July 12, 2019 Education & DEI Working Group Call

Agenda

• Introductions / record attendance
• What are the short term goals for this working group -- what could be accomplished (or balls that could get rolling) this year and how do we get there?
• What are the longer term goals we are working toward
• Are there goals where a small amount of seed funding from EFI (<$5K) would help move us forward
• Leave with a plan for a next call (either exact date or data range to poll) and hopefully some discrete, assigned next steps.
• Links to EFI2019 Conference Notes
    First Breakout Notes [LINK REMOVED]
    Second Breakout Notes [LINK REMOVED]

Notes From the July 12 Call
Introductions/Attendance

Mike Dietze - goal is to develop both short and long-term goals for working group; determine the timing and structure of future meetings; is there something tangible that we could achieve if given a small amount (~5k) of seed funding; RCN has been funded == hooray!

John Zobitz - mathematics in Augsburg U. in Minneapolis, Minnesota; teach algebra to modeling/diff eq; would like to see this group develop coursework and curriculum/materials accessible to undergrads from a variety of backgrounds

Diana Dalbotten - U of Minn; work with diversity and community-based research; work with native communities and an REU program; how to make data science more diverse and avoid widening the gap

Cayelan Carey - freshwater ecosystem scientist, Virginia Tech; developed project EDDIE and Macrosystems EDDIE; introduce undergrads to real-life messy sensor data; just got grant to develop forecasting concepts modules for undergrads; would like help in development and volunteers to help demo and test modules in the classroom

Mary Lofton - grad student at Virginia Tech; comes from a HS teaching background before grad school. How could you set the seeds on forecasting earlier than undergrad

Gretchen Stokes - PhD student at UF and did Masters at VT; education working group brought realization that there is no formal training in ecological forecasting; how do we craft meaningful courses at different levels; interested in trying out what we develop at UF

Anna Sjodin - PhD student at UConn; post-doc in October at U. Idaho. US-AID PREDICT project on viral spillover from animals to humans. Ultimate goal not possible now, but look into

what's going on in the forecasting world. Interested in education because know lacking skills in what could have been done differently. Start earlier so not so steep later. Also interested in pre-undergrad and diversity/inclusion.

Discussion

- Note that this is a joint call between Education and Diversity/Inclusion
- Think about how do we leverage education efforts to increase diversity?
- Is there an education level to prioritize?
    - E.g., are there materials developed for undergrads?
    - Undergrads seem to be an under-served niche; there are materials developed for grad students, but not undergrad
    - Current grad courses have been very open with course material
    - Grad students not in the field of ecological forecasting also a potentially under-served population
        - Even if you never make a forecast, how do you publish data in a way that supports forecasting (reporting uncertainties, etc.)
- There are a lot of skills that you need to forecast - everything from data wrangling to model-building, validation, etc.
- Biology not really taught from a predictive perspective; could we shift that by making relatively small changes to activities that are already commonly taught?
    - E.g. tweaks to an R shiny population model app.
- From May meeting: Key components of ecological forecasting
    - Visualization
    - Uncertainty quantification & propagation
    - Data ingest
    - Data cleaning
    - Data management (including databases)
    - User interfaces for the end user (best practices)
    - Reproducibility
    - Modeling & Statistics
    - Workflows/PipelinesAutomation?
- John: looking at that list you could build some small modules that tackle each of these but may have a forecasting perspective on it. Could be a non-invasive ways to insert these skills into existing curriculum.
- Modules sketched out in Cayelan's project

- Next steps list from MAY meeting:
    - Define key components/modules of ecological forecasting
    - Define the key vocabulary for usage within EFI efforts [SHORT TERM]
        - Create an EFI (wiki / living document) to support collaborative development of definitions [SHORT TERM]
    - Edit Ecological Forecasting Wikipedia page [SHORT TERM] → maybe RCN?

    - Define knowledge/learning objectives needed at different levels of education [MEDIUM TERM]
        - K-12
        - College (intro bio)
        - College - possible future practitioners (e.g., Wildlife students) to participate in ecological forecasting efforts
        - Participant in an REU doing forecasting
        - Forecast user (5-10 key ideas end users need to understand)
            - Potential synergy with DECISION
        - Kinds of things we want taught
    - Identify & curate key resources for learning necessary quantitative, computational, conceptual and collaboration skills
    - Identify the components of an achievable 10 week REU forecasting project (and identify necessary skills)
    - Write blog posts on basic concepts [SHORT TERM]
        - HPC/Cloud/Scaling
    - Consider developing workshops for key skills (e.g., HPC Carpentry)
        - GLEON will have forecasting workshop in Nov (Zwart)
    - Develop a document on what is ecological forecasting and its history
- Are there pedagogical techniques that are more useful for teaching forecasting techniques
    - Collaborative activities bring in more students and greater diversity
- Potentially creating tools (e.g. Shiny apps) which may be less intimidating that having to learn to code
- Where to put things: start within this community and then see it's way out, or produce with a public interface to begin with?
- Diana: project and place based learning works really well, especially for underserved students. E.g. CUHASI access of place-based data. Tools to visualize and play with the data. Lot of trends and interesting things.
- Potential for even grade school level projects (data visualization)
- Mike: gave talk at Mass. Environmental Education society - teachers and environmental educators in other settings; really were excited about the potential synergies between ecological forecasting and community science; community science data has a lot of potential b/c of low latency and broad use
- Diana: when communities gather data, they rarely get to take the next step about why they gathered and what it meant; good pitfall to avoid!
- Local -- should EFI project listing be map based??
- Could put together a survey to existing EF about lessons learned and effective strategies? What's been useful (or not) so far that could be useful to new instructors
- How to make forecasts diversity oriented -- forecasting doesn't always require the same amount of field work; can be intimidating; could be way for those not comfortable with the field to get exposed
- Is EFI an international or US based community? How does that affect how we develop EDU

