

Greater than the sum of the parts: collaboration in the U.S. LTER Network

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You Cheng, University of California-Santa Barbara

LTER Network Background

Collaboration in LTER-related papers

- Individual
- Institution
- Duration
- Distance

Cross-site Collaboration

- Site Age
- Ecosystem type
- Evolution of inter-site sub-communities
- Factors related to cohesion

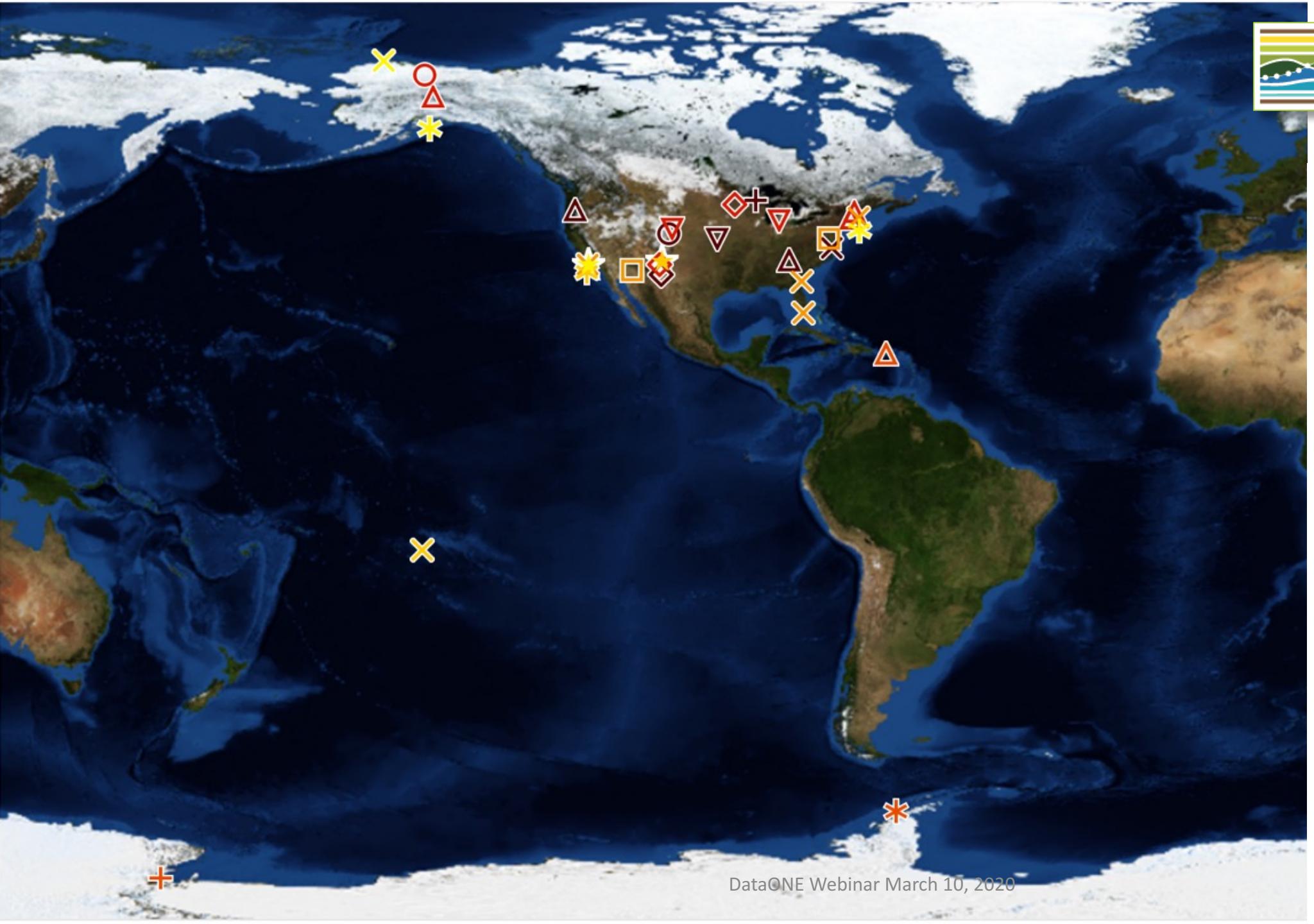
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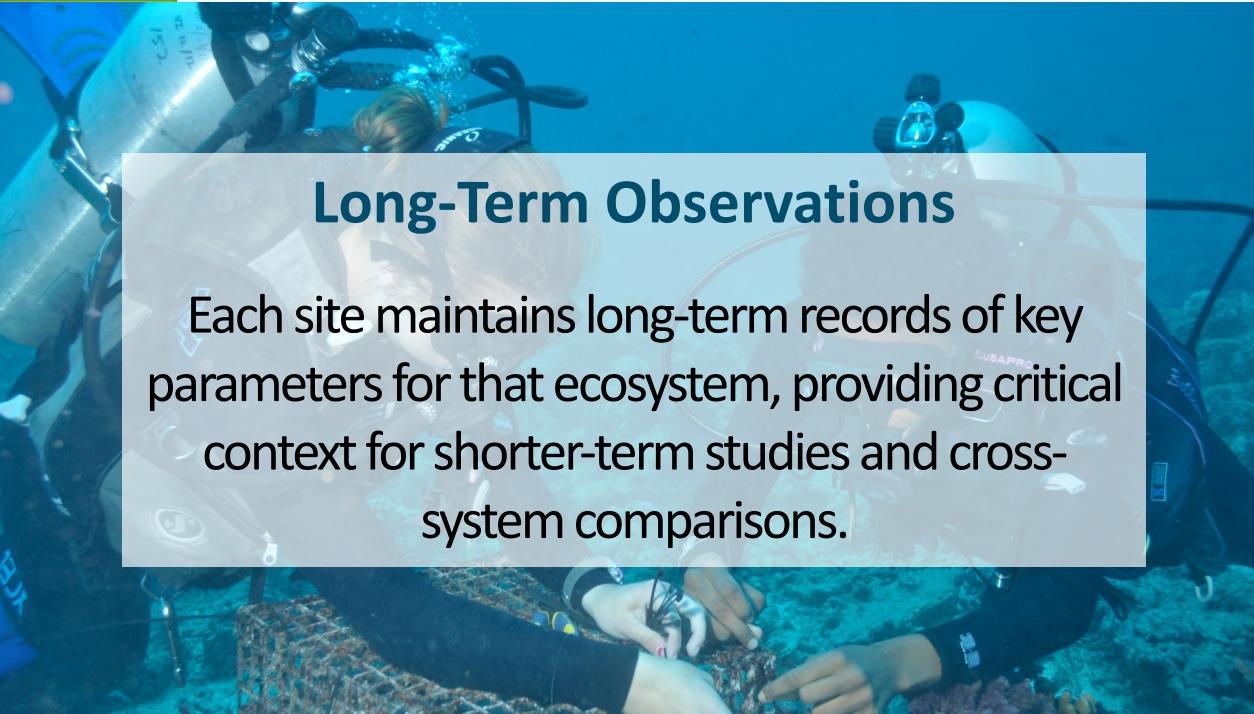
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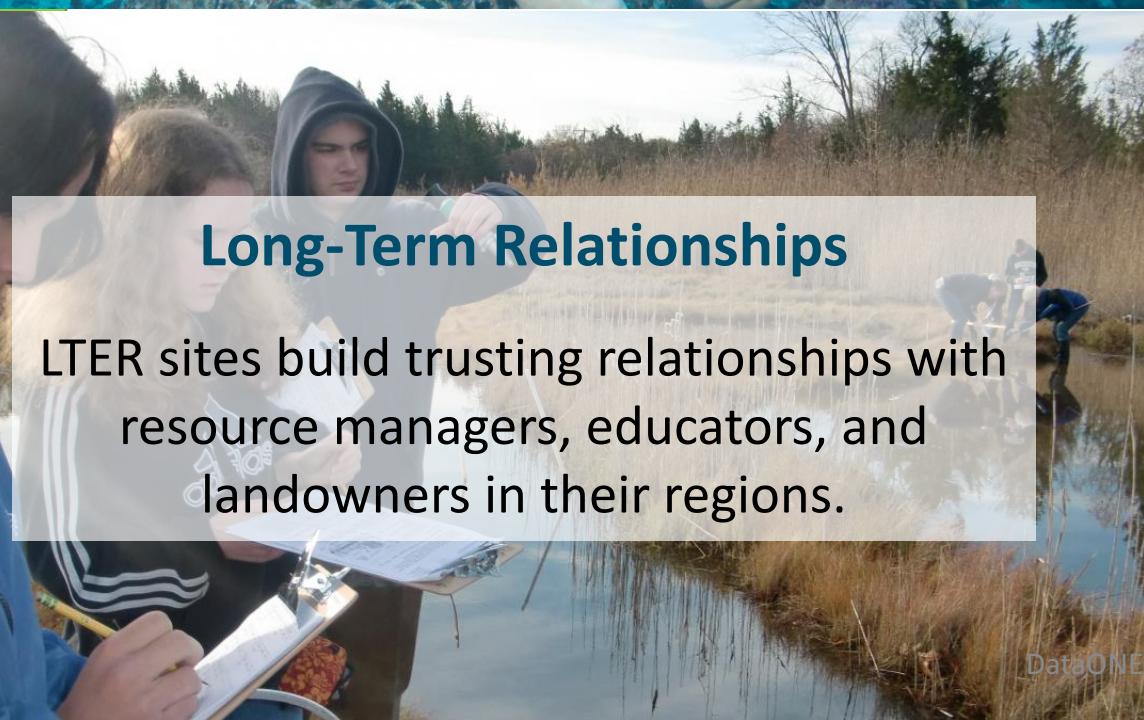
Long-Term Observations

Each site maintains long-term records of key parameters for that ecosystem, providing critical context for shorter-term studies and cross-system comparisons.



