I want to begin by telling you the story of the brown tree snake of Guam. Only, it wasn’t always called the brown tree snake of Guam. In fact, the snake was originally from the islands of Australia and Papua New Guinea… 100 tree snakes per hectare, about the size of 2.5 football fields.

This is just one example of a single invasive species causing an incredible amount of ecological harm. Imagine this happening on a global scale. You won’t have to try to hard.

This is a graph of the cumulative number of marine invasive species in Europe over the past century. You can see that the number of introductions is actually increasing over time. Invasive species have been a problem all throughout history, but right now we’re seeing more introductions than ever before. Why is that? With globalization and the expansion of shipping routes throughout the world, humans have established themselves as the number one transport vector for species introductions.

As a result, the costs are staggering. Pimental 2005 estimated that the US alone loses $120 billion in agriculture due to invasive pests. In addition, it’s estimated that 42% of endangered species are at risk primarily due to invasive species. With a problem so large and little resources to deal with it, we’ve found that prevention is truly our best measure. And so a huge part of prevention is understanding invasion dynamics and producing models capable of prediction where invasive species will go next, so we can stop them in their tracks.

Integro-differential

Poisson distribution: Random variable X from a poisson distribution has the probability p, where p is the probability of realizing x events in a given unit of time. The rate R is the mean rate of arrival (ultimately, the total transition rate).

Exponential distribution: The exponential distribution with mean 1/R describes a distribution of random variables where the probability of x is the mean time between events from a Poisson distribution.