sDiv working group meeting summary
"sERVICES2"

Can ecological network information improve the efficacy of biodiversity conservation for ecosystem services in the face of unavoidable uncertainty?

Main results and conclusions

Managing ecosystems to provide ecosystem services (ESS) in the face of global change is a pressing challenge for policy and science. Predicting how management actions and changing future conditions will alter ESS is complicated by interactions among and within ecological and socioeconomic systems. However, failure to consider those interactions can lead to detrimental outcomes from management. Using networks to study ecosystem services can help with this challenge. While network theory offers promising approaches to examine ecosystem services, few studies have identified how to operationalize networks for managing and assessing diverse ecosystem services, facing diverse impacts. **This working group is contributing to our understanding of how ecosystem services will be affected by global change and management actions, using a variety of network approaches (modeling and data synthesis).**

This working group meeting focused on three themes:

(1) how to conceptualize and model ecosystem services as integrated networks of species, people who benefit from services, management actions, and drivers
(2) relationships between species traits, network attributes and ecosystem services
(3) how environmental drivers and human impacts will affect ecosystem services, via networks

Alison Iles and Benjamin Rosenbaum joined this meeting (which was very exciting!), and Alison presented on her work on determining predictability in allometrically constrained food webs (from Iles & Novak 2016 *Am Nat*). We had a productive discussion on the implications of this work and interaction strength uncertainty for ecosystem service research.

Products of workshop and next steps

Operationalizing network theory for ecosystem service assessments, led by Laura Dee

We wrote a perspectives paper outlining how to use networks to assess how drivers and management actions will directly and indirectly alter ecosystem services. This paper considering modeling ecosystem services as an

integrated network with species, people who benefit from services, management actions, and drivers.

Species traits and their connections to ecosystem services, led by Anna Eklöf

In this project, we analyse which species-specific traits (if any) are most informative as predictors of delivery of ecosystem services, using use data from a variety of marine ecosystems that we synthesized. The data consists of three parts: i) a description of the ecological network showing who interacts with whom in the specific system; ii) species-specific traits for all species in the system; and iii) what ecosystem services the species in the system are delivering (described for only the species known to actually deliver a service). We develop code for and use two basic models to evaluate the traits roles for predicting ESS: mutual information criterion and logistic regression. The plan is to finalise both analyses and writing before January.

Predictability in how ecosystem services provided by networks will respond to temperature change, led by Alison Iles and Benjamin Rosenbaum

Alison Iles and Benjamin Rosenbaum are leading a paper that will outline how to quantify the uncertainty of species responses and the ecosystems services they provide (e.g. food provisioning, carbon sequestration) to press perturbations (e.g. climate change), given error or variation in species interaction strengths. That is, to evaluate the extent to which ecosystem services are sensitive to error in species interaction strengths and the network complexity. As a case study for this project, our team will evaluate with what level of confidence can we predict the effects of temperature change on carbon sequestration with an existing food web model for Lake Constance. The approach combines model simulations with sensitivity analyses on the resulting community matrices.

An Integrated Decision Framework for Protecting Ecosystem Services and Biodiversity, led by Ute Jacob

We spent time working on a science-policy piece, led by Ute Jacob. This paper synthesizes vulnerability of ecosystem services to key threats across ecosystems types and provides guidance for prioritizing management interventions when faced with limited management resources to mitigate threats.

Our next steps are to finish these products and to start new papers together in this area! We are looking out for funding opportunities. We had a great time being at sDiv for the 2 meetings!