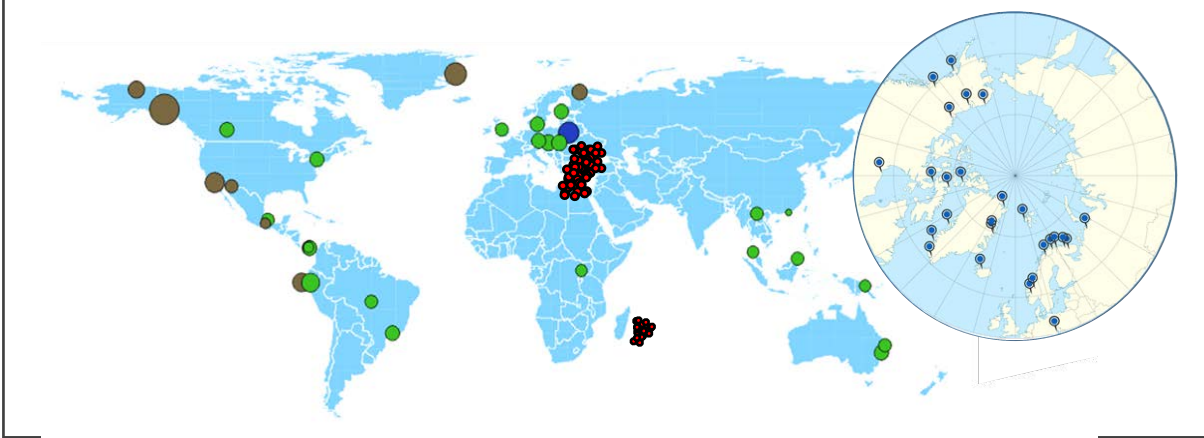
Workshop December 1, 2020



# Me: a passion for large-scale collaborations

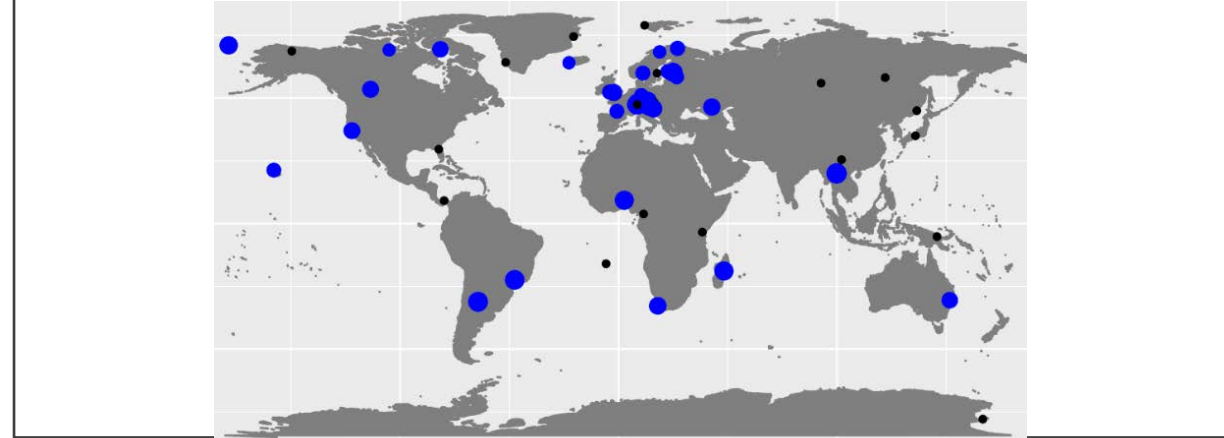
1

## GLOBAL AND ARCTIC DISTRIBUTED EXPERIMENTS



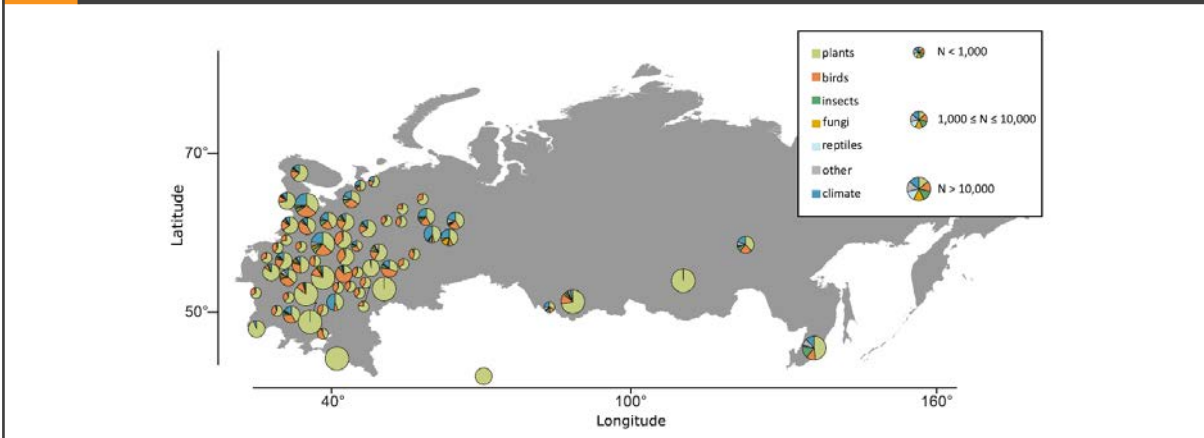
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## GLOBAL SPORE SAMPLING PROJECT



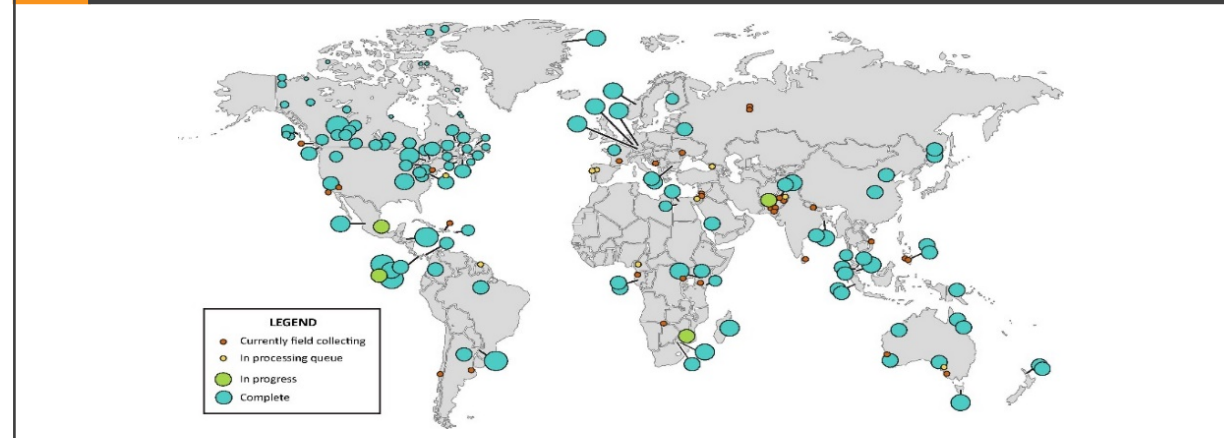
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## RUSSIAN NATIONAL PARKS PROJECT



