Measuring the microbial biodiversity by single-cell analysis

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Hot topic...

Functional Ecology

British Ecological Society

Functional Ecology 2015, **29**, 1341–1349 doi: 10.1111/1365-2435.12445

Bacterial diversity amplifies nutrient-based plant–soil feedbacks

Shifts in microbial diversity through land use intensity as drivers of carbon mineralization in soil

Vincent Tardy [a], Aymé Spor [a], Olivier Mathieu [c], Jean Lévèque [c], Sébastien Terrat [b], Pierre Plassart [a], Tiffanie Regnier [a], Richard D. Bardgett [d], Wim H. van der Putten [e, f], Pier Paolo Roggero [g, h], Giovanna Seddaiu [h], Simonetta Bagella [h, i], Philippe Lemanceau [a], Lionel Ranjard [a, b], Pierre-Alain Maron [a, b, *]

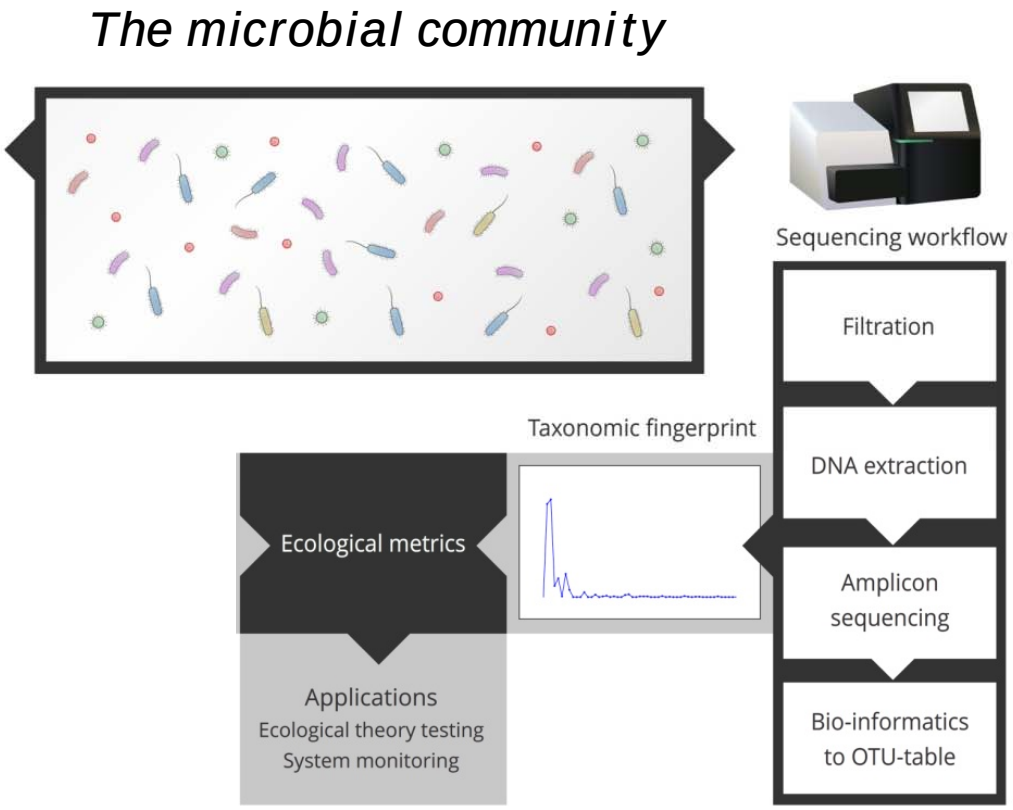
Testing biodiversity-ecosystem functioning relationship in the world's largest grassland: overview of the IMGRE project

Jianguo Wu · Shahid Naeem · James Elser · Yongfei Bai · Jianhui Huang · Le Kang · Qingmin Pan · Qibing Wang · Shuguang Hao · Xingguo Han

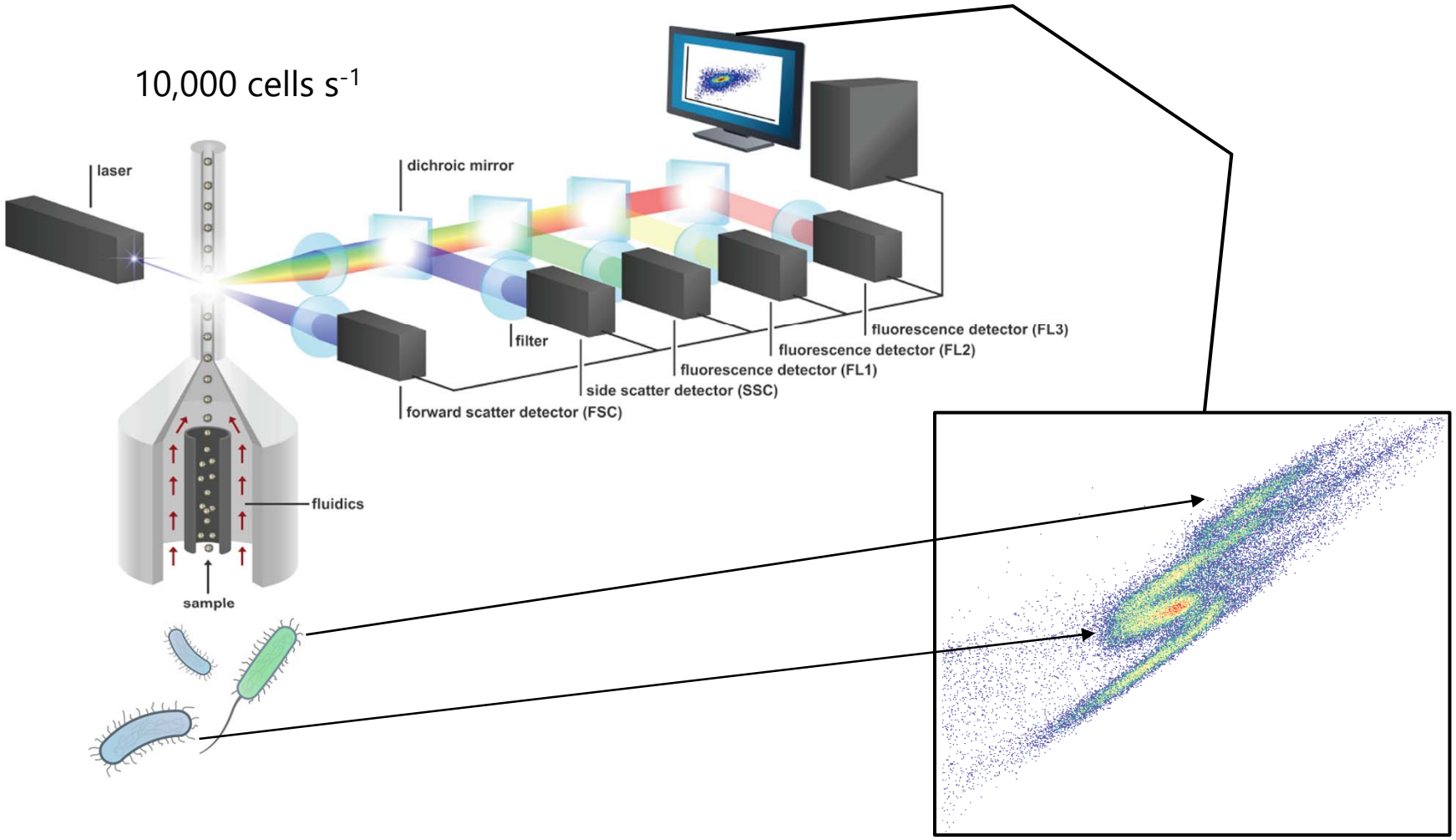
Marine biodiversity and ecosystem function relationships: The potential for practical monitoring applications

