May 24, 2021 Theory Working Group Call

Attendees: Amanda Gallinat, Mike Dietze, Jaime Ashander, Elyssa Collins, Dan McGlinn, Ann Raiho, Abby Lewis, Daijiang Li, John Foster, Christy Rollinson, Peter Adler, Jody Peters

Agenda:

1. Poll to find times to meet in June-August. Make sure your timezone is selected. Jody will schedule the calls later this week, so take time today or tomorrow to fill out the poll.
    a. If you are interested in participating in the Forecasting Standards call, make sure to fill out that poll too.

2. Authorship Guidelines Update
    a. Updates from last month - split doc into two docs. Pg 1: One specific to the Theory group manuscript and Pg 2-4: one that is more general that the EFI Steering Committee can look at and decide whether to use for a broader EFI authorship guideline
    b. If anyone has suggestions/edits to the guidelines, put it in Slack and we can discuss updates.

3. Draft Outline of Theory group manuscript
    a. Next steps
    b. 3 parts that will be included
        i. Forecasting as hypothesis testing
        ii. Synthesis questions
            1. How does predictability relate to spatio-temporal variability?
                a. Lots of people
            2. When does an understanding of one process will transfer to another context?
        iii. Will include lit for the 2 Synthesis topics outside forecasting, lit within forecasting, and tentative hypotheses of what we expect to see
    c. Ideas for how to work through this talk as a group and then have breakout rooms
    d. Group discussion
        i. Response to how this manuscript is different Houlahan
            1. Our draft is distinct. They bring up transferability but they don't bring up expectations which our group has been focusing on for the past 2 years.
            2. Don't talk as much about spatio-temporal scale, which we are
            3. Houlahan isn't talking about forecasting specifically. Talking about unknown states which could be modeling with observed drivers. So we can talk about how forecasting is different from other modeling approaches
            4. Recent Ecology paper that Peter is on - practical guide to selecting models for exploration, inference, and prediction in ecology. There are different motivations. Dan thinks our Theory

group's motivation is connecting this into a cycle. Who is our audience?

   a. We are writing for people who don't think about modeling or forecasting. People who are not currently using forecasting, but who would find value in using forecasts to address ecological questions
   b. Want to draw direct links between the elements of a forecast and ecological theory as well as ecological practice. Where would people find the topics we are discussion in their own systems.
   c. Pitch mostly to people who are not currently forecasting.
   d. Make sure there is a conceptual framework for forecasts so that people who are using forecasts think about the ecological theory
   e. Pitched toward the person who thinks understanding/prediction as separate things. This person would think that prediction as a applied ecology rather than answering deep theoretical questions in ecology
   f. Make the pitch that prediction and theory are not separate things in ecology
   g. Christy, Sydne and Carl are putting together a special issue for Methods in Ecology and Evolution focused on forecasting. This seems like a paper that would fit well there and the editor was on board with the 1 sentence gist. Ecological forecasting as a method to approach ecology. If we go with this special issue, it will also give the group a deadline to work towards.
   h. Use forecast to test theory is not novel, but coming up with specific hypotheses for the 2 synthesis questions would be where the contribution would be made by this manuscript

5. Jaime, Christy, and Amanda will be working on the conceptual figure over the next month
6. Forecasting as hypothesis testing Section
   a. Mike added notes to this section
   b. Explain why forecasting can do things that general hypothesis testing does not always do
      i. Distinction between in sample and out of sample validation (out of sample is considered a strong test of a hypothesis)
      ii. Ability to make specific predictions from a theory is stronger test
      iii. Mike brought up the 5 points from the Currie's 2019 paper on Newtonian model of ecological investigation

iv. Important synergy between adaptive monitoring and forecasting. New data is most useful to forecasts when not all the models predict the same thing. So if we have ensemble of models that all predict the same thing, then new data isn't helpful. But if there are places where models diverge, then new data help. To make that we have to make the forecasts.

v. This group spent a lot of time on vocab early on. Does forecasting have to be temporal where you have to predict something in the future or can we have forecasts in space? Think what Mike has said can be applied to spatial analyses too. The student's group talked about forecasting in situations not in time and had some difficulty with that.

