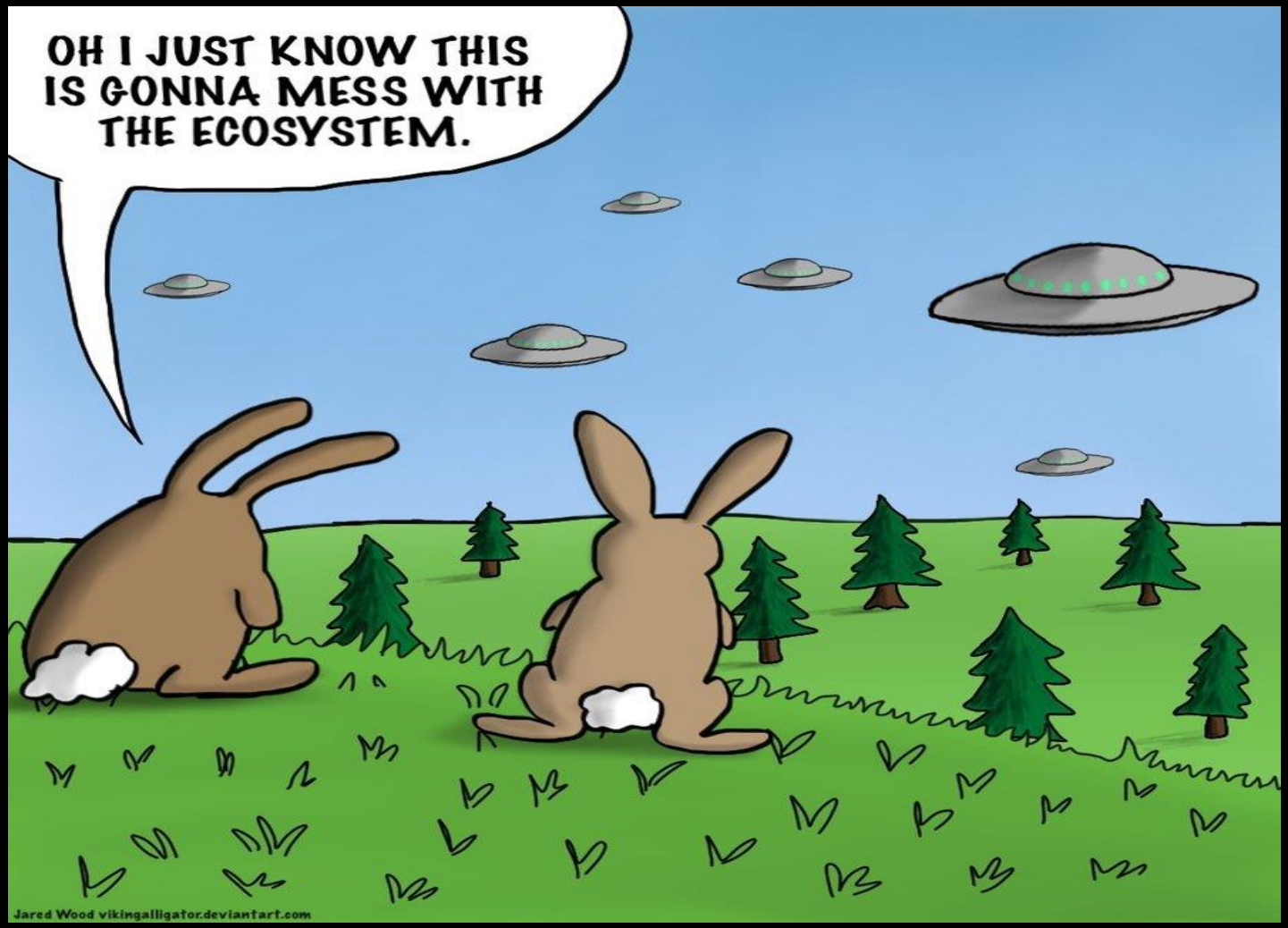
Impact of invasive alien plants on riparian habitats



