June 7, 2022 Theory Working Group Call

Attendees: Amanda Gallinat, Christy Rollinson, Jamie Ashander, Caleb Robbins, Mike Dietze, Noel Juvigny-Khenafou, Jody Peters, Cole Brookson
Regrets: Abby Lewis

Agenda:

1. Amanda will step back as official co-chair. Abby is willing to continue to chair. On the next call, check to see if anyone is interested in co-chairing

2. Celebrate the Methods in Ecology & Evolution manuscript revisions!
   a. Abby is working on revisions. Noel and Jonathan have offered to help.
   b. Comment to discuss as a group from Reviewer 3 about adding a worked example
      i. What kind of worked example is the Reviewer looking for? Forecast synthesis or forecasts that have a
      ii. Could add a couple of sentences with citations in the Roadmap section pointing to examples from published forecasts that could test some of what is in the framework
      iii. Cite the EFI RCN as a place for where worked examples exist? Don't want to take the thunder out of Quinn's paper summarizing the Challenge
      iv. The most we might want to do is add a box to point to the Forecast Challenge and examples for forecasts. Do we think this would be a useful addition to the paper? Would we regret it if we don't include it? Do we think we could do it in the next 2 weeks? Think we could roll without an example, if it is too hard
          1. A box would be a couple of paragraphs. Mike is happy to collaborate on the Box (but can't lead it).
      v. Could we use the Box as a way to help with Reviewer 3's question about what is a forecast? Not sure if that would make it more or less doable, but could be a rationale for it.
      vi. Amanda will bring these options back to Abby as she is working on revisions

3. EFI Conference - any insights about what people gleaned from the conference that can guide the Theory group?
   a.

4. What hypotheses from the manuscript could be explored within one or across the NEON Forecasting Challenge themes or with forecasts listed on the EFI forecasting profiles webpage or from the EFI community
   a. Hypothesis 1: The rate of decline in predictability over increasing forecast horizons differs across variables and scales

b. Hypothesis 2: Predictability increases with biological and ecological aggregation
  i. Had previously discussed with this group that the Phenology Challenge has a lot of data that could be used to test hypothesis 1
  ii. Think the Challenge is low-hanging because it is standardized and if there is something we want we will be able to guide the Year 3 forecasts
  iii. Make optional uncertainty partitioning analyses. If we wrote out a protocol for anyone who did this and offered people who provide forecasts to join a paper about it
  iv. Opportunities for the future - it is hard to disentangle these two hypothesis with the available data. With Phenology we are forecasts greenness at ecosystem and species scale. NEON should have NPP that would allow us to test this at the same site. Could possibly hindcast to look at parallels.
  v. For beetles there are aspirations to push this, but need to get more teams participating.
  vi. With Terrestrial Flux could possibly split net flux. This could potentially be to compare across variables. Mike's BU's team avoided this. But could do it with the tower data, litter data, soil respiration data - could break it down into a substantial budget.
  vii. Noel shared the dataset: https://www.safeproject.net/
    1. Landscape commissions by Malaysian gov't. Cut down pieces of rainforest split into triangles to be able to look at multiple scales
    2. Have 10 year data across organism, ecosystem
    3. Could be used for aggregation - the whole point of the project was to be able to aggregate the data at multiple scales
    4. Noel used the data for his master's work
    5. If we had the right dataset we could look at hypothesis 1 and 2 at the same time
    6. Are there teams modeling this data?
      a. Best way to talk to the person who knows what projects have been done
      b. There have been people that have modeled some of the data, but nothing comprehensive
    7. This looks like a great dataset, but want to think about balancing the effort to take forecasts already developed from the NEON Challenge vs starting from raw data with this dataset. Right now leaning towards the NEON Challenge since the forecasts have already been created. But keep this dataset in mind depending on who is going to take the lead on the activities for assessing the manuscript hypotheses.
  viii. As we continue to talk about this project and what steps we need to take, we need to talk about how to get the work done
  ix. Think the RCN framework and outputs provide models that have been produced that have forecast output we can synthesize across forecasts or

gives the ability to include authors or submitters to ask them to produce additional outputs with the carrot of authorship once we know what type of manuscript we are working on

 x. Phenology Challenge is greenness and redness at multiple sites

 xi. First part of hypothesis 1 is the easiest - we have at least 5 variables across the Challenge to be able to compare. The scale is harder to compare. Most of the Challenges are 1 forecast per site

 xii. Ticks had multiple plots per site that could be used for year 1. In year 2 the group went to being aggregated at the site.

 xiii. It is possible to find dates that we can compare across models with varying models of complexity - Christy hypothesizes that simple models do better at long time scales than more complex models.