James Asa Strong [a, *], Eider Andonegi [b], Kemal Can Bizsel [c], Roberto Danovaro [d], Mike Elliott [a], Anita Franco [a], Esther Garces [e], Sally Little [a], Krysia Mazik [a], Snejana Moncheva [f], Nadia Papadopoulou [g], Joana Patrício [h], Ana M. Queirós [i], Chris Smith [g], Kremena Stefanova [f], Oihana Solaun [b]

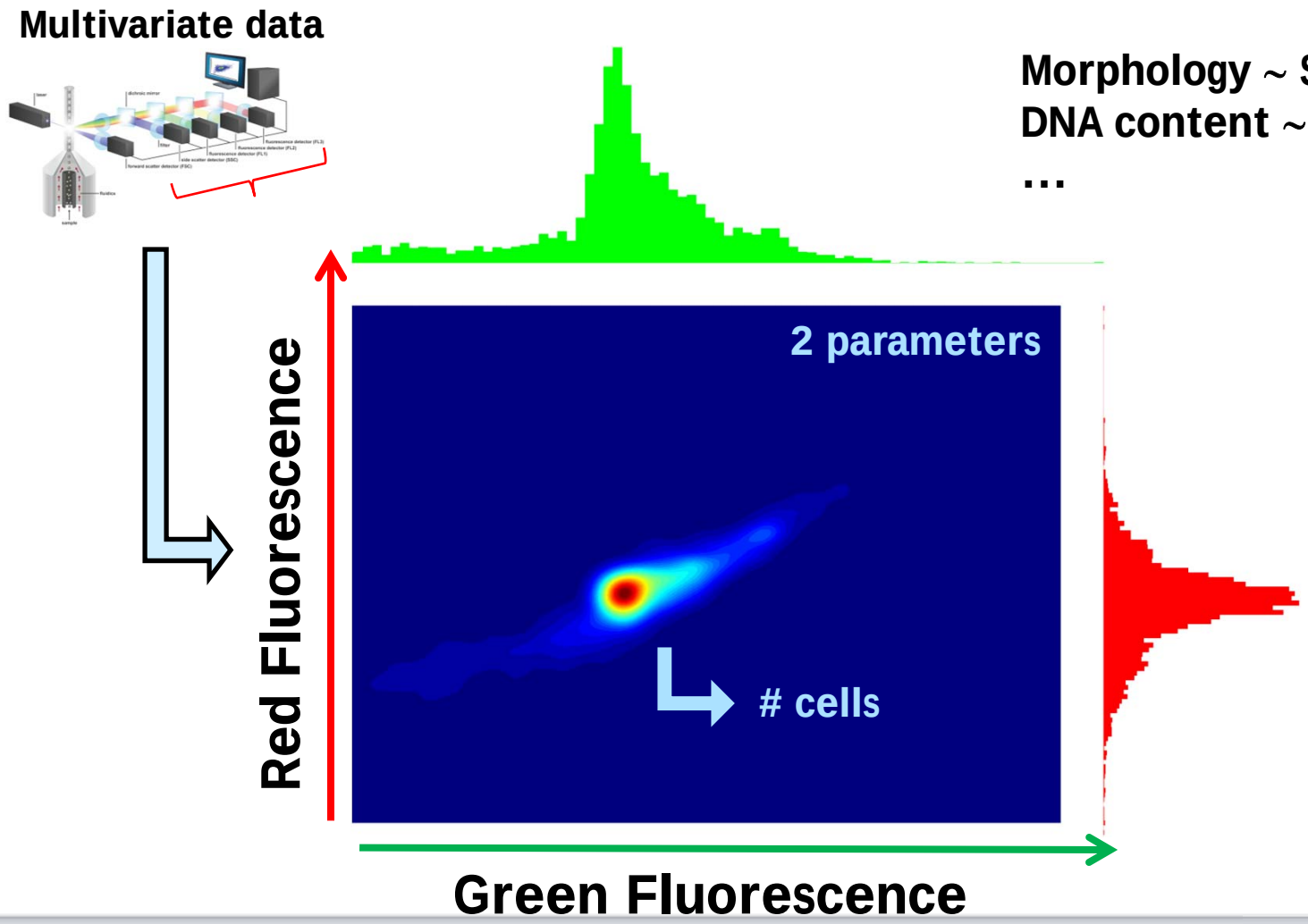
Assessing biodiversity



Flow Cytometry

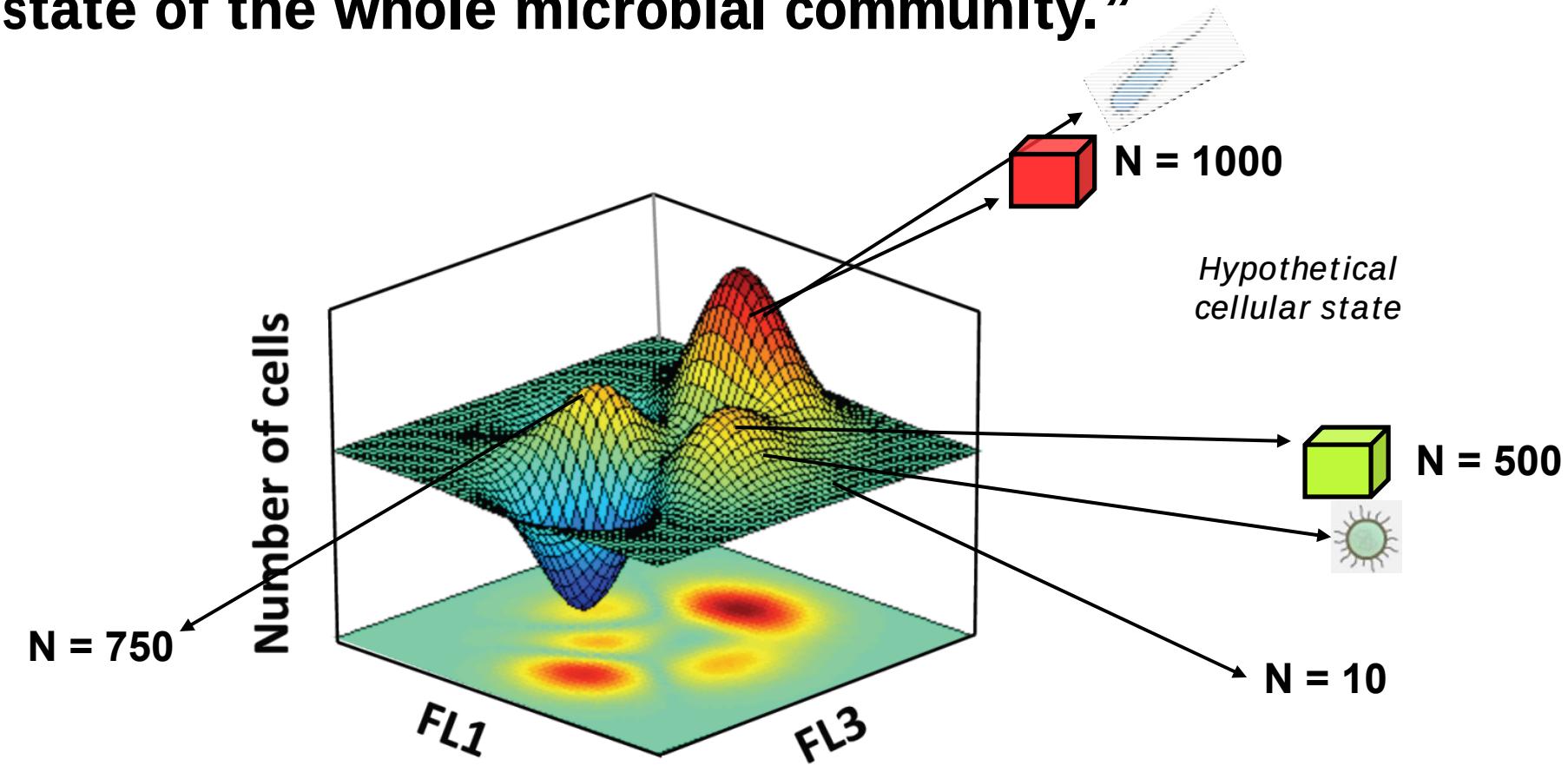


Phenotypic markers

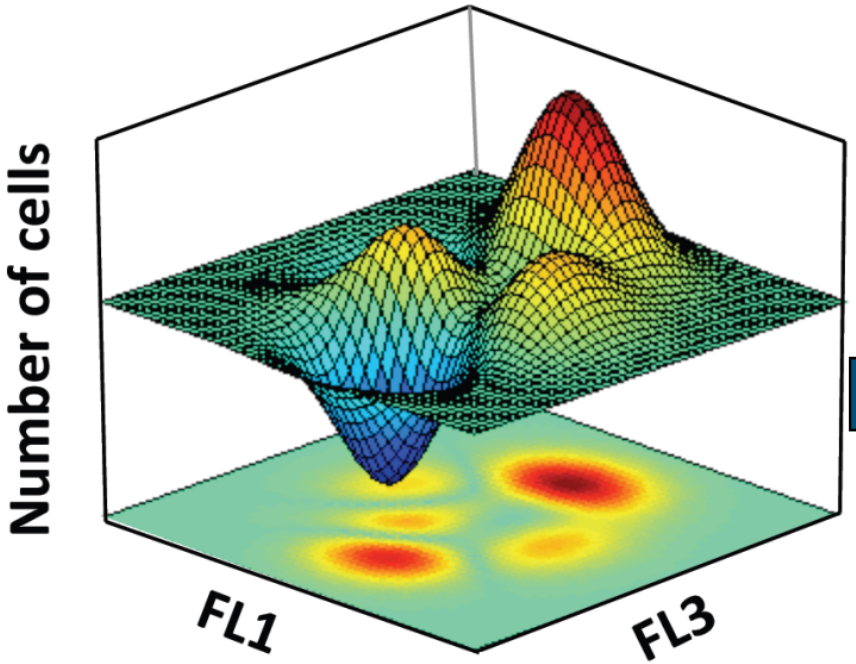


Rationale

“The community landscape represents a phenotypic state of the whole microbial community.”