@ZarahPattison & @AlexSeeney

with Robin Whytock, Philip Boon, Colin Bull & Nigel Willby

Scottish Natural Heritage
All of nature for all of Scotland

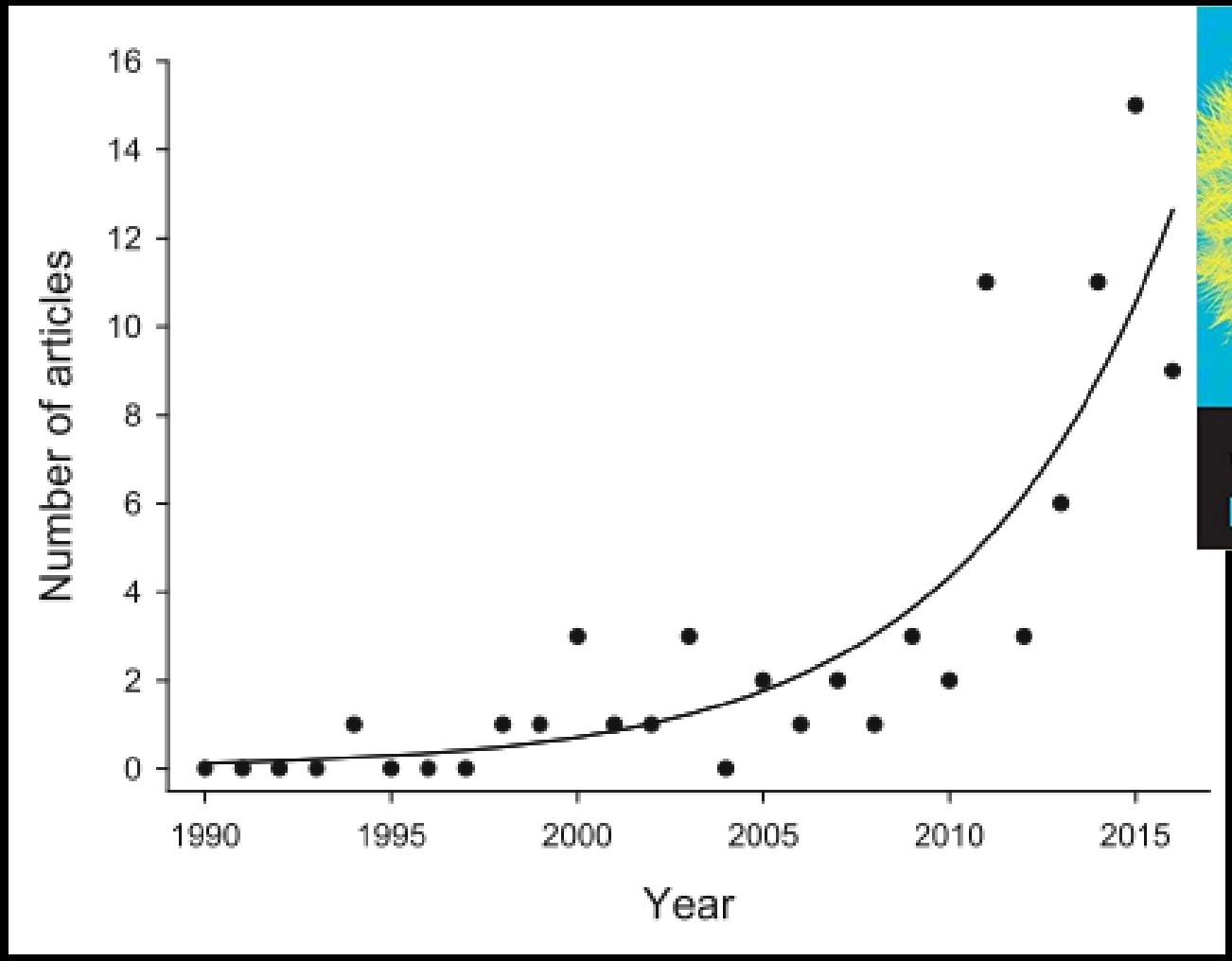
SEPA
Scottish Environment Protection Agency

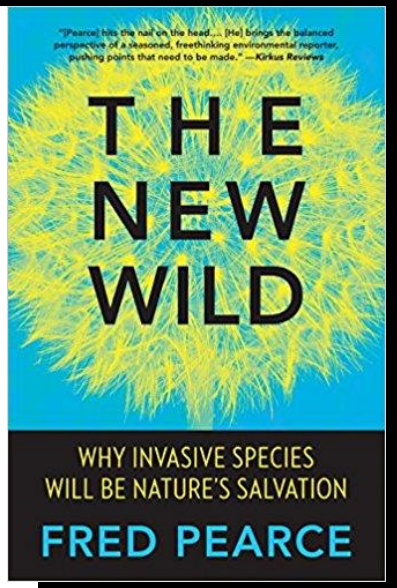
UNIVERSITY of STIRLING

Invasive species: beauty or beast?

"…the two great destroyers of biodiversity are, first habitat destruction and, second, invasion by exotic species." – E.O. Wilson

