**Long-Term Resilience Group -2nd meeting**  
**Participants:** Neil, Valentina, Eric, Zabdi, Willy, Ruben  
**Discussion Topic:** Morel and Nogué paper

**1. Summary of the Morel and Nogue paper**

Presented by Valentina.

The paper is way less comprehensive and daring than we assumed. The diversity of sites and the intention is appreciated and some ideas are good. It is clear that it doesn’t really address or joins the definitions and outcomes across scales. We agree this is not a great example to follow in content or in form. Feels more like a collection of random studies without overarching advances or numeric approaches. Implementing resilience theories in paleoecology would greatly improve it too.

**2. Notes and insights**

Can come up with a resilience metric that applies across scales but that also includes communities, long-term population patterns, and changes in ecosystems? Paleo methods, both tree rings and sediments may be useful for this.

In paleo stability is talked in terms of species compositions or ecosystems shifts, in community ecology in terms of stability of a function (e.g. carbon fixation), in population ecology in stability or recovery of a property of the system/individual (e.g. growth).

Paleoecological time series can estimate stability at 3 differrent scales (doable with current data, but not across many regions) 1) in structure, 2) in community composition, and 3) in population dynamics (e.g. amount of carbon or density of forests around the lake).

The best resolution of paleorecords is 5-20 years, with series 20000+ years old.

We could calculate from these time series the amount of environmental change that triggers changes in the three levels (structure/community/population density). (These can also include fire, but that may be a daunting task at first).

Lack of response of species/communities/ecosystems are equally telling (e.g. conditions in which the shift in environment would have granted a change in ecosystem but DIDN’T happen. Does that imply non-climatic mechanisms stagnating the shift / alternative stable states / activation energy??

An interest discussion on resilience vs. Opportunity (can we have a metric of ‘stability’ that accounts for taking advantage of positive conditions?). This may be an important mechanism for future persistence on the face of increasing pressure (especially at short time scales).

What is the availability and completeness of sediment lake information across continents with enough resolution to achieve this. Are the resilience dynamics expected to be the same? An interesting factor may be the diversity of the species pool: Are ecosystems with higher richness able to recover or respond faster from environmental shifts? Comparisons between north America, Europe and Asia would help investigat this, since the temperate ecosystems there have contrasting richness. We have a discussion on the availability and Willy consults also some colleagues (see message at the end about it).

Paleo records provide an interesting way to investigate ecological responses to directional shifts / non stable systems, like climate change. Using the expansion of Beech forests in Europe since the 8.2K event is highlighted, with the possible comparison with Fagus grandifolia in north America as counterpoint. Similarly: the expansion of mixed-oak forests after the Younger dryas.

In paleo records it shows consistently that systems transition or deteriorate rapidly, but they take frequently 500-1000 years to reach equilibrium in terms of densities and compositions (even when dispersal back is fast). Some unpublished data of Willy with Harald Bugmann would strongly supports this.

Discussion on species distribution models and mechanistic models and their how they are limited and influenced by current distribution bias or systematic human influence. The example of Silver fir is highlighted as a species that tends to do pretty terrible in SDMs because their current distribution is strongly shaped by humans, but that is expected to thrive based on their physiological and historical conditions. A point of stability being not necessarily a good predictor of upcoming quick shifts come up, which may use the silver fir point as discussion.

We agree we want something that is new and that actually tries to work across scales explicitly. A diagram of a graph and a diagram of a graph

AI-generated content may be incorrect.

The idea of thinking about stability of a function of the ecosystems (as in community ecology) using tree ring or paleo records is brought up. If there is an expected ecological relationship, resilience may be measured as a response to something that affects this relationship. So, if there is a correlation, for example, between productivity and climate in a forest community, a disturbance will likely alter this, creating a ‘growth deficit’, the resilience may be calculated to that reference, as the time that the system takes to recover this relationship, irrespective of the species, structure or community that reaches it. Is this feasible? Is this the expectation we should have? What about changes in ecosystem, if there is a permanent shift in the climate effects on productivity for example, how that be resilience? Or just ecological shifts.

This seems also related to successional theory and successional trajectories, and how that may be a good example to use: where disturbance altern ecosystem trajectories or can completely change them.

Dynamic modelling or theoretical models may also help prove this without empirical data?

We agree for the next meeting to be on September, date to determine. And to have one extra meeting discussing one or a few papers (and reflecting on Lizzie’s opinion paper on phenology and climate change as potential inspiration of structures).

*Message form Willy Summary:*

*Conversation with Feng Sheng Hu revealed:*

*Phil Higuera is working on high-resolution paleo time series in the U.S.*

*Feng Sheng not aware of similar Asian datasets—potential to reach out to colleagues in China, Japan, India.*

*Europe remains the best covered in terms of high-resolution and well-dated records.*

*Proposed comparative study of Fagus grandifolia and F. sylvatica responses to disturbance/climate change:*

*Could offer insight into niche conservatism and resilience.*

*Classic papers exist, but few (if any) focus directly on resilience metrics.*