Global Analysis of Population Growth and Decline

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INTRODUCTION

Species of plants and animals have populations that are declining at a rapid rate and possibly face extinction. To combat this decline, we must first understand where and why species are declining. We compared known species population growth rates in the COMPADRE (7024 different plant populations) and COMADRE (1927 different animal populations) databases to a variety of possible factors and other databases.

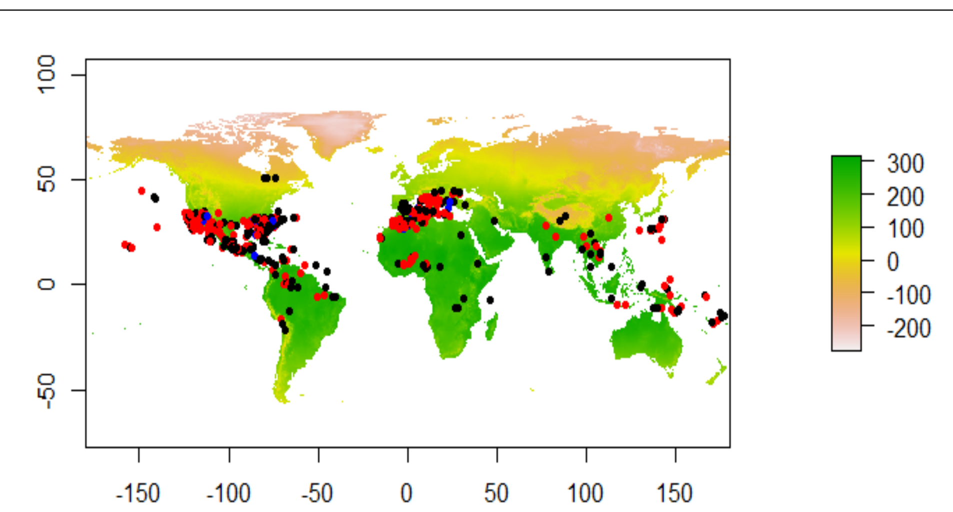
METHODS

1. Using RStudio we downloaded the COMPADRE (Salguero−Gómez *et al.* 2015) and COMADRE (Salguero-Gómez *et al.* 2015) databases
2. Using the population matrices within those databases for each of the studies within the database we calculated the population growth, or eigenvalues, for that population, excluding those without enough information, complex eigenvalues, or outlier eigenvalues (greater than or equal to 100).
3. We examined how population growth rates vary across the planet and across [name traits] using data available in the COMPADRE and COMADRE databases, first visually with plots and bar graphs then with regressions.
7. We then downloaded global climate and temperature (Hijmans *et al.* 2005) and mammal traits data (Jones *et al* 2009). We used this data to statistically model the predictors of population growth and decline.

PLANT RESULTS

Figure 1 shows global plant population stability and the trend for populations growth in compared to temperature grid cells. However, we were unable to find statistically significant predictors of population growth in plants, although we did detect slight trends that plant populations are increasing along bodies of water with multiple land masses nearby, such as channels and gulfs.

Fig 1.



