**Materials and Methods:**

This review focuses on papers which model species occupancy state across multiple sites and seasons using real-world data. To qualify for inclusion, a paper must include a study which fits these criteria:

* Multiple sites which can exhibit multiple occupancy states
* Multiple time-steps between which occupancy state may change
* Must model transitions between states as a Markovian process (i.e., not fitting independent occupancy models for each time step.)
* Real-world data – not solely mathematical theory or simulated data

This review was conducted in two phases. In the first a preliminary review was conducted to clarify which papers should be included, solidify key focal areas for the review, and determine how to best objectively describe the papers reviewed. The results of this preliminary review were assessed, and protocols adjusted based on the findings. This was followed by the formal review phase in which additional papers were solicited to address deficits in the preliminary paper library and all papers were assessed. All results presented in this review are derived from the formal review phase.

*Preliminary review*

In the first phase, key terms were selected to capture papers applying the method of interest: models of species occupancy dynamics across multiple sites and time-steps which fit models to real data (i.e., not papers using only simulated data or mathematical descriptions of models). Following conversations with co-authors and other experts, four terms were selected to describe this broad model class: “dynamic occupancy model (DOM),” “occupancy dynamics model (ODM)”, “multi-season occupancy model (MSOM),” and “stochastic patch occupancy model (SPOM).”

Queries for each term were made on Google Scholar (see Appendix I for details). The first 100 records for each term were considered for inclusion. Papers which were clearly not in the field of ecology, not in English, or not available from Google or through standard University search engines were immediately discarded. 287 papers remained and were saved to a spreadsheet. These papers were stratified by the search query they fell under and time-period of their publication date (defined as 2000-2005, 2005-2010, 2010-2015, 2015-2021). Papers were assigned ranks with a random number generator. Those papers ranked within the lowest 5 or 25% of their query/time-period strata (whichever was larger) were included in the preliminary review. If after reading it a paper did not qualify for inclusion, it was excluded and replaced by the next lowest paper in its strata. Each paper was read by J.K., and its findings were described in a structured spreadsheet including categories for study data, objectives, taxa, location, data collection, detection, covariates, modelling, and outputs. 75 papers were ultimately included in the preliminary review.