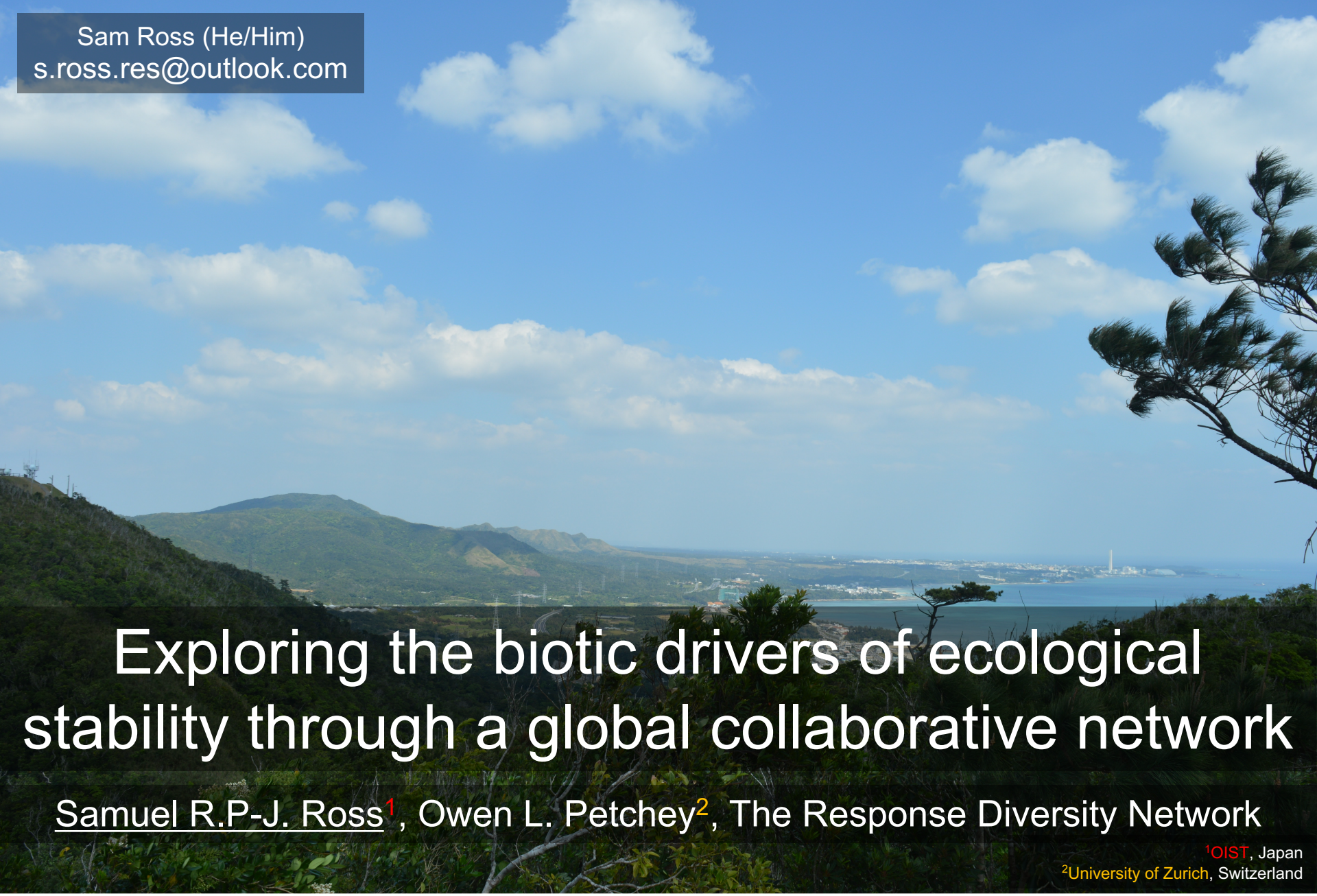
Sam Ross (He/Him)
s.ross.res@outlook.com

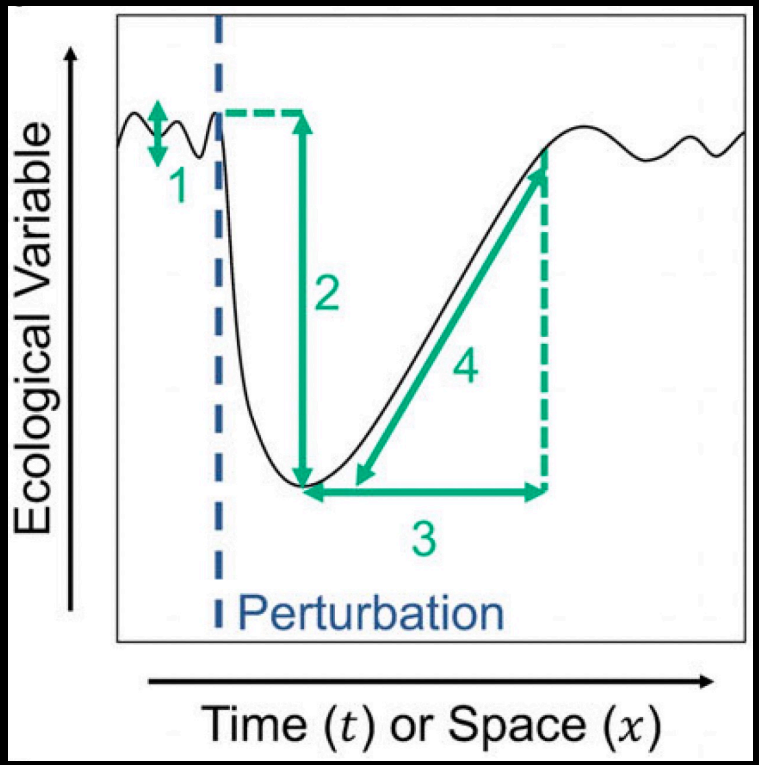


Exploring the biotic drivers of ecological stability through a global collaborative network

Samuel R.P-J. Ross[1], Owen L. Petchey[2], The Response Diversity Network

[1]OIST, Japan
[2]University of Zurich, Switzerland

Ecological Stability



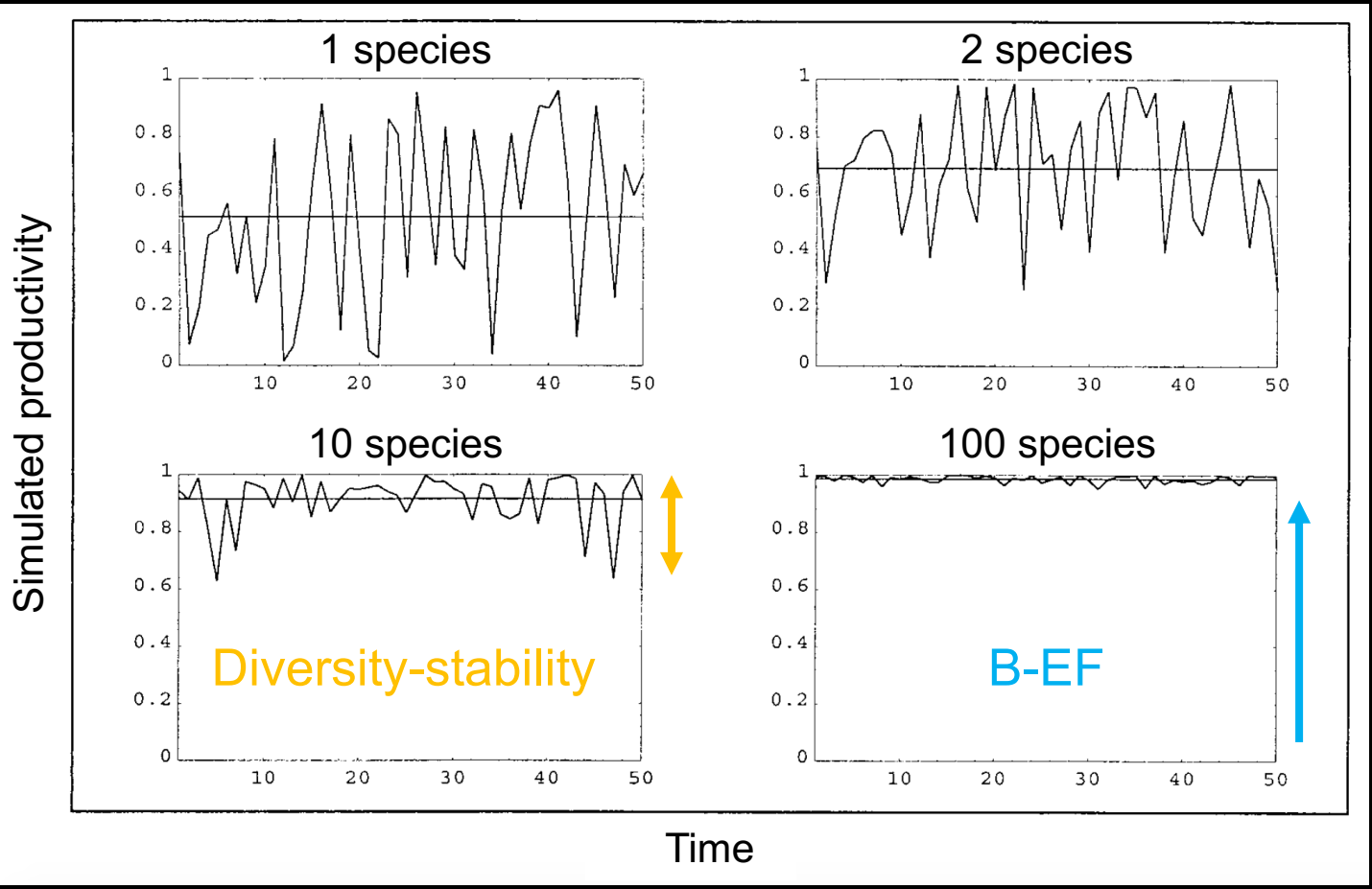
Ross, Suzuki *et al.* (2021) *Ecological Research*

"…the central framework to understand an ecosystem's ability to absorb or recover from environmental change."

