

October 19, 2021 Theory Working Group Call

Attendees: Glenda Wardle, Abby Lewis, Andrew Allyn, Mike Dietze, Jono Tonkin, Christy Rollinson, Jody Peters, Steph Brodie, Amanda Gallinat, John Foster, Christa Torrens
 Regrets: Cole Brookson, Elyssa Collins

Agenda:

1. Discuss Abby's new Manuscript Text. Black text is new text ready for review/edits. Gray text is draft outline leftover from previous versions that may not match with the current framing. Focus on the Abstract and the new (black) text on pages 8-11 for this call.
 - a. Thoughts on this framing?
 - i. Want to have specific wording in place. First draft is trying to separate predictability and transferability into 2 sections that are theory focused. First section - how forecasts contribute to existing ecological questions. Second section - how forecasts create question people wouldn't be able to ask without having a forecasting approach - focuses on predictability
 1. Generality across ecosystems
 2. Forecasting as hypothesis testing. Creating a model and testing it with new data. Trying to understand the relationship between variables. This is similar to questions that have already been asked in ecology, but takes a new iterative approach
 - ii. Forecasting is exciting - it combines research across ecosystems and scales
 - iii. Theory doesn't need to be separate from management
 - b. Thoughts on the hypotheses currently suggested in the text?
2. Discuss: What is the difference between using forecasting to "advance ecological theory" vs. "advance ecology," which do we aim to do, and does the MS currently serve that purpose?
3. Notes from the Discussion During the Call
 - a. Suggestion from Jono: Have a section separate from the intro that explains the jump from theory to application. Here is why forecasting is suitable for developing new theory or testing theory. Need to have as many examples that we can
 - b. Offering others to see the thinking we have done and invite them into the conversation.
 - c. From Glenda: By forecasting we are putting each hypothesis to a quick test and then letting it go with new observations. Getting into the habitat of letting go of hypotheses. It is a weak test in that we weren't that committed to it in the first place. Want to see where that leads.
 - i. Gives the opportunity to easily and rapidly test lots of different hypotheses. You can do it quickly with data gathered in multiple ways. And it gives the opportunity to test hypotheses that you are wedded strongly to.

- ii. Uncertainty can also help with this. Partitioning uncertainty can help tell you what/where it is best to test next (e.g., if you have a lot of driver uncertainty then perhaps you can do tests in new locations)
- iii. Weak test - tests in local situations. Strong test - test more generally across systems. Tick example, local vs broad scale forecasts
 1. Strong vs weak testing. Think that even weak tests are stronger than what regular inference gives you
 2. There is something to say about the iterative nature and how even a number of weak tests will give you more information than what you get with single experiments
 3. Combination of the test, observed, and where you sharpened and retested. If you didn't look at where you reduced the uncertainty it wouldn't be as overall useful.
 4. Forecasting creates shifts in thinking.
 5. It gives us a place to be integrative in our thinking about ecology. Would you see these same things in a journal together.
 - a. From Mike: On this point of discussion, there are some in-the-weeds stats issues on how iterative model selection works that we may or may not want to get into
 - i. This may be beyond the scope of the paper. But perhaps could have a supplement.
 - ii. Or there we do have the table of pros and cons of forecasting that is starting to get at nitty gritty stats that could get tied in
 6. Not sure about the "weak"/"strong" terminology. But think the concept is what we are going for
- d. Rebalancing between applied and theoretical is a rich part of what is in the text. Synthesizing across areas which is a role of theory - to see the commonality.
- 4. Discussion about Wording for the first section after the Introduction
 - a. "Forecasting centers prediction" text - how on board are people with this text?
 - i. What does "center" mean?
 1. Forecasting is not just a method, but a way of doing science. The goal is doing prediction. Because your goal is prediction you are doing iterative testing. Because your goal is prediction you think about how the pattern differs between space and scale. It is the mindset and practice of forecasting. Forecasting puts prediction front and center.
 2. The focus on "centering prediction" definitely helps this build upon a long history of making ecology more quantitative and quantitative hypothesis testing
 - ii. What about "function"
 1. Think about the type of function that ecosystems do
 2. Could do something more general like: "advance the understanding of ecology"