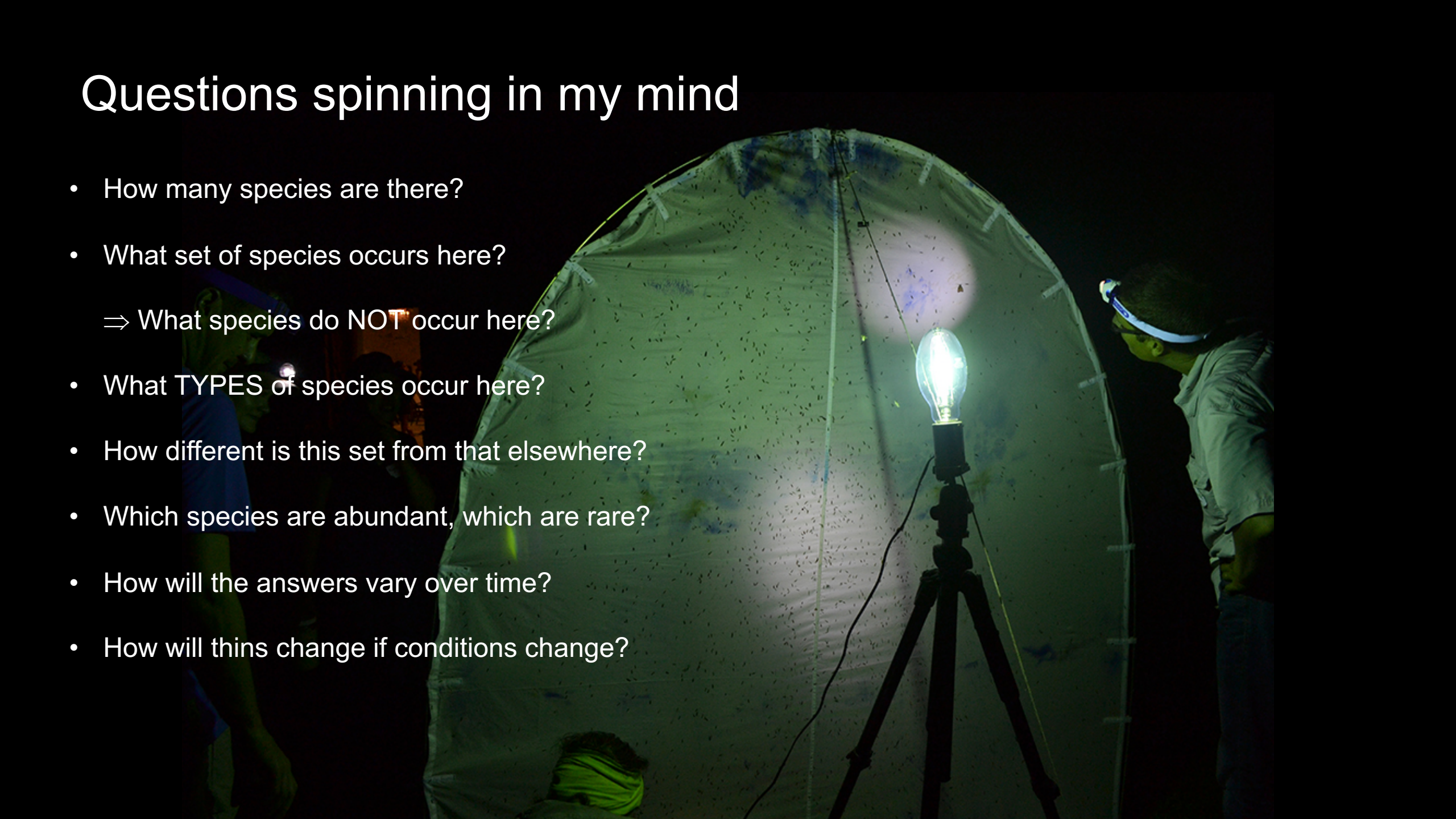
4

## GLOBAL MALAISE TRAP PROJECT



# Questions spinning in my mind

- How many species are there?
- What set of species occurs here?
  - ⇒ What species do NOT occur here?
- What TYPES of species occur here?
- How different is this set from that elsewhere?
- Which species are abundant, which are rare?
- How will the answers vary over time?
- How will things change if conditions change?



# ERC-synergy project LIFEPLAN



Tomas Roslin



# ERC-synergy project LIFEPLAN

**Methods for  
big data statistics**

**Globally distributed  
sampling design**



David Dunson

**Scalable Bayesian inference,  
spatiotemporal modelling**



**Otso Ovaskainen  
Statistical, mathematical and  
theoretical ecology**

**Distributed experiments,  
biodiversity research**



Tomas Roslin

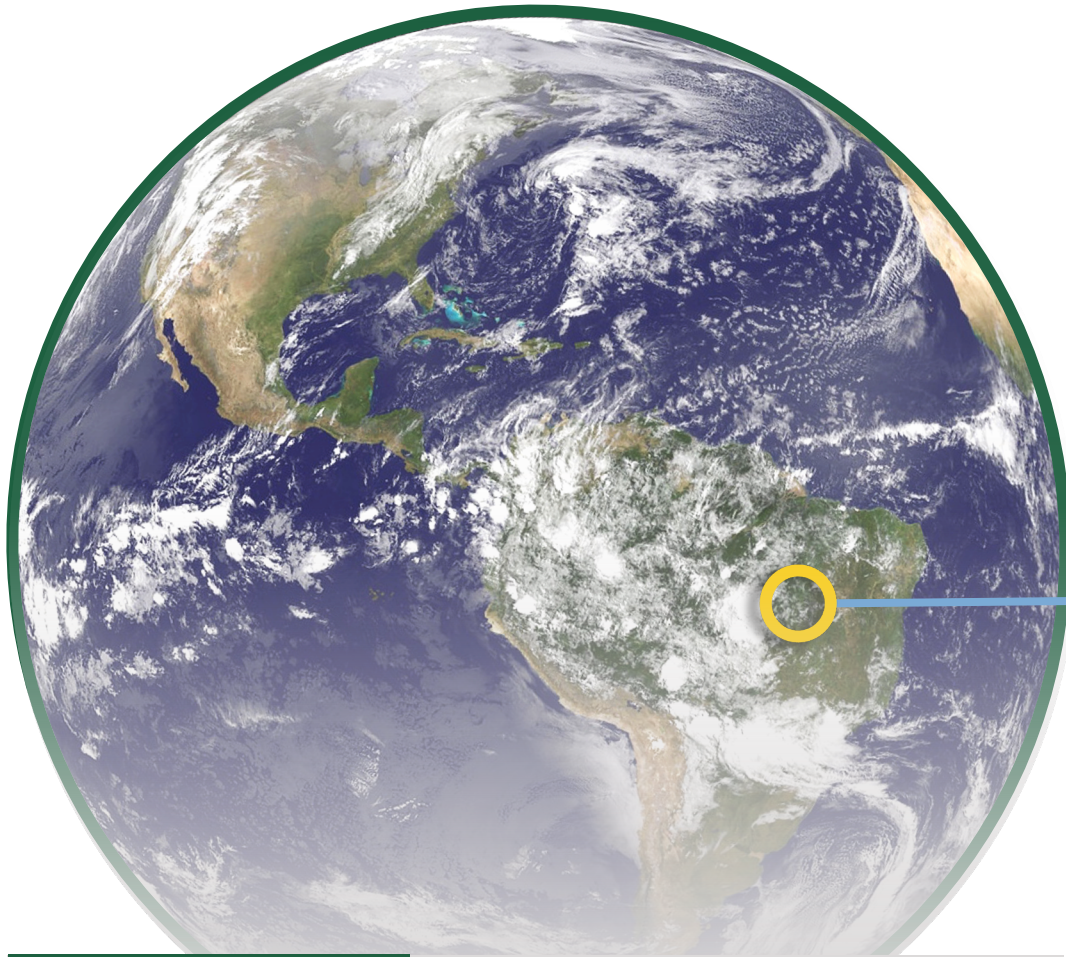
**Improved understanding of global biodiversity dynamics**