The exponential growth of invasive species denialism



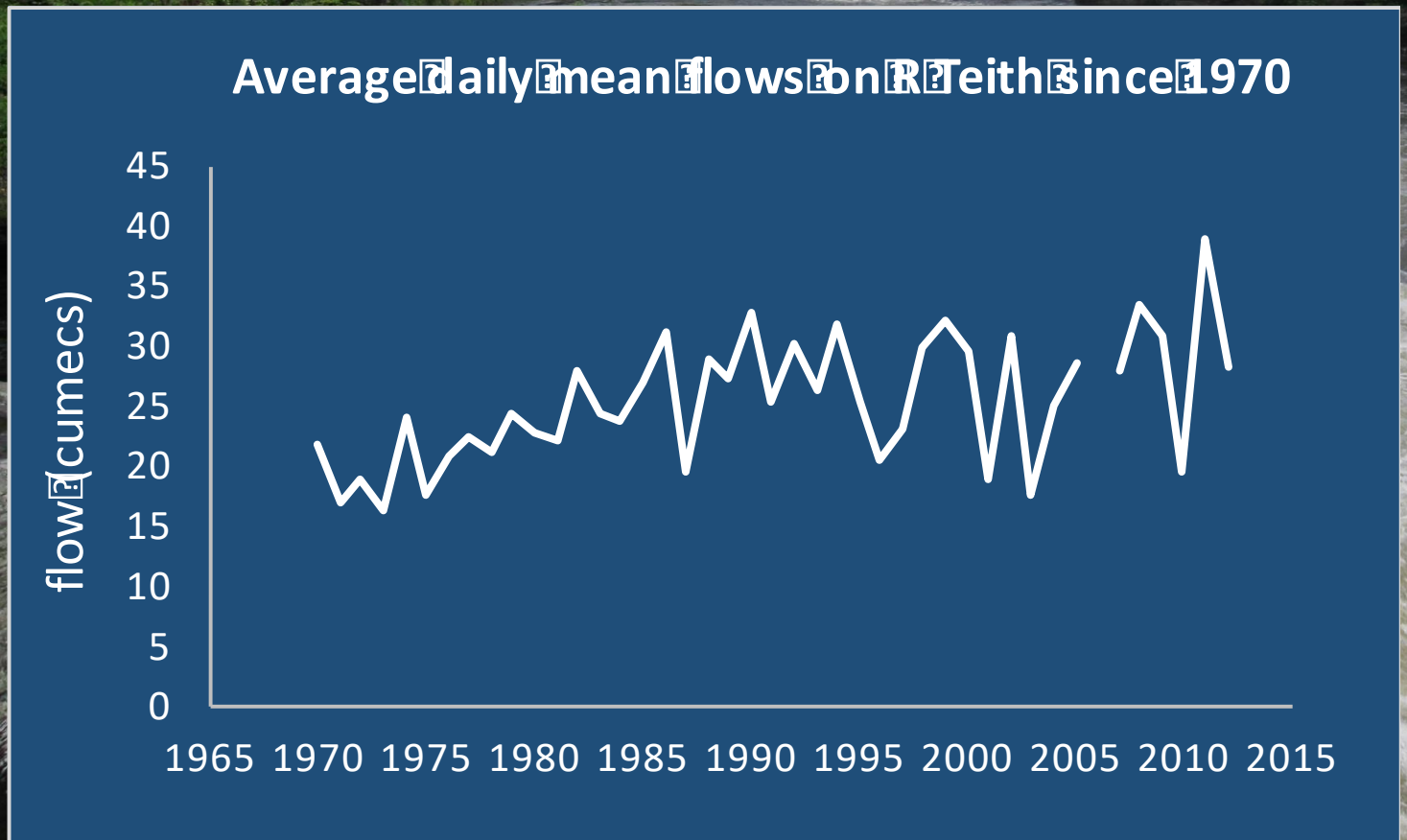


An increase in the number of published articles that promote invasive species denialism *Ricciardi & Ryan (2018) Bio. Invs.*

The environment is changing

The environment is changing

27% ↑ in mean annual flow



Can the environment negate invasion impact?

- Variations in river flows mobilize, transport and deposit mineral sediment, but also invasive plants?! *Gurnell et al. 2006 etc.*

- Links between sediment and seed deposition *Goodson et al. 2003*

Can the environment negate invasion impact?

- What is the main driver of native vegetation? Sediment or invasion?
- Invasion = reduce native plant diversity BUT sediment may increase native diversity!

Methods: veg. surveys & germination experiment

Vegetation surveys along 100m stretches of 20 river banks :

- Summer 2013
- Spring 2014
- Summer 2014

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AstroTurf mats collected sediment over winter

Methods: veg. surveys & germination experiment

Vegetation surveys along 100m stretches of 20 river banks :

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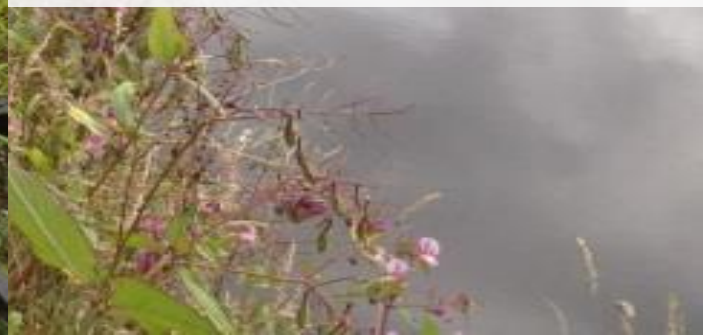
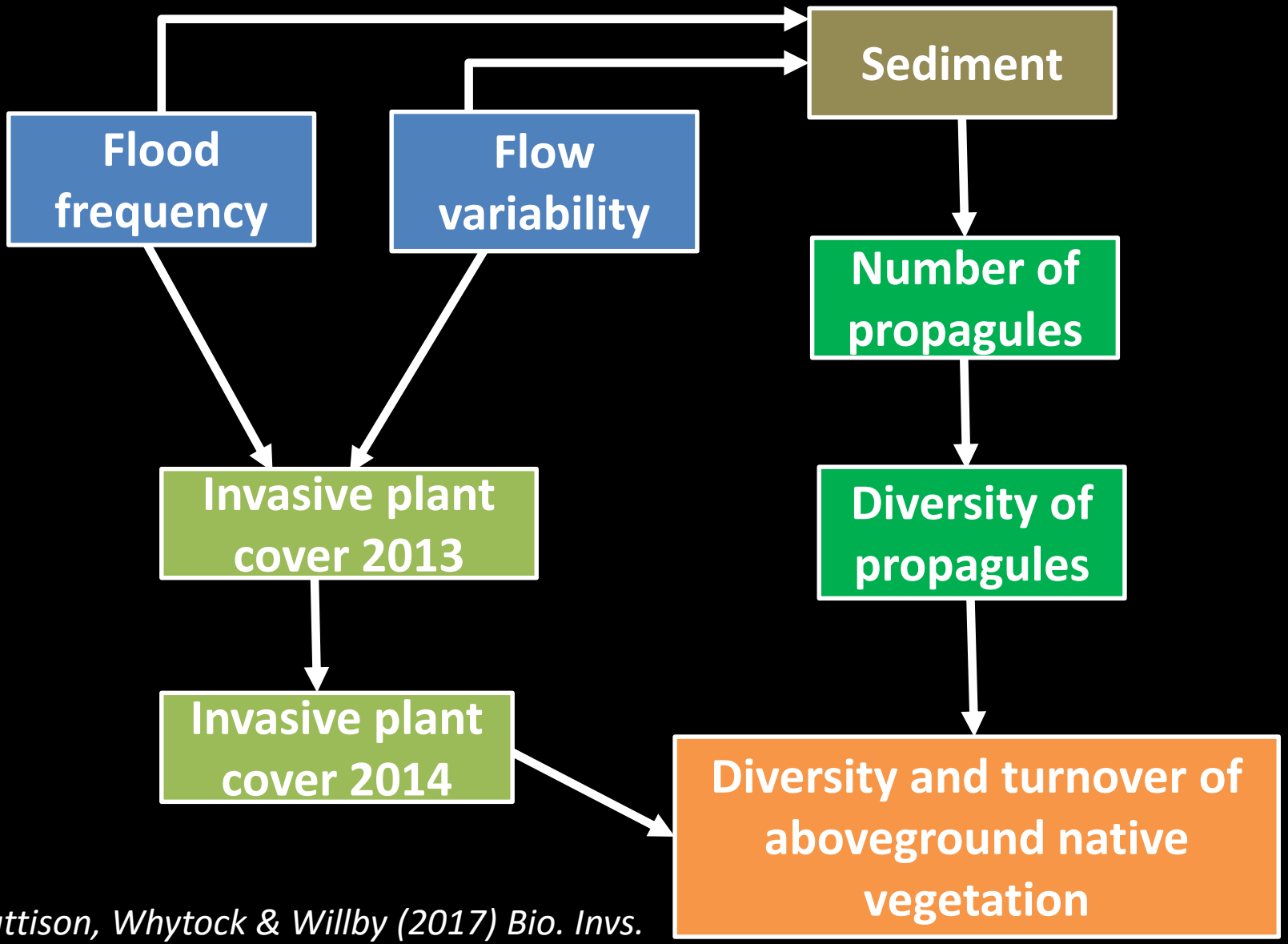
AstroTurf mats collected sediment over winter