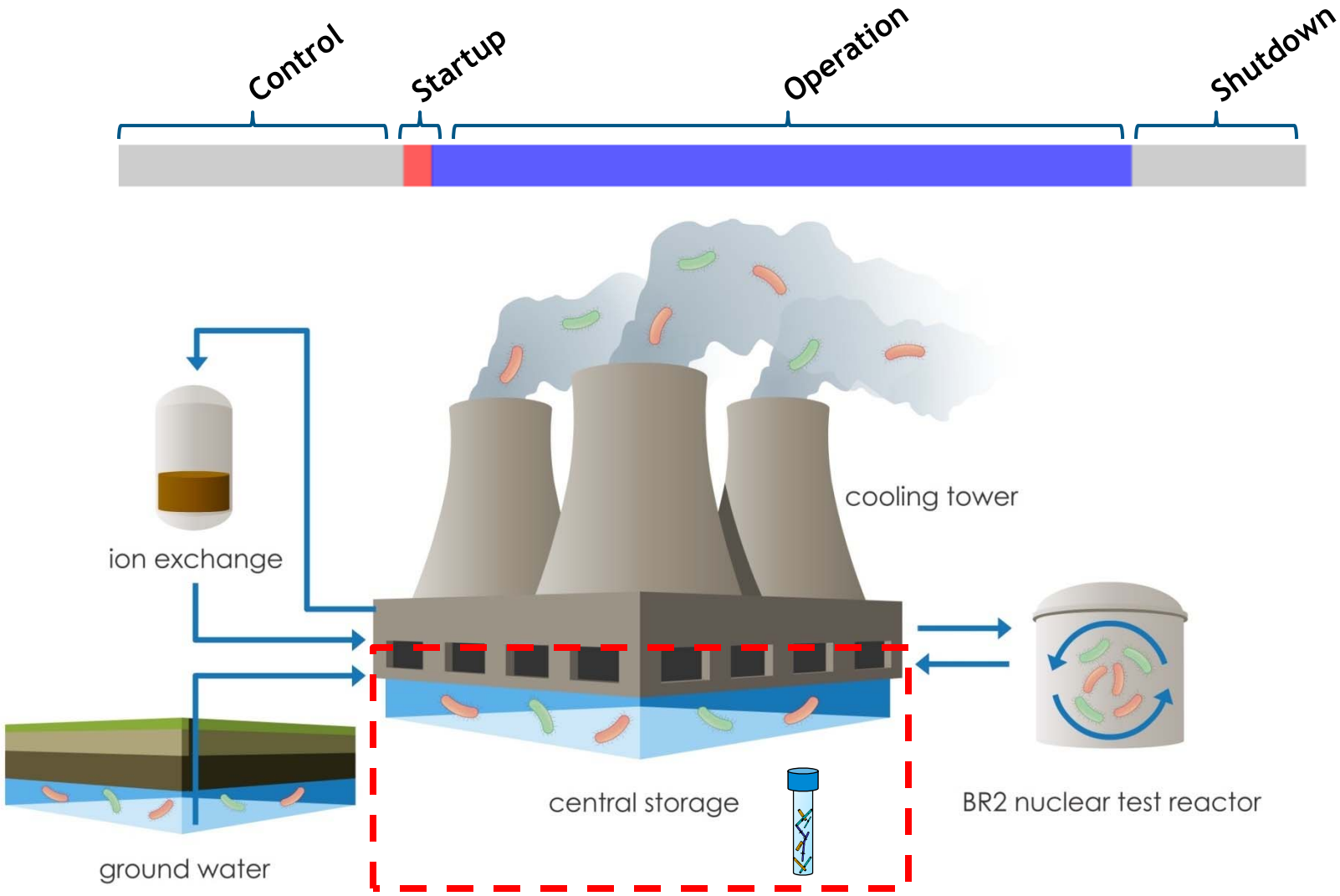
Rationale



25	90	63	22	16	2	0	0	0	0
35	127	278	214	73	25	8	3	1	0
241	897	2532	3205	1736	588	155	52	9	3
581	2058	6762	11946	8168	3268	995	301	103	26
57	220	780	1596	1526	713	279	89	33	13
0	4	8	15	15	14	3	2	1	0

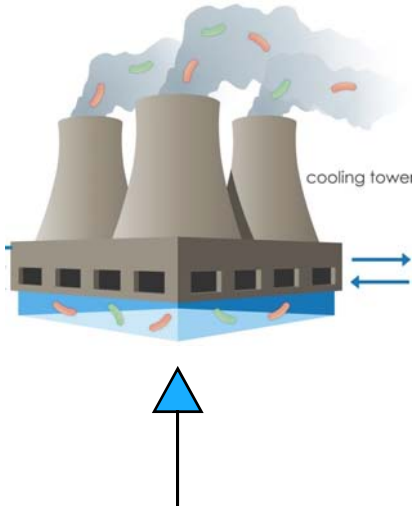
Hill Order (q)	Diversity metric (D_q)
0	$D_0 = S$
1	$D_1 = e^{-\sum_{i=1}^{S} p_i \ln (p_i)}$
2	$D_2 = \frac{1}{\sum_{i=1}^{S} (p_i)^2}$