    - Vocabulary
    - Cultural assumptions
    - Technological
- Native speaker should do translations -- ASLO has grants to do that
- Another piece: maybe writing a how-to piece on how to develop new modules for a different context (e.g. different, local data)

Scheduling:

Diane busy Aug 12-16
Also is ESA
Anna not available week of 19th-23rd
Classes start at VT week of 26th
Week of Sept 9th better

- Top tasks:
    - Key vocabulary words: at least ID terms, if not define them
        - Google Doc
    - Feedback from other instructors about what works and doesn't work
        - Cayelan might lead, existing IRB
    - John and Diana could chat face-to-face
        - Anna in MN in Aug 23-Sept
    - Mary: focused on GLEON workshop
        - Half to full day workshop
    - Wikipedia hackathon
    - Blog ideas
        - Pull:
        - Push: how to teach EF at the undergrad level (John)
        - Google Doc...

Proposed Macrosystems EDDIE undergrad modules that will be created for the new forecasting education project

Macrosystems EDDIE module	**Macrosystems concept and forecasting skill learning objectives**	**Examples of scaffolded module activities in activities A, B, and C**

Module 1: Introduction to Ecological Forecasts	*Macrosystem Concept*: Cross-scale interactions (students examine the effects of local land use and regional climate change) *Forecasting Skills*: Ecosystem modeling; Model parameterization; Using models for hypothesis testing and inference	*A)* Students are first introduced to a simple ecosystem box model calibrated for their focal aquatic or terrestrial site in the Shiny app and explore how forecasts of their site's productivity change as they adjust nutrient and temperature parameters in the model. Second, they examine how different parameter values alter productivity responses to pre-packaged land use and climate change scenarios. *B)* Students are introduced to the ecosystem models in RStudio and modify pre-developed code to manipulate parameter values and generate forecasts. *C)* Finally, students compare productivity forecasts from different ecosystems, sites, and parameter sets under varying cross-scale scenarios.
Module 2: Forecast Uncertainty	*Macrosystems Concept*: Cross-scale predictability (students study how and why the predictability and uncertainty of ecosystem processes vary across sites) *Forecasting Skills*: Understanding the sources of forecast uncertainty; Basic probability	*A)* Students are introduced to the concept of uncertainty in forecasts and compare total uncertainty in pre-developed productivity forecasts across sites in the Shiny app. *B)* Students then examine the relative importance of the different components that contribute to total uncertainty (e.g., parameter uncertainty) in forecasts for their focal site in RStudio. *C)* Finally, students compare total uncertainty and the relative importance of different drivers of uncertainty in aquatic vs. terrestrial forecasts across sites to discuss how uncertainty and predictability vary across scales.
Module 3: Confronting Forecasts with Data	*Macrosystems Concept*: Novel ecosystems (students examine what happens when a model calibrated to historical data is forced with previously unobserved conditions) *Forecasting Skills:*Parameter optimization; Model-data assimilation; Using models for hypothesis testing	*A)* Student teams adjust parameters in the Shiny app to make their ecosystem model output match historical observations at their focal site and calculate metrics of model-data fit. *B)* Students then force their calibrated model with pre-developed climate and land use scenarios outside the range of historical driver data to forecast productivity responses in RStudio. *C)* Finally, student teams make hypotheses about which ecosystems and sites will exhibit the greatest productivity changes in response to extreme scenarios and compare forecasts among teams to see which sites are most likely to exhibit novel ecosystems.

Module 4: Forecasts for Decision Support	*Macrosystems Concept*: Scaling uncertainty (students explore how best to communicate forecasts with different levels of uncertainty) *Forecasting Skills*: Visualizing and communicating forecasts; Using models for decision support in the context of uncertainty	*A)* Students use an existing water quality forecasting system to make 16-day algal bloom forecasts in the Shiny app for a GLEON site that is a drinking water source. Students choose different time periods for making forecasts that vary in bloom intensity and likelihood and discuss how to disseminate their forecasts to managers. *B)* Students discuss how to interpret and communicate uncertainty and create mini-presentations to share their forecasts with managers. *C)* Finally, students access algal data from their forecast period in RStudio, and discuss how their communication of the forecast changes as observations become available.