Propagules in the sediment grown

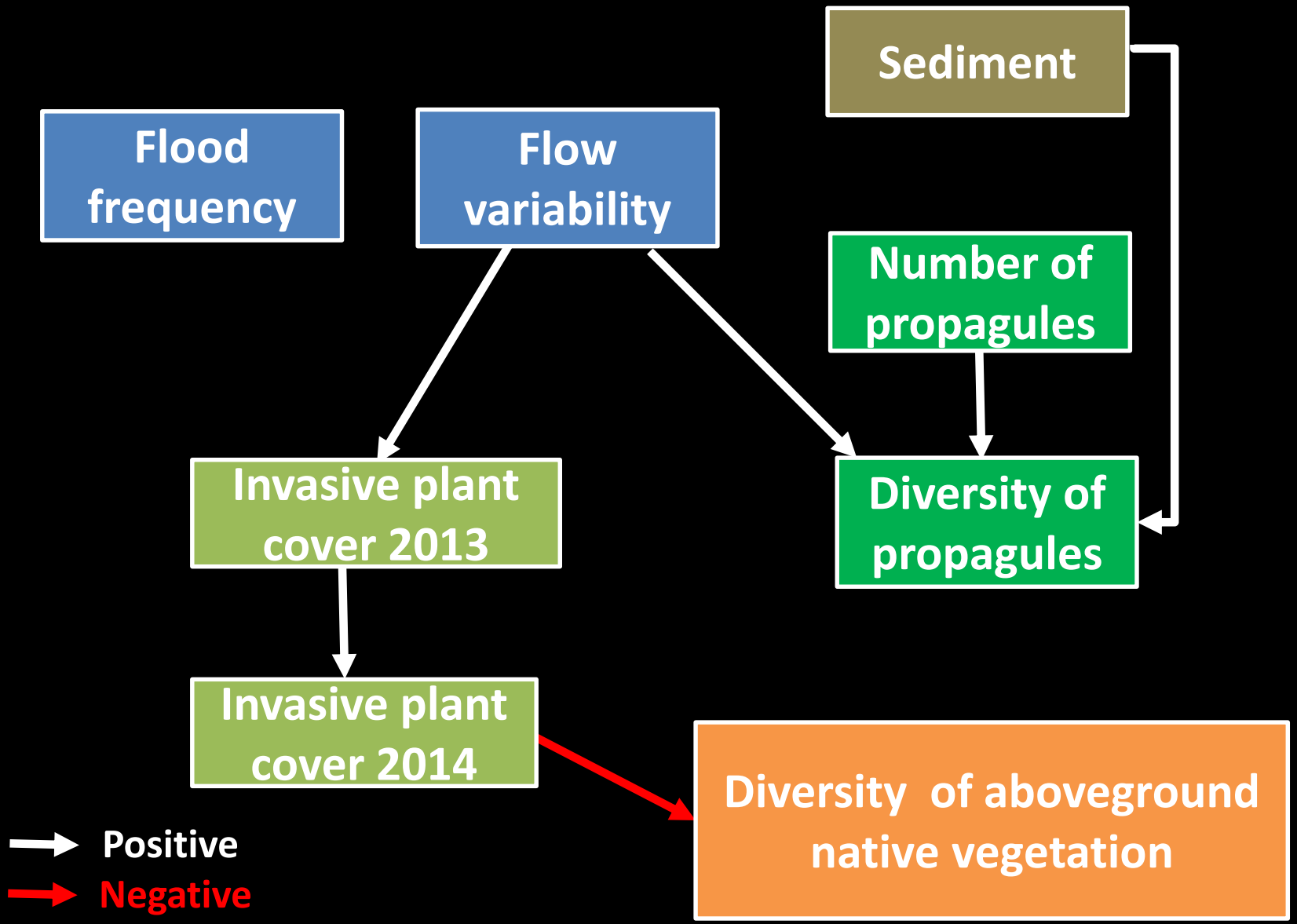


Can changes in flow and sediment override negative invasion effects on native plant communities?