vi. At some point in the discussion want to say that this whole argument can apply to all kinds of predictions. But clarify that when we are talking about forecasts we are talking about going forward in time.

vii. Also space doesn't have to be physical, it can be phylogenetic or functional. It needs to be specific to be a forecast rather than a prognostication. Make it quantitative and specific with an uncertainty with it.

viii. The reason to focus on forecast rather than other predictions is because forecast are difficult. It is easier to collect data in space. But forecasting in to the future in time is harder.

ix. Over space you can interpolate so can lose boundary condition when going forward in time. This could be something specific about forecasting to add to this list. Also hard to come up with a space that we have no information about already.

x. For simplicity can focus on temporal forecasting because it is enough to chew on and it sets up fundamental questions. So may not need to wade into the murky space/time realm

xi. Say we are focusing on temporal forecasting, but be able to point out where things can be applied to space and phylogeny etc. This will helpful to draw in a broader crowd.

xii. Examples - emergent diseases. New hosts, new organisms

7. Question for this section
    a. How does uncertainty in driver forecast influence the statements made?
        i. When testing a hypothesis (e.g., how temp vs precip affect salamander populations) - a temp-based forecast may be better than precip-based forecast because the temp forecast is better than the precip forecast
        ii. Does this get covered in the transferability section?
            1. We should. We've talked about driver uncertainties a lot
            2. Don't think there is currently text on that included
            3. Diurnal cycles - any time the environment has a clean repeating cycle, it makes things easier because there is less driver uncertainty. So it is about finding the scales where you know something
            4. Temp forecasts are good in long-term (decadal scales we know it will get hotter everywhere, but next year, who knows). But we do know that temp is easier to predict in short term than long term.
            5. If we find a strong link in a forecast it is a caveat, we might have a lower error in that variable. Distinguish between different kinds of successes and how to distinguish between each other.
            6. Issue of driver error and driver uncertainty, may make forecasting less usable than using observed modeling. May be an issue that comes up in review
            7. Compounding error when talking about driver uncertainty. An example where it can be helpful in forecasting is where the error goes when you make the forecast. This temporal example is good - if you get long term trend you get the biome right
            8. Where does the uncertainty go. With precip vs temp, some processes will be more influenced by temp vs precip. You won't see everything move in sync. With forecasting communities we might see the same thing. When trying to forecast more than one

variable can help diagnose processes and pathways.

9. Ultimate question - what aspects of nature is predictable? What scales, what level of organization? Where do we find predictability? This can be a new question. It will still advance understanding.
10. Synthesis question - forecasts as hypothesis testing

b. What if we relabel sections? For the forecasts as the hypothesis section could turn it into: Here is how forecasting can be used to test traditional theory (and perhaps highlight hindcasting to get past driver uncertainty). Then in the next section, here are new ideas and new questions that are inspired by forecasting or can be answered by forecasting.
c. For each section, do we want examples of the fundamental questions we think will be highly doable in the next decade that forecasting can advance?
    i. For the Transferability section, Abby pulled out a couple questions from the 100 questions paper. Also think the 2 questions are along these lines.
    ii. Include a section on fundamental questions - Daijiang/others can add questions as they think of it

8. Elyssa interested in helping on the Synthesis goals Ecology question 1
9. Back to who the audience is and how broad to pitch. May want to have a glossary of terms in the paper. If we are pitching to non-forecasters this would be useful. Keep talking about which terms we would need to define some place and keep working with the Education group that is thinking about the vocab terminology as well.

e. Steps moving forward

i. Could have a submeeting at the half month point in the separate Q1 or Q2 groups.
ii. If we go with the MEE special issue, then need to keep that deadline in mind. Christy, Sydne, Carl working with MEE to figure out what a good deadline is. Right now are working with potential authors to submit abstracts by the end of the summer. First months of 2022 is tentatively planned for submission deadline
iii. Abby/Amanda to talk through a timeline

4. Jody is leaving this point in for reference. We don't need to discuss this point on the call if there are no updates. Forecasting Vocab Terms
    a. Abby is working to compile the terms for a box for Anna Sjodin and Gretchen Stokes manuscript. Vocab Box
    b. From Nov call, the goals was to compare these terms with how they are used in the Forecast Standards to make sure they are consistent