Hillebrand *et al.* (2018) *Ecology Letters*

"…a complex and multifaceted concept, including components such as variability, resistance, resilience…"

Donohue *et al.* (2013) *Ecology Letters*

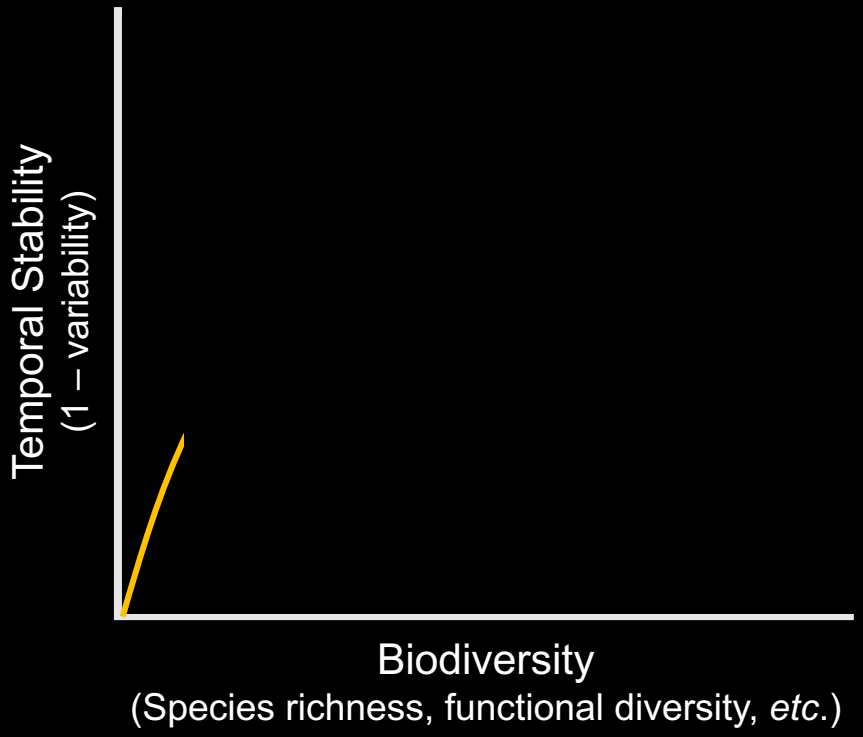


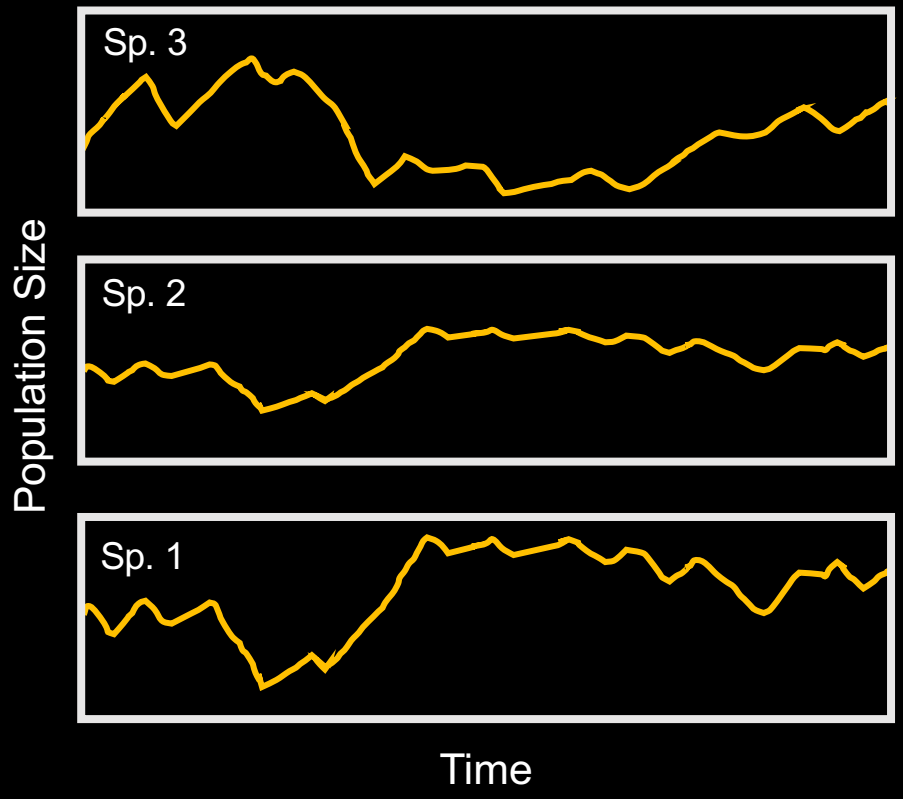
The Insurance Effect of biodiversity: biodiversity both *increases* and *stabilises* ecosystem functioning

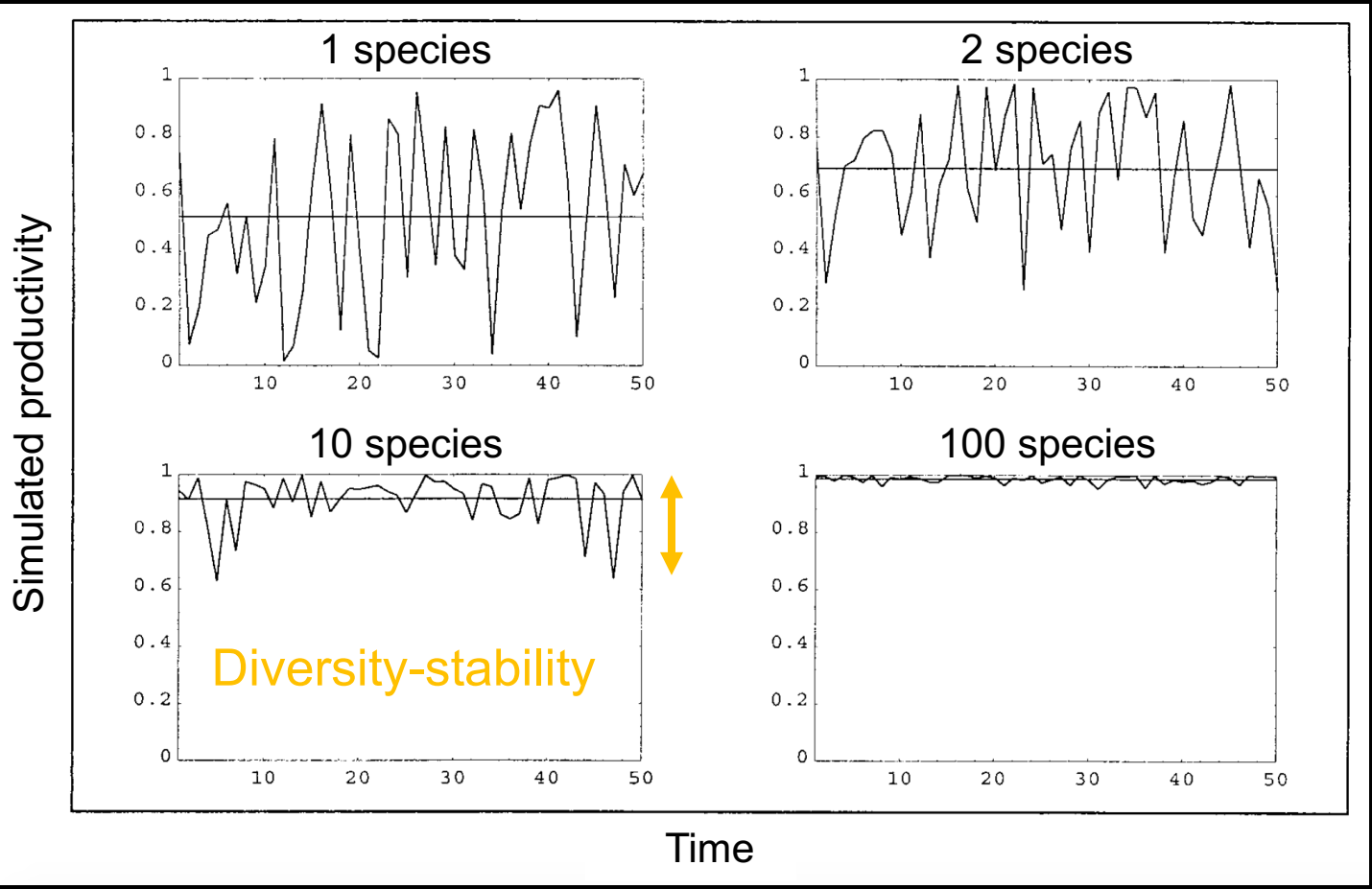
Yachi & Loreau (1999) *PNAS*

Why does biodiversity increase stability?