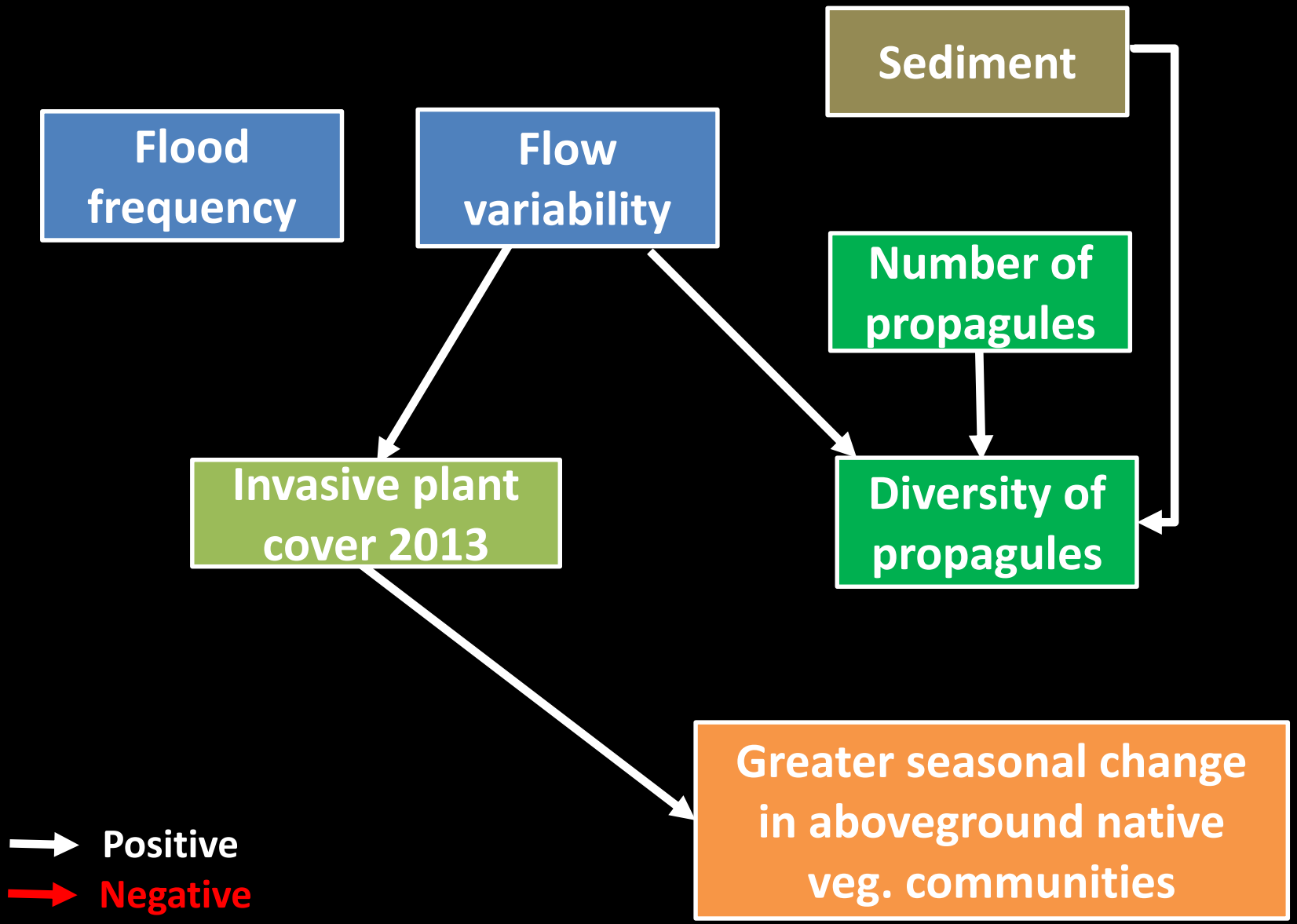


Pattison, Whytock & Willby (2017) Bio. Invs.

