

sDiv working group meeting summary

“ sTRAITS: Integrating in-situ, upscaled and air- and spaceborne observations of plant traits”

The first workshop consisted of two main parts: first, discussion of the results of the global foliar trait map intercomparison, second, establishment of the roadmap for the next steps in the project. Over the course of four and a half days, a large range of topics relevant for upscaling foliar trait maps were discussed.

The primary focus of the workshop was to make progress towards a first manuscript comparing global foliar trait products from different upscaling approaches. Prior to the workshop, a full first draft of the manuscript was provided to participants. The results from the analyses were presented (including analyses not included in the manuscript), with considerable discussion of the figures and key messages for the manuscript. New analyses were identified and partly evaluated during the workshop and then scheduled as follow-up analyses by the postdoc. One of the outcomes of the workshop was a concrete plan for the order and content of figures to include in a revised manuscript.

Among the important aspects that were discussed was whether vegetation (tree) height maps should be included along foliar trait maps. The original sTRAITS proposal did not include height as one of the traits, but global upscaled height maps are available from a range of sources and utilize many methods similar to those for foliar traits. As well, we discussed whether the overall focus should be more on the trait maps themselves or rather on an development of the synthesis maps from the multiple sources, which would be used to address ecological questions. Another relevant aspect was the challenge of benchmarking the global trait maps due to sparsity of ground data as well as the considerable differences in spatial scales and trait metrics used among the different products compared.

Apart from the intercomparison of global trait maps at different scales, the global maps were also compared to regionally upscaled trait maps and trait maps derived from airborne hyperspectral imagery. We considered the potential and limitations of such intercomparisons at finer spatial scales (both extent and grain size). Furthermore, we discussed the importance of different types of input predictor information as well as potential reasons for discrepancies between the existing upscaled global foliar trait maps. Identification of the most important factors explaining differences between global upscaled trait maps emerged as an important activity of the working group. As such, we decided to conduct a sensitivity analysis of the upscaling approaches to the key inputs in advance of the second workshop. This could provide quantitative insights as the basis for future upscaling efforts.

Related to this, we also discussed how to quantify gaps in currently available trait data (in-situ and airborne maps) in terms of a “representativeness” analysis. We decided to conduct this analysis using the key environmental predictors identified in the sensitivity analysis, in which we would statistically map for the globe the relative representativeness in environmental space of every pixel (y-values) with respect to the in-situ trait data (x-values) used for upscaling. The results of the sensitivity analyses are now planned to be the main focus for the second workshop and likely the basis for a second publication. We made a

concrete plan to collect key forcing datasets (y-values) and use them as standardized inputs to different upscaling approaches. Overall, considerable progress was made over the course of the workshop both on the work in progress as well as the work planned in the next steps.

Additional topics that emerged from these discussions included the use machine learning (ML) techniques for trait upscaling as well as the use of airborne and spaceborne hyperspectral imagery to estimate foliar traits and as possible data for calibration/validation of upscaled maps. Both of these topics are important for current and future trait mapping efforts given the prospect of upcoming satellite missions and increase in data volume, lending itself well to implementation of ML methods. In particular, we discussed the advantages of machine learning approaches over traditional multivariate methods.

Several participants gave short presentations relevant to the working group, which led to vigorous discussion and exchange of ideas on trait upscaling and related applications. These presentations covered numerous recently developed upscaling/modeling approaches in considerable detail and provided an outlook on future mapping applications. These discussions led to additional collaborations among group members with the sTRAITS postdoc.

The workshop was held in a positive and constructive atmosphere, with groups based in Leipzig and Madison, and a few remote participants. Although not ideal, the split format worked well, as the Leipzig and Madison participants communicated freely and respectfully despite the different venues. The biggest challenge of the split format was that the two groups were not synchronized. The majority of the meeting was in plenary, but each group met individually for part of the time, which meant that the discussions were not always fully aligned when the larger group re-convened. This was overcome easily when the groups reported back to each other, but pointed to the preference for a single venue. All in all, the workshop included valuable feedback on presentations and the open exchange of ideas and opinions. Lively discussions around the topics of the workshop and, more generally academic life, continued during lunch breaks and dinner.

Although it was sometimes challenging to have a combined in-person meeting in Europe and the US, with a number of remote participants covering a large range of time zones, the workshop was a success and went smoothly. This was largely due to the great support from the sDiv Synthesis Center team.

The first paper from sTRAITS currently has a complete manuscript, awaiting review by the full sTRAITS working group.