Oligotrophic ecosystem model

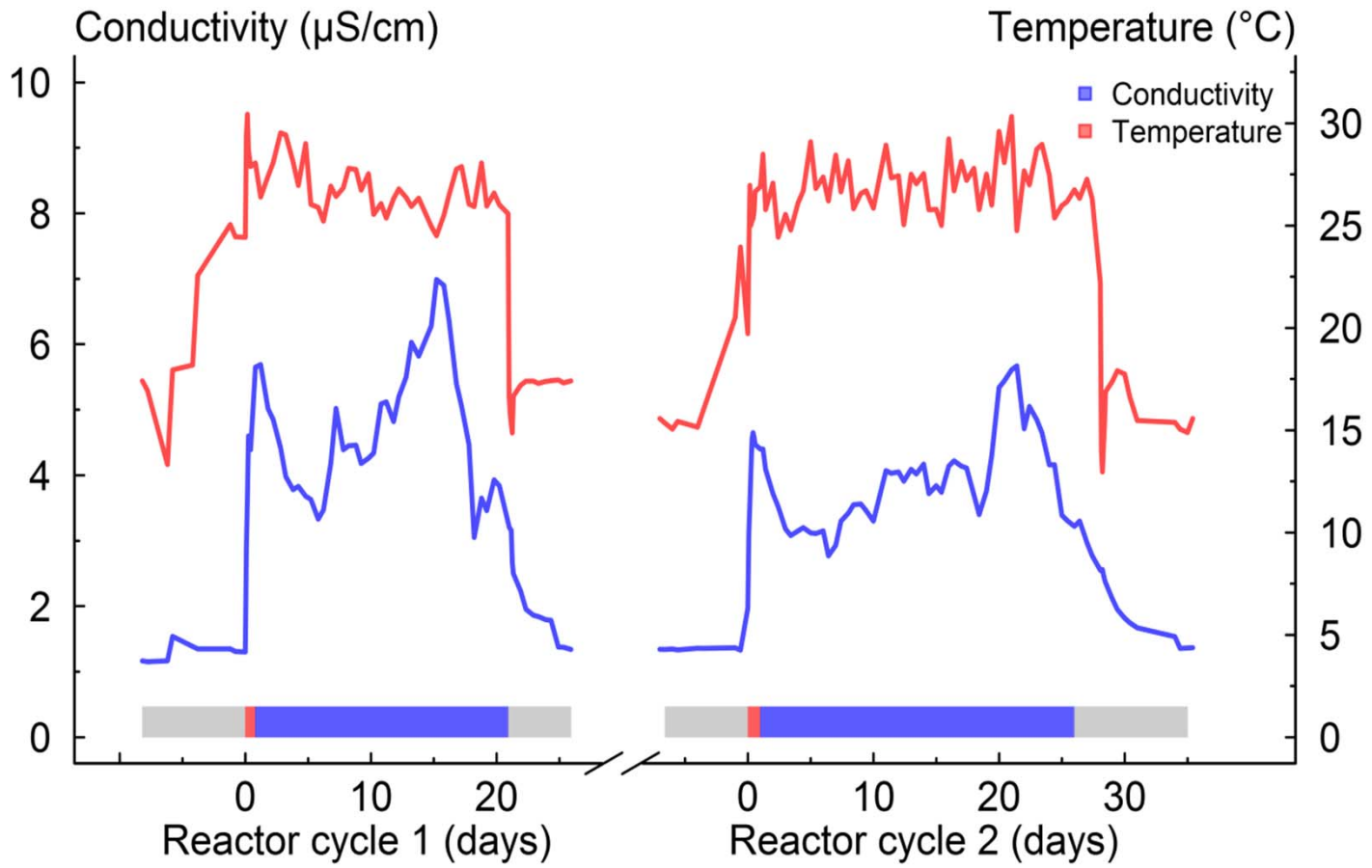


Both a dynamic and stable system

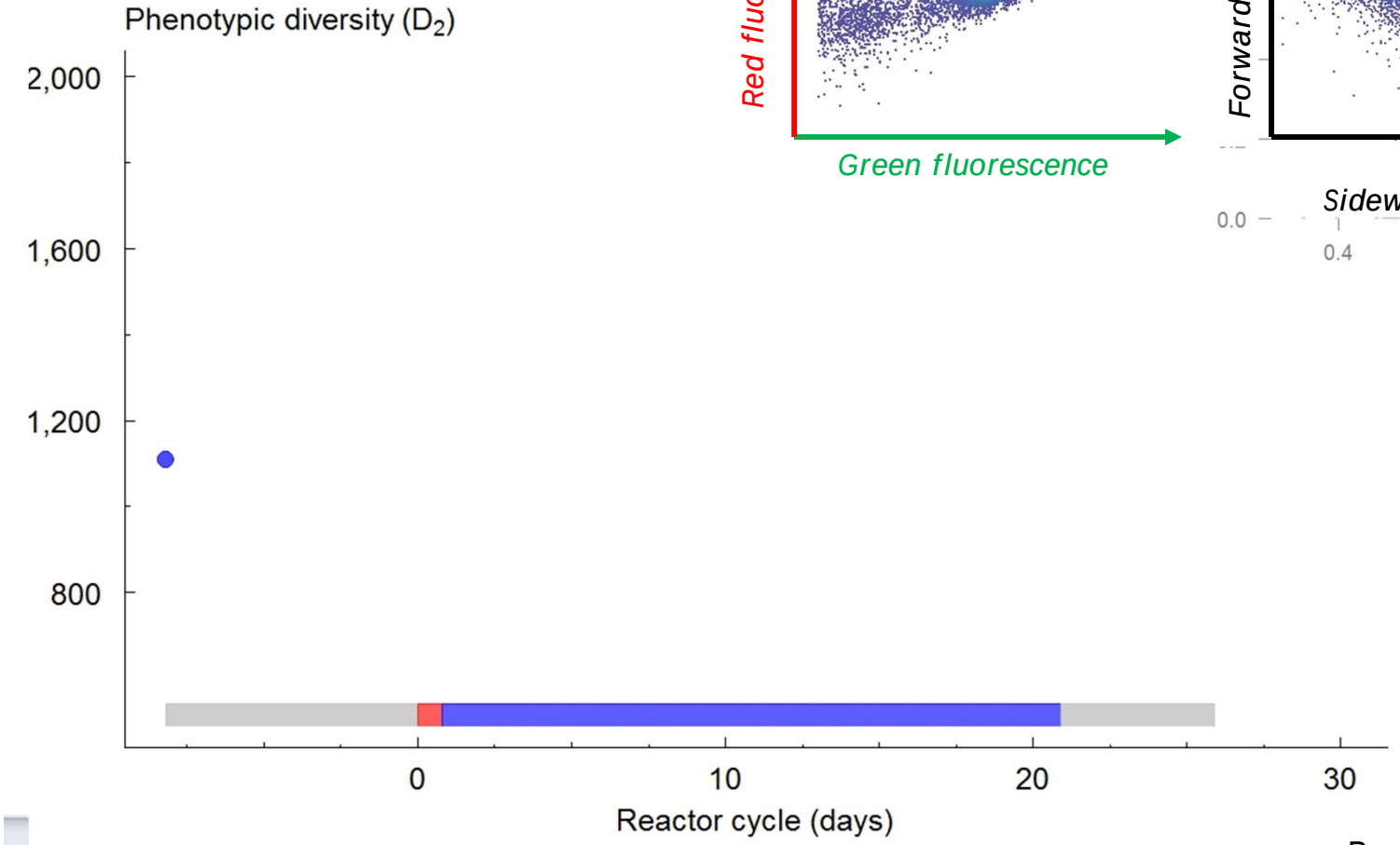
- 60 m^3 h^{-1} → 4,000 m^3 h^{-1}
- 15 °C → 30 °C
- 1 µS cm^{-1} → 7 µS cm^{-1}

