**Spatiotemporal Models for Ecologists**

**Structural equation models**

Goal: Explore how structural equation models can generalize linear models.

**Data generating process**

Envision a simple linear model:

Simulate 100 samples from this model, while (for the purposes of this demonstration) also simulating , , , and . Fit this model using the `lm` function in R, and record the estimated parameters and fitted log-likelihood.

Next, load the `sem` package and refit the same model using that syntax, with response . Compare the estimated slope with the prior linear model.

Finally, recall that a structural equation model can be implemented by defining the exogenous variance, which in this case is:

Where in this case , and defining the path matrix , and calculating the joint covariance **:**

And then defining a Wishart distribution for the sample covariance:

Where is the sample covariance and is the number of samples, or a multivariate normal distribution for each sample :

Where is the vector of mean parameters (which is not needed when using the Wishart distribution, given that the sample variance is calculated after centering variables).

Try implementing the Wishart SEM model yourself in R (using `CholWishart::dWishart( S, n, Sigma)` to evaluate the Wishart PDF), and then the multivariate-normal SEM model in TMB, and compare the results with the prior linear model and SEM implementation using package sem.