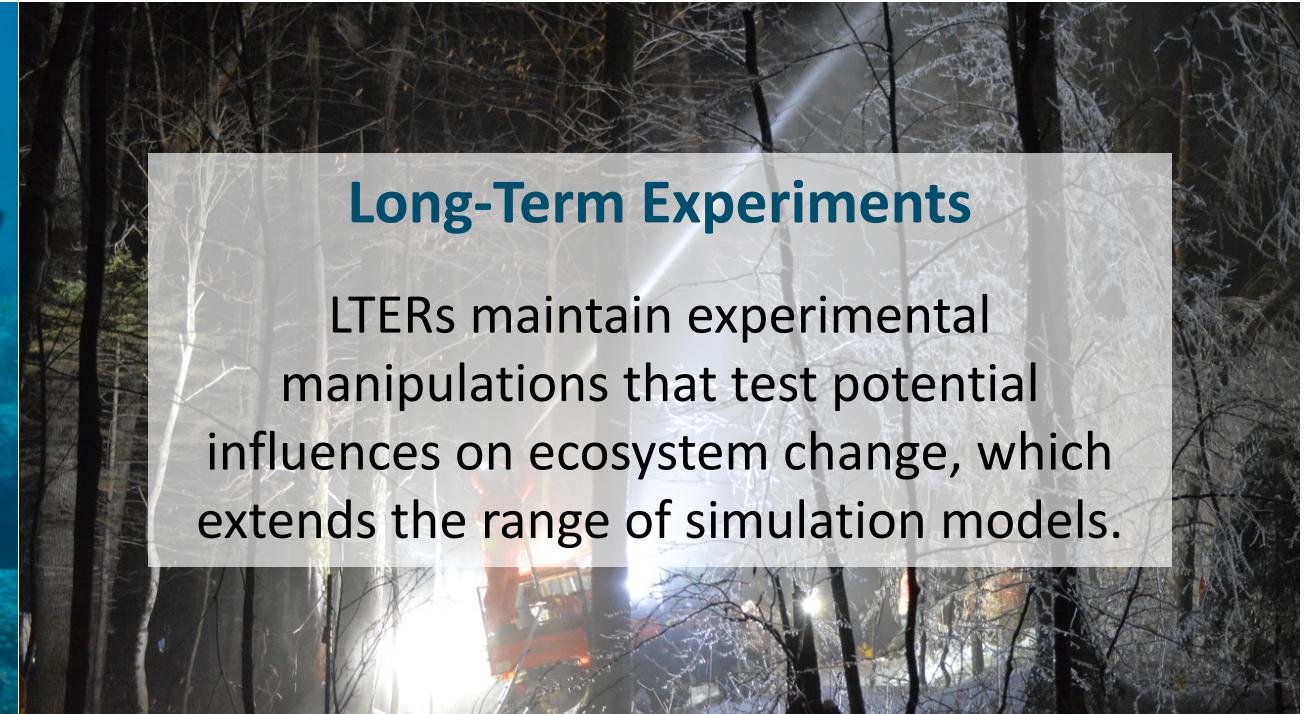
Long-Term Relationships

LTER sites build trusting relationships with resource managers, educators, and landowners in their regions.



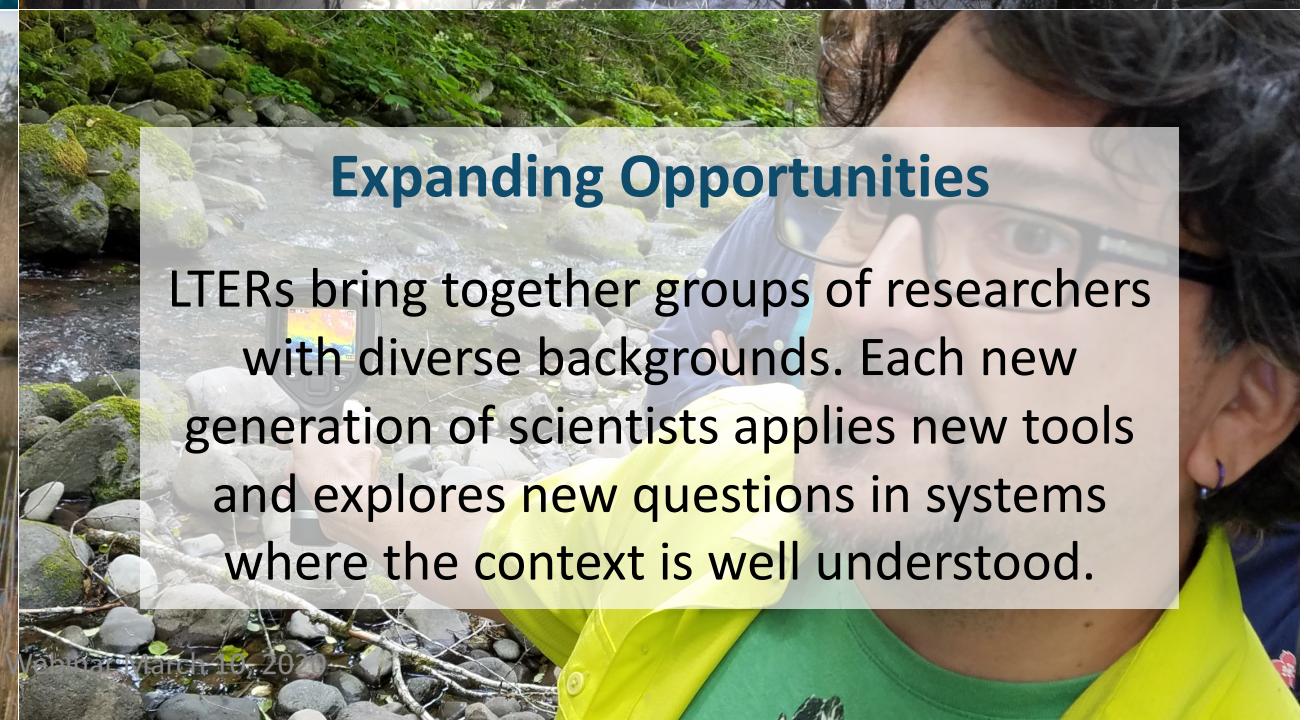
Long-Term Experiments

LTERs maintain experimental manipulations that test potential influences on ecosystem change, which extends the range of simulation models.

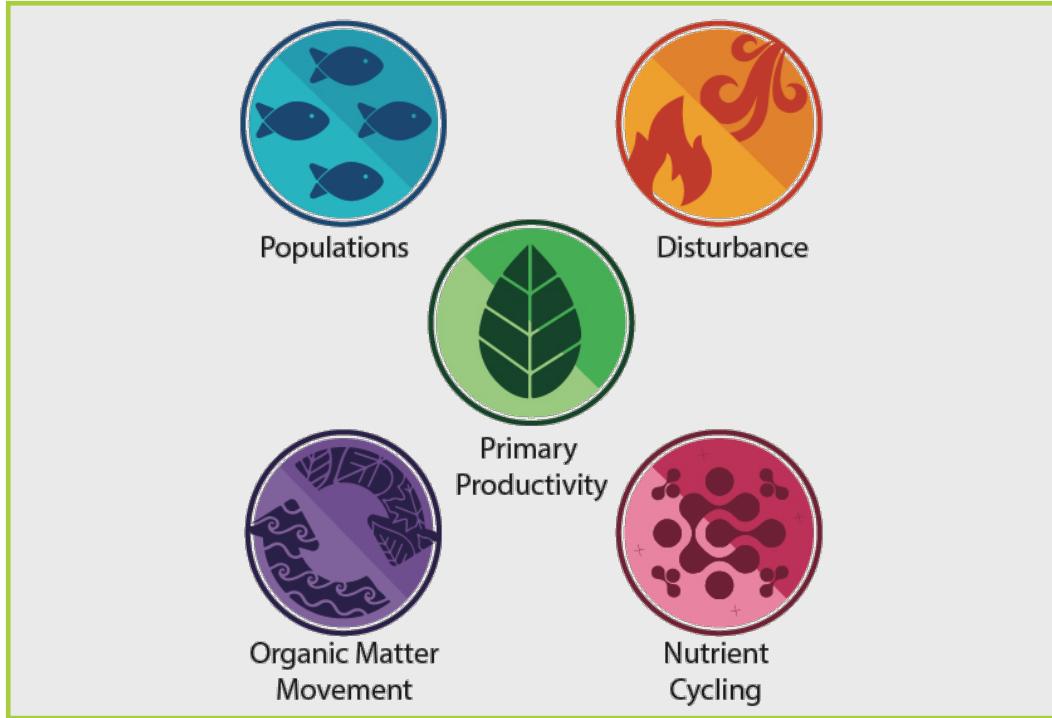
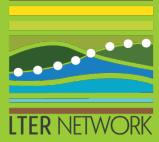


Expanding Opportunities

LTERs bring together groups of researchers with diverse backgrounds. Each new generation of scientists applies new tools and explores new questions in systems where the context is well understood.