Regardless of propagule diversity & abundance, invasion reduces native diversity

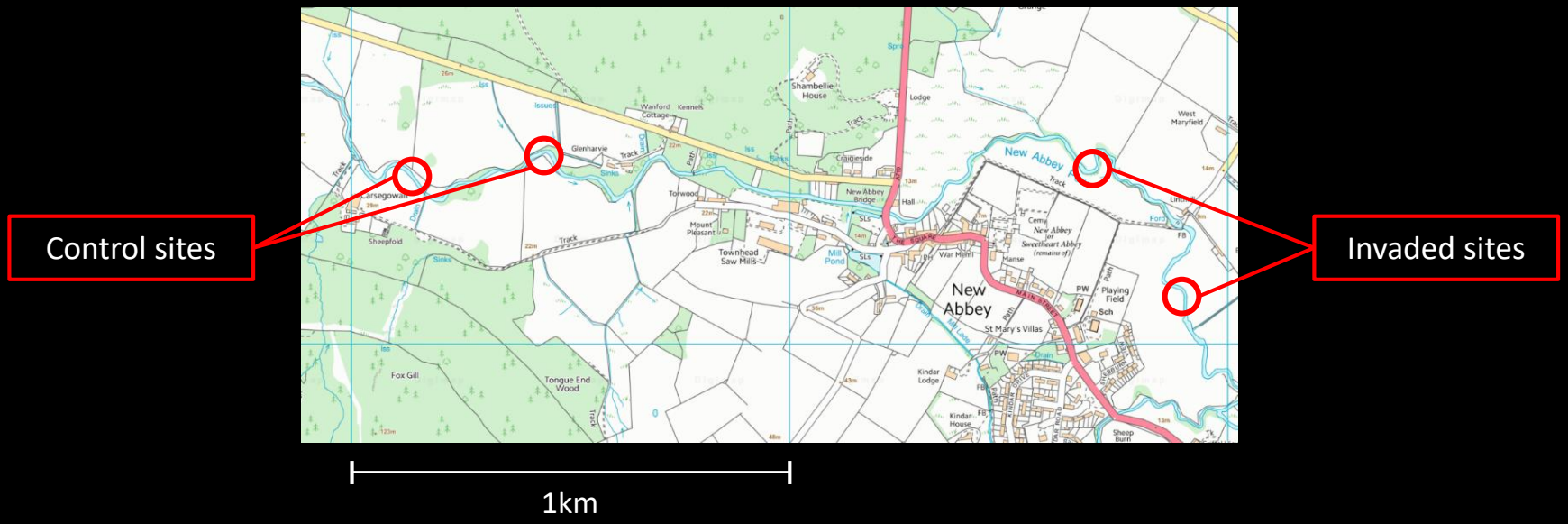


Regardless of propagule diversity & abundance, invasion changes native plant composition

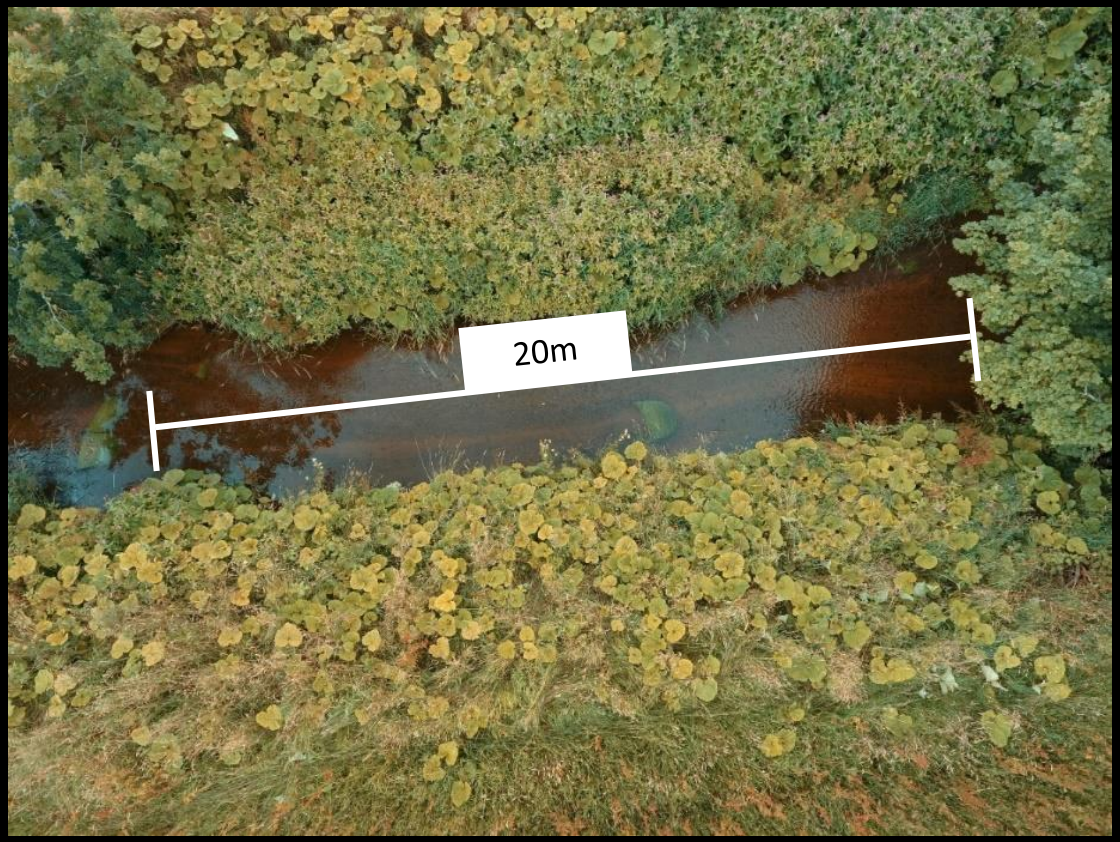


Responses of stream macroinvertebrate communities to invasive riparian plants

- Do invasive riparian plants induce ecological changes in rivers?
- Are they cause for concern?



