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| **Table S1:** Review of selected ecological forecasts with partitioned uncertainty. IC = initial conditions | | | | | | |
| **Paper** | **Ecosystem or region** | **Focal forecasting variable** | **Forecast horizon** | **Type of model** | **Types of uncertainty quantified** | **Dominant source of uncertainty** |
| (Dietze 2017) | Forest | Net ecosystem exchange | Daily | 2-covariate Bayesian state-space | Driver, IC, process, parameter | Driver |
| (Diniz-Filho et al. 2009) | Western hemisphere | Bird population distribution | Multi- decadal | Species distribution model | Driver, process | Process |
| (Fox et al. 2018) | Arid woodland/ grassland | Carbon stock | Annual | Community land model | Driver, IC | IC |
| (Gauthier et al. 2016) | Arctic | Snow goose population | Multi- decadal | Time-varying matrix population model | Driver, parameter, process | Parameter |
| (Gertner et al. 1996) | Forest | Red pine growth | Multi- decadal | Pipe model (process-based) | IC, parameter | Parameter |
| (Jiang et al. 2018) | Peatland | Carbon stocks and fluxes | Decadal | Process-based | Driver, parameter | Driver |
| (Kim et al. 2014) | River | Chlorophyll | Spatial | Process-based | Driver (different sources) | Driver (river flow) |
| (Mbogga et al. 2010) | Forest | Aspen habitat | Multi- decadal | Bioclimate envelope model | Driver, process | Driver |
| (Ouellet-Proulx et al. 2017) | River | Water temperature and discharge | Daily | Process-based | Driver, IC | Driver |
| **Paper** | **Ecosystem or region** | **Focal forecasting variable** | **Forecast horizon** | **Type of model** | **Types of uncertainty quantified** | **Dominant source of uncertainty** |
| (Page et al. 2017) | Lake | Phytoplankton  community | Weekly | Complex numerical process-based | Process (different sources) | Process (representation of light, nutrients) |
| (Raiho et al. 2020) | Forest | Tree species biomass | Multi- decadal | Process-based forest gap model | Driver, IC, parameter, process | Process |
| (Thomas et al. 2018) | Forest | Productivity | Decadal | Complex numerical process-based | Driver, parameter, process | Process |
| (Thomas and Others!! 2020) | Lake | Water temperature | Daily | Complex numerical process-based | Driver, IC, parameter, process | Driver |
| (Wang et al. 2009) | Forest | Forest carbon | Spatial | Kriging algorithm | Driver (different sources) | Driver (satellite data) |
| (Watling et al. 2015) | Southeastern U.S. | Vertebrate species distribution | Multi-decadal | Species distribution model | Driver, IC, process | Process |

Dietze, M. C. 2017. Prediction in ecology: A first-principles framework: A. Ecological Applications 27:2048–2060.

Diniz-Filho, A. F., L. M. Bini, T. F. Rangel, R. D. Loyola, C. Hof, D. Nogue, and M. B. Arau. 2009. Partitioning and mapping uncertainties in ensembles of forecasts of species turnover under climate change. Ecography 32:897–906.

Fox, A. M., T. J. Hoar, J. L. Anderson, A. F. Arellano, W. K. Smith, M. E. Litvak, N. MacBean, D. S. Schimel, and D. J. P. Moore. 2018. Evaluation of a Data Assimilation System for Land Surface Models Using CLM4.5. Journal of Advances in Modeling Earth Systems 10:2471–2494.

Gauthier, G., G. Peron, J.-D. Lebreton, P. Grenier, and L. van Oudanhove. 2016. Partitioning prediction uncertainty in climate-dependent population models. Proceedings of the Royal Society B 283.

Gertner, G., P. Parysow, and B. Guan. 1996. Projection Variance Partitioning of a Conceptual Forest Growth Model with Orthogonal Polynomials. Forest Science 42:474–486.

Jiang, J., Y. Huang, S. Ma, M. Stacy, Z. Shi, D. M. Ricciuto, P. J. Hanson, and Y. Luo. 2018. Forecasting Responses of a Northern Peatland Carbon Cycle to Elevated CO2 and a Gradient of Experimental Warming. Journal of Geophysical Research: Biogeosciences 123:1057–1071.

Kim, K., M. Park, J. H. Min, I. Ryu, M. R. Kang, and L. J. Park. 2014. Simulation of algal bloom dynamics in a river with the ensemble Kalman filter. Journal of Hydrology 519:2810–2821.

Mbogga, M. S., X. Wang, and A. Hamann. 2010. Bioclimate envelope model predictions for natural resource management : dealing with uncertainty. Journal of Applied Ecology 47:731–740.

Ouellet-Proulx, S., O. Chimi Chiadjeu, M. A. Boucher, and A. St-Hilaire. 2017. Assimilation of water temperature and discharge data for ensemble water temperature forecasting. Journal of Hydrology 554:342–359.

Page, T., P. J. Smith, K. J. Beven, I. D. Jones, J. A. Elliott, S. C. Maberly, E. B. Mackay, M. De Ville, and H. Feuchtmayr. 2017. Constraining uncertainty and process-representation in an algal community lake model using high frequency in-lake observations. Ecological Modelling 357:1–13.

Raiho, A., M. Dietze, A. Dawson, C. Rollinson, J. Tipton, and J. McLachlan. 2020. Determinants of Predictability in Multi-decadal Forest Community and Carbon Dynamics. in prep for Global Change Biology.

Thomas, R. Q., A. L. Jersild, E. B. Brooks, V. A. Thomas, and R. H. Wynne. 2018. A mid-century ecological forecast with partitioned uncertainty predicts increases in loblolly pine forest productivity. Ecological Applications 28:1503–1519.

Thomas, R. Q., and Others!! 2020. FLARE paper placeholder. TBD in prep.

Wang, G., T. Oyana, M. Zhang, S. Adu-prah, S. Zeng, H. Lin, and J. Se. 2009. Forest Ecology and Management Mapping and spatial uncertainty analysis of forest vegetation carbon by combining national forest inventory data and satellite images. Forest Ecology and Management 258:1275–1283.

Watling, J. I., L. A. Brandt, D. N. Bucklin, I. Fujisaki, F. J. Mazzotti, S. S. Roma, and C. Speroterra. 2015. Performance metrics and variance partitioning reveal sources of uncertainty in species distribution models. Ecological Modelling 309–310:48–59.