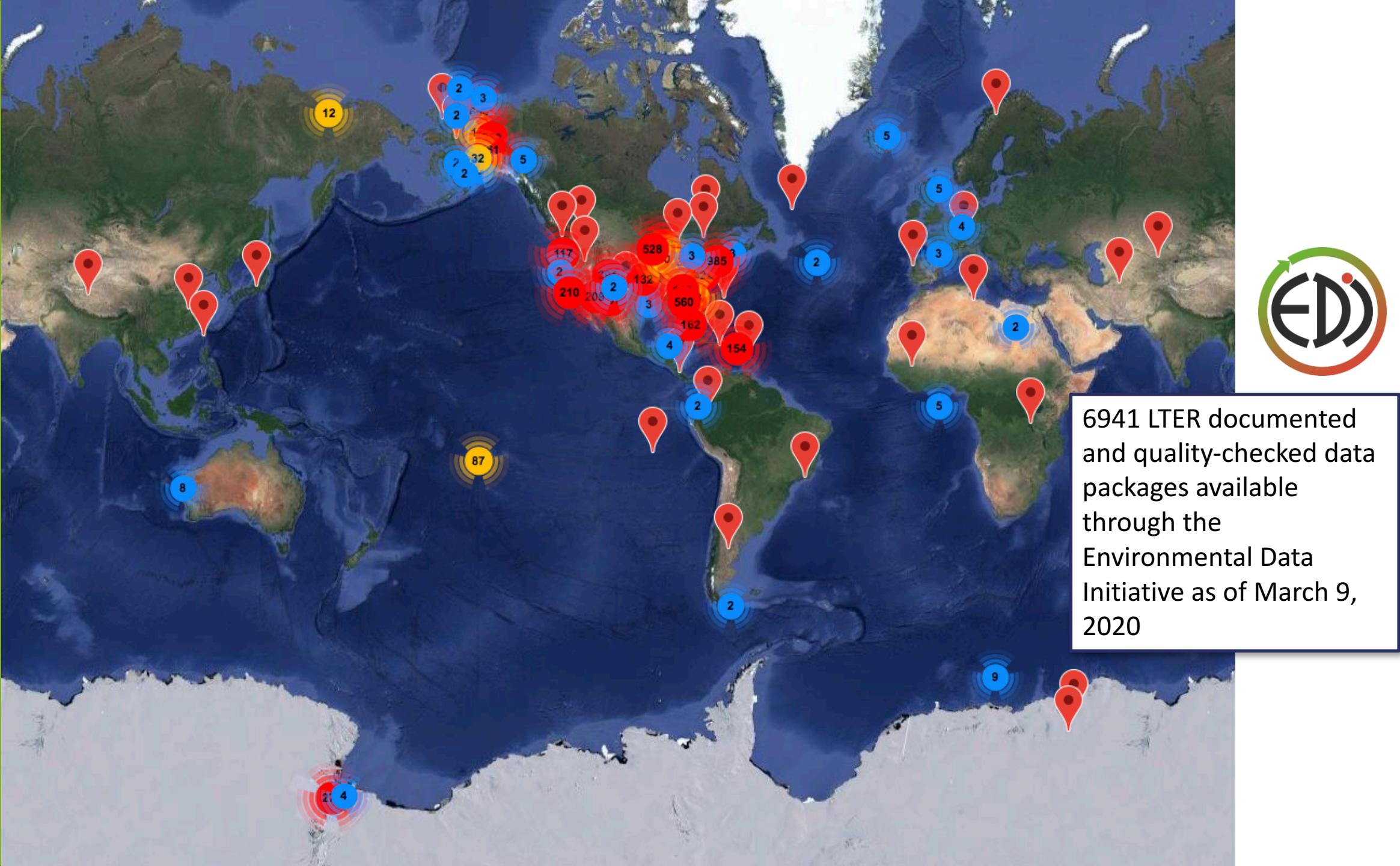
LTER Background



DataONE Webinar March 10, 2020



LTER Background





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[Coweeta LTER](#)

[Florida Coastal Everglades LTER](#)

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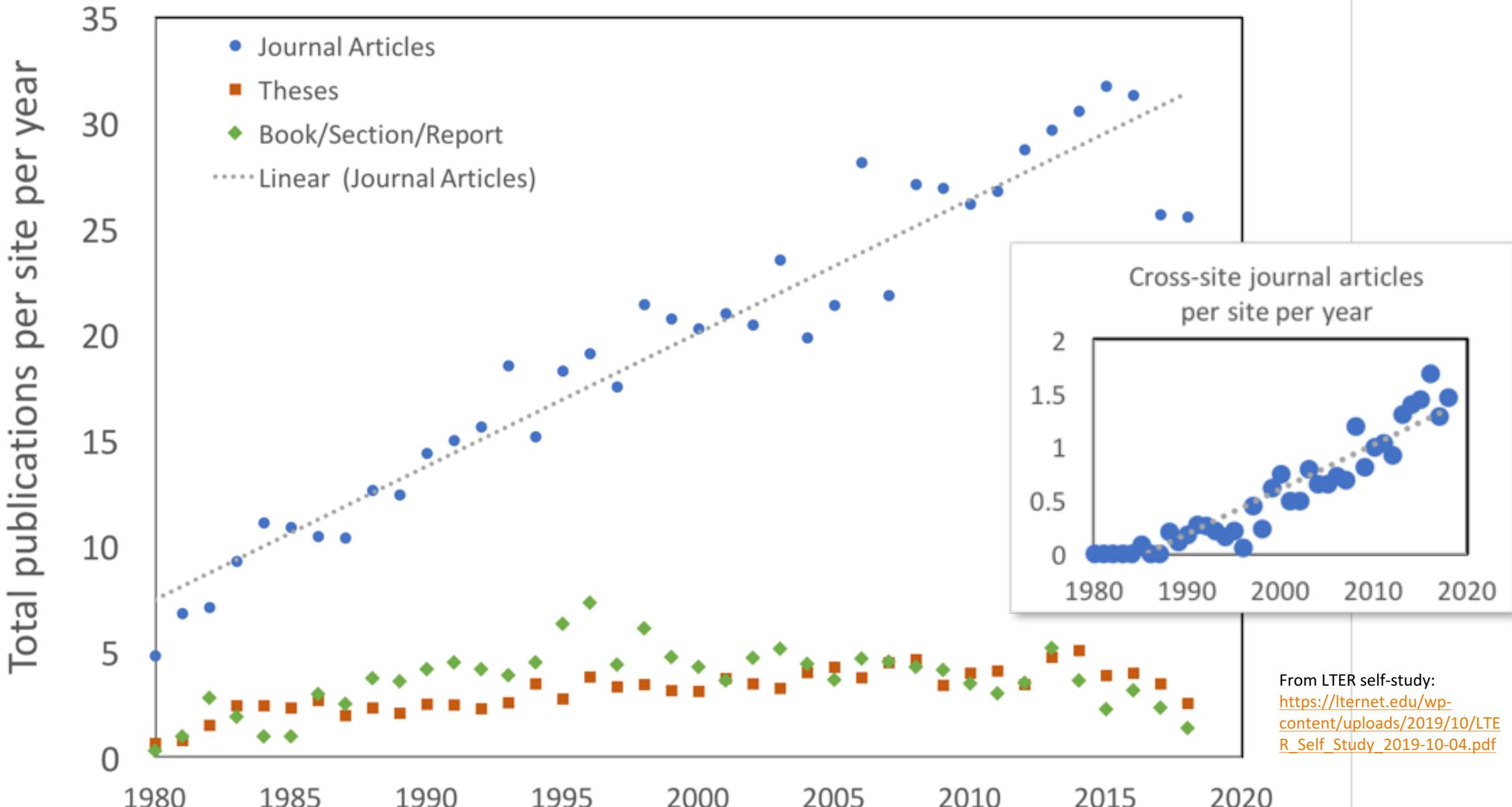
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<input type="checkbox"/>			Coupling telemetric and stable isotope techniques to unravel ...	Eggensperger et al.	Journal Article	OCT 2010	Fisheries Research
<input type="checkbox"/>			Assessing vegetation selection and heterogeneity in urban land cover config...	Galeotti et al.	Journal Article	JUL 2010	International Journal of Remote Sensing
<input type="checkbox"/>			Direct observation of permafrost degradation and reworking by ground squirrels	Plaza-González et al.	Journal Article	AUG 2019	Nature Geoscience
<input type="checkbox"/>			Extreme weather events and transmission losses in arid stream ecosystems	McGraw et al.	Journal Article	AUG 2019	Environmental Research Letters
<input type="checkbox"/>			Impacts of climate and insect herbivory on productivity and ...	Boyd et al.	Journal Article	AUG 2019	Environmental Research Letters
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<input type="checkbox"/>			Parental environments alter DNA methylation in offspring of ...	Strader et al.	Journal Article	AUG 2019	Journal of Experimental Marine Biology and Ecology
<input type="checkbox"/>			Spatial patterns of extracellular enzymes: Combining X-ray c...	Kravchenko et al.	Journal Article	AUG 2019	Soil Biology & Biochemistry
<input type="checkbox"/>			Soil microbial, nematode, and enzymatic responses to elevate...	Thakur et al.	Journal Article	AUG 2019	Soil Biology & Biochemistry

https://www.zotero.org/groups/2055673/lter_network/items/



Thank you to the many current and former LTER information managers and administrators who have maintained the database of products over the past 40 years.

LTER Publications per site per year (1980-2018)



From LTER self-study:
https://lternet.edu/wp-content/uploads/2019/10/LTER_Self_Study_2019-10-04.pdf

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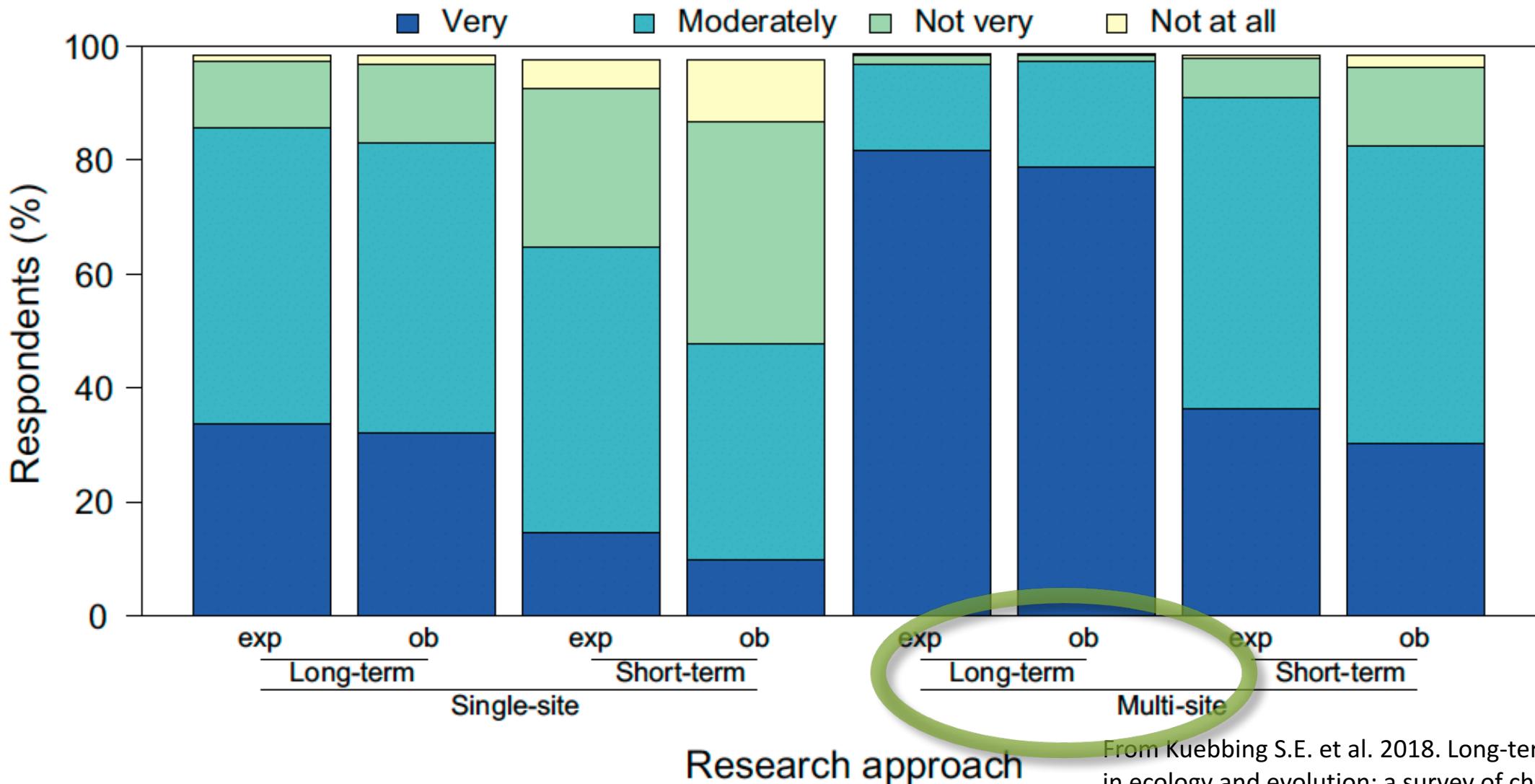
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Collaboration Comparison