Portfolio effect/ compensatory dynamics/ community asynchrony:
In **diverse communities**, declines of one species **more likely to be offset** by neutral/positive responses of others.







Is there a ***unifying framework*** to capture the processes underlying the **Insurance Effect** of biodiversity?

Yachi & Loreau (1999) *PNAS*

Response Diversity

Owen Petchey
U. Zurich

Takehiro Sasaki
Yokohama Nat'l U.

Dave Armitage
OIST

"*…the **range of responses** **to the environment** displayed among species in a community*"

Methods in Ecology and Evolution
BRITISH ECOLOGICAL SOCIETY

REVIEW | Open Access

How to measure response diversity

Samuel R.P-J. Ross, Owen L. Petchey, Takehiro Sasaki, David W. Armitage

doi: https://doi.org/10.1101/2022.04.26.489626

Ross *et al*. (2023) *Methods in Ecology and Evolution*

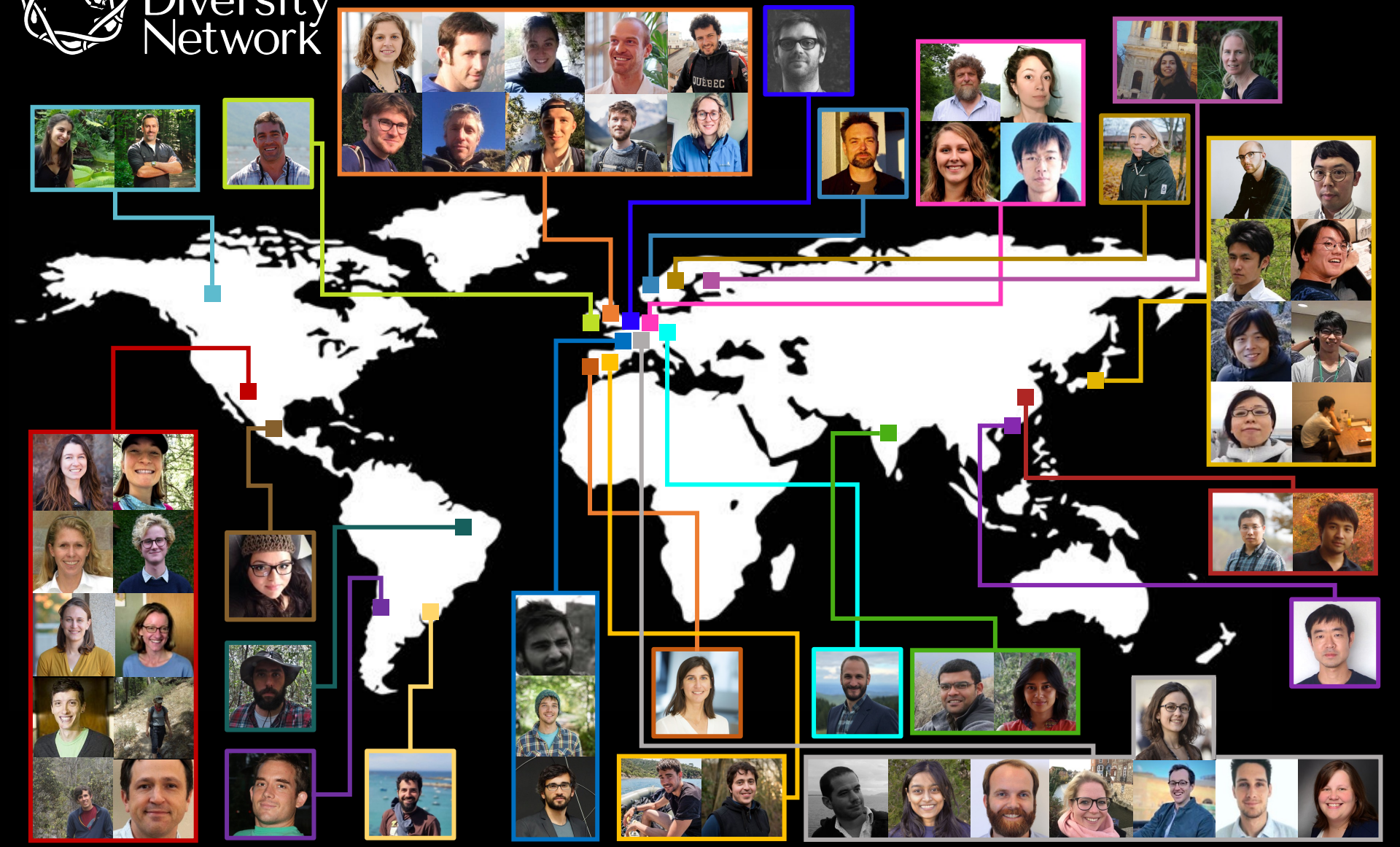
"*Few empirical studies have explicitly measured response diversity*."

Ross *et al*. (2023) *Methods in Ecology and Evolution*

A **global** and **collaborative** approach to response diversity research should accelerate progress, and prevent response diversity from being overlooked.

Response Diversity Network

64 members from 45 institutions in 22 countries



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Response Diversity Network

Measuring Response Diversity



Low-level traits

e.g., specific leaf area, clutch size, *etc.*

Relationship with environment

Assumed

Traits defined as "response traits".

Calculation method

Functional diversity

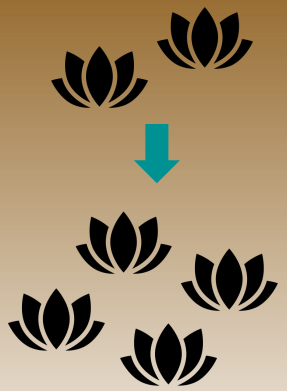
e.g., FDis, RaoQ, Others.

Response diversity definition

Response trait diversity

Diversity of response traits.

High-level traits

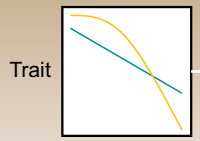


e.g., intrinsic rate of increase, carrying capacity, *etc.*

Relationship with environment

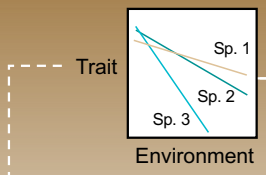
Measured

Environmental responses can be linear or nonlinear.

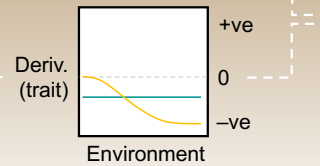


Calculation method

Species identity interaction



Take first derivatives



Response diversity definition

Binary response diversity

Do responses differ? Y/N.

Performance-environment relationship

Variation in performance-environment relationship. [*e.g.*, range, (dis)similarity, divergence, others].