Total 130M SEK, six years, 52M SEK to SLU



# LIFEPLAN will

generate a predictive understanding  
of global biodiversity and its drivers



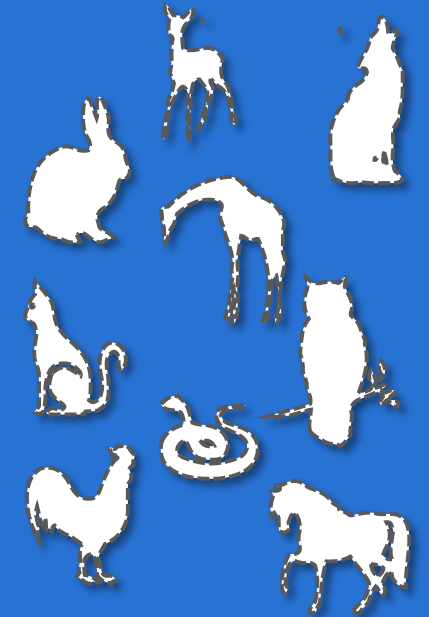
## Challenges

- Partial, biased data
- Complex processes

Explain and predict  
current state

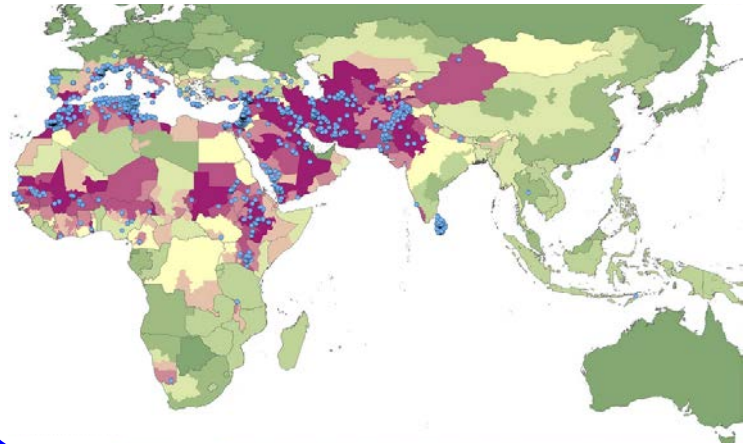


Predict future state,  
considering  
environmental change

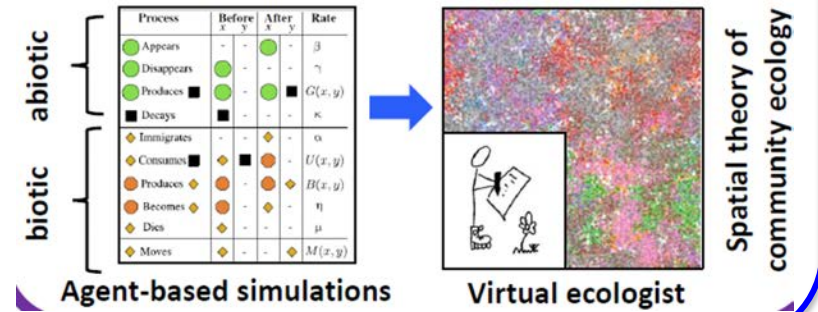




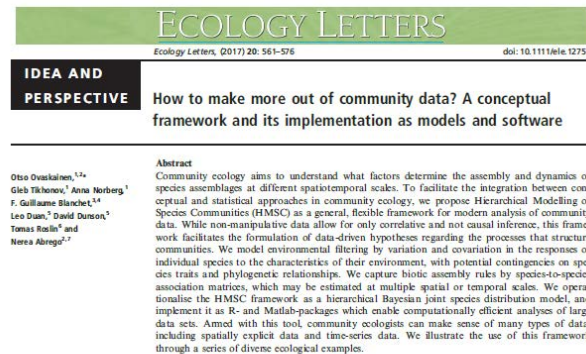
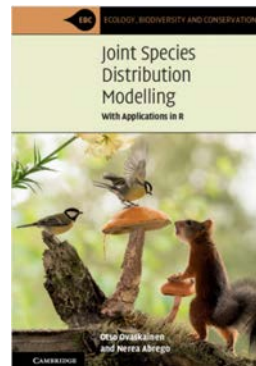
## Globally relevant data