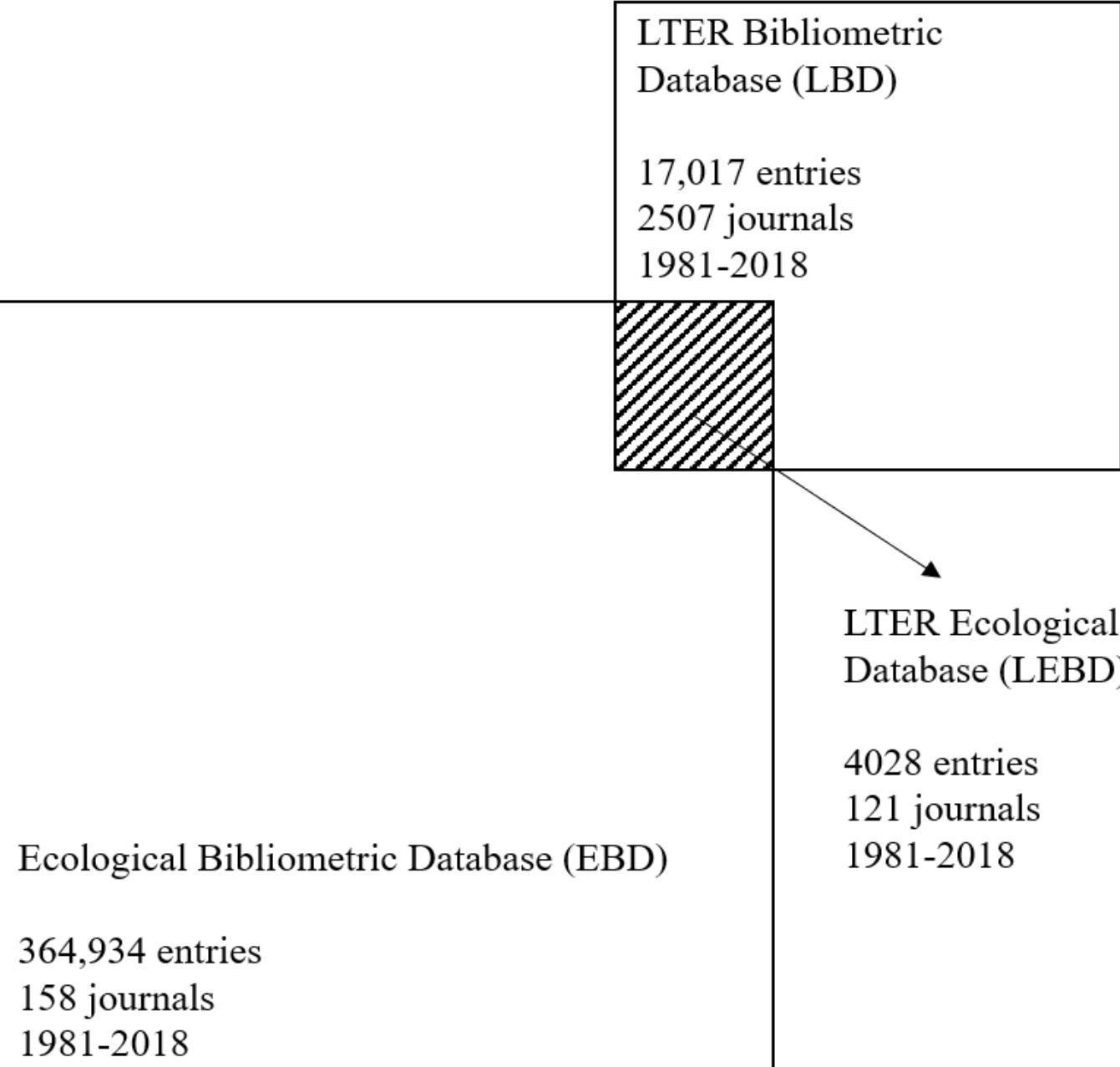


To what extent are the following research approaches important to developing general theories in ecology and evolutionary biology?



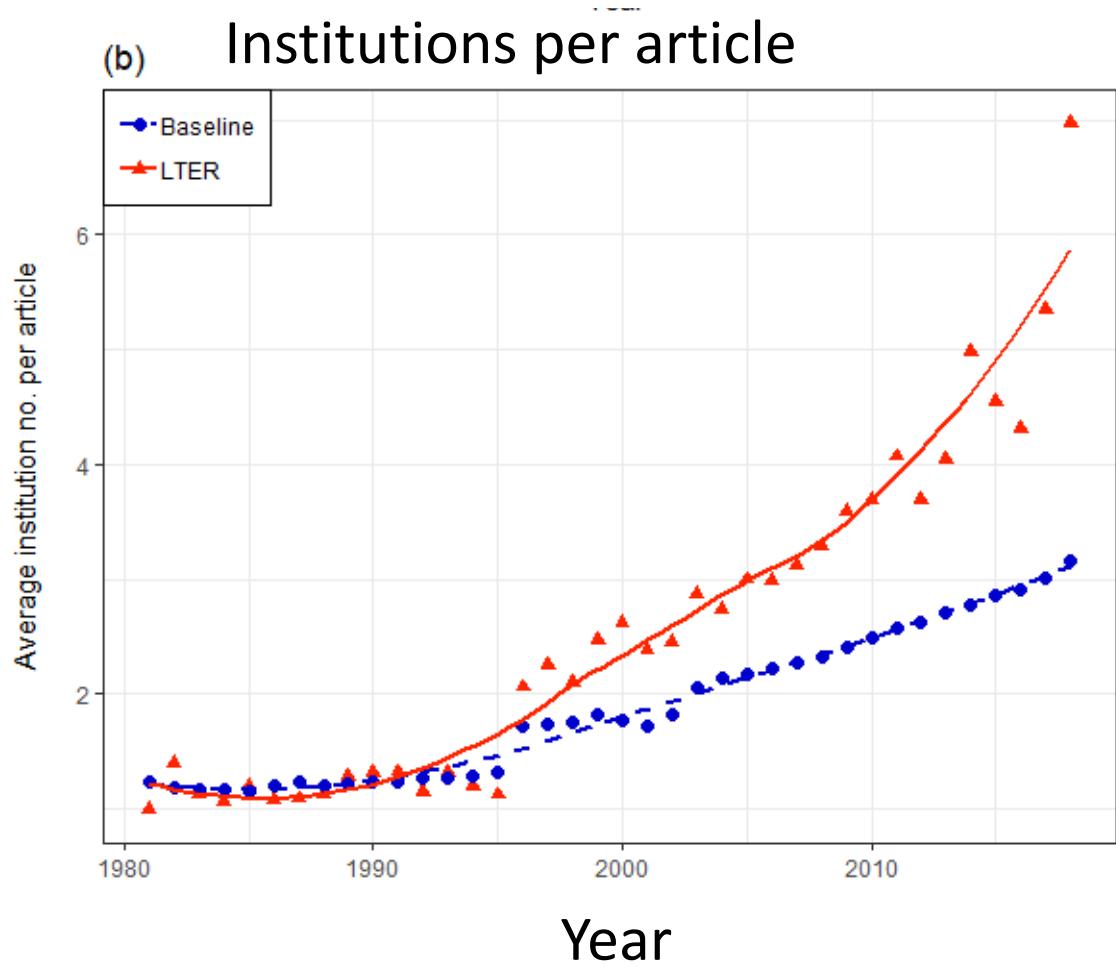
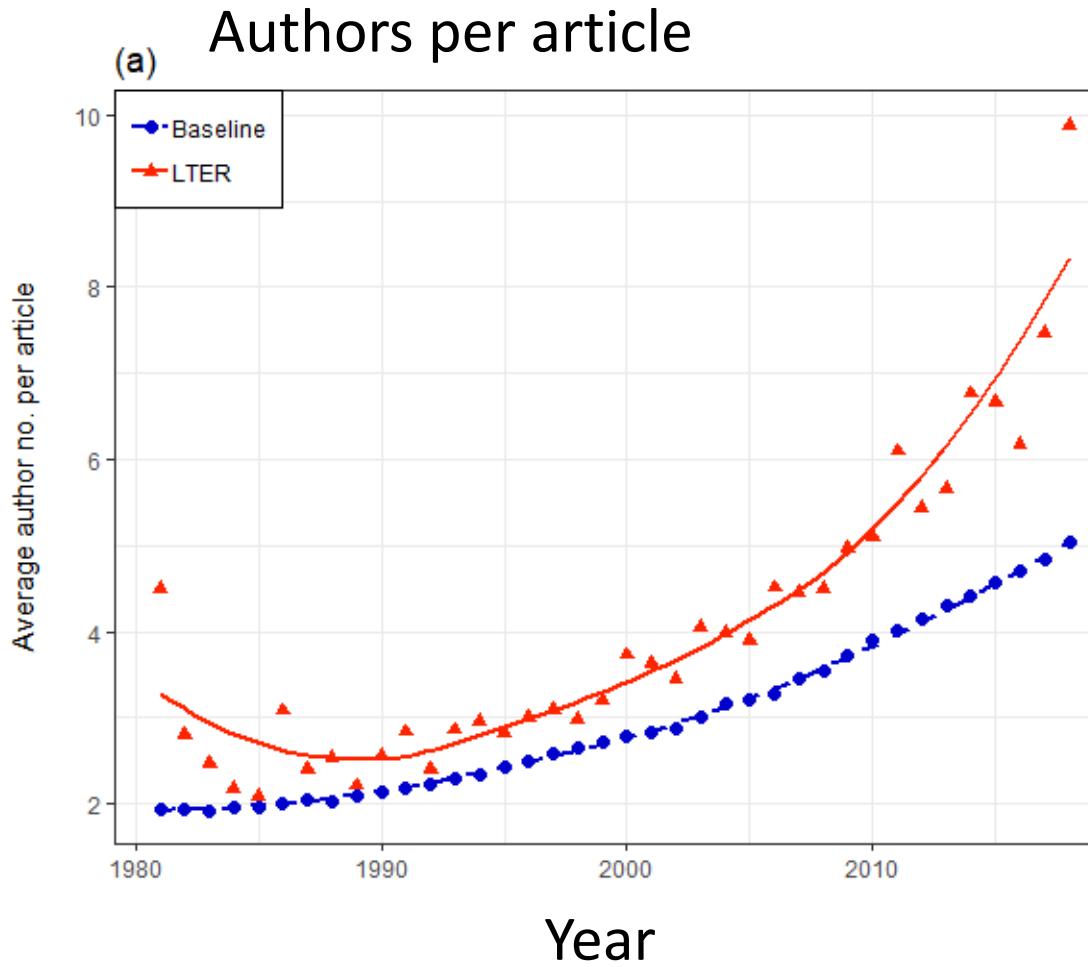
From Kuebbing S.E. et al. 2018. Long-term research in ecology and evolution: a survey of challenges and opportunities. Ecological Monographs