Ross *et al.* (2023) *Methods in Ecology and Evolution*

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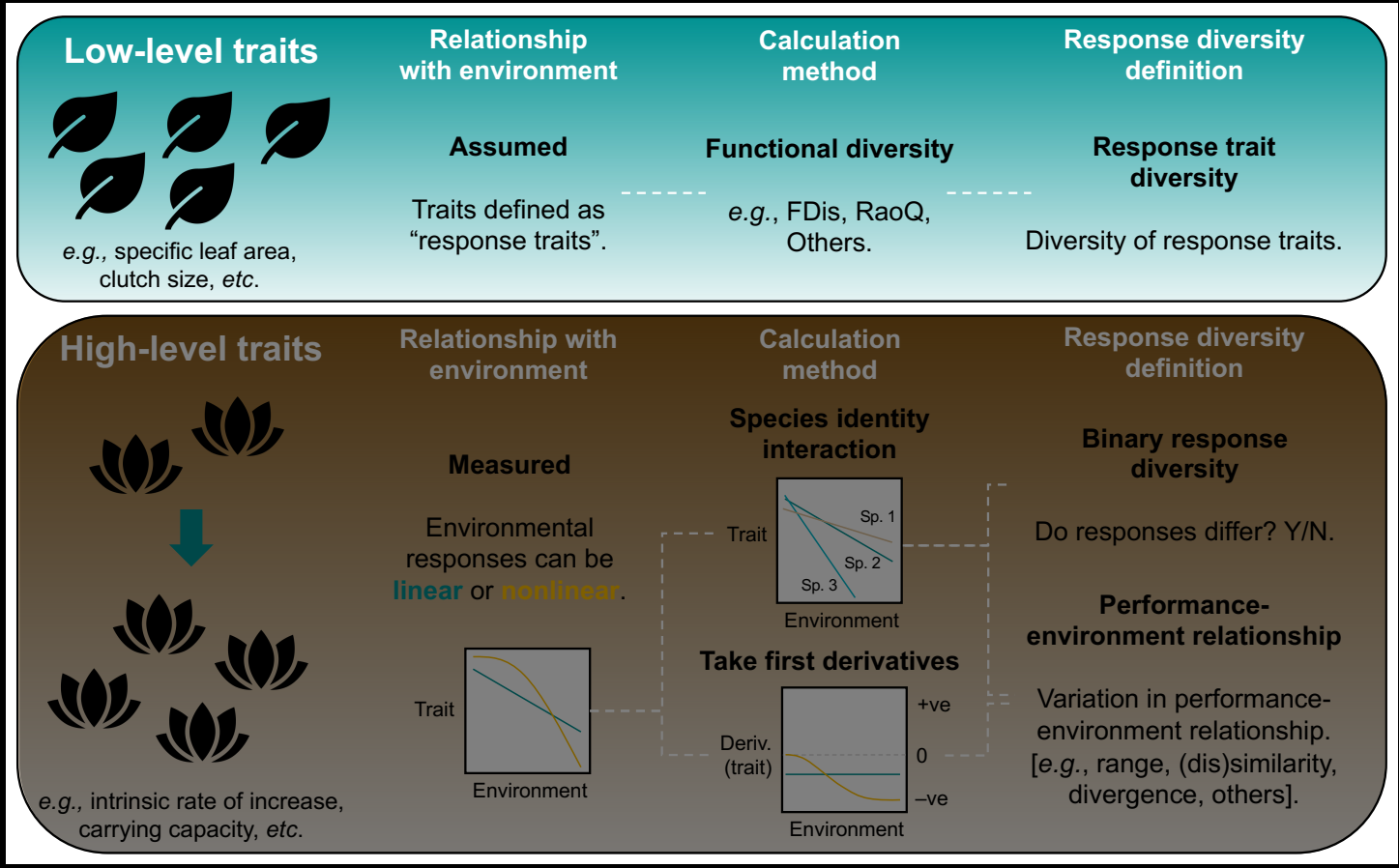
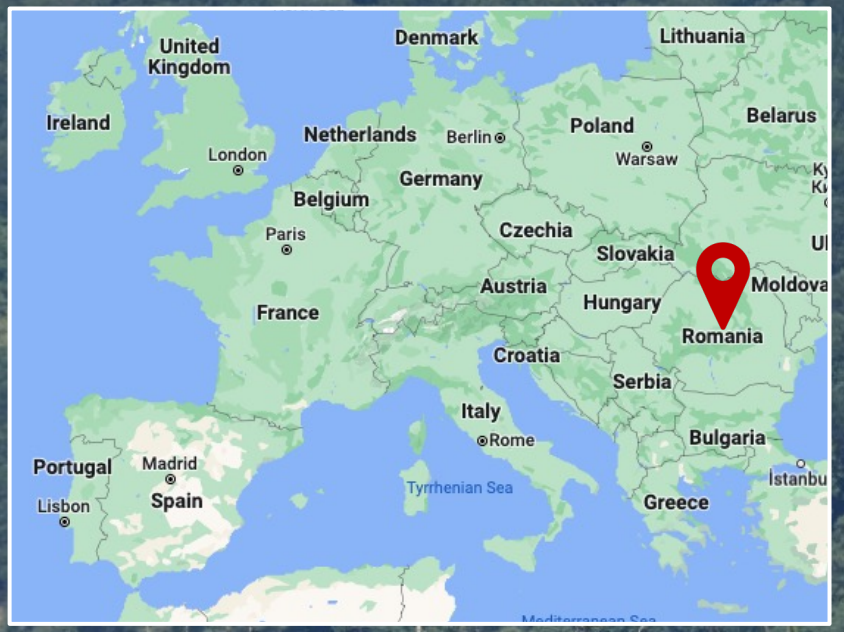
Response Diversity Network

Response trait diversity



Ross *et al*. (2023) *Methods in Ecology and Evolution*

Romanian birds



5+ years of bird community data (species abundances)

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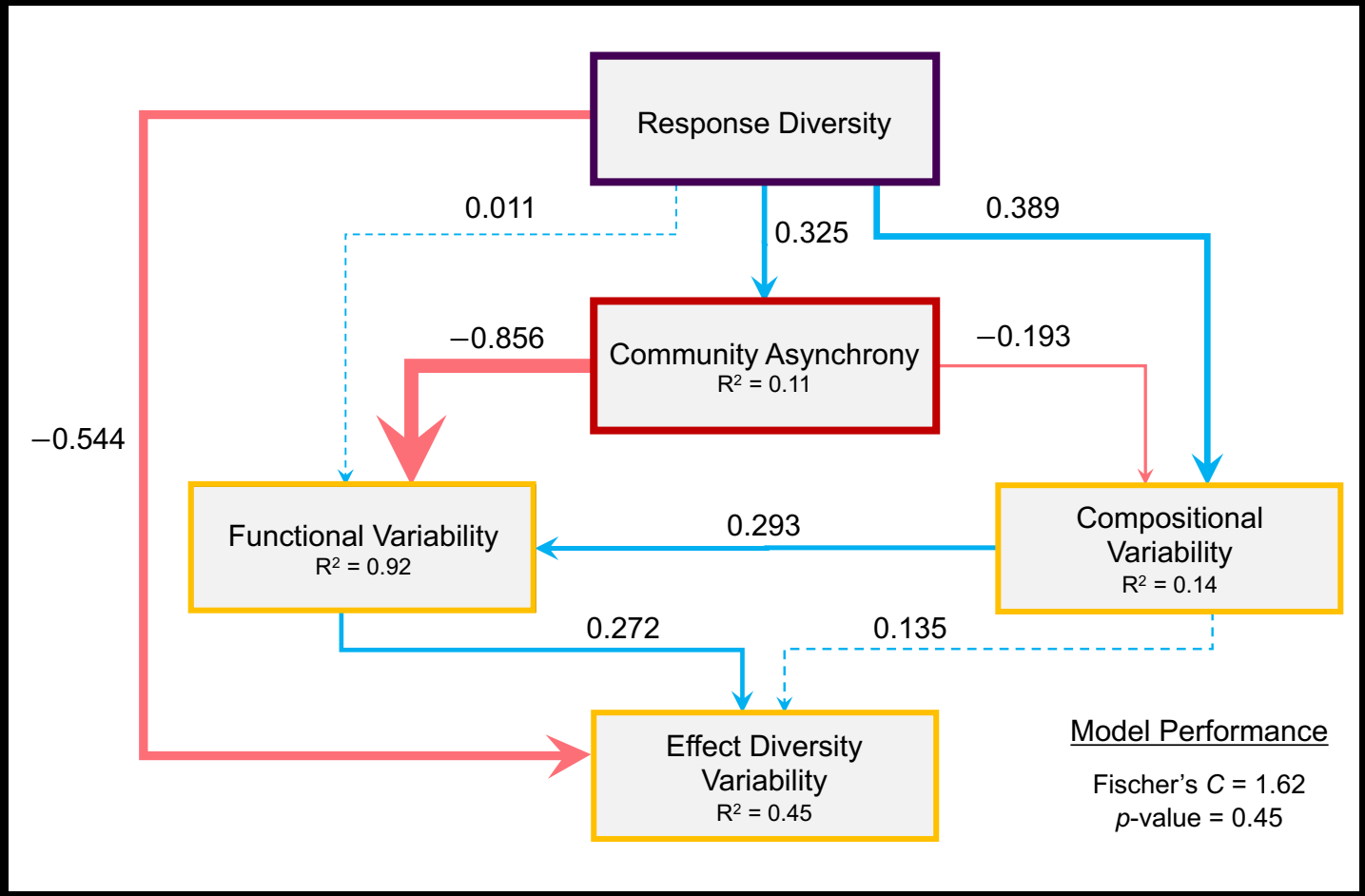
Response Diversity Network

Romanian birds

Hannah White
Anglia Ruskin Uni.