3. From Christy: I feel like the key is forecasting centers prediction of “what’s next” or what’s yet to come
- iii. Could also say modeling centers prediction or statistics center prediction. Is there a way to have a small tweak to really highlight why forecasting centers prediction?
1. Translate second half of sentence to generalizing - synthesizing or unifying theory.
 2. “centers” is trying to be efficient, but perhaps need more - what is between forecasting and prediction as a concept?
 3. Can we substitute words
 4. “Forecasting advances understanding because....”
 - a. It is the how it is doing it that we want the reader to know.
 - b. “Because it predicts AND evaluates in a rapid, iterative cycle”? (Terrible wording, but maybe that’s the idea?)
 - c. “Because prediction is the engine of forecasting it offers an opportunity to generalise across locations, variables and scales, and thus advance...”
 5. Prediction is still the key - if we set up field experiments or lab experiments it is less about prediction and is more about understanding relationships. Forecasting goes beyond what we observe
 6. “Forecasting emphasizes prediction to rapidly advance understanding of ecological processes ...”
 7. It is not just the prediction itself. It is the predictions and the iterative learning. It is constantly assessing are we right. Constant evaluation is what sets forecasting apart from modeling. Ground truthing on steroids.
 8. From Steph: But not all forecasts are iterative
 - a. If this is only about iterative forecasts, then should specify that. But if it's about forecasts generally, then don't go down this track.
 - b. From Christy: Thinking about what Steph said: is the thread then predicting what WILL be observed?
 9. Find a word that contrasts with traditional statistical inference where the model is the end game.
 10. Forecasting emphasizes prediction is in contrast to many modeling and other ways of doing ecology
 11. Prediction is the goal of forecasting - will be a more direct way compared to “Forecasting centers ...”
 12. Forecasting centering prediction. Forecasting gains its strength because prediction is doing all the work and because it is so wrapped up in prediction it is getting attention where we want it. With prediction comes transferability, generality, etc

13. Everything we want to say about forecasting we are saying about prediction. Remember forecasting is mostly prediction. Everything good about prediction translates to forecasting. Now that we have a prediction focus what can we do about it. Get back the power of getting prediction as the goal. Not a goal we invented, but one that we want to be reminded of.
 14. "Forecasting uses predictive models as the vehicle for testing competing ideas"
 15. A lot of emphasis about research and science is about solving a problem and we were too busy doing other things [Jody didn't catch the specifics of the other things Glenda brought up]. False dichotomy. Applied and theoretical are not separate things and forecasting brings them together
 16. Want one concrete header for this first section after the Introduction. Abby is planning to work on drafting this section over the next month.
- iv. Make it 2 parts for the first section header
1. Spell out what the relationship is. One word is that we can't convey enough. "Centers" is as good as any other
 2. This section focuses on prediction and the importance of centering prediction
 3. Potential for 3 sub-sections in this section
 - a. From Amanda: Sub-sections can go into how the goal of prediction allows us to: 1) link applied and theoretical, 2) focus on what's next/what will be observed, and 3) generalize/synthesize across locations/variables/scales/sub-fields
 4. Maybe not have iterative hypothesis tests since that might limit who feels included in forecasting. But could see it going into one of these sections.
 - a. Forecasting allows for this iterative testing that other methods do not allow
 5. "Forecasting centers prediction, challenging our ecological understanding beyond the limits of statistical inference."
 6. From Steph: in the interests of helping Abby define a subtitle today, I think I like 'harnesses' as the best way forward. +1 from Glenda for keeping harnesses
- b. Section on New horizons - understanding the limits of predictability
- i. Hypotheses on initial conditions uncertainty (see hypotheses on pg 9 and 10)
 - ii. New horizons and paradigm shifts - this came up on a previous call and somebody had a concise term, but Abby can't remember who made the comment or what the term was. If anyone remembers that, let Abby know.

- iii. Want to make sure the “New horizons” section is closely linked to examples.
 - 1. How do we make this language appealing to people in your subfield. Want examples of what systems can be forecast and examples of initial conditions. Connect to synthesizing across subfields. Initial conditions exist in all fields and what we mean by synthesizing across subfields is this...
 - 2. **Homework task - find examples of where theory has improved our understanding of an ecological system by using forecasts.**
 - a. Find 2 papers that use forecasts to advance ecological theory. Or find applied products of a forecast that was developed for an applied problem but that also gave better understanding of the ecological system.
 - b. Abby will share a new Google doc and everyone can add title of paper and add a couple of bullet points
 - i. Make it a table
- iv. On Theory in Ecology
- v. Pablo A. Marquet, Andrew P. Allen, James H. Brown, Jennifer A. Dunne, Brian J. Enquist, James F. Gilgooly, Patricia A. Gowaty, Jessica L. Green, John Harte, Steve P. Hubbell ... Show more
- vi. BioScience, Volume 64, Issue 8, August 2014, Pages 701–710, <https://doi.org/10.1093/biosci/biu098>
 - 1. This Theory and Ecology paper has the statement “we argue that efficient theory in ecology is simple, parsimonious, derived from first principles, quantitative, and mathematical, with few inputs and many predictions.” Glenda is mining the paper to see if it applies to this and the idea of inefficient theory. But did think the idea of efficient theory resonates with forecasting.
 - 2. Should be aware of papers like this
- vii. **Want feedback on second section over the next month. Abby will work on the first section.**