  1. In metadata standards is high level information about the complexity of different models in terms of covariates, parameters, variables predicted, etc

  2. This is not included in the current manuscript with results from the phenology challenge - so could be looked at moving forward

  3. Did not look at the complexity of the models used in the phenology challenge, so could be an option to look at

  4. Best model is a GAM with day of year and some covariates added in.

 xiv. What is the timeline we want for deciding on how or what to push forward on?

  1. Questions most related to this group are probably figure G4 from the phenology manuscript - the lead time vs skill graphs. This averaged across the full spring season from year 1. Nothing from the fall and nothing

  2. Want to have conversations this summer about what would be useful for synthesizing across forecasts so we can ask the design teams for the Challenge themes to consider modifying the rule for the Challenges for round 3 in 2023.

  3. Mike might be able to pull together the code to show how the dataframe is organized

  4. In year 1 the Phenology Challenge was the only one that people could submit forecasts each day. For the other Challenge themes the forecasts start on the first of each month.

  5. This year, the Terrestrial and Aquatic Challenges also have daily resolution.

 xv. Back to Timeline - may be easier to figure out the timeline after we figure out who/what people will lead it

  1. Doesn't have to be a single lead - could be leadership by committee

        2. Want to gauge interest, time, and availability for who in the group would want to take leadership - people who have lot of interest, little interest, no time

        3. Also worth discussing what the theory group could do if people were not interested in this. Is there something that would allow for a lower barrier of effort
   - a. Discussion of ongoing research paper, theory focus outreach - what do people want to get out of their participation in the working group if the idea of getting into a whole paper is too big of a lift

        4. Send poll out to people to gauge interest? Could be a timezone issue, could be an issue with not having a concrete product vs talking and networking

        5. From Christy: With the RCN synthesis idea, I'm happy to provide heavy support, but don't have capacity to be the one leading actually analyses, writing etc.

  c. From EFI admin side of thing - we would like to increase the number of forecasts listed on the forecast projects page
   - i. At some point would like to have a database with information about the metadata for forecasts to get a better feel for what the community is doing. What variables, what scale, etc

5. Reanalyzing long term experiments with a forecasting view

6. Jody is leaving this in as a reminder of ideas suggested - Recap from icebreaker from the April call about ideas from the group about what to work on next
   - a. Test some of the hypotheses put forth in the manuscript
   - b. Several versions of figure 1 that lays out forecasting - produce something in a non-manuscript format, but through EFI that lays out underlying theory of forecasting and expand and provide through EFI (not necessarily through traditional manuscripts). Graphical abstract of what forecasting is about
   - c. Test transferability
   - d. Work on/test the toy model that Abby and Elyssa started a while ago
   - e. Use existing experiments to reanalyze with a forecasting approach. Start to understand how to do science differently. Put into practice the idea of how forecasting can change what we are currently doing. Especially some of these experiments that have been done across multiple sites
   - f. Journal club - dive into and discuss papers that cover existing theory. (student group has had fun and productive discussions on complexity and simplicity - could possibly have cross-over call)

g. Opportunity for synthesis and to learn from each other. Thinking about different scales of ecological organization and where predictability scales across that. Synthesis across domains (marine, terrestrial, freshwater). Think about different end users - resource managers, ag management, water management. Sounds like some of the ideas in the very first manuscript outline-- comparing predictability across levels of biological organization, geography, life history, etc

h. Model validation/model selection using large datasets or past datasets. Transferability

i. Use manuscript as starting point to put things into practice to show benefit of forecasts. Like having the manuscript to motivate to read new papers and organize thoughts more than just discussing a topic.

j. Working on the uncertainty component of the manuscript - is uncertainty the key part of forecasting or required? Can work to explain the different sources and show how to do it and visualize.

k. Something else that came up on June 7 call - toy models have come up as the group has been meeting - this is something the group could come back to think about how to analyze messy real data

    i. Elyssa had given a reminder of the toy model she had created for the manuscript so could be good to go back to.