White *et al*. (In revision)

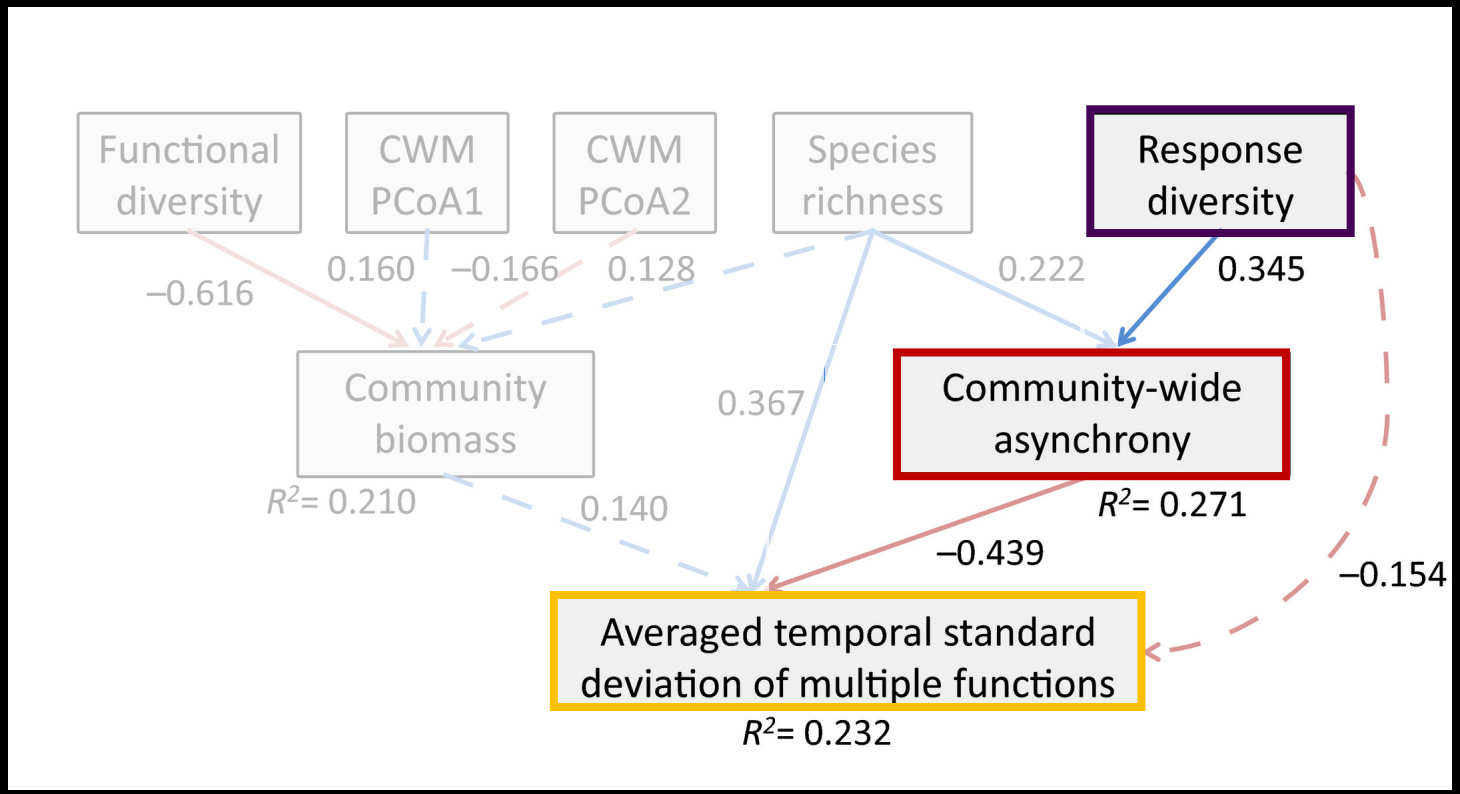
Traits

Asynchrony

Stability

Mongolian plants

Takehiro Sasaki
Yokohama Nat'l U.



