

# Inferring Characteristics of Interaction Matrices in an Ecological Context

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July 31, 2018

## Abstract

In this paper,

## 1 Background

What is random matrix theory?

Random Matrix Theory is a combination of statistics and traditional matrix theory. In this field, many tools from statistics are used to describe matrices with random elements instead of relying on those individual elements. It allows us to generalize about certain characteristics of matrices with similar statistical properties. Many problems in physical systems modeling and biological systems modeling involve matrices with random entries.

Random Matrix Theory in Ecology

-what is it useful for?

Traditionally in one-dimensional models of population growth blah blah (get from biology book).

Model

Although, in ecological models of population growth across species we often include something called an interaction matrix. It describes the way that different species interact with each other and effect each others survival whether it be positively, negatively or with no effect at all. This is an essential aspect of a species environment which plays a large role in its survival. The simplest model of populations size of the  $i$ th species in an ecosystem is given by,

$$y_i(t+1) = y_i(t) + \Delta t(A_{ij} \times y_j + \xi_i)$$

where  $y_i(t)$  is the population of species  $i$  at time  $t$ ,  $\xi_i$  is random noise that might affect a species growth, and  $A_{ij}$  is the matrix that describes the interactions between the species.

An example interaction matrix is illustrated in Figure (blah)(notes from Andy).

figure

Here we have a small ecosystem of just 2 species for simplicity. In this case the model for population size of species  $i$  can be expanded to,

(Explain what would happen for a couple different values)

-motivation?

-relevant results from randommatrix theory?

-graphs that illustrate results

Punchline(what am I trying to prove/show; goal)

## 2 Methods

Deriving Likelihood

Simulating Data

Testing Likelihood

-graphs

### 2.1 This is a subsection

Blah

## 3 Results

Predicted output parameters vs actual parameters(include graphs)

Behavior of simulation outputs

In this model,

## 4 Discussion

In this paper, (basic summary of Methods and Results and contextualize them in terms of the background information) In further research, (future directions)

Variable	Meaning	Unit
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Variable	Meaning	Unit
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This is a cite [1]

## References

- [1] Gomero, B., *Latin Hypercube Sampling and Partial Rank Corelation Coefficient Analysis Applied to an Optimal Control Problem*, University of Knoxville Tennessee, .(2012) .