## Linking empirical results to ecological theory



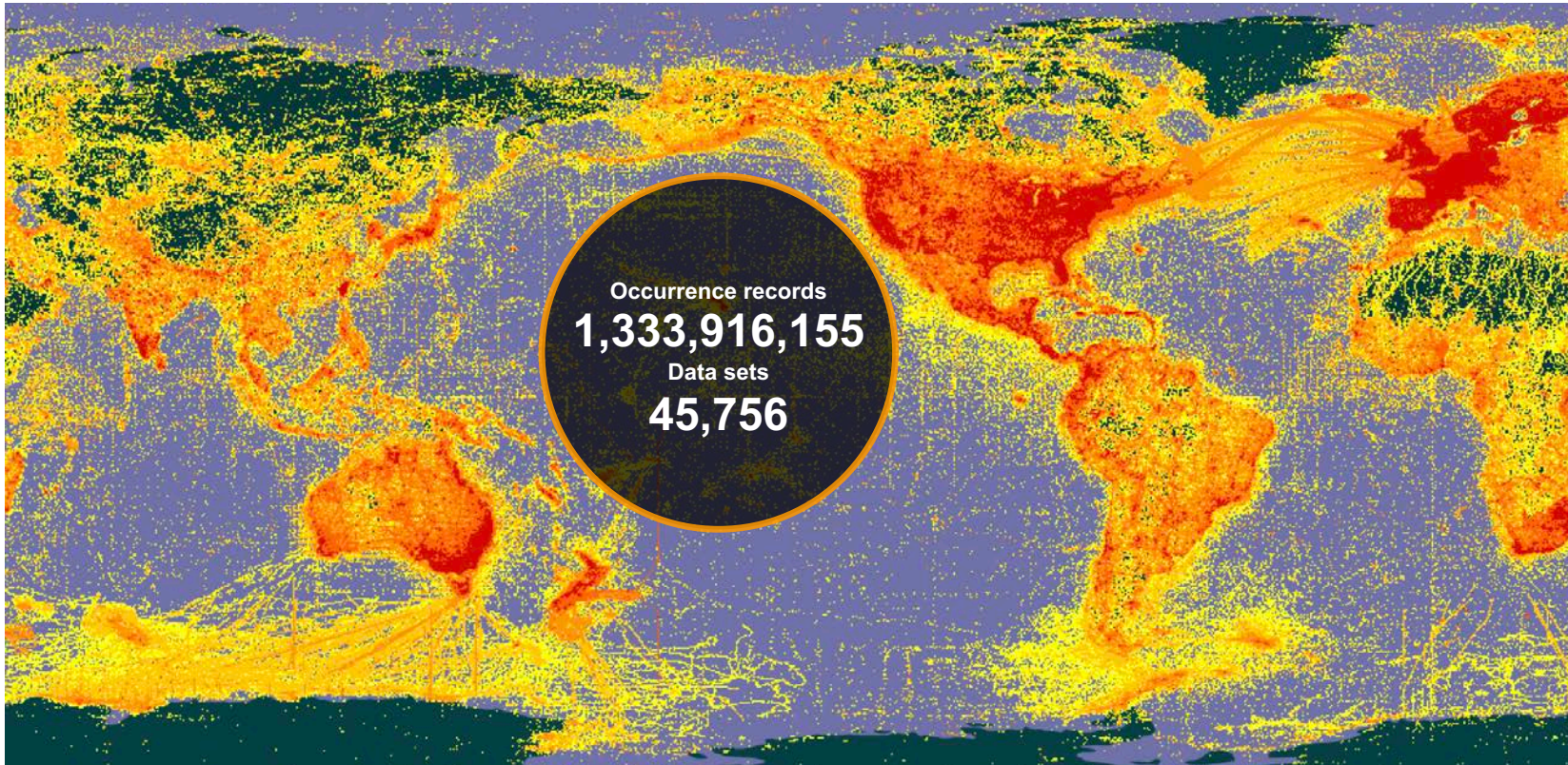
## Predictive models of biodiversity





# A deluge of biodiversity data

Example: the Global Biodiversity Information Facility (GBIF)  
Heatmap of species occurrence records



Need for *systematic* sampling

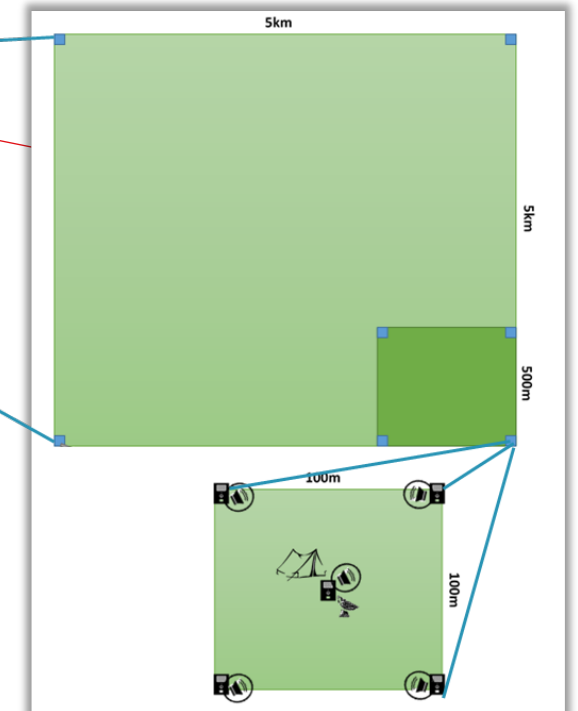
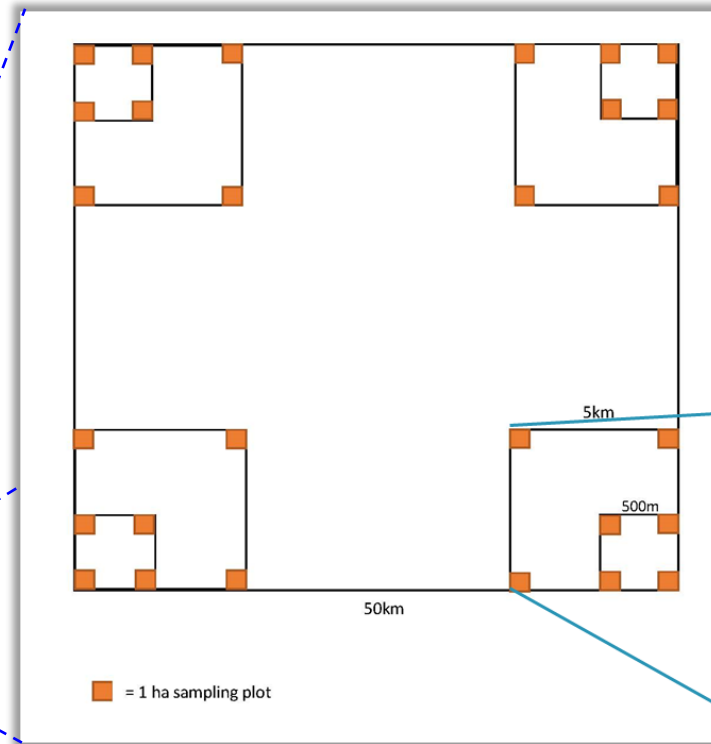
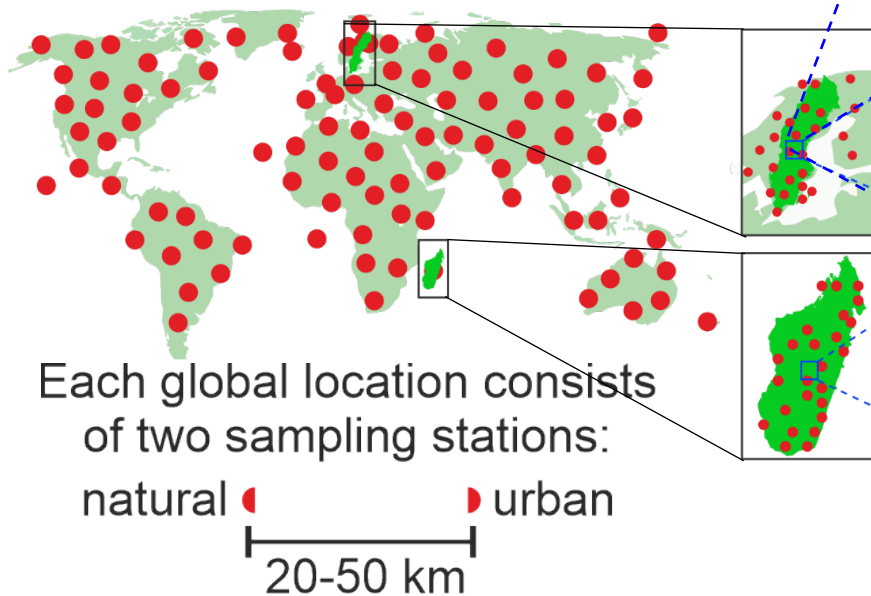