Collaboration Comparison



Tian-Yuan Huang, Martha R Downs, Jun Ma, Bin Zhao,
Collaboration across Time and Space in the LTER
Network, *BioScience*,
biaa014, <https://doi.org/10.1093/biosci/biaa014>

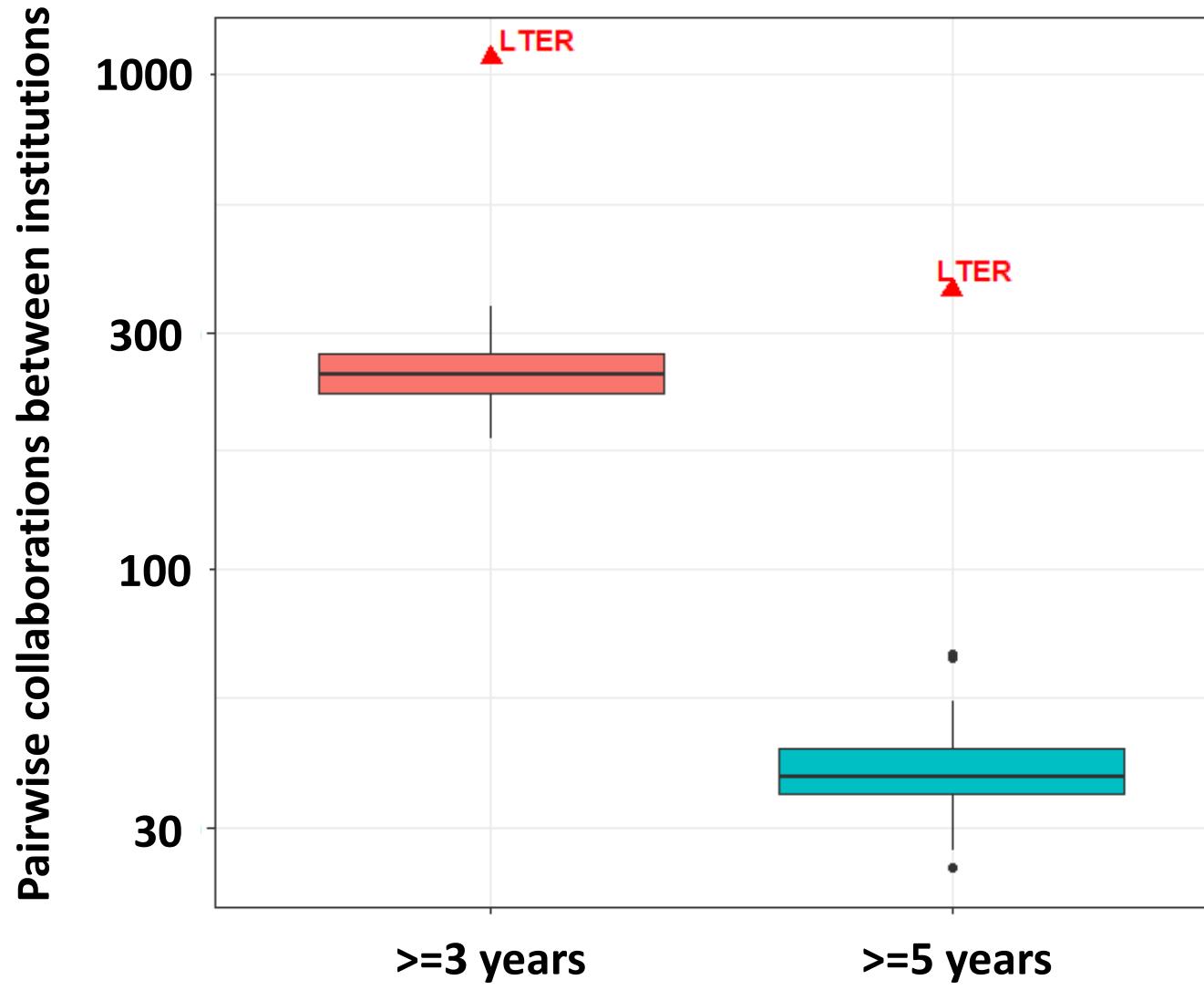
Authors and Institutions per Publication



Collaboration Comparison



Duration



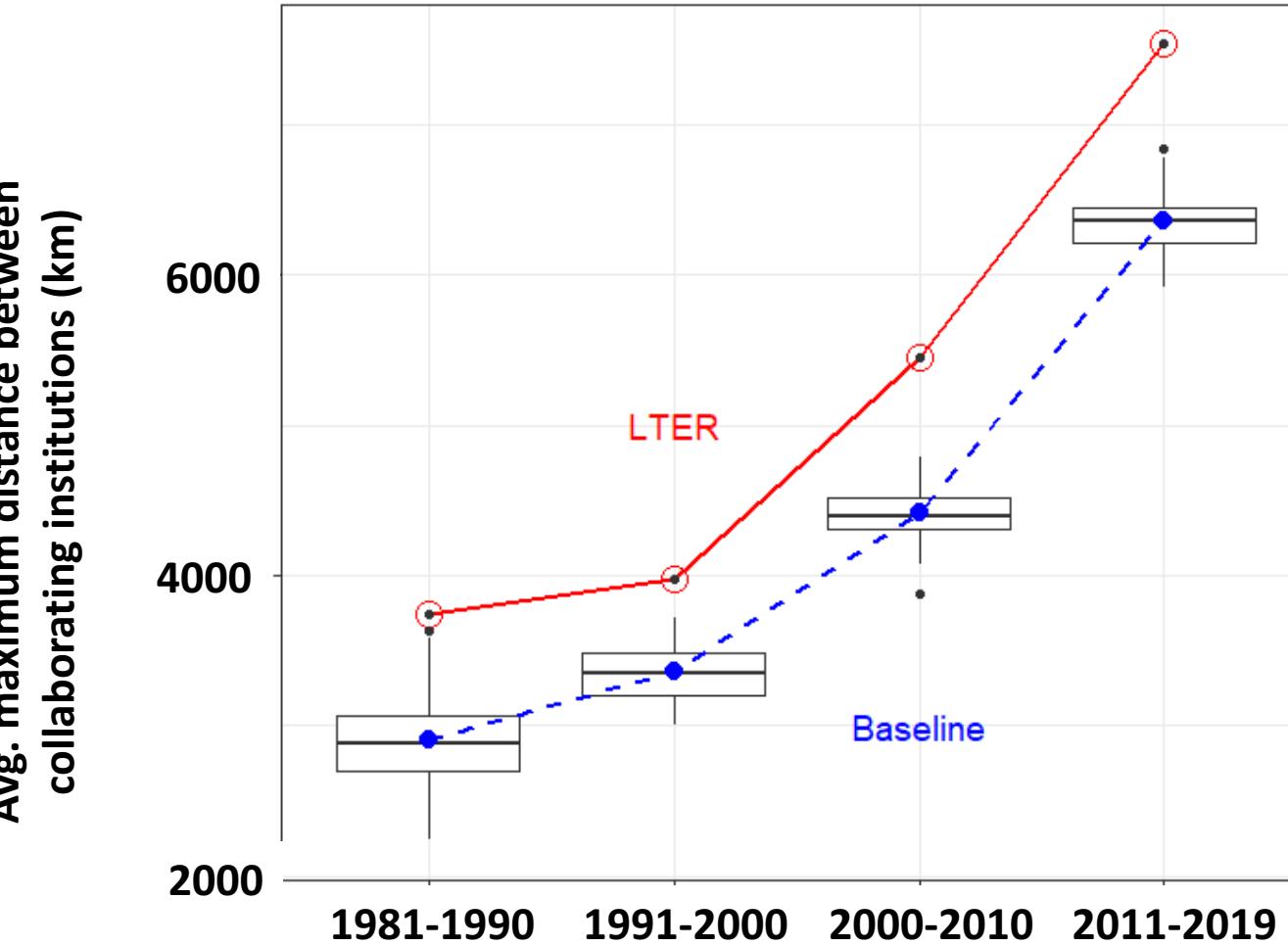
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Collaboration Comparison