Red Dots are declining populations

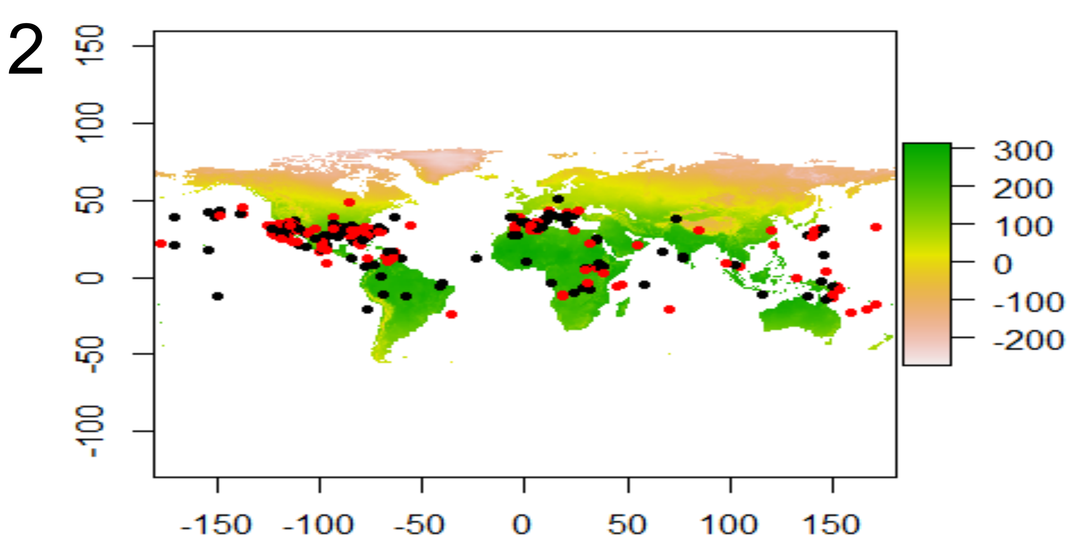
Blue Dots are stable populations.

Black Dots are growing populations.

MAMMAL RESULTS

Figure 2 shows global mammal population stability and the trend for populations growth in compared to temperature grid cells. We found statistical support that larger litter sizes, warmer grid cells, and being an omnivore or carnivore were associated with growing populations ($F_{264,4}=12.4$, $R^2=0.1592$, $p<0.0001$) as shown in Figure 3.

Fig 2



Red Dots are declining populations

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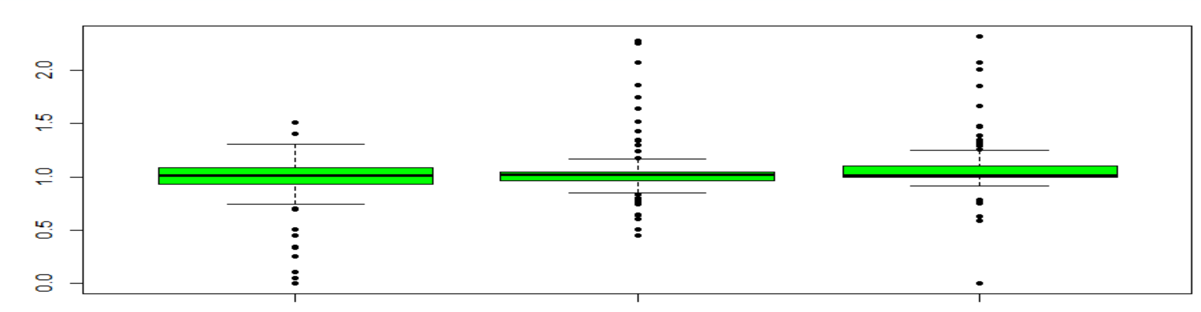
Black Dots are growing populations.

Fig 3.

	Estimate	Standard Error	t value	Pr(>|t|)
Herbivore	0.71	0.053	13.43	< 0.0001
Temperature	0.0008	< 0.001	3.43	0.0007
Litter Size	0.05	0.013	4.13	< 0.0001
Omnivore	0.81	0.039	2.35	0.0195
Carnivore	0.85	0.060	2.23	0.0267

Fig 4.

1 = Herbivores
2 = Omnivores
3 = Carnivores



DISCUSSION

There is greater biodiversity in warmer climates and greater amounts of competition (Brown *et al.* 2014), such that populations are bettered suited to their niches and so can grow faster. Producing a larger litter size gives a greater chance that more of the offspring will survive to adulthood and produce offspring of their own, growing a population faster. There is the greatest variance in population stability among the omnivores (Fig 4.), likely because some omnivores' diets rely heavier on meat (whose populations are growing) and while others rely heavier on plants (declining). It should be easier to stabilize populations of carnivores and omnivores whose primary diet consists of meat with our conservation efforts than populations of herbivores or omnivores whose primary diet consists of plants.

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