# We aim to generate globally relevant, unbiased community-level data

Semi-automated methods

Systematic sampling

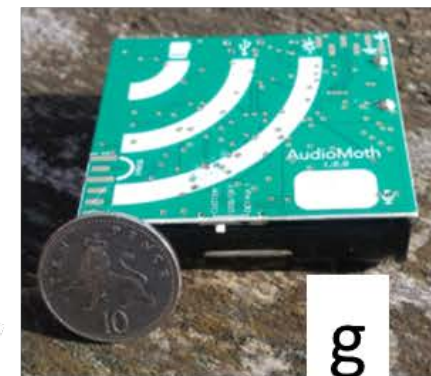
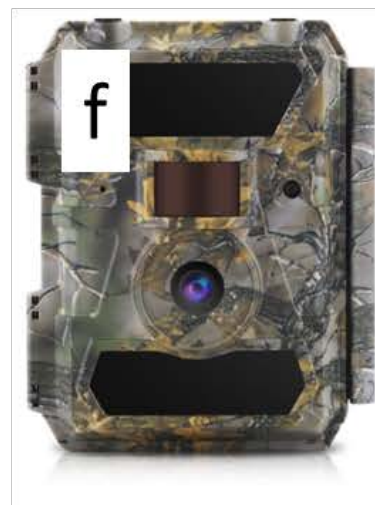
Independent of expertise



GLOBAL

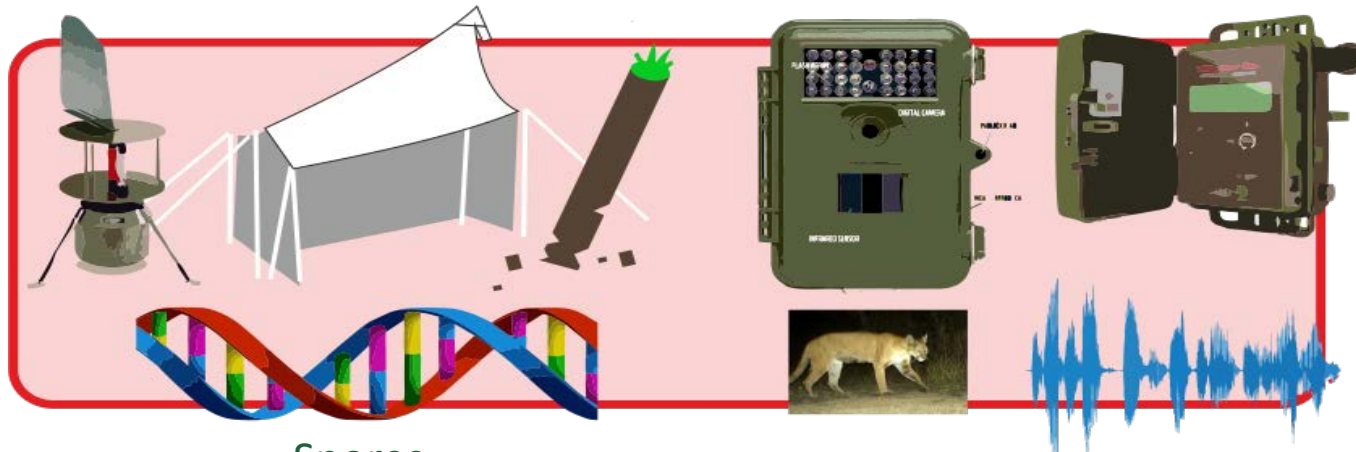
NATIONAL

HIERARCHICAL





# Data analysis pipeline



Spores  
Insects  
Soil & Roots

Images

Audio files

DNA extraction & sequencing

Automated species identification

Methods in Ecology and Evolution

Methods in Ecology and Evolution 2017, 8, 398–407

doi: 10.1111/2041-210X.12721

TECHNOLOGICAL ADVANCES AT THE INTERFACE BETWEEN ECOLOGY AND STATISTICS  
Quantifying uncertainty of taxonomic placement in DNA  
barcoding and metabarcoding

ECOLOGY LETTERS

Ecology Letters, (2018) 21, 1244–1254

doi: 10.1111/ele.13092

METHODS

Animal Sound Identifier (ASI): software for automated  
identification of vocal animals

Improved understanding  
of biodiversity dynamics

EBC

ECOLOGY, BIODIVERSITY AND CONSERVATION

Joint Species  
Distribution  
Modelling  
With Applications in R



# Some pilot studies/results

## ECOLOGY LETTERS

Ecology Letters, (2018) 21: 1244–1254

doi: 10.1111/ele.13092

### METHODS

**Animal Sound Identifier (ASI): software for automated identification of vocal animals**



### Research

**PROTAX-fungi: a web-based tool for probabilistic taxonomic placement of fungal internal transcribed spacer sequences**

Kessy Abarenkov<sup>1\*</sup>, Panu Somervuo<sup>2\*</sup>, R. Henrik Nilsson<sup>3,4</sup>, Paul M. Kirk<sup>5</sup>, Tea Huotari<sup>6</sup>, Nerea Abrego<sup>6</sup> and Otso Ovaskainen<sup>2,7</sup>

Bioinformatics, 32(19), 2016, 2920–2927  
doi: 10.1093/bioinformatics/btw346  
Advance Access Publication Date: 13 June 2016  
Original Paper

OXFORD

## ECOGRAPHY

### Research

**Spatio-temporal scaling of biodiversity in acoustic tropical bird communities**

Ulisses de Camargo, Tomas Roslin and Otso Ovaskainen

### Sequence analysis

**Unbiased probabilistic taxonomic classification for DNA barcoding**

Panu Somervuo<sup>1,\*</sup>, Sonja Koskela<sup>1</sup>, Juho Pennanen<sup>1</sup>, R. Henrik Nilsson<sup>2</sup> and Otso Ovaskainen<sup>1,3</sup>