Distance



LTER Network Background

Collaboration in LTER-related papers

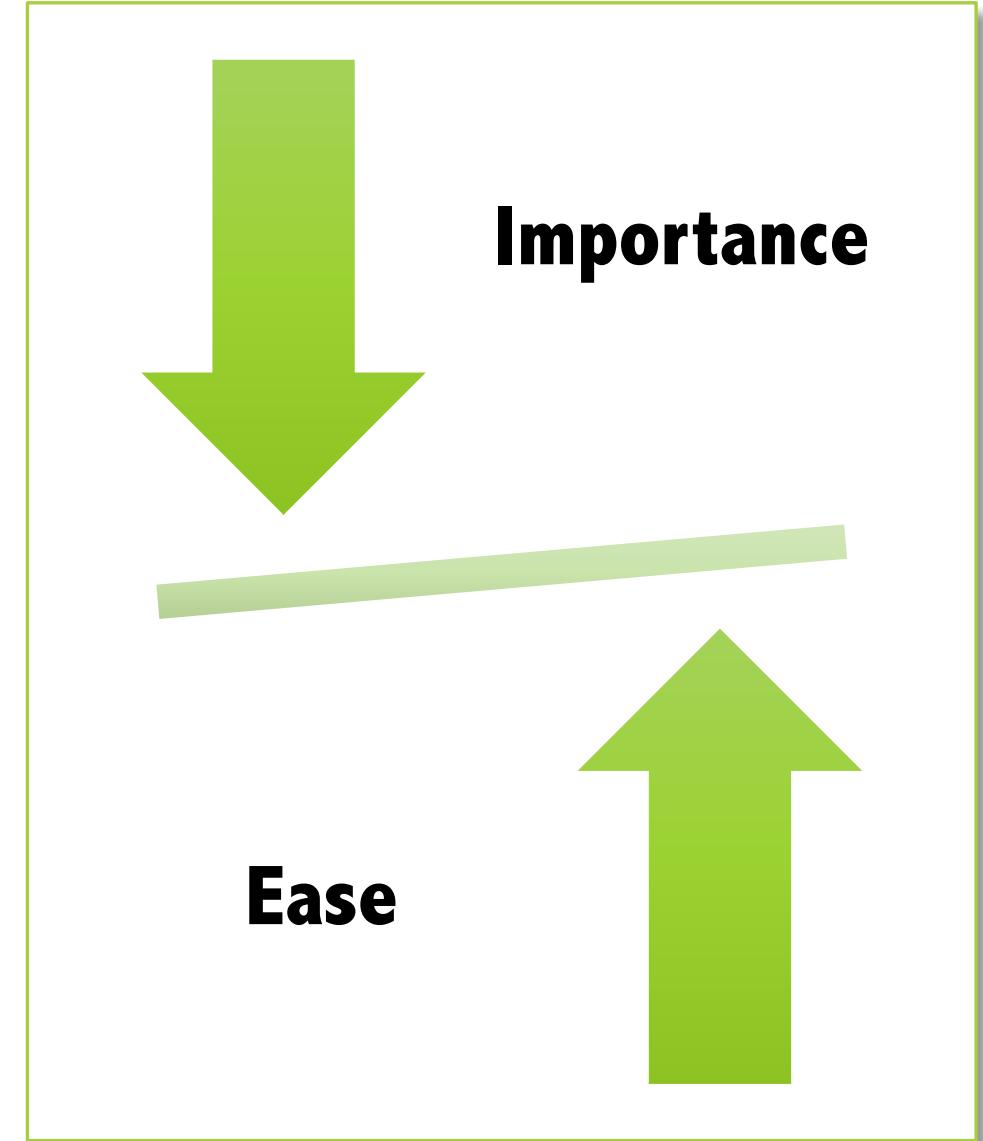
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Why THIS collaboration?

1. Physical proximity (within institution, within site)
2. Existing personal relationships (mentorships, friendships, career moves)
3. Ecological comparisons (similar systems or broader inference space)
4. Deliberate incorporation of needed skills or perspectives (modeling, social science, genomics, management perspective, etc.)

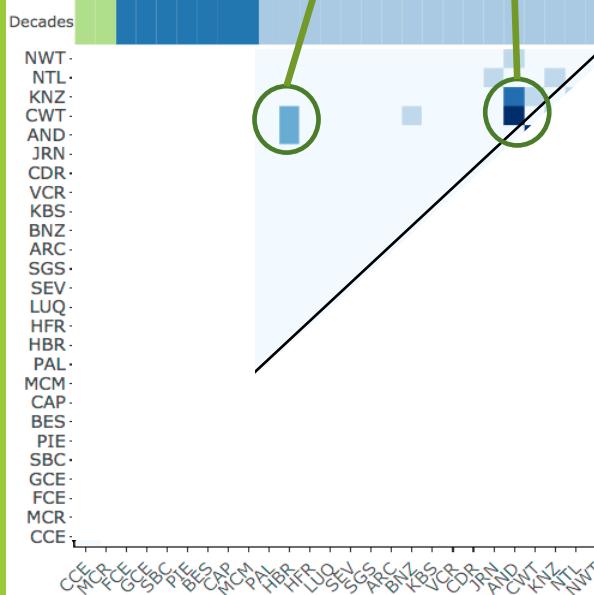




Pairwise Collaboration Count by Site Age

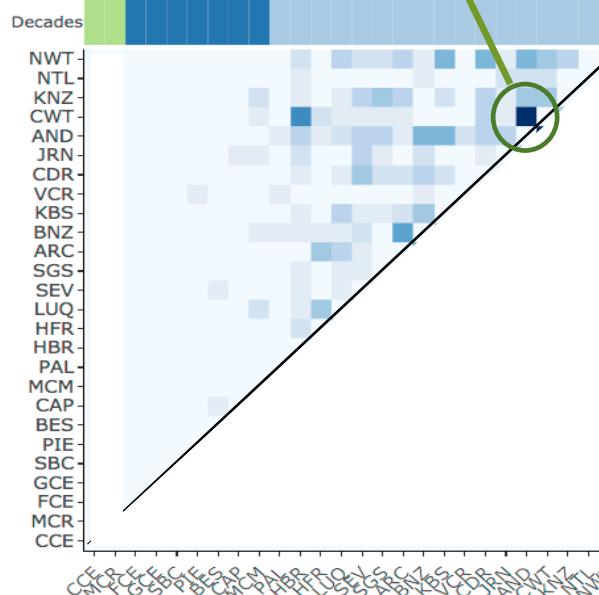
Coweeta-Hubbard Brook/
Andrews/Hubbard Brook