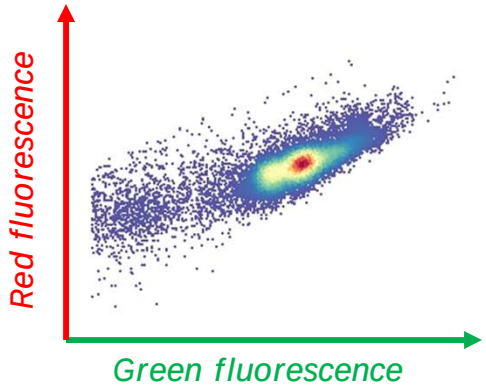


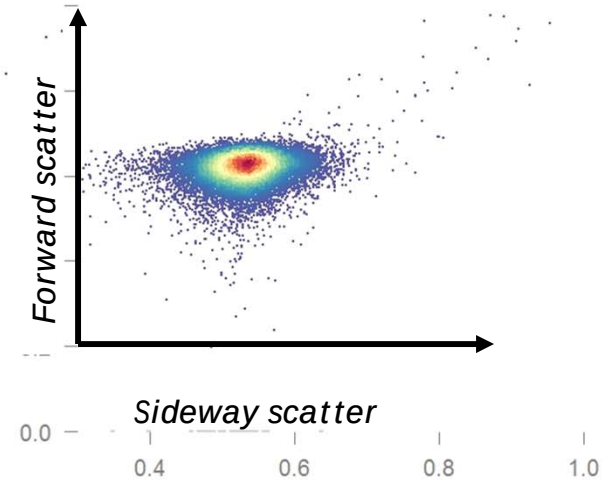
Both a dynamic and stable system



Monitoring the biodiversity

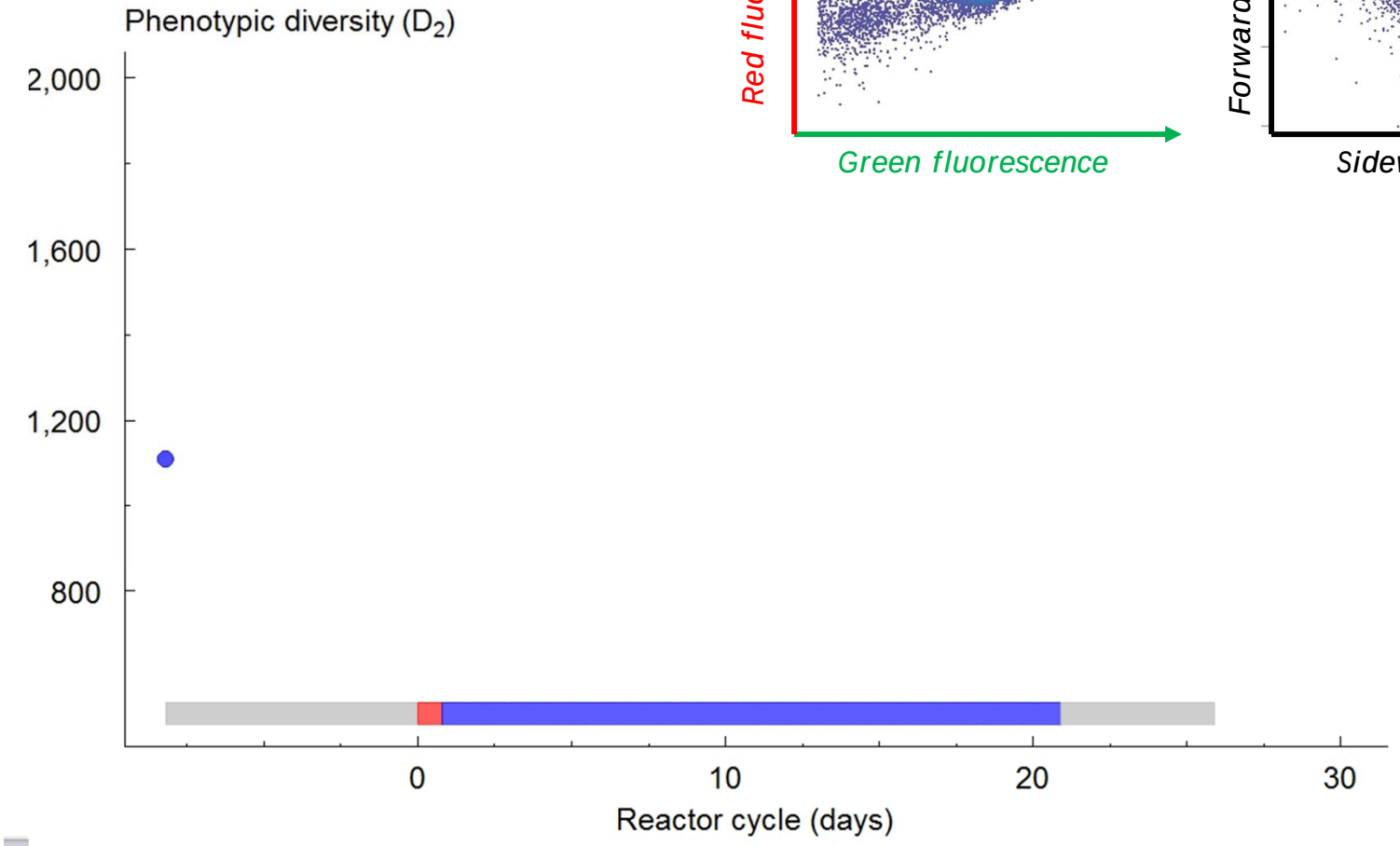


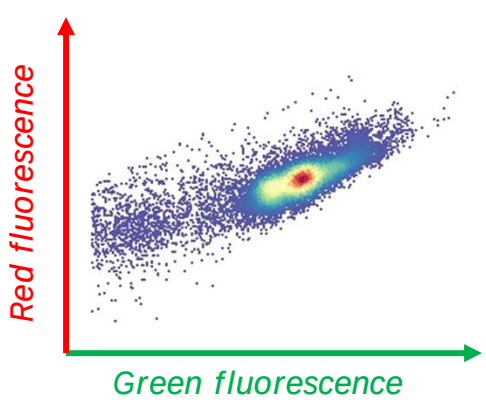


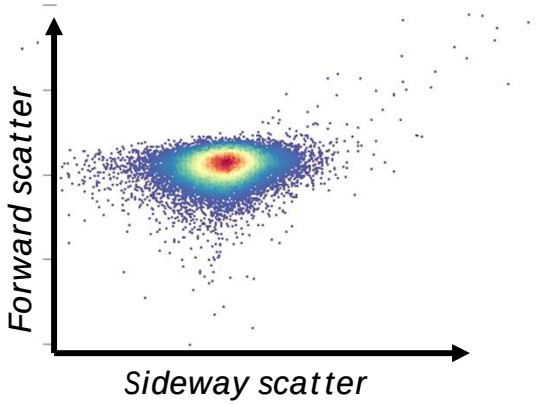


Props, R. et al., submitted.