- 600,000 one-minute audio segments
- 60 species

 **frontiers**  
in Ecology and Evolution

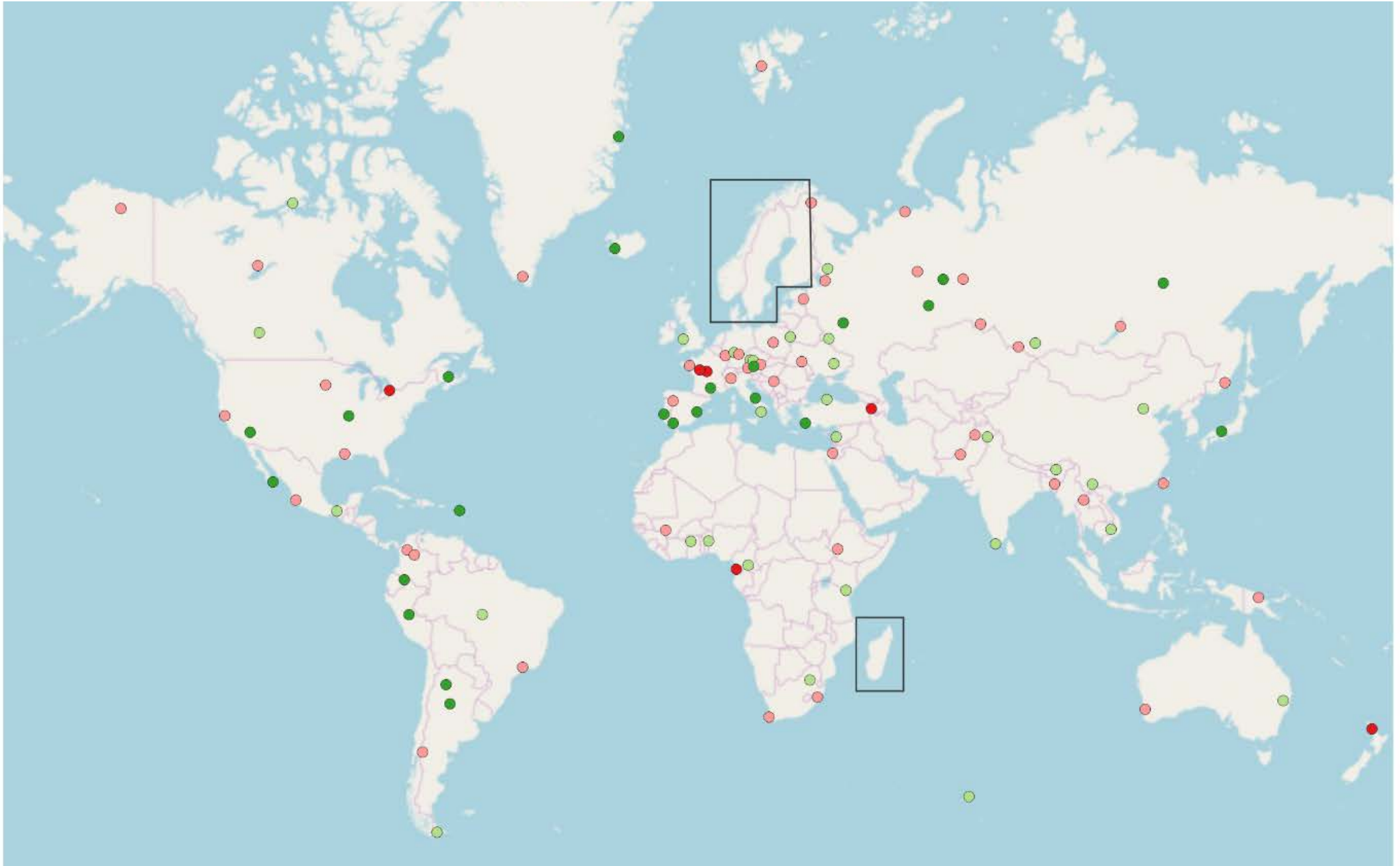
BRIEF RESEARCH REPORT  
published: 14 January 2020  
doi: 10.3389/fevo.2019.00511

## Monitoring Fungal Communities With the Global Spore Sampling Project

Otso Ovaskainen<sup>1,2\*</sup>, Nerea Abrego<sup>3</sup>, Panu Somervuo<sup>1</sup>, Isabella Palorinne<sup>3</sup>, Bess Hardwick<sup>1,4</sup>, Juha-Matti Pitkänen<sup>4,5</sup>, Nigel R. Andrew<sup>6†</sup>, Pascal A. Niklaus<sup>7</sup>, Niels Martin Schmidt<sup>8,9</sup>, Sebastian Seibold<sup>10,11</sup>, Juliane Vogt<sup>10</sup>, Evgeny V. Zakharov<sup>12</sup>, Paul D. N. Hebert<sup>12</sup>, Tomas Roslin<sup>3,4</sup> and Natalia V. Ivanova<sup>12</sup>

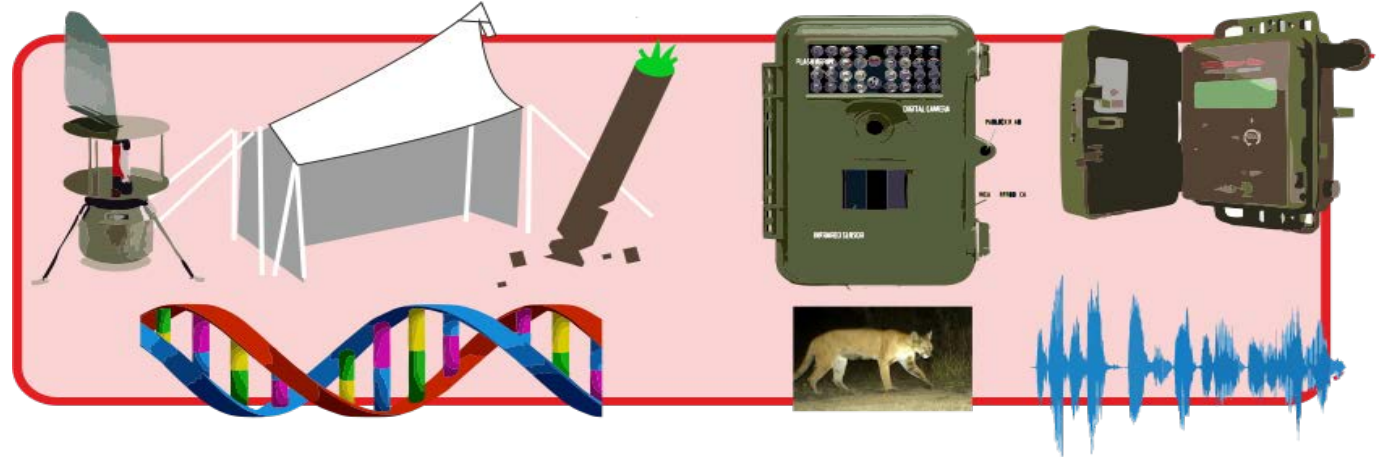
- 31 locations
- 336 samples
- 100 million sequences
- 160,000 species





# LIFEPLAN sampling scheme in numbers

- 100 global + 50 national + 50 hierarchical = **200 stations**
- Sampling year-round for **six years**
- Covering **450 different locations**
- **Five sampling methods:**



## The sampling scheme will yield

- 1000,000 camera trap images
- 1000,000,000 one-minute audio segments
- 10,000,000,000 DNA sequences

= **1000-5000 terabytes of data**

- Aerial spore sampler, 1 sample / week
- Malaise trap for insects, 1 sample / week
- Soil & root core samples, 16 samples/yr
- Camera traps, motion activated
- Audio recorders, daily recording schedule





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# Nagoya Protocol

From Wikipedia, the free encyclopedia

The **Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity**, also known as the **Nagoya Protocol on Access and Benefit Sharing (ABS)** is a 2010 supplementary agreement to the 1992 [Convention on Biological Diversity](#) (CBD). Its aim is the implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources, thereby contributing to the conservation and sustainable use of biodiversity.<sup>[1]</sup> However, there are concerns that the added bureaucracy and legislation will, overall, be damaging to the monitoring and collection of biodiversity, to conservation, to the international response to infectious diseases, and to research.<sup>[2][3][4]</sup>

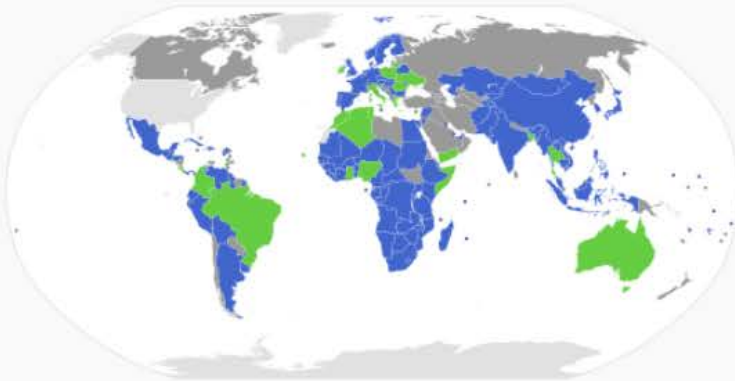
The protocol was adopted on 29 October 2010 in [Nagoya](#), Japan, and entered into force on 12 October 2014. It has been ratified by 123 parties, which includes 122 [UN member states](#) and the [European Union](#)<sup>[5]</sup>. Another supplementary protocol to the CBD is the [Cartagena Protocol on Biosafety](#).