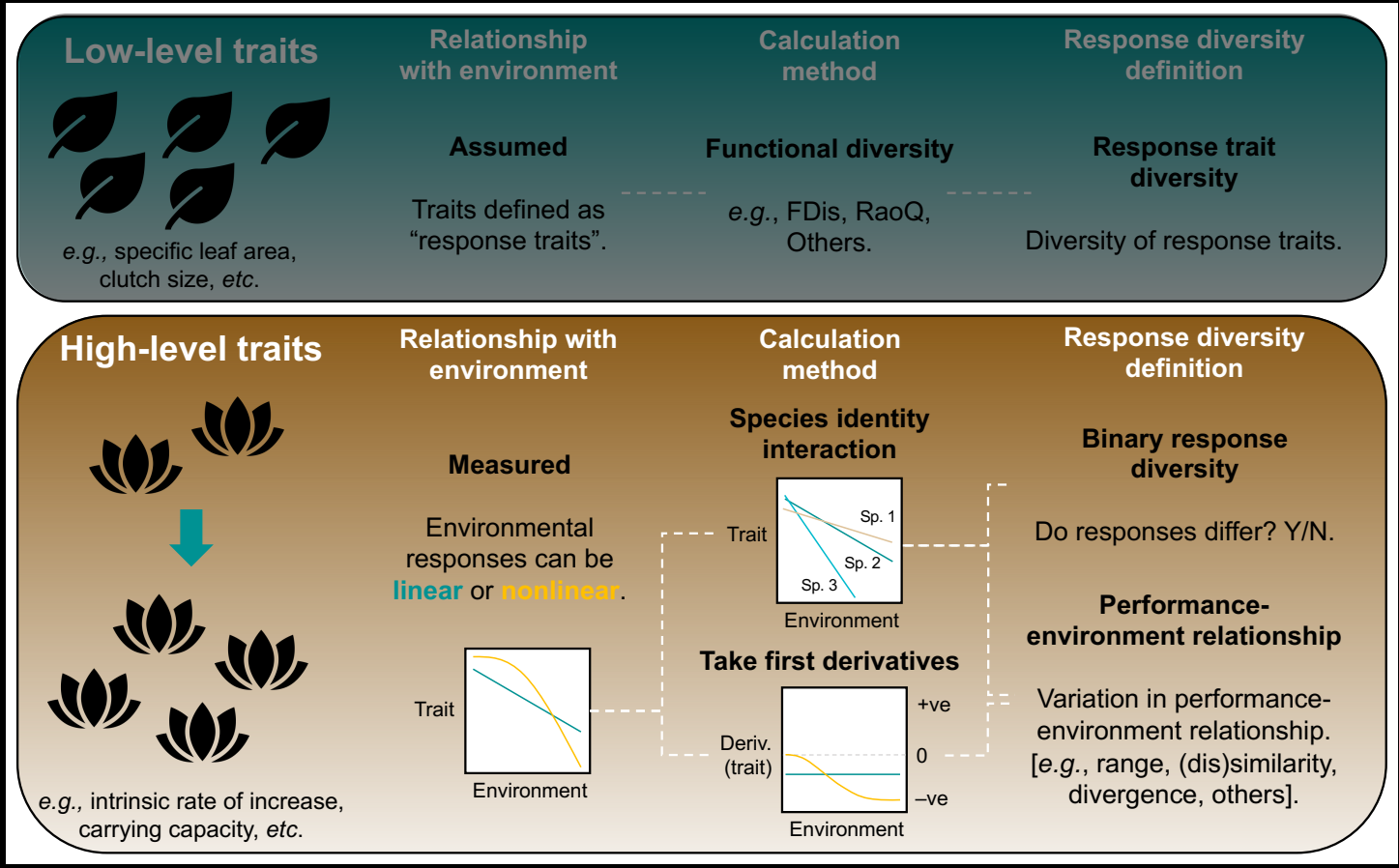
Traits

Asynchrony

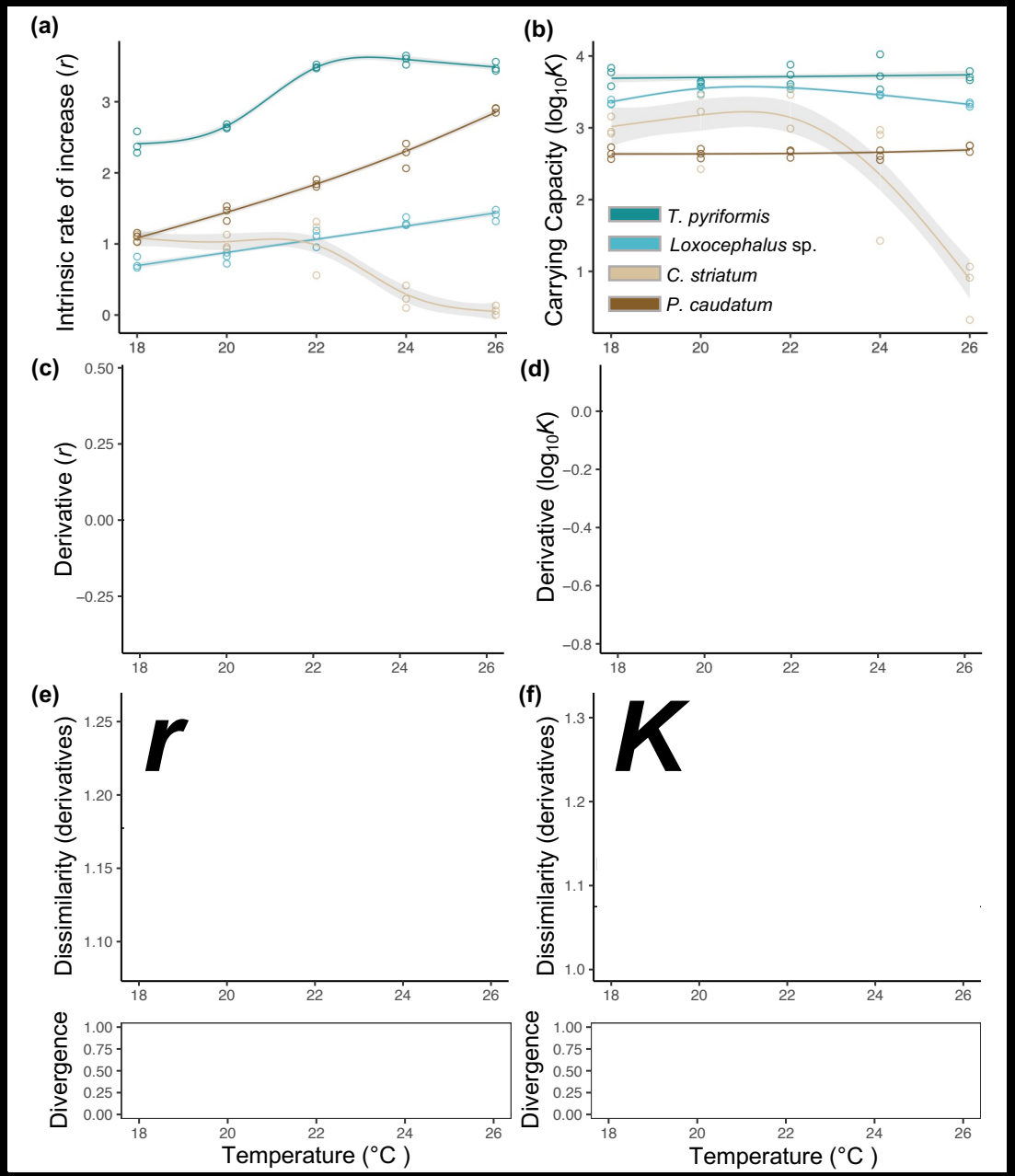
Stability

Sasaki *et al.* (2019) *Journal of Ecology*

Performance-environment relationships



Ross *et al.* (2023) *Methods in Ecology and Evolution*



Journal of Animal Ecology

Journal of Animal Ecology 2009, **78**, 1143–1151 doi: 10.1111/j.1365-2656.2009.01586.x

Testing a biological mechanism of the insurance hypothesis in experimental aquatic communities

Daniel J. Leary and Owen L. Petchey*

Leary & Petchey (2009) *J. Anim. Ecol.*

- Take **derivatives** of species-environment relationships.
- Method can handle **nonlinear** responses (temperature-dependency).
- Environment-stability relationships driven by underlying **biotic environmental dependencies**?

Ross *et al*. (2023) *Methods Ecol. Evol.*

@SamRPJRoss

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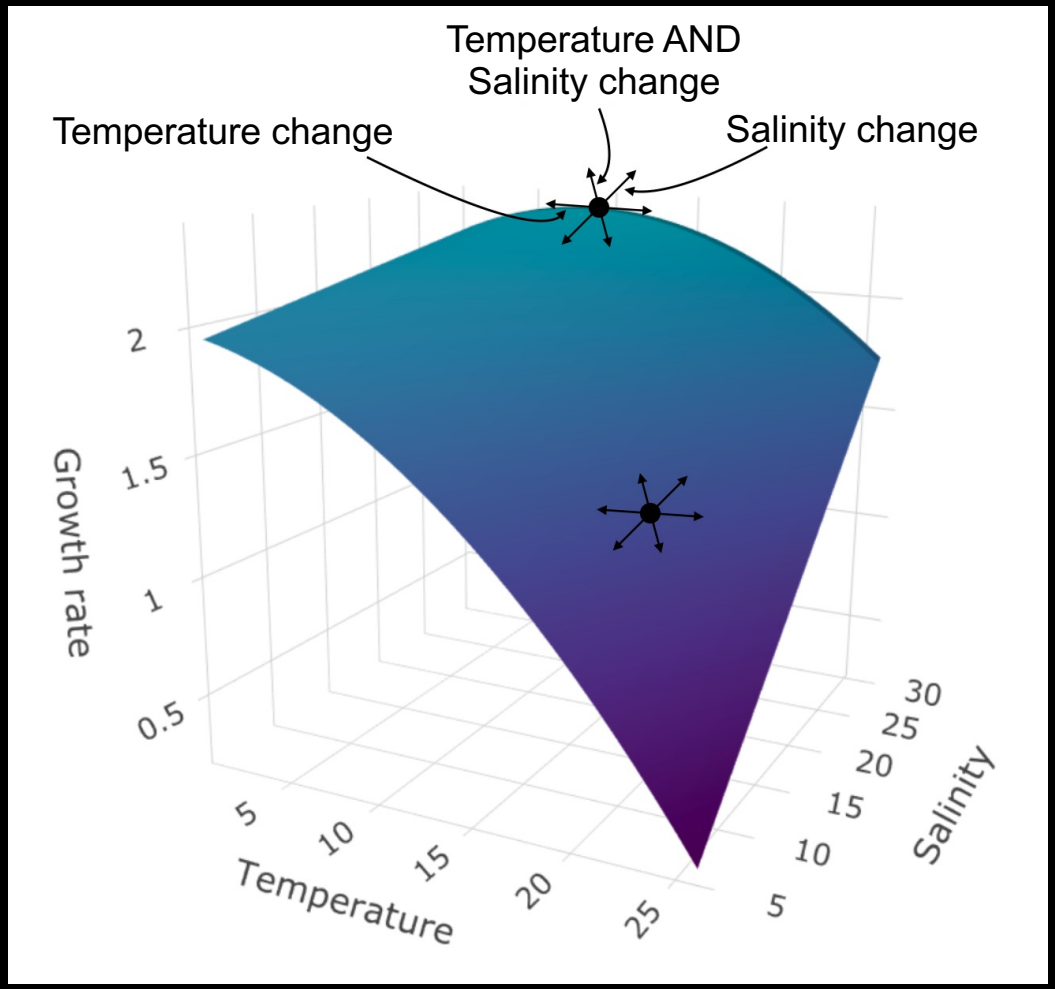
OIST Response Diversity Network

Multiple stressors



Polazzo *et al*. (In prep.)

Francesco Polazzo
Uni. Zurich

How can we consider response diversity to **multiple environmental changes** simultaneously?

Requires multidimensional **response surface** and understanding of ***direction*** of **environmental change**.

Expert opinion polling

Laura Dee
U. Colorado Boulder

Survey aims

Send to Response Diversity Network and authors of response diversity papers.

CONCEPT

1. Understand **what** people currently consider response diversity to be.

INTEREST

2. Understand **why** people are interested in response diversity.

METHODS

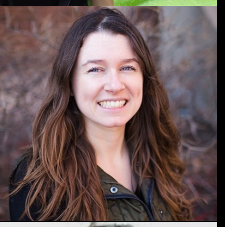
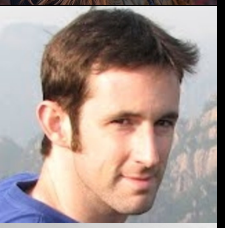
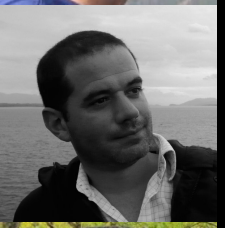
3. Reveal **how** people are currently measuring response diversity.

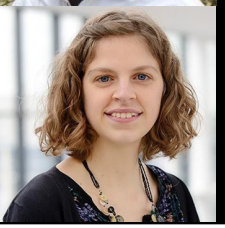
HOT TOPICS

4. Reveal the **challenges and priorities** in terms of research and application.

MANDATE

5. Inform the **agenda and goals** of the Response Diversity Network.



Response Diversity Network

Objectives

Steering committee

Ceres Barros
Laura Dee
Mike Fowler
Owen Petchey
Sam Ross
Takehiro Sasaki
Hannah White

RESEARCH

- Organise and accelerate **scientific advances** about response diversity and stability.

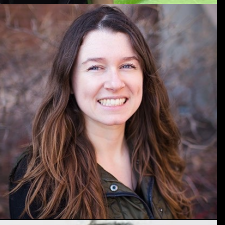
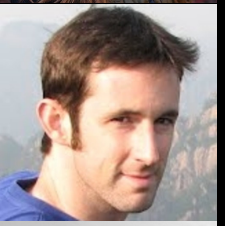
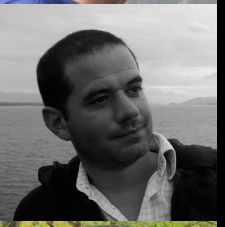
MONITORING

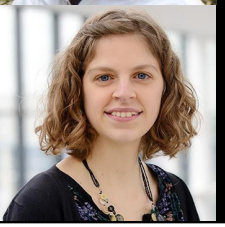
- Promote the **inclusion** of response diversity in **monitoring and assessment** of biodiversity change.

RESOURCE

- Provide **clear and accessible information** about response diversity to relevant individuals and organisations.

Objectives are **flexible** and should **evolve** to meet the needs of the network over time.