Konza-Coweeta/
Coweeta-Andrews



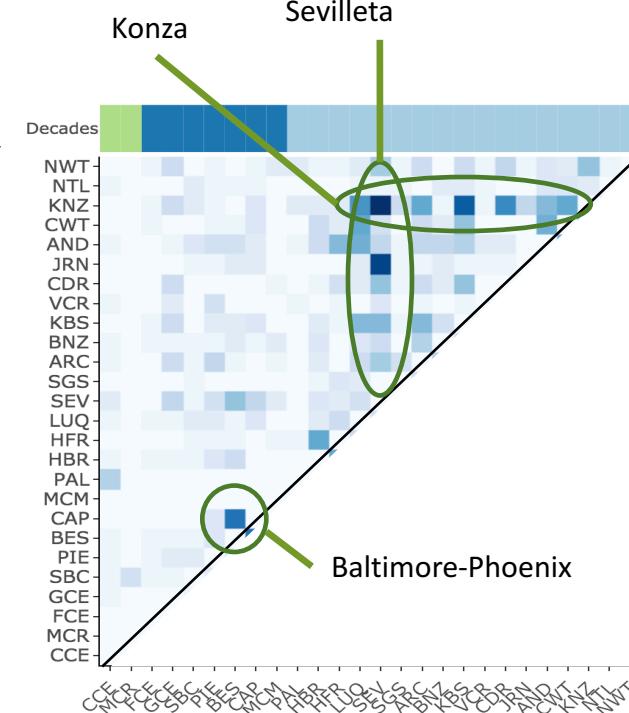
1981-1990

Coweeta-Andrews



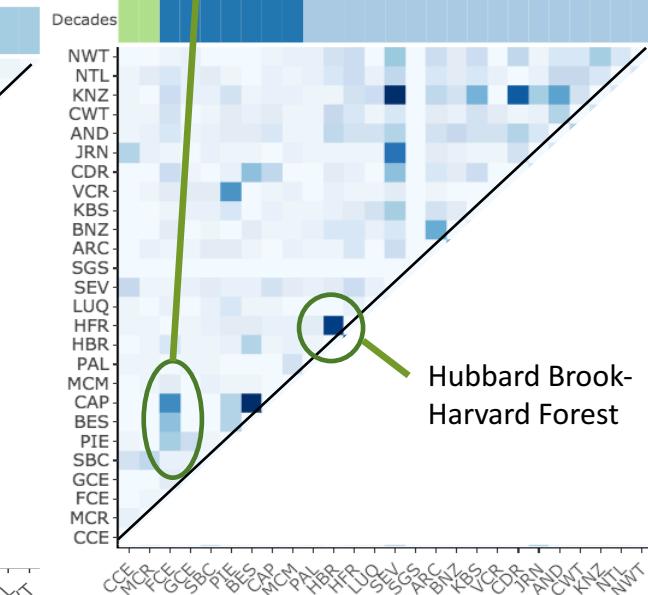
1991-2000

Konza Sevilleta



2001-2010

Florida Coastal Everglades-Phoenix-Baltimore-Plum Island



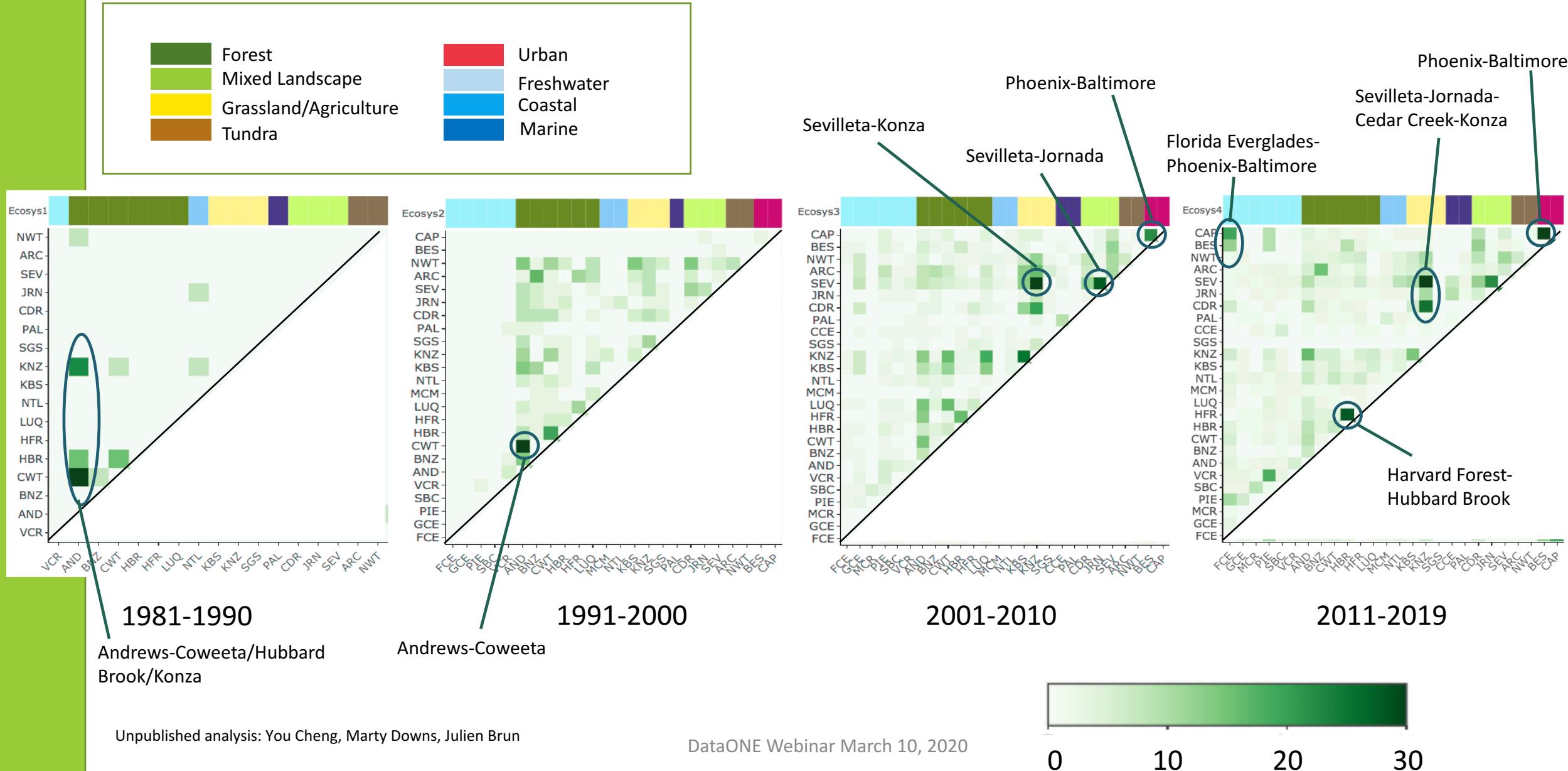
2011-2019

Unpublished analysis: You Cheng, Marty Downs, Julien Brun

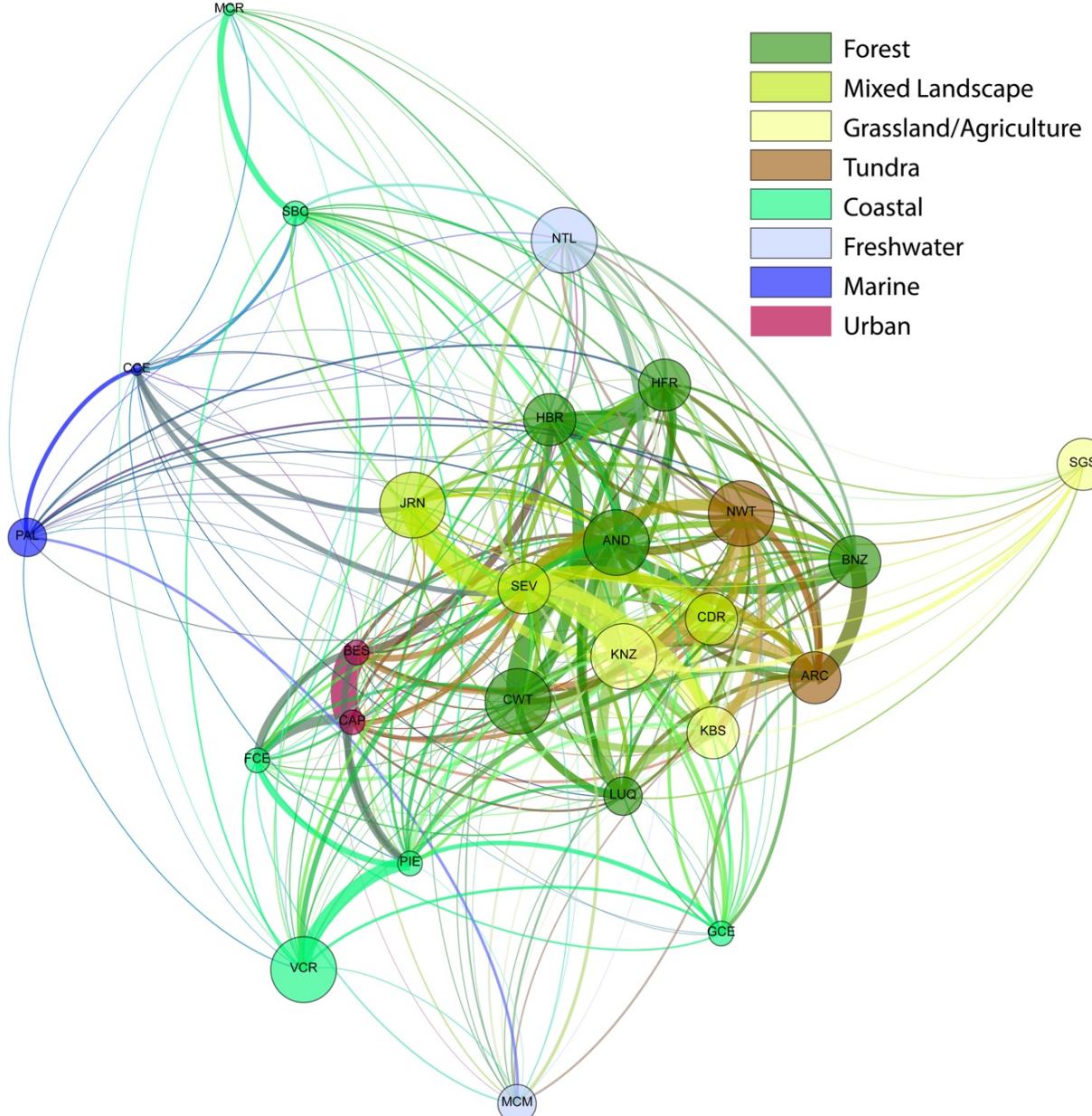




Pairwise Collaboration Count by Ecosystem Type



Intra-network Collaboration

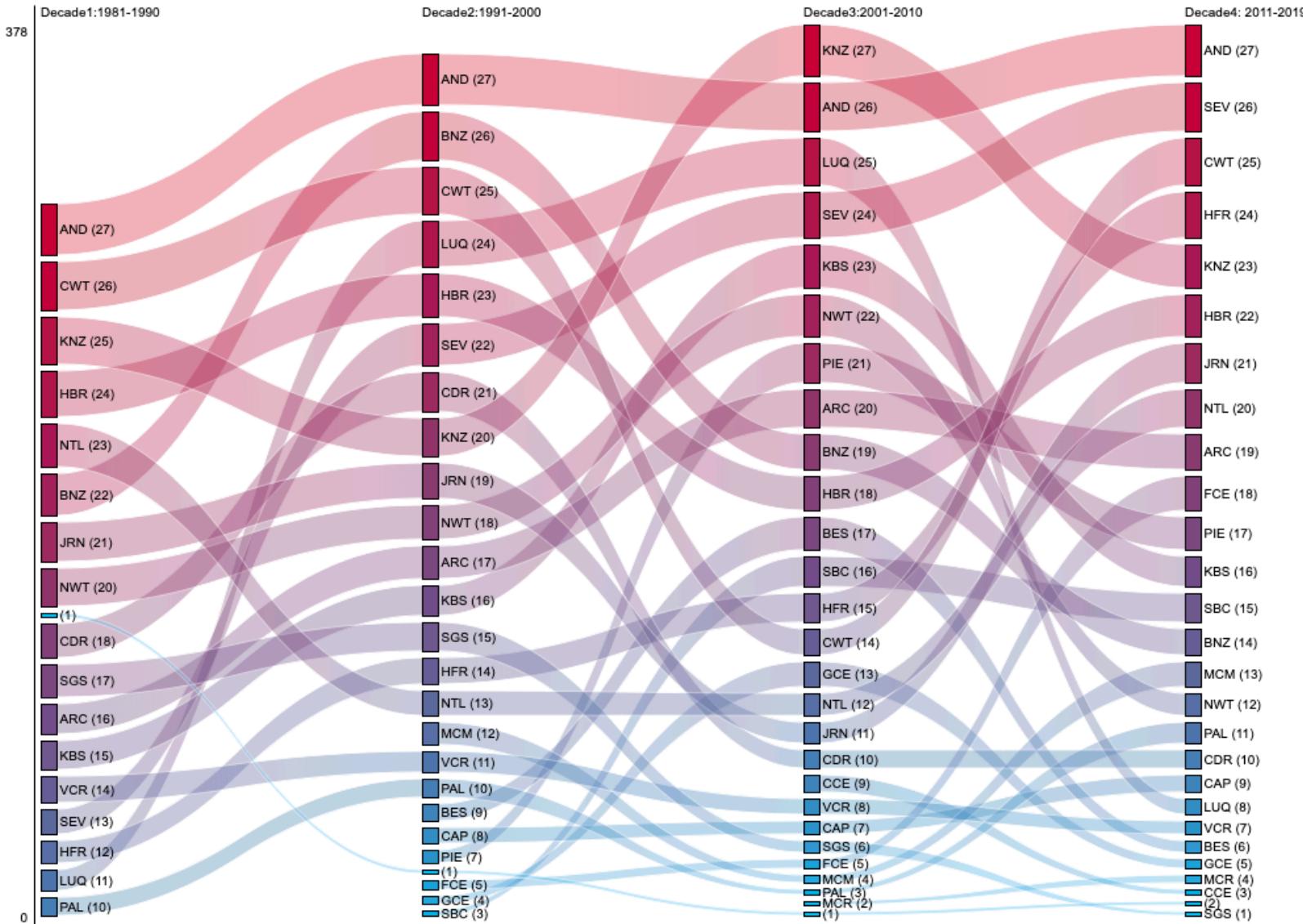


Force matrix algorithm in Gephi

Node size: site age
Node color: ecosystem type
Edge thickness: collaboration count
Position: network centrality