Sampling



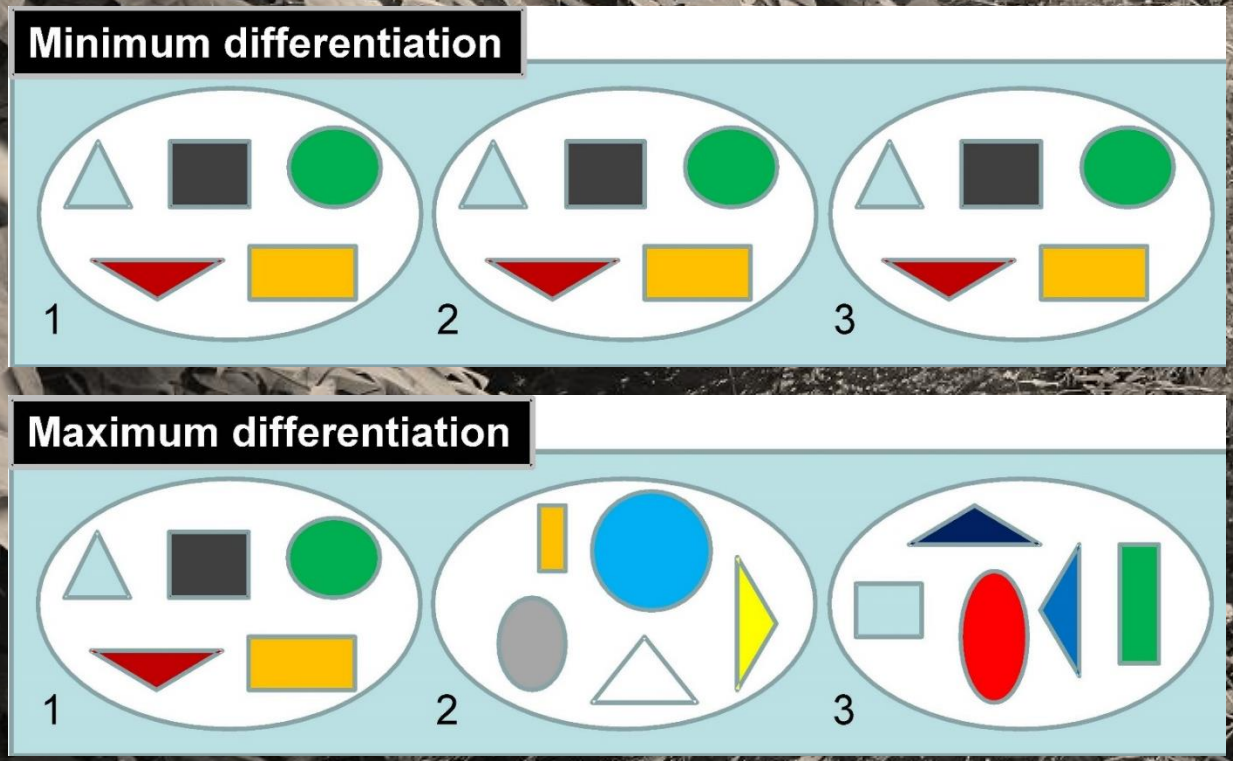
Models

Simpson's diversity index:

- Community score based on number of different species & abundance
- Higher scores = higher diversity

Models

Spatial dissimilarity:



Reproduced from *Baselga, 2016*

Models

- Model responses:
  - Whalley-Hawkes Paisley Trigg (WHPT) score

REVISION OF THE BIOLOGICAL MONITORING WORKING PARTY (BMWP) SCORE SYSTEM: DERIVATION OF PRESENT-ONLY AND ABUNDANCE-RELATED SCORES FROM FIELD DATA

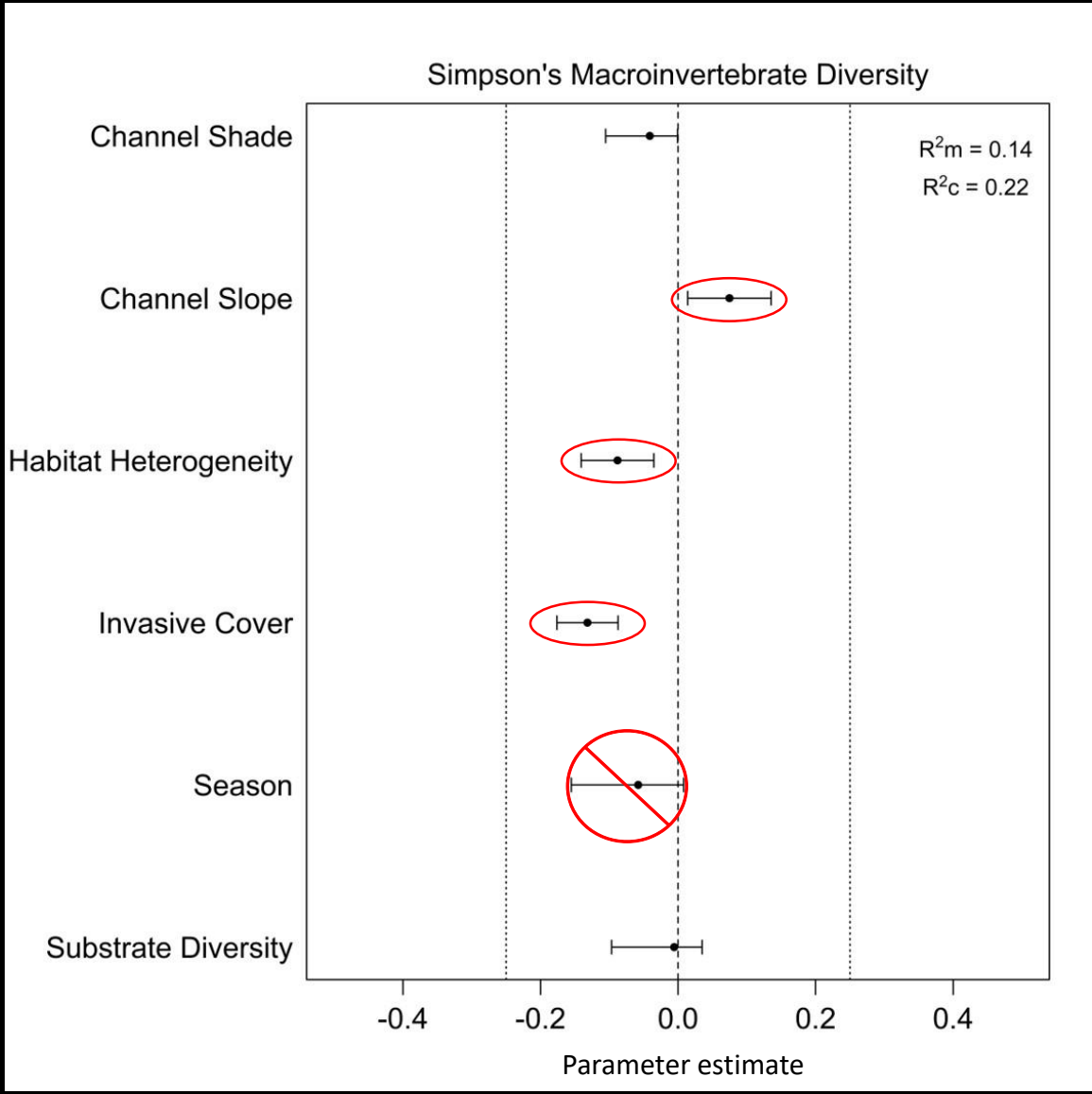
M. F. PAISLEY*, D. J. TRIGG AND W. J. WALLEY