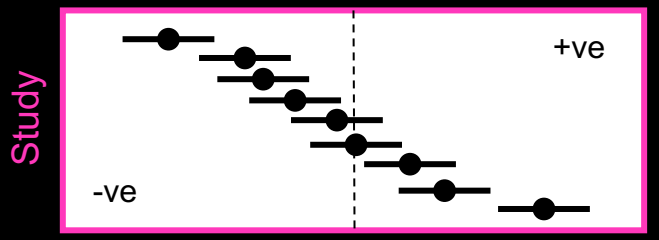







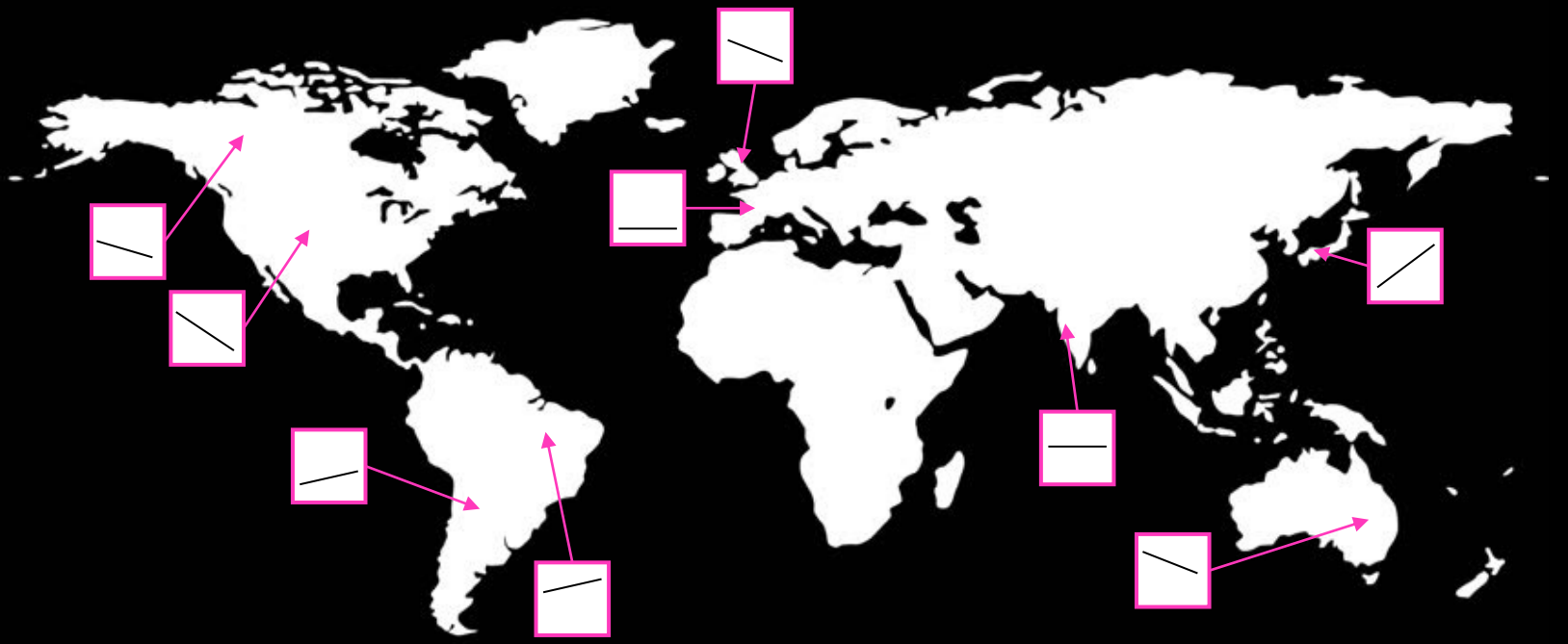
Response Diversity Network

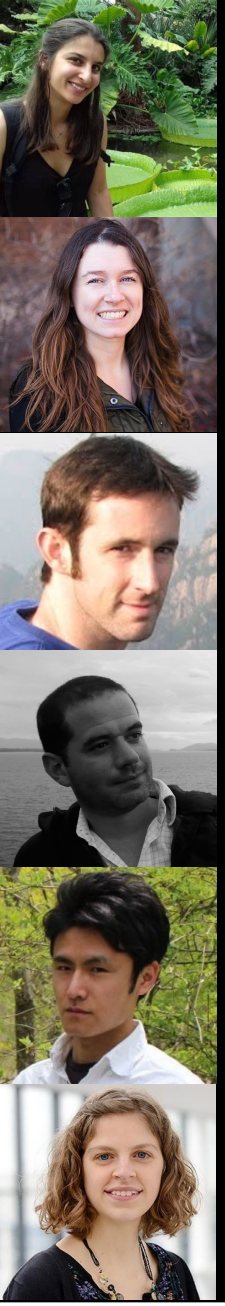
Longer-term goals

Global synthesis



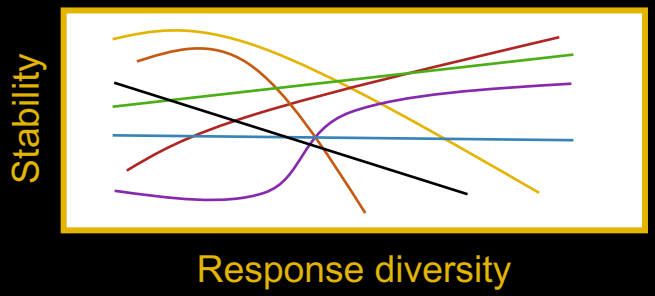
Effect size (stability ~ diversity)