Unpublished analysis: You Cheng, Marty Downs, Julien Brun

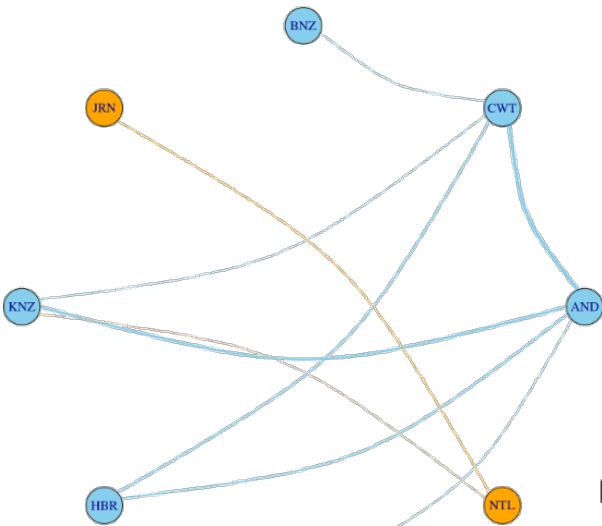
Intra-network Collaboration



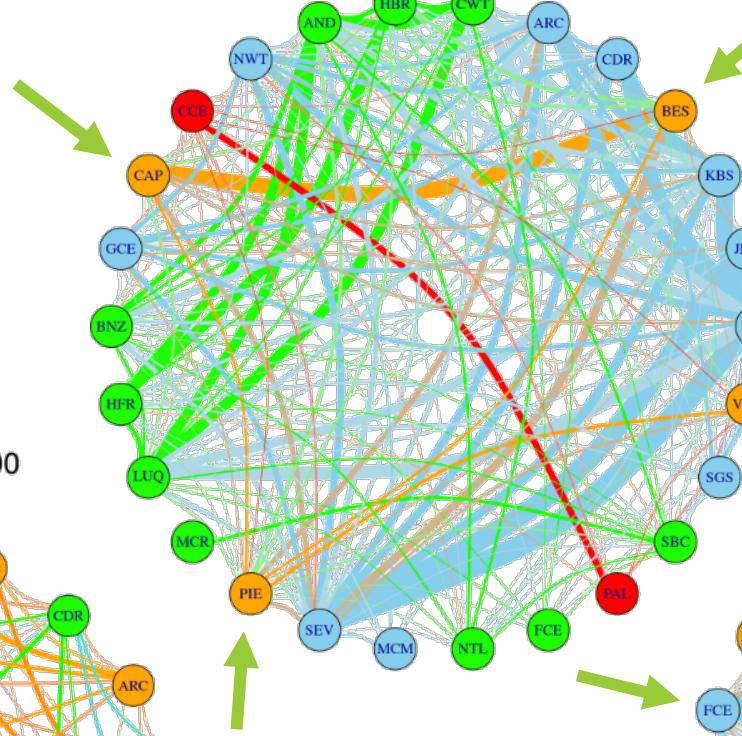
Intra-network Collaboration



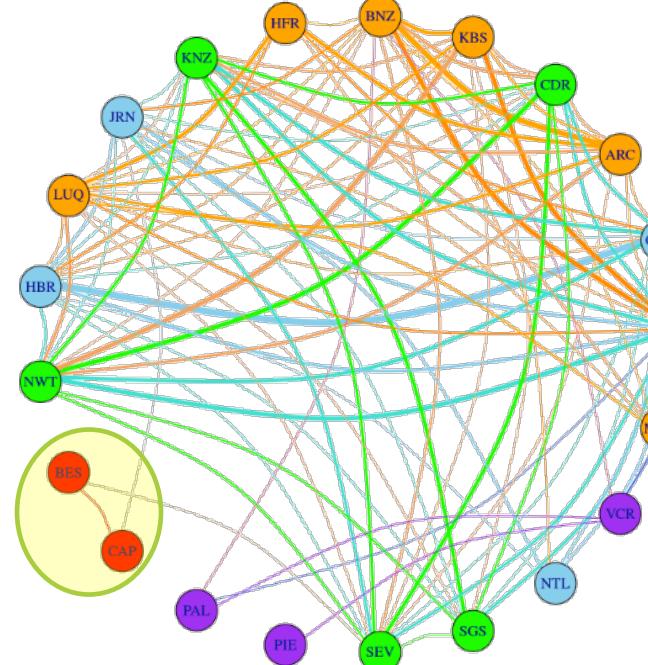
Decade1: 1981 - 1990



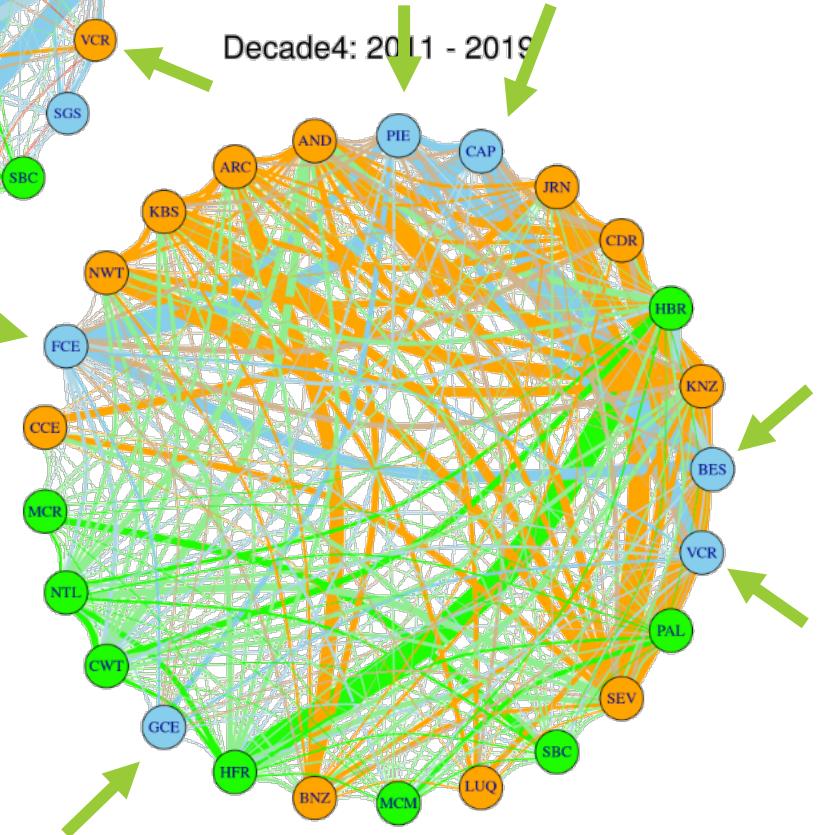
Decade3: 2001 - 2010



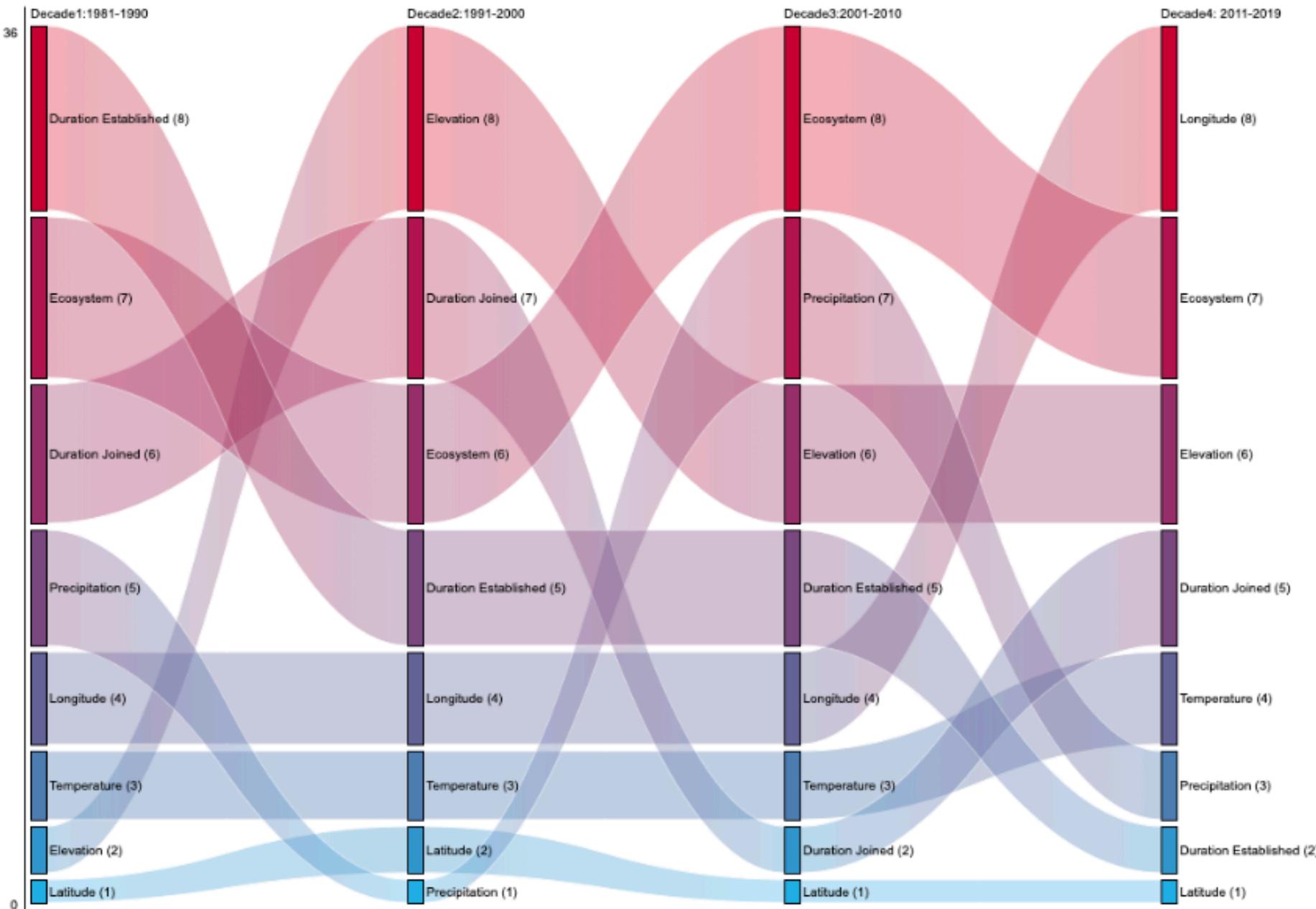
Decade2: 1991 - 2000



Decade4: 2011 - 2019



Intra-network Collaboration



Factor Importance Ranking Across 4 Decades
DataONE Webinar March 10, 2020

You Cheng, Marty Downs, Julien Brun. Unpublished analysis using Random Forest package
<https://CRAN.R-project.org/package=randomForest>

Conclusions

Collaboration in LTER-related papers

- Individuals: about 1.5 x the field average for ecology
- Institutions: rapid acceleration after 1995 to more than twice the field average
- Duration: ~3 times as many collaborations lasting 3 or more years and 10 times as many collaborations lasting 5 or more years
- Distance: LTER collaborations involve slightly greater distances than the field in general, throughout the period of record

Cross-site Collaboration

- Intersite collaborations are most frequent among sites of the same ecosystem types funded at about the same time
- Interests at sites evolve over time and the network helps to rapidly engage other sites with similar interests.
- Factors related to cohesion: Importance of site duration plateaus after ~10 years. Other factors (elevation, precipitation) vary over time.

Thanks

Questions?

