Version 1

Local studies of habitat selection have identified that shorebird breeding densities are influenced by abiotic factors including elevation, geology, surface water, snow cover, temperature and precipitation, and biotic factors including vegetation community and presence of conspecifics (Gratto-Trevor 1996; Morrison 1997; Smith et al. 2007; Walpole et al. 2008; Saalfeld et al. 2013; Swift et al. Senner 2017; Lathrop et al. 2018; Cunningham et al. 2016). However, the process of habitat selection occurs at multiple spatial and temporal scales (McGarigal et al. 2016). I will examine the relative influence these factors on observed densities and richness of shorebird species across their Arctic breeding ranges, testing three hypotheses from recent literature about how the relative influence of abiotic and biotic factors depends on spatial scale. I will then use these relationships to develop detailed contemporary distribution maps for Arctic breeding shorebirds.

Hypothesis 1: Biotic interactions that influence species distribution are closely correlated with abiotic conditions across all spatial scales (Soberón and Nakamura 2009). I predict that I would observe abiotic predictors alone can sufficiently capture variation in shorebird nesting density and richness.

*Hypothesis 2:* The factors influencing species distribution are hierarchical. Biotic interactions are important at finer spatial scales, but their effects are averaged out at coarse spatial scales where abiotic factors are most important (Pearson and Dawson 2003; Soberón and Nakamura 2009). I predict that I would observe strong relationships between shorebird nesting density and vegetation or conspecifics at finer spatial scales, but not at coarser spatial scales.

*Hypothesis 3:* Biotic interactions and abiotic conditions can both potentially limit distribution at all spatial scales (Wisz et al. 2013). I predict that I would observe strong relationships between shorebird nest density and vegetation or conspecifics at coarse spatial scales for one or more shorebird species. However, I would not expect to detect this relationship in all species, as abiotic factors are recognized to be commonly important in defining species ranges, and are more likely to limit distribution and abundance at higher latitudes than at lower latitudes

Brainstorming

Idea 1: relative importance of abiotic and biotic variables

-Lenore keeps disagreeing with phrasing it that way. I have read other ways of describing – scenopoetic vs …?, the paper where they might have used different words but it was essentially density dependent or not

-most of the ways that people make inferences about this logically flawed. How could you do it better?

Idea 2: trying to identify what the most important predictors are for predicting climate change

-inspiration from how weather prediction works

Both of them relate to how species distribution model can be better used for making future predictions (I think)?

Ides 3: Are there time lags in associations between distribution and certain variables?

-relationship with generation time?

I’m really intrigued by willow’s description of shorebird species moving into different areas that she’s worked.