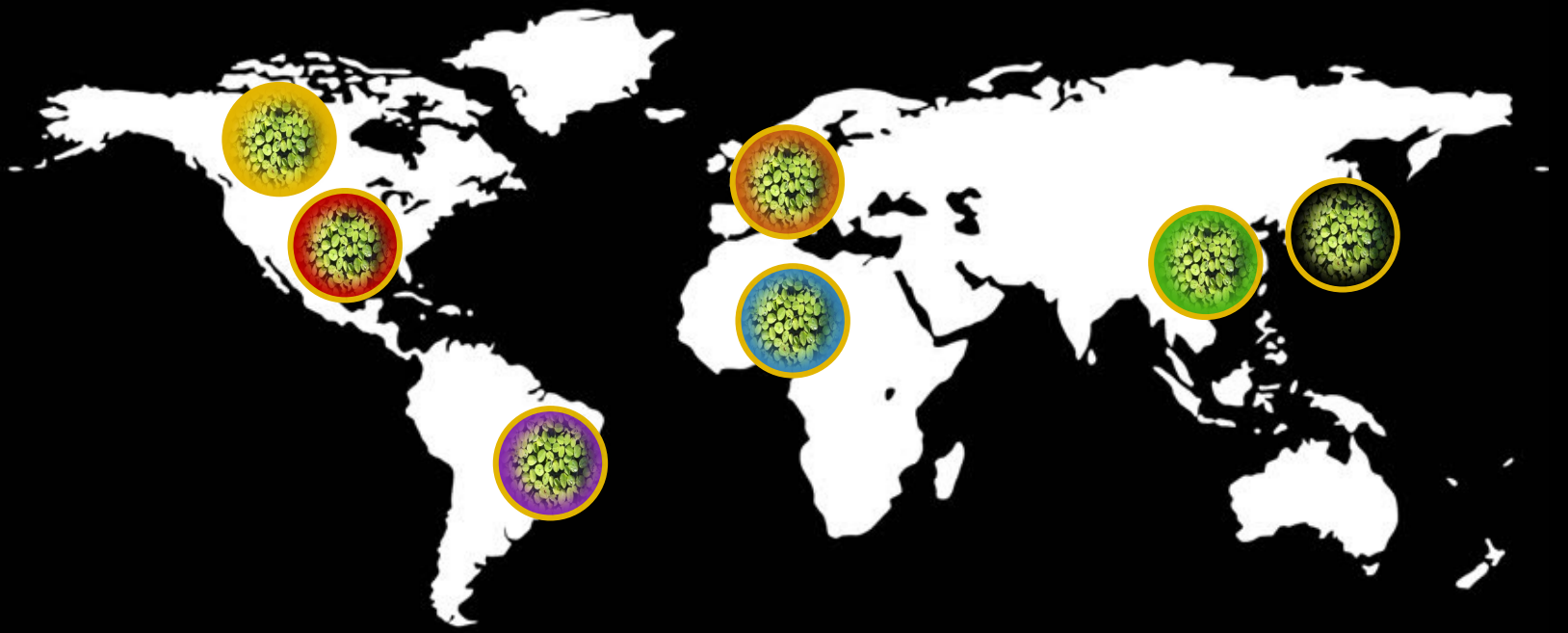


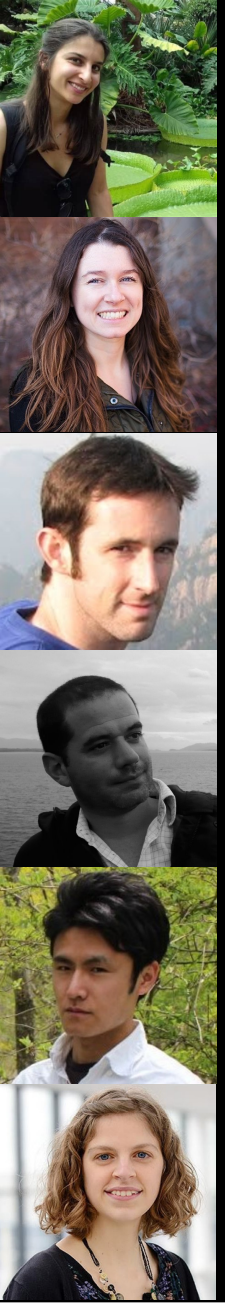
Response Diversity Network

Longer-term goals



Distributed experiment





Response Diversity Network

Longer-term goals

Global synthesis

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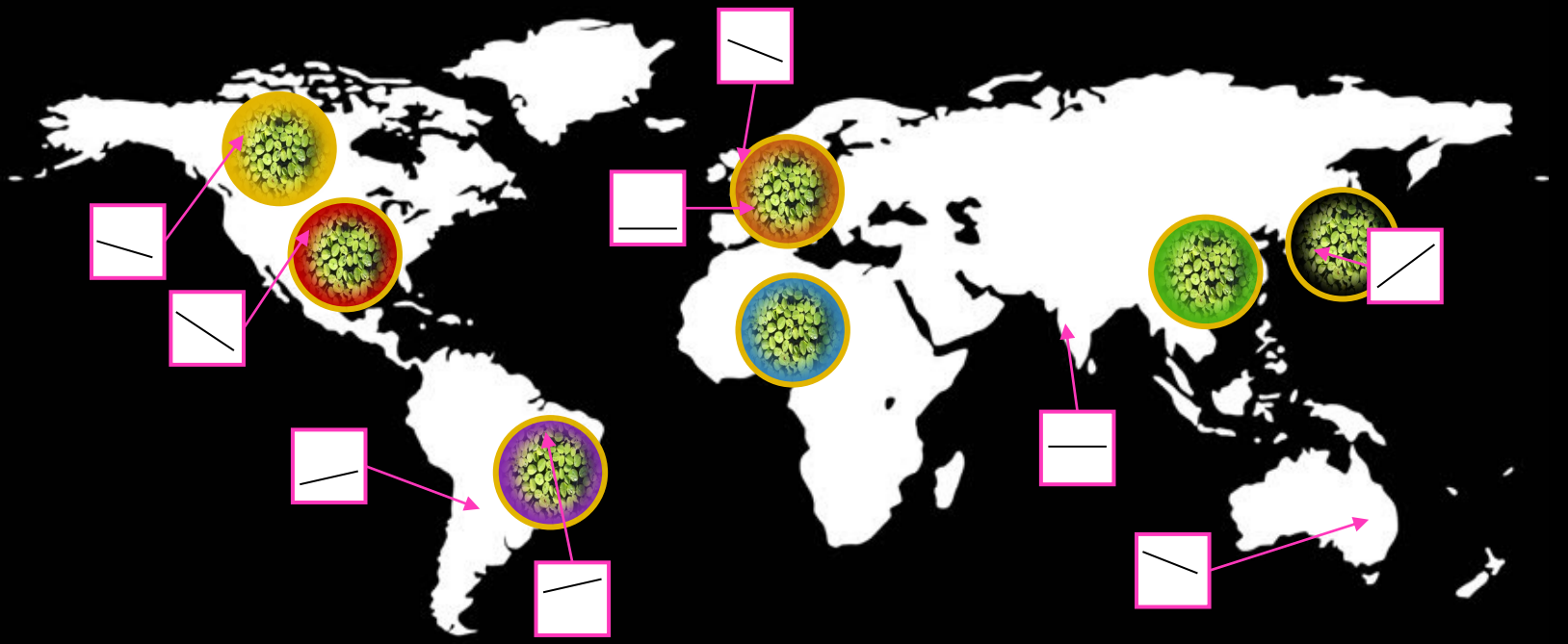

Ross *et al*. (2023) *Methods in Ecology and Evolution*

- ❑ Response diversity should predict ecological stability (Insurance Hypothesis)
- ❑ Different approaches for conceptualising and quantifying response diversity.
- ❑ By coordinating and accelerating research, the Response Diversity Network has the potential to be a useful community resource.

Thank you


Owen Petchey


Takehiro Sasaki


Dave Armitage

JSPS

BRITISH ECOLOGICAL SOCIETY

OIST

Hannah White
Laura Dee
Mike Fowler
Ceres Barros
Francesco Polazzo
Gavin Simpson
Frank Pennekamp
Joseph Bailey
Ciortan Bogdan

...and

Response Diversity Network

@SamRPJRoss

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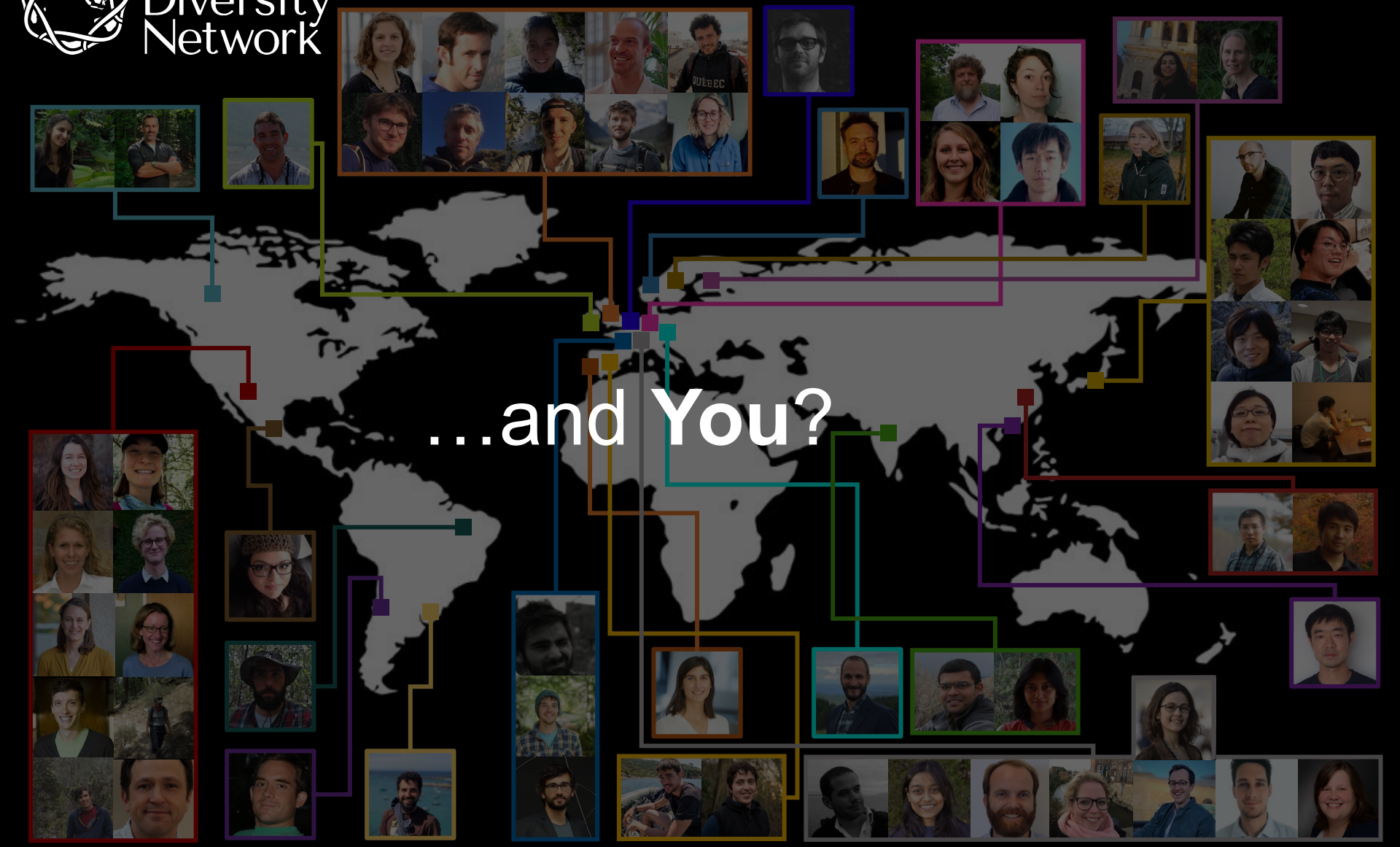
Response Diversity Network

Response Diversity Network

64 members from 45 institutions in 22 countries



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OIST Response Diversity Network

Experiment on response diversity and stability of floating plants

Dave Armitage
OIST

JSPS

BRITISH ECOLOGICAL SOCIETY

Hiring: Research Assistant
求人：研究助手
Jun (六) – Aug (八) 2023

OIST
沖縄

Nitrogen
窒素

75 mesocosms
メソコスム

Floating plants
浮遊植物

@SamRPJRoss

Email: s.ross.res@outlook.com

OIST Response Diversity Network

21/03 (火) 14:40
第11回 日本生態学会奨励賞（鈴木賞）

地球環境変動下における生態系の安定性の規則性と原動力の解明に用いる統合的手法

Integrative approaches for understanding the patterns and drivers of ecological stability under global environmental change

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