Perlodidae (10.5)

Cordulegasteridae (9.8)

Rhyacophilidae (8.4)

Results – Simpson's diversity index

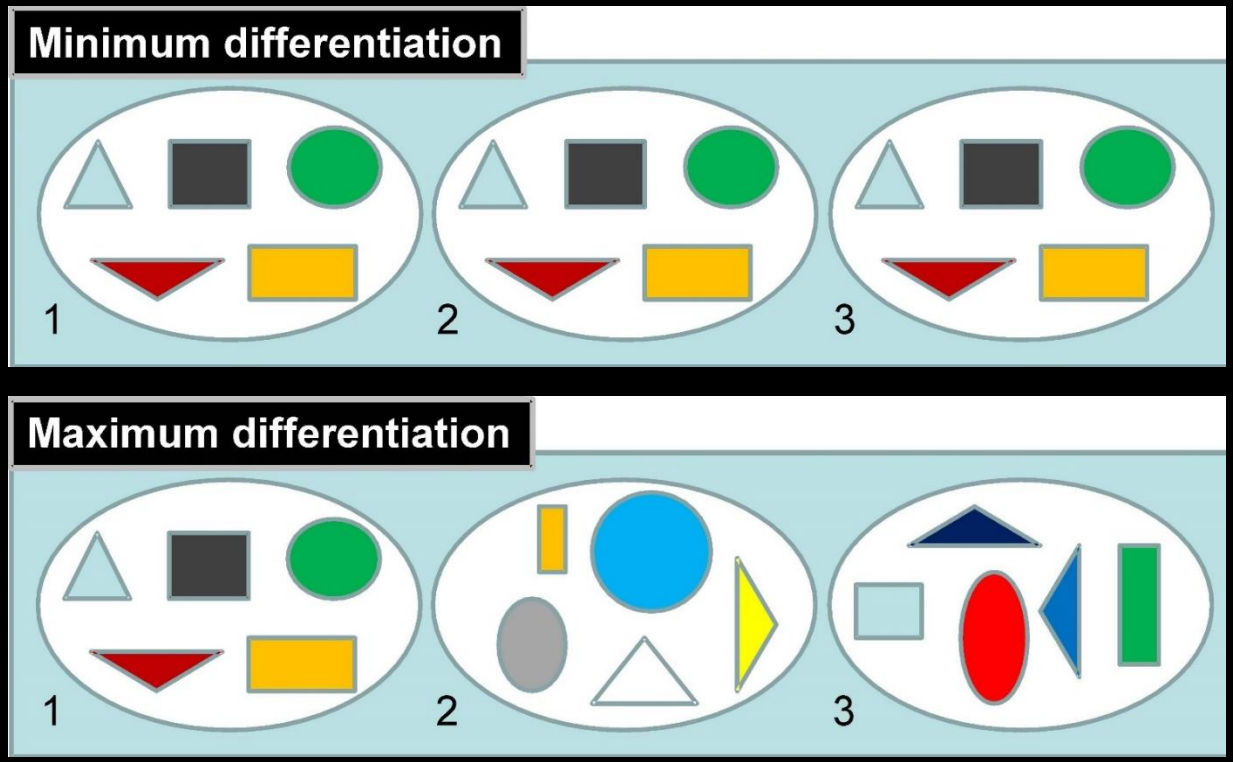


What does this mean?

- Aquatic stressors may interact to become more than just the sum of their parts. *Jackson et al., 2016*

What does this mean?

- Invertebrate samples are more similar at sites with higher invasive cover.



Reproduced from *Baselga, 2016*

What does this mean?

- Reductions in WHPT score associated with increasing conductivity and invasive cover.
- Supported by loss of several high-scoring taxa in autumn invertebrate samples.

Wormaldia spp. (11.2)

Brachyptera risi (11.3)

Ecdyonurus spp. (11.1)

Conclusion: Invasion **does** affect riparian habitats, evidenced by:

- Invasion by alien plants reducing native plant diversity
- Rivers with a history of invasion showing a greater change in native community composition
- An increase in invasive cover was associated with:
  - Reduced Simpson's macroinvertebrate diversity
  - Lower macroinvertebrate WHPT score
  - Reduced spatial dissimilarity between samples (i.e. a homogenising effect)
- These findings offer support for actively managing riparian invasions in a bid to improve the ecological status of low order stream habitats

Thank you!

- Chief Detective Prof Nigel Willby, Dr Colin Bull and the Freshwater Detective Agency
- Professor Phil Boon, Dr Mario Vallejo-Marin and Robbie Whytock
- Field and lab assistants
- Funding: SNH, SEPA, UoStirling







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