Monitoring the biodiversity

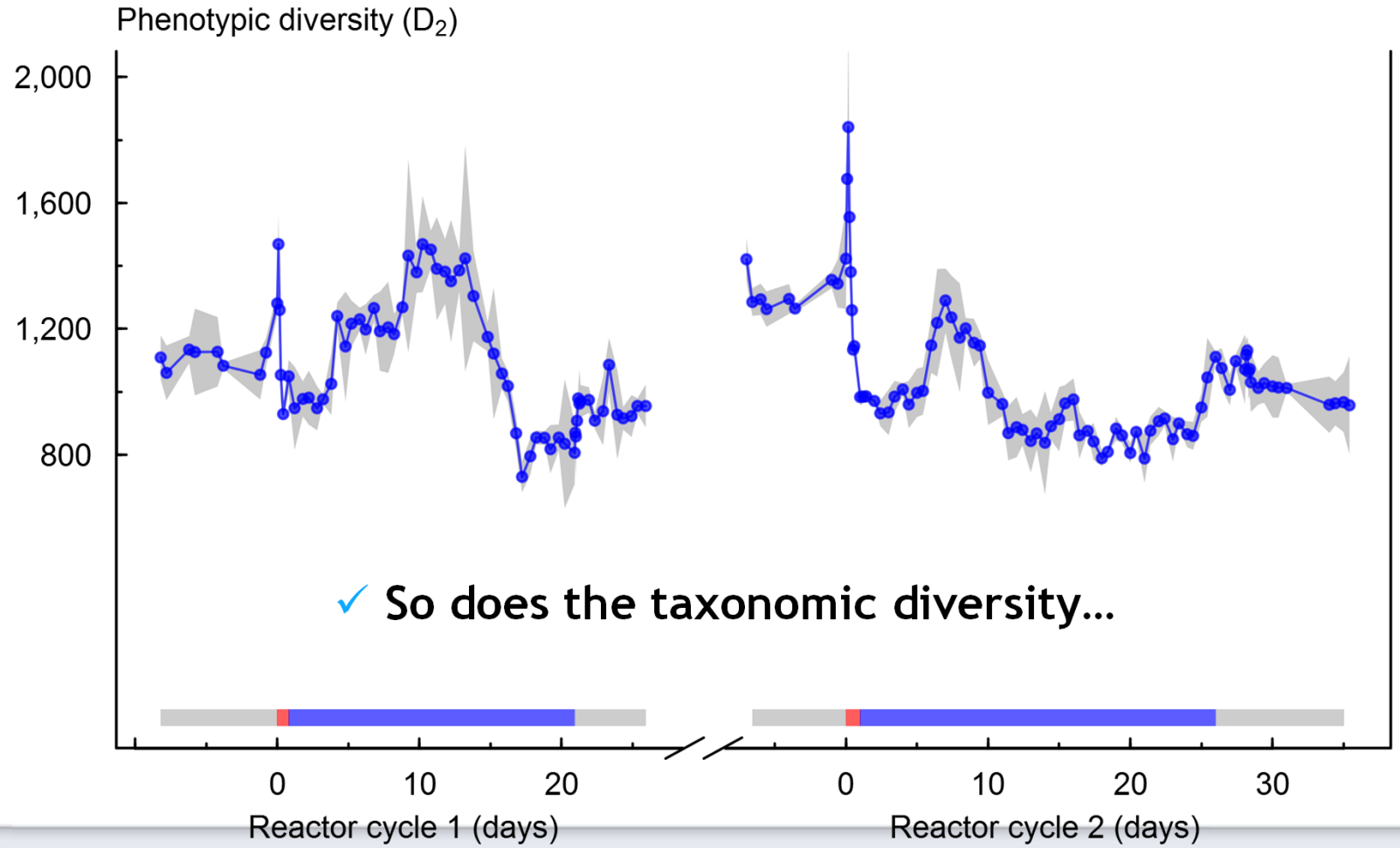




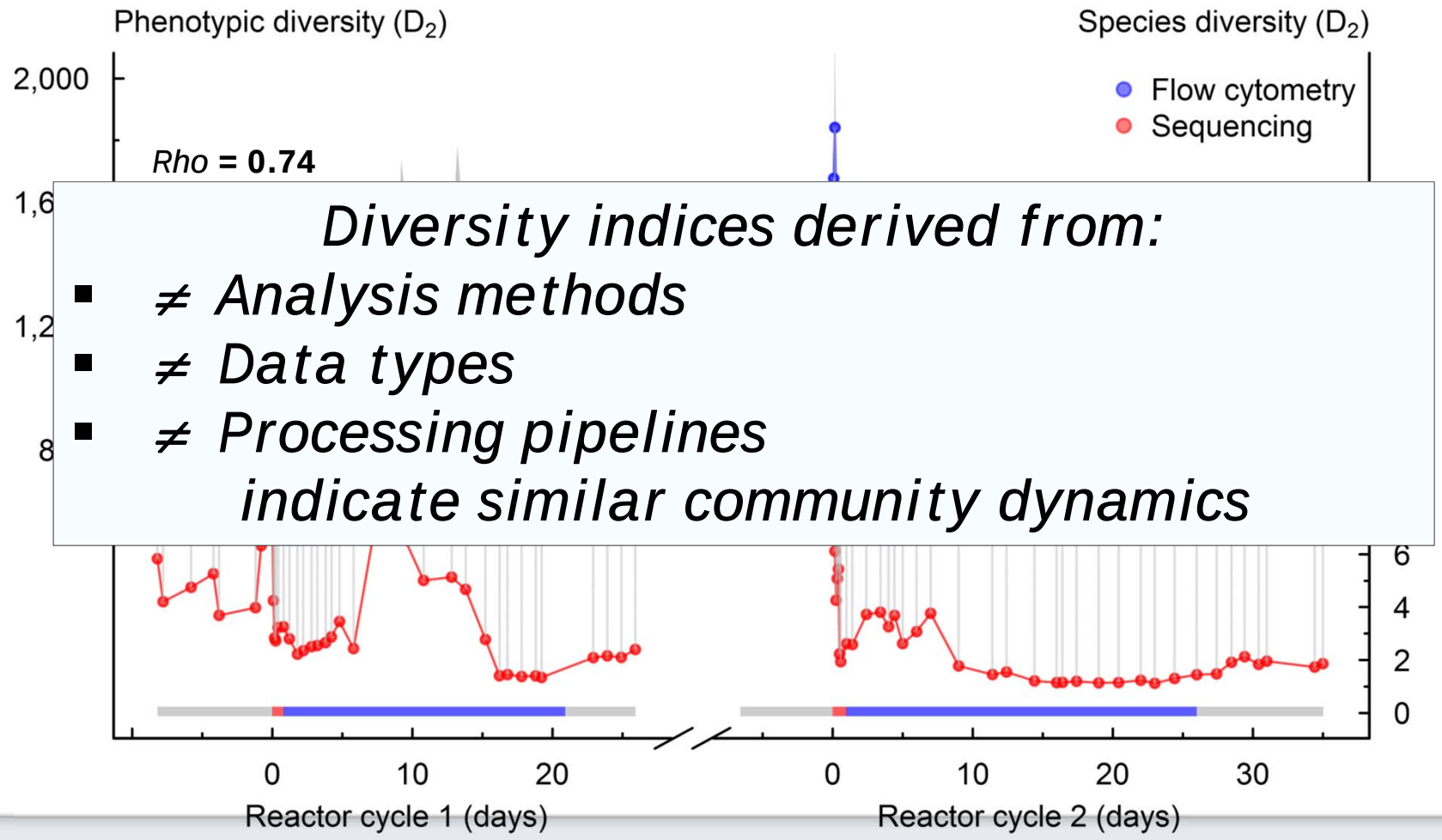


Monitoring the biodiversity

✓ **Phenotypic diversity indicates dynamic changes**



Monitoring the biodiversity

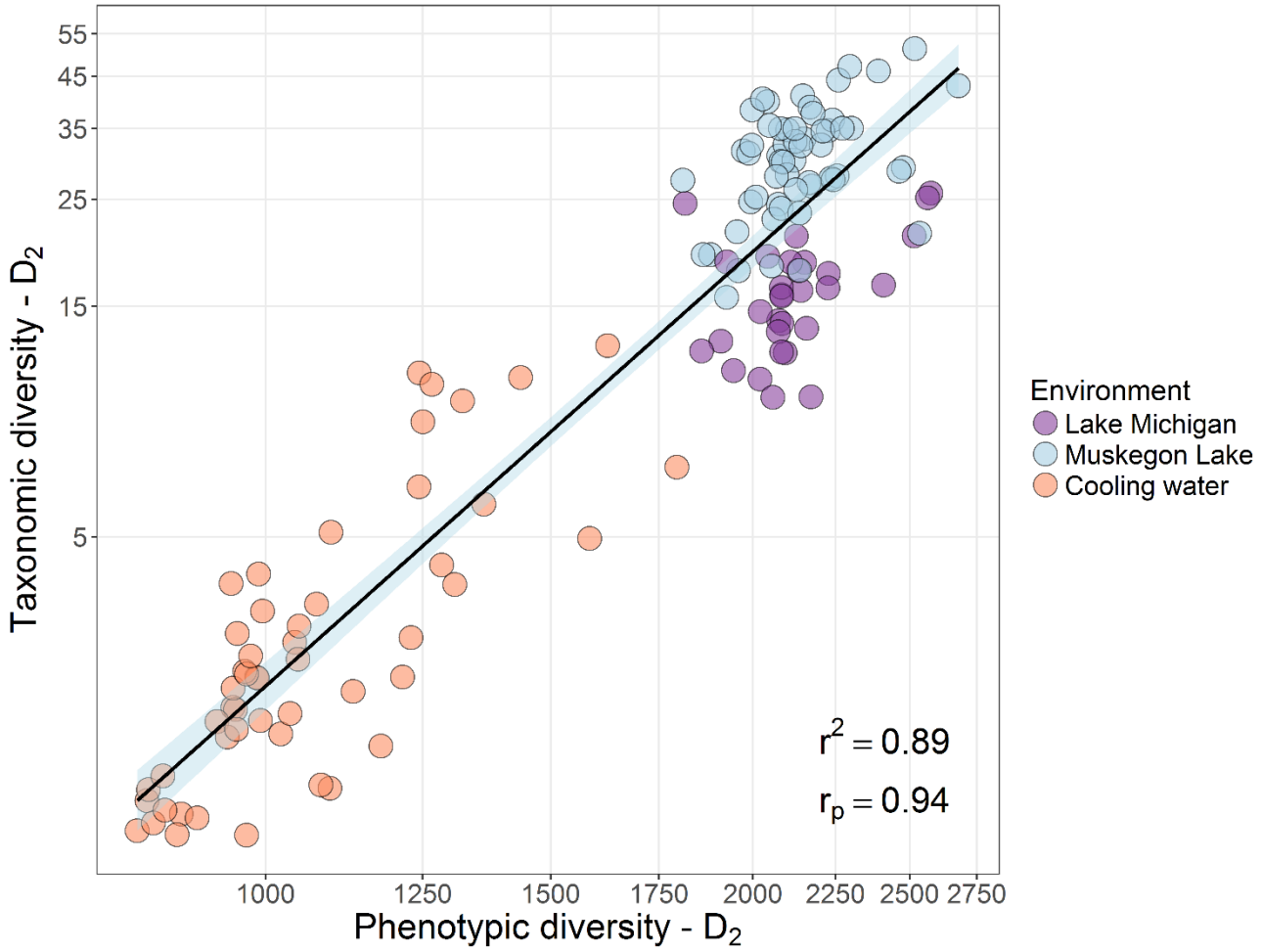


Diversity indices derived from:

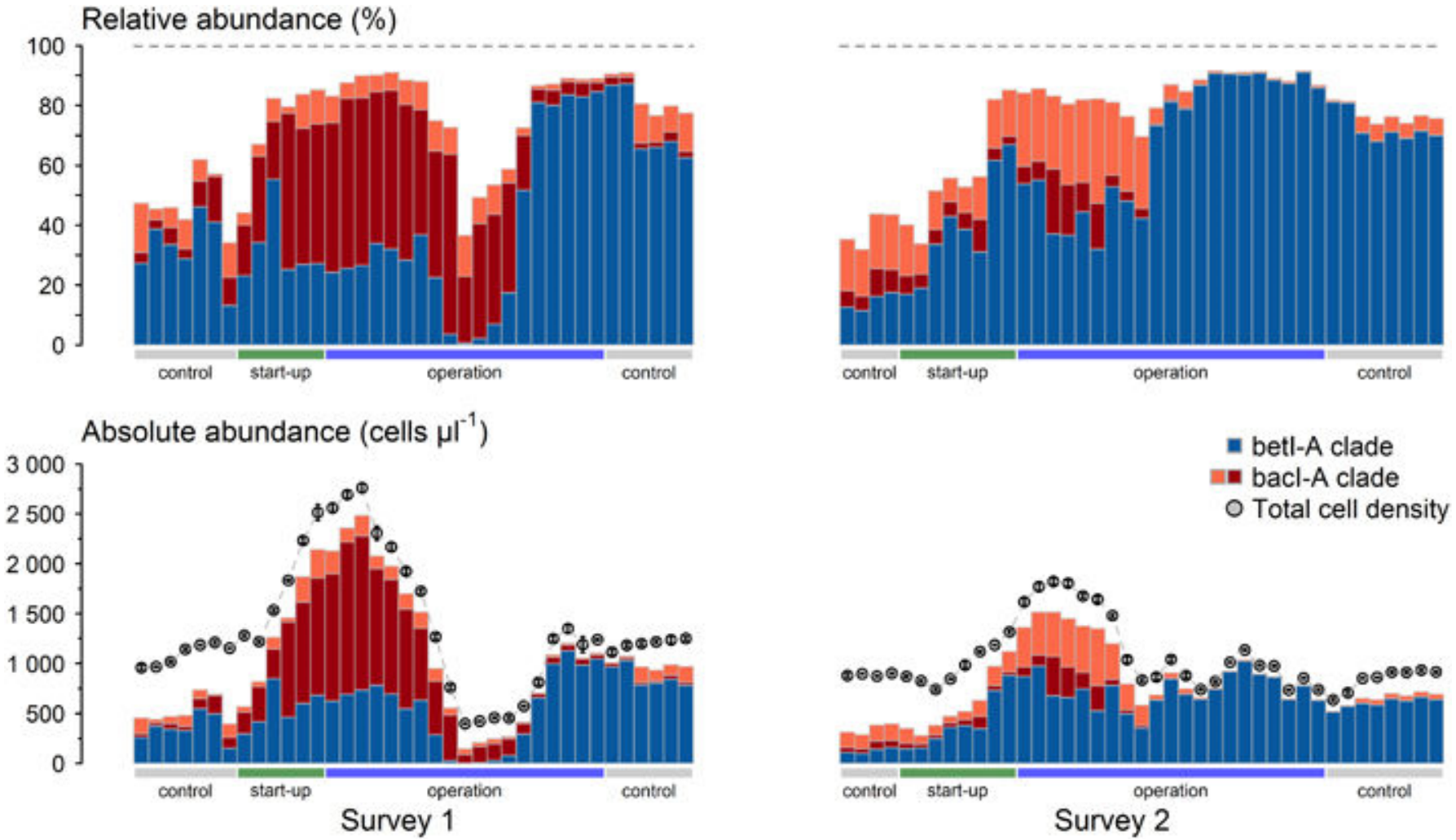
- *≠ Analysis methods*
- *≠ Data types*
- *≠ Processing pipelines*

indicate similar community dynamics

Other Ecosystems



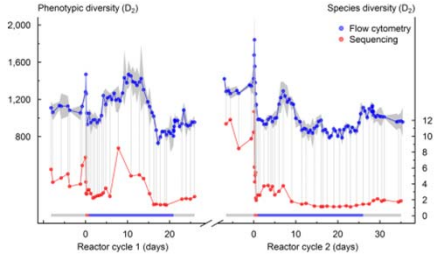
Absolute quantification of OTUs



Applications

- ✓ **In-situ real-time monitoring of biodiversity**

- ✓ **Intelligent experimental design**



When do I sample? And how frequently?

- ✓ **Complementary tool to sequencing platform**

https://github.com/rprops/Phenoflow_package

Acknowledgements

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