

## **sDiv working group meeting report**

### **“sToration III – Applying Coexistence Theory to Restoration Ecology and Adaptive Management”**

The primary, and continued, goal of the working group is to connect coexistence theory with that of the applied branch of restoration ecology. Connecting ecological theory, within the coexistence framework, allow us to provide a more predictive context to base our restoration actions. Alternatively, through the use of empirical ecological restoration based data we further build, and ultimately test, our theoretical understanding surrounding coexistence. Using ecological restoration to help test theory, and theory to help build ecological restoration, the third meeting held both at iDiv, and remotely, continued with these core aims of (i) having data driven application of coexistence theory using real world restoration datasets and (ii) continuing to build a synthesis or conceptual framework addressing the overlap of coexistence theory and restoration goals and actions. We structured our formal meeting around two these two primary goals that were translated into distinct working group tasks.

The first task was led by Dr. Lauren Shoemaker and Dr. Lauren Hallett and consisted of our remote working group members, with input from the in-person attendees. This task continued our data driven approach to apply coexistence theory to empirical data. The published long-term data from previous meetings (Aoyama et al. 2022) illustrated the importance of long-term data on a single species. For this second data driven approach, restoration data for multiple species, both native and invasive, from two field sites in the York Gum Woodlands (YGW) of Australia were revisited. With the primary analyses and a substantial portion of the writing completed before the start of the meeting, the working group was able to spend the majority of the meeting refining analytical efforts, writing and editing different section of the manuscript, and updating figures to best demonstrate findings. Working group members felt this was a productive meeting and a great deal of progress was made. To keep the momentum of the manuscript preparation, shortly after the formal meeting all working group members were invited to, and many attended, a remote follow up meeting.

The second task was to combine a conceptual framework with a broader data driven approach to more effectively generalize across multiple restoration projects. An outcome of the previous meetings was a conceptual synthesis paper entitled “Restoration ecology through the lens of coexistence theory” led by PI Dr. Lauren Hallett that was accepted in the journal Trends in Ecology and Evolution (Hallett et al. 2023). Using distinct individual datasets to support this effort, this third meeting was focused on building on the concepts in the Hallett et al. 2023 paper through utilizing multiple datasets. Here, we used the Global Restore Project (GRP) database led by Dr. Emma Ladouceur. The GPR database is an extremely rich dataset and has as many as 164 ecological restoration datasets (and growing) coming from 139 contributors, and 27 countries.

Prior to the in-person meeting Dr. Ladouceur held virtual meetings with a subset of the working group to help consolidate the database to meet working group goals. From this



starting point at the beginning of the meeting, the in-person iDiv working group was able to work together to develop objectives surrounding restoration related questions such as how population growth patterns compare across seeding treatments, and whether restoration projects remain in transient states, or match their natural reference communities, and why. With the objectives in place, the group began assessing different individual datasets to decide what datasets met our objectives, and what datasets did not. With a smaller group of in-person attendees than previous years, we followed an approach where there was a combination of larger group discussions and smaller breakout groups for very specific details. For most of the week, however, in-person attendees remained as a single larger group to work on developing, and refining, our objectives for this study, and the associated workflow best accomplish the objectives. This was an effective way to ensure different opinions could be heard, and allow for a fluid approach to asking, and answering, questions with such a robust dataset. At the end of the meeting, clear timelines and personnel were designated for different pieces of the effort (e.g., conceptual diagrams versus data analysis) to ensure momentum after the meeting adjourned. As the first task was led by the remote group with input from in-person attendees, this task was led by in-person attendees with input from the remote group.

For the duration of this third meeting, the working group was set up that the in-person participants started their mornings at 9:00 local time and finished around 17:00 or 18:00 local time with a pre-determined overlap with remote participants starting at 16:00 iDiv time. As it proved to be quite useful in previous meetings, this built-in overlap in the in-person afternoons for debriefing what was covered, homework “assignments” and necessary communication was once again an important piece of what made this meeting successful. In addition to the overlap in meetings across in-person and virtual working group members, to further facilitate communication, careful note keeping was maintained throughout both groups. This consisted of detailed notes, and a summary section for easier digestion of the primary points. In addition to each group/task identifying next steps, we concluded the meeting with ways to bring the different sub-groups back together to include all members of the broader working group.

As was true in previous meetings, the working group was collaborative, and the momentum gained from previous papers, relationships, and efforts are also expected to be maintained. In fact, many working group participants are meeting at the 2023 Ecological Society of America annual conference in Portland Oregon, USA in early August to continue with the different tasks. Also, as was the case for previous meetings, iDiv was excellent at fostering a collaborative and productive atmosphere. Guidance prior to meeting in preparing the agenda was very useful, particularly with so many remote participants and our distinctly different tasks to accomplish across in-person versus remote participants. During the meeting staff were always available for questions and continued to guide working group members through the process in a very productive manner. With quick responses to our small, or larger, questions, the support from the staff once again made the meeting a great experience and helped us focus our time on our scientific endeavors.

**Publications:**

Aoyama et al. 2022: <https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.2649>

Hallett et al. 2023: [https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347\(23\)00152-0](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(23)00152-0)