

## May 26, 2020 Theory Working Group Call

Attendees: Christy Rollinson, John Foster, Abby Lewis, Kathryn Wheeler, Laura Super, Amanda Gallinat, Jaime Ashander, Winslow Hansen, Jody Peters, Peter Adler, Jason McLachlan, Glenda Wardle, Hassan Moustahfid

Agenda:

1. RCN Update and Introduction of New People
  - a. Peter's video summarizing the Theory group for the RCN:  
[https://youtu.be/9GFI0UjEa\\_g](https://youtu.be/9GFI0UjEa_g)
  - b. Introductions:
    - i. Mike - EFI director, Boston University
    - ii. Peter - Plant population and community ecologist. Started some true forecasting projects. Peter did the summary for the group, but he is not the leader of the working group. Want to move these working group discussions towards a manuscript, but we need someone in the group to lead the paper. This role could be very well suited for someone who is ea
    - iii. Abby - PhD student at Virginia Tech. Doing some forecasting projects for dissertation.
    - iv. Kathryn - PhD student at BU studying vegetation phenology
    - v. John - PhD student at BU forecasting ticks and small mammals
    - vi. Winslow - postdoc at Columbia, soon to start at Cary Institute
    - vii. Amanda - postdoc at Utah State work on a project using NEON data to integrate species occurrence and co-occurrence models. Use phylogeny to support forecasting
    - viii. Christy - research scientist at Morton. Applied research on forest conservation, citizen science phenology, etc. Forecast phenology of collection and engage visitors who want to know when things are going to bloom
    - ix. Glenda - from Sydney Australia. Ecologist and evolutionary biologist. Arid research group collecting data on plants and animals for 30 years and have weather stations. Looking at how interactions respond to drivers of system which are unpredictable rainfall, big fires, and invasive species
    - x. Hassan - oceanographer interested in fisheries operational forecasting. Work for NOAA
    - xi. Jaime - postdoc at Resources for the Future (RFF)
    - xii. Laura - PhD student at U of British Columbia. Plant-microbe interactions and climate interactions. Also interested in sustainability (part of the Sustainability DG group)
    - xiii. Jason - ND. Paleoecologist interested in interaction between short term and long term forecasts. Lead the Education component of EFI
  - c. RCN update
    - i. RCN will launch short term working group to finalize the focal topics for the forecasting challenges

1. Land fluxes
  2. Aquatic (Freshwater, Coastal and Marine)
  3. Population/Community
  4. Ticks
  5. Phenology
- ii. Still need to work out a lot of the details
  - iii. Look for emails to come for scoping out these working groups and scheduling of calls
  - iv. If there are inputs we want to have on how the forecasting challenges are run to ensure we have the outputs we need to run synthetic analyses.
  - v. This group has given much input on the Standards originally to make sure we get what we need
  - vi. Rather than laying out a long list of uncertainty we want people to analyze, we want people to report their uncertainties for those analyses
  - vii. How do we make sure that the inputs to the forecasts are standardized enough that analyses could be done that we want to do
  - viii. Does the Forecasting challenge allow us to make a prediction about the forecasts at different scales?
    1. This could give us something concrete to work with now before the forecasts happen
    2. If we take the hypotheses and figure out what to predict and then use that to make sure we are collecting the information we need
    3. Metaforecast for the forecasting challenge. From the theory group we would say - here is what we expect from the forecasting challenge
    4. Do we pull these into the forecasting hypotheses paper as examples from the forecasting challenge? Or do we make it stand alone
    5. Peter - have a fair amount of work to do to get the metaforecast put in place
    6. We have a lot of expectations in the group. We have learned that before we can talk to each other, we have to be specific about spatial and temporal scales before we get to the specific tasks
    7. Like this goal, not sure it will change what we will do next
  - ix. Do we have a list of case studies that we can use?
    1. We will have the forecasting challenge forecasts.
    2. We also have the forecasting examples on the EFI website
    3. Looking at the common Framework Slide - Slide 8 predicts that all 5 forecasting challenge forecasts should be dominated by initial conditions. Mike isn't sure that will be the case
    4. Make a list of available case studies and put them on Slide 8 or Slide 9
      - a. Pick 2 or 3 Common Framework slides and put case studies on them.

