

sDiv sabbatical project report

"Dissecting SLOSS: why are there more species in several small than few large patches?"

by Lenore Fahrig, Carleton University, Ottawa, Canada

Scientific hosts: Henrique Pereira, Jonathan Chase

- What is the project status?

The sabbatical project is complete. Along with collaborators at iDiv, elsewhere in Germany, and in other countries, I synthesized SLOSS data and theory to develop a new hypothesis that we are calling the "SLOSS cube hypothesis." We have submitted a paper describing the new hypothesis to Ecology Letters.

- Please describe briefly the main results/conclusions and if applicable the open questions, work steps etc.

The idea that a single or a few large habitat patches (SL) hold more species than several small ones (SS) of the same total area, the "SL > SS principle," has influenced conservation decision-making for over 40 years. Small habitat patches often have little or no protection, due to their assumed low conservation value. However, empirical studies have failed to support the SL > SS principle, raising the possibility that its continued influence on decision-making is detrimental to biodiversity conservation.

We tackled this dilemma by asking, "are there consistent, empirically-demonstrated conditions leading to SL > SS?" We synthesized relevant theoretical and empirical work. Based on this synthesis, we proposed the "SLOSS cube hypothesis", which predicts SL > SS only when all three of the following conditions are true: between-patch movement is low, population dynamics are not influenced by spreading-of-risk, and across-habitat heterogeneity is low. We then developed a research agenda for testing this prediction.

We anticipate that our paper will generate strong interest by providing direction for future research. If the majority of such future studies support the SLOSS cube hypothesis then this will delineate the situations in which the SL > SS principle can continue to be used in conservation planning. On the other hand, if the majority of such future studies find SS > SL or SS = SL even in conditions predicted to produce SL > SS, then the SL > SS principle should be abandoned.

- Please mention if applicable the outputs (e.g. publications) and their status (e.g. in prep, submitted, published etc.).

We submitted the following paper:

Fahrig L, Watling JI, Arnillas CA, Arroyo-Rodríguez V, Jörger-Hickfang T, Müller J, Pereira H, Riva F, Rösch V, Seibold S, Tscharrntke T, May F. Resolving the SLOSS dilemma for biodiversity conservation: a research agenda. Submitted 11 December 2020 to Ecology Letters.

- Please describe briefly if and how your stay at iDiv was an inspiration for your own work?

During my first week at sDiv I gave a presentation and facilitated a 1.5-day workshop (5-6 February 2020) to kickstart the collaboration that eventually produced the paper above. The workshop logistics were extremely well organized by sDiv staff so that we could concentrate fully on the work. During the workshop we developed some initial ideas and an overall plan for a paper. During the remainder of my fellowship (February-April 2020), and for 8 months afterwards, the group continued to collaborate remotely, ultimately resulting in our "SLOSS cube hypothesis".

In addition to my sabbatical project, my short time at sDiv was very intellectually stimulating. I attended seminars, participated in Jonathan Chase's lab meetings and in the sDiv lab meetings, and I regularly went to lunch with the PhD students and PDF's. I particularly enjoyed discussions about the challenges encountered in research syntheses that involve large-scale data compilations. Despite the broad array of research topics at sDiv (and iDiv more generally), including ecology and micro- and macro-evolution, and covering taxa from microbes to insects to plants and others, there are common technological, social, and ethical challenges encountered in research synthesis. My only regret was that these in-person interactions were cut short by the Covid restrictions, reducing my anticipated 3-month stay to just 6 weeks.

- Please give feedback about the general working atmosphere and feedback on sDiv support.

The sDiv staff were extremely helpful with all logistical assistance during the months before our move to Leipzig. As mentioned above, the workshop logistics were also extremely well organized by sDiv staff.

I found the working atmosphere to be very friendly and relaxed. I particularly appreciated being immediately included in lunchtime at the Max Planck cafeteria, where I started to get to know sDiv researchers through many interesting discussions on a wide variety of topics.

- Which new collaborations/networking within iDiv were established and what is their status after the stay?

Within iDiv I developed new collaborations with Henrique Pereira and his PhD student Theresa Jörger-Hickfang, as well as with Felix May (now in Berlin). I also established a new collaboration with another German researcher (not at iDiv), Verena Rösch, and I reinforced existing collaborations with other German researchers, Jörg Müller, Sebastian Seibold, and Teja Tschardt. Most of the iDiv collaborators had not previously worked with the non-iDiv German collaborators, so these connections built collaborations within Germany. The same is true for the non-German collaborators, James Watling (USA), Carlos Arnillas (Canada), Victor Arroyo-Rodríguez (Mexico), and Federico Riva (Canada).

We have all remained in close contact after my sabbatical stay as we developed our paper.

- What are the next steps?

In the immediate future we are looking forward to learning the reviewers' responses to our paper. In addition, immediately following my sDiv stay, in May 2020, I hired a PDF and a PhD student to continue working on questions arising from the collaboration. In particular, we will test the SLOSS cube hypothesis using butterflies, grassland birds, and mammalian predators.