## Nagoya Protocol

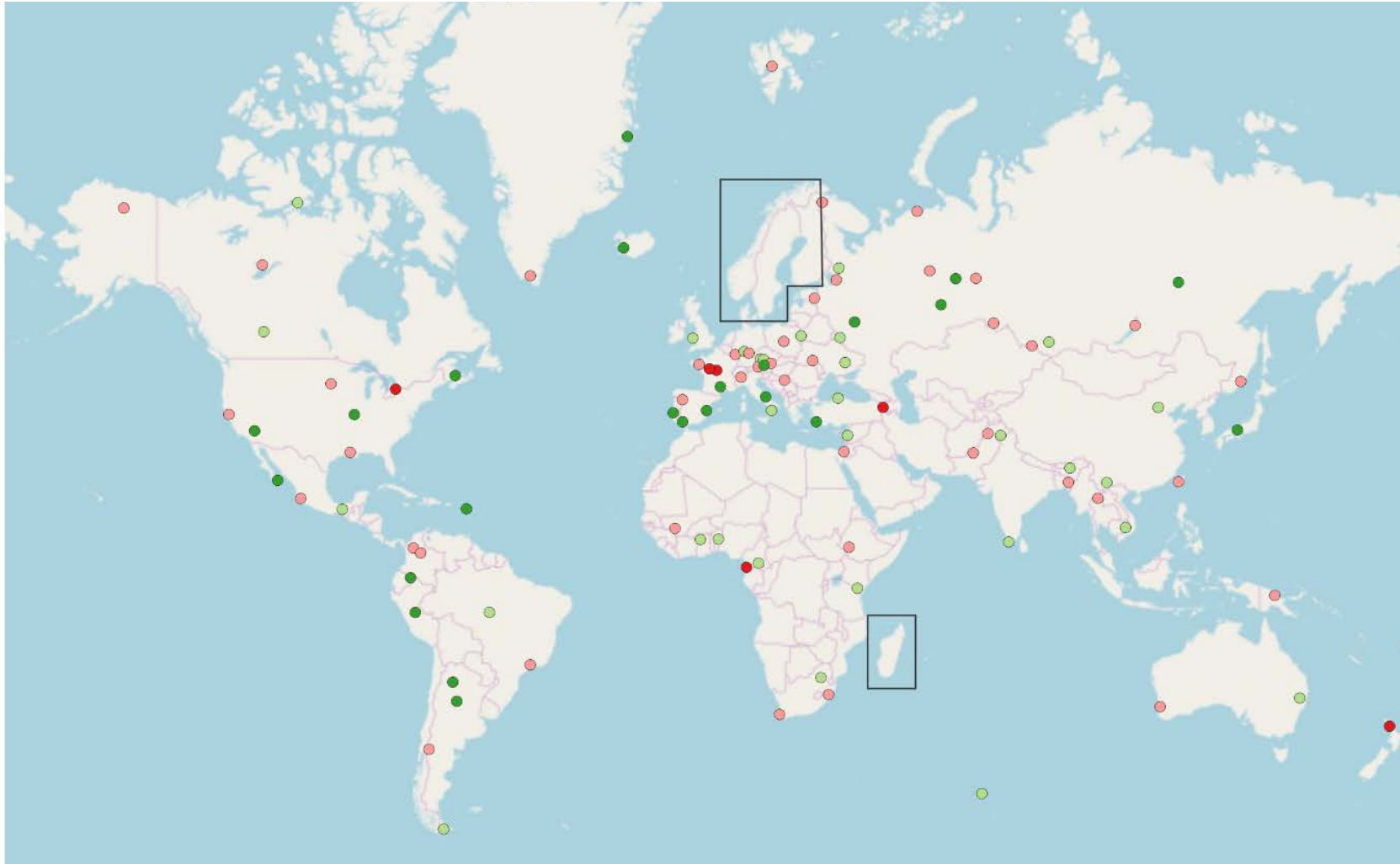
Long name:

[\[hide\]](#)

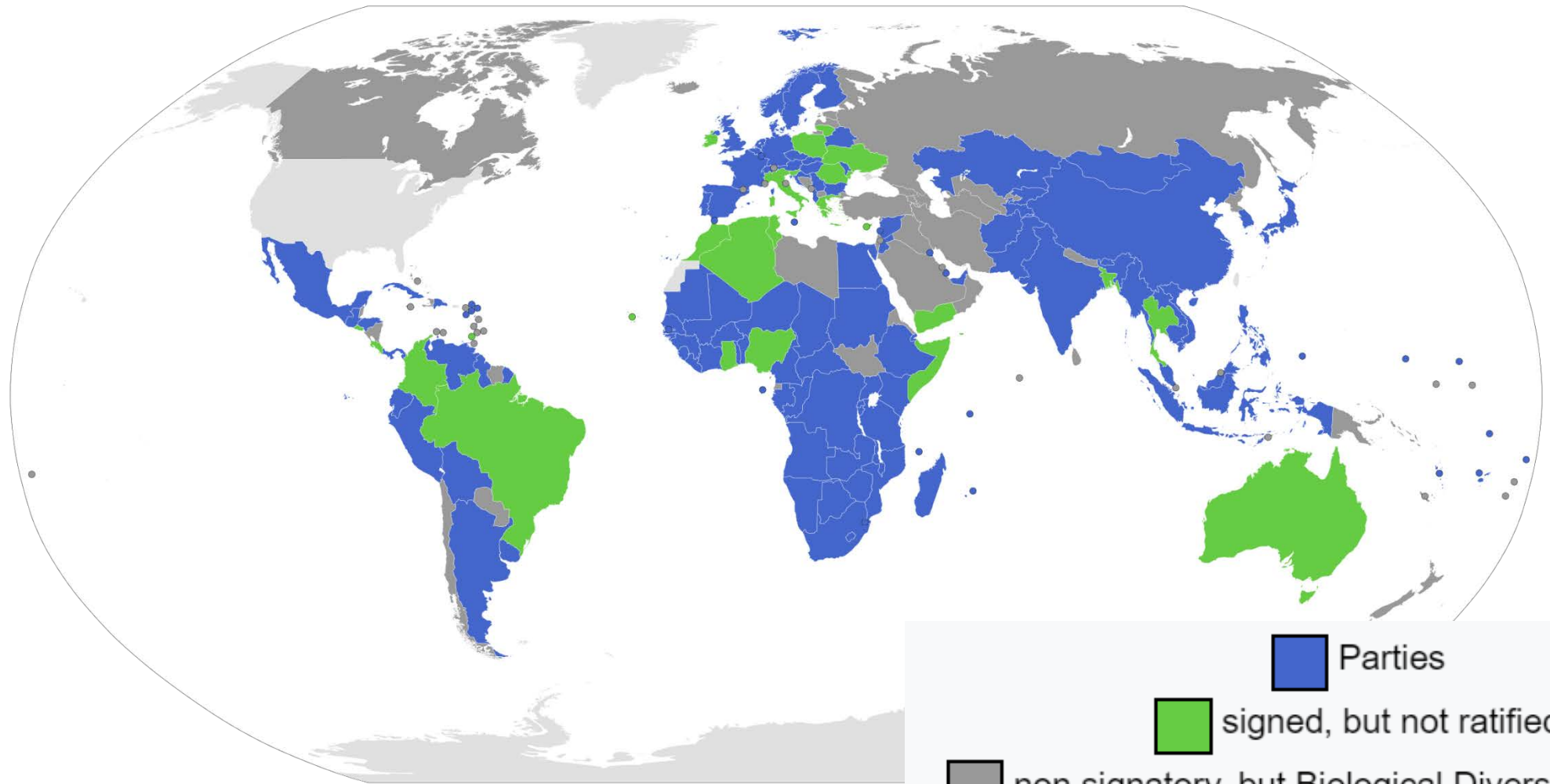
**Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity**