- b. Looking at Slide 9 - what are people's a priori expectation for what the forecast horizon is for the forecasting challenge forecasts
- x. 30 second recap of the paper idea
  - 1. Work towards a concrete product. If we can generate interesting predictions about what is predictable/forecastable. We are still in the process of figuring out how to compare forecasts
- xi. Want to hear new people's reactions to what the group has put together in the Common Framework slides. Are there hypotheses that are not showing up? Things you agree/disagree with
- xii. Abby - reading through as many forecasting papers as possible and will be making a matrix with the goal to have the matrix finished by the end of summer. Could be useful for this group. Abby is leading this effort with others from Virginia Tech.
  - 1. Define forecast as short term - predicting 10-years. Models predict future conditions. Has to be ecological
  - 2. Could be interesting to compare notes with Nick Record - Slide 10
- xiii. Collective resources in ecology examples
  - 1. Population community - COMPADRE and COMADRE database
  - 2. Trait data efforts
- xiv. If the group can come up with hypotheses over the summer, then we can apply it to the database that Abby is pulling together
- xv. Glenda: Another question to consider - has there been any thinking about what we learn from a forecast?
  - 1. System dynamics
  - 2. Where is the sweet spot where you get more out of it from a forecast rather than understanding it mechanistically
  - 3. Time lags from when a driver hits a new state. Glenda has some results from their long term data. If they have flooding rain they will get rodent eruptions in their populations. But they do not know when the rain will come. Have very little seasonality. Either have little or lots of rain. They know the prediction, but don't have a timescale for when it will occur
  - 4. What can we learn from forecasting? Will be wrong most of the time because they don't have a good handle on the drivers. Latency of the drivers
  - 5. Christy: How do we match up the process and different scales - a key thing that can help to evaluate models is to think of the driver time step, the model timestep, and update time step. Use this to evaluate how scale fits in and compare models at different scales
  - 6. Peter: Glenda's system offers a nice comparison to other systems. Slide 9 - uncertainty due to exogenous drivers. Maybe the forecast doesn't help Glenda's system but helps others at a general level. But could help because you know for sure that a chaotic process

driving weather will set the pace of rain events. If it is chaotic and the intervals between rain is unpredictable, then you know that for management. Then you can handle the uncertainty for meteorology by collecting as much data as possible about the meteorology to improve the forecast.

7. Another aspect of system - native marsupials do not respond to rain events. They use the within system heterogeneity to help. But would be nice to have exogenous drivers and internal drivers

## 2. Next Steps/homework -

### a. Need list of forecasts.

- i. RCN Forecast Challenge. Know 4 out of 5 of them enough to make informed hypotheses. Population/Community is not well defined enough yet. But for the other ones:
  1. Leaf phenology
  2. Carbon and water fluxes (eddy flux) between land and atmosphere
  3. Aquatic - chlorophyll a, Fish
  4. Ticks - abundance. Timing of the peak or abundance through time as observations come in
- ii. Forecast horizon - what is the inherent predictability of each system?
  1. Null models are about 1.5 hours

### b. Work with Jody to define homework for the group

- i. What are the forecasts topics
- ii. What are the slides we are going to put them on,
- iii. What is the null model
  1. "Pure persistence" Next time step is same as current time step
  2. Historical means forecast - with fluxes any particular time of day what have we seen in the past. Lower density data use moving window
  3. 1 day lag persistence model

### c. New people look through the previous materials

- d. If there are case studies that are similar to what will be used for the RCN forecasting challenge we can add those to the list

## 3. Next call -

### a. Talk about vocabulary - Peter/Mike to go over offline to finalize list to talk about.

- i. What is forecast horizon
- ii. Forecast timescale
- iii. Make sure that we define terms the same way that is used in other literature
  1. Forecasts are a set of dynamical systems. Don't want to reinvent that, just find out what is distinctive forecasts
  2. Hierarchy theory from 80s-90s. Think about how forecasting operationalizes those concepts
- iv. Post short list of vocab on Slack ahead of the next call

- v. CI group putting together output/metadata - could be good to synergize with them since people who will be submitting forecasts will be using the metadata document and will be using that vocab
  - b. Mike to walk through STC figure
  - c. Use another call getting the whole group caught up
  - d. Ask Education
  - e. Have Anna join the next call to talk about Forecasting/Prediction
    - i. Jody to send everyone link to Anna/Gretchen's forecast terminology survey
  - f. How to measure things relative to the Slides
  - g. Jody will send out Peter's slides from the RCN workshop to the group
  - h. Bring folks up to speed about the role of uncertainties and distinguish the difference between uncertainty and transferability (what is my ability to take a forecast and move it to another system)
  - i.
- 4. Manuscript updates and plans to move forward.
  - a. Here are the documents we have been working on
    - i. Brainstorm of the top 3 things people want to communicate about the forecasting hypotheses we have been discussing in a manuscript [link removed]
    - ii. Look at the Common Framework Slides [link removed]
    - iii. For reference, the hypotheses are here [link removed]