# INTRODUCTION

As you know, in the past decades there has been a lot of push to study the functioning of ecosystems. We want to the functioning of ecosystems so that we can then preserve it in face of global change so that nature can keep providing those services that our societies are based on. When it comes to ecosystem function, there has been a lot of work done on how it is influenced by biodiversity. We now know that biodiversity is important for ecosystem function because the more species we have, the more likely we have to find a species that drives a lot of ecosystem function (sampling effects) and because more species use resources differently and therefore tend to utilise them more efficiently (complementarity effects).

This focus of how biodiversity changes ecosystem function, however, is only a patch approach. In other words, it applies only to a single patch. Because patches do not exist as single entities floating in space, totally isolated from their surroundings, we need to look at the landscape level to see how spatial processes influence their function. In other words, we need to look at multiple patches to understand ecosystem function. One key element in spatial ecology is the flow of resource between ecosystems. Ecosystems that are connected through the flow of resources and organisms are called meta-ecosystems. We are now starting to understand how meta-ecosystems processes influence ecosystem function.

Theory predicts that the function of a meta-ecosystem is determined by its topology, how connected its ecosystems are on average (average node degree), and how connected their most connected ecosystem is (maximum node degree). Furthermore, meta-ecosystem function is improved by resources flowing between ecosystems at a faster pace. However, how much resource flow increases ecosystem function depends on network topology and how fast autotrophs are flowing (Marleau2014). But I guess at some point resource flow will be too much and destabilise the meta-ecosystem and with it its function. Meta-ecosystem function is also influenced by the number of individuals receiving which fertilise its patch (expand on this) (Gravel2010). Productivity is enhanced when nutrients are well mixed into different patches so that they can be used more efficiently, for example, because of high connectivity (Gülzow et al., 2019), having different types of ecosystems (Oehri et al., 2020), maybe because they present more habitat which can be used for different life stages (Marini et al., 2019).

Lately, there has been a push to scale up biodiversity ecosystem function (BEF) research to include larger spatial (as well as temporal) scales. This was done in particular through the review of Gonzalez et al. (2020). However, in this highly cited review, the functioning of a landscape assumes almost no nutrient flow and its effects on fragmentation and the size of different ecosystems. In this article we refer to ecosystem function and productivity interchangeably, as the function we focused on is productivity. Expand on this.

One aspect that has been ignored so far when linking meta-ecosystems to ecosystem function is patch size. It is quite obvious that we cannot understand the effect of meta-ecosystems on ecosystem function without considering patch size. This is because patches of different size have different ecology. For example, bigger patches have more species, are more productive and are more resistant to perturbations. Here add a lot of studies on ecosystem size, such as the ones of (Hanski, Pakkala, Kuussaari, & Lei, 1995), (MacArthur & Wilson, 1963).

There has been some work done on the effect of subsidies coming from different ecosystem sizes. *Here I need to find them, look at Subalusky.* However, there hasn’t been done much about how subsidies change according to the size of the ecosystem they are from. *This is what I think but I need to make sure, look at Subalusky.* However, there hasn’t been done any work looking at the size difference between the two ecosystems (*at least that’s how I think, but I need to make sure*). And how the feedback loop between the two ecosystems influences it.

Diagram

Description automatically generated

*Figure 1. We compared two patch meta-ecosystems that were made of patches of different size.*

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