Parties









 Parties

 signed, but not ratified

 non signatory, but Biological Diversity Convention party

 non signatory, non-Biological Diversity Convention party

Besides several member states, the EU is also a party (not on map)

# A researcher's perspective

- Nagoya protocol affects every single project with an element of exchange of biological samples between nations
  - No researcher or university can afford to neglect
  - Nations outside of protocol also well aware of their biological resources
  - Diversity of international agreements and applications creates a tough jungle to navigate
  - Funding agencies highly aware of this legislation:  
any major grant will call for a clarification of how Nagoya is dealt with



As a part of the evaluation process, our proposal 856506 – LIFEPLAN was reviewed by an ethics panel composed of independent experts. They identified a set of ethical requirements that need to be fulfilled. We were therefore asked to provide additional information and/or documents in support of our proposal. In response to these queries, we have now drafted the following explanatory note, addressing each requirement separately. For clarity, we have maintained the same order and numbering as used in the report (see Table below). Overall, we confirm that our research fully complies with the fundamental ethical principles set out in the relevant EU rules, and that we will be happy to provide further clarification at your discretion.

Ethics Requirements	
1	If applicable, a statement with the applicant's commitment not to start or include any animal experiment before obtaining the relevant authorisations and training certificates as described in the Directive 2010/63/EU must be provided.
2	A statement with the applicant's commitment not to transfer any material from or into the EU before obtaining the relevant authorisations must be provided.
3	The applicant must confirm that the ethics standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research takes place.
4	Detailed information must be provided to confirm that fair benefit-sharing arrangements with stakeholders from low and/or lower-middle income countries/communities are ensured during the project.
5	The applicant must provide details on the material which will be imported to/exported from the EU. Adequate authorisation(s)/Material Transfer Agreement(s) must be provided.
6	Detailed information must be provided on foreseen measures to minimise the risks to research participants and staff involved in this project, i.e. in developing tailored security, health and safety plans. A risk assessment plan must be provided.
7	A statement with the applicant's commitment not to start any research before obtaining the relevant authorisation(s) to conduct research on endangered species and/or protected areas must be provided.
8	The applicant must demonstrate that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed by the staff involved in this project.
9	The applicant must demonstrate that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed by the staff involved in this project.

to the local collaborators, strengthening the local research infrastructure and new means for mapping local biodiversity – along with the training to do so. This represents conscious, targeted capacity building in the participating regions. We also encourage our collaborators to use both the training and equipment provided by us to conduct their own investigations of their local fauna and flora, thus promoting local biodiversity research beyond the LIFEPLAN project as such. Once generated by project resources, all data generated will be directly released to the collaborators, providing unparalleled (and otherwise unachievable) insights into the most diverse and least known species groups of their respective sampling sites.

collaboration in each country, and provide training and equipment through virtual workshops. We anticipate that most of the collections will be carried out by a competent local collaborator who is trained and already working in the required field settings.

**Environment, Health and Safety (7).** A statement with the applicant's commitment not to start any research before obtaining the relevant authorisation(s) to conduct research on endangered species and/or protected areas must be provided.

The PIs confirm their commitment not to start any research before obtaining the relevant authorisations to conduct research on endangered species and/or protected areas.

Tomas Rosta  
St Petersburg, November 23, 2019



David Durson  
Durham, November 25, 2019

## Explanatory Note: 856506 – LIFEPLAN

To: EUROPEAN RESEARCH COUNCIL EXECUTIVE AGENCY  
Unit B1 – Ethics Review and Expert Management

Dear Sirs/Madams,

As a part of the evaluation process, our proposal was reviewed by a panel composed of independent experts. The panel fulfilled. We were therefore asked to provide additional information and/or documents in support of our proposal. In response to these queries, we have now drafted the following explanatory note, addressing each requirement separately. For clarity, we have maintained the same order and numbering as used in the report (see Table below). Overall, we confirm that our research fully complies with the fundamental ethical principles set out in the relevant EU rules, and that we will be happy to provide further clarification at your discretion.

## Ethics Requirements

Animals	1	If applicable, a statement with the applicant's commitment not to start or include any animal experiment before obtaining the relevant authorisations and training certificates as described in the Directive 2010/63/EU must be provided.
Non EU countries	2	A statement with the applicant's commitment not to transfer any material from or into the EU before obtaining the relevant authorisations must be provided.
Non EU countries	3	The applicant must confirm that the ethics standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research takes place.
Non EU countries	4	Detailed information must be provided to confirm that fair benefit-sharing arrangements with stakeholders from low and/or lower-middle income countries/communities are ensured during the project.
Non EU countries	5	The applicant must provide details on the material which will be imported to/exported from the EU. Adequate authorisation(s)/Material Transfer Agreement(s) must be provided.
Non EU countries	6	Detailed information must be provided on foreseen measures to minimise the risks to research participants and staff involved in this project, i.e. in developing tailored security, health and safety plans. A risk assessment plan must be provided.
Environment, Health and Safety	7	A statement with the applicant's commitment not to start any research before obtaining the relevant authorisation(s) to conduct research on endangered species and/or protected areas must be provided.
Environment, Health and Safety	8	The applicant must provide further information about the possible harms to the environment that may be caused by the research and state the measures that will be taken to mitigate those risks.
Environment, Health and Safety	9	The applicant must demonstrate that appropriate health and safety procedures conforming to relevant local/national guidelines/legislation are followed by the staff involved in this project.

# Key challenges for LIFEPLAN:

- Non-standard samples: “soups” rather than specimens
- Species identification possible only AFTER sample processing
- Share *number* of nations, permits
  - National agreements based on national conditions and legislation
  - Export permits
  - Bilateral agreements with every team involved
- SLU rules prescribes that signatory = Head of Department
- Acknowledgements: without the support of ABS-INT & Sebastian Bromander this project would implode



<https://www.helsinki.fi/en/projects/lifeplan>



Duke  
UNIVERSITY

