

Impacts of Sea Level Rise on Invasive Species Spread in North America: A case Study Examining the Invasive Cuban Tree Frog *Osteopilus septentrionalis*



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Introduction

The negative impacts of climate change and Sea Level Rise (SLR) on ecosystems and wildlife have been demonstrated in several previous studies. Coupled with rising global temperatures these factors can be exacerbated and worsened. There is unequivocal evidence that suggests that in addition to Sea Level Rise global temperatures will continue to rise as much as twenty to thirty percent (Kirtman, 2016). In particular the spread of invasive species into previously unsuitable habitats is of particular concern due to the fact that invasive non-native species threaten native animal and plant species, natural ecosystems, and infringe upon and disrupt human activities (Simberloff et al., 1997). The resulting control costs, native species losses, and agricultural damages would total billions of dollars in damage.

In this study we examine the potential spread of the Cuban Tree Frog *Osteopilus septentrionalis* into previously uninhabitable climates due to Sea Level Rise and climate change. As the climate warms and Sea Level rises the range of *Osteopilus septentrionalis* is expected to expand northward possibly as far north as Maryland. This study will examine the northern expansion of *Osteopilus septentrionalis* due to human impacts and factor in the projected Sea Level Rise by the year 2100. Using these predictions we will predict the northern reach of *Osteopilus septentrionalis* and discuss potential impacts on these northern communities. Namely the major effects expected are loss of native tree frog populations, destruction of human property, and loss of ecosystem services. These impacts will highlight the potential dangers of Sea Level Rise and *Osteopilus septentrionalis* to northern communities.

Methodology

Relevant current research was identified using SearchWiSE®. The research evaluated was from the year 1997 to present (2016). The current research was compiled from over twenty-four databases. Additionally research from the Intergovernmental Panel on Climate Change (IPCC) was also compiled and evaluated. The relevant terms searched were Sea Level Rise, Global Temperature increases, Cuban Tree frogs, and Invasive species. The research gathered from these searches was distilled and a meta-analysis was conducted to find similarities and differences among the literature and applied to the context of the IPCC Research and current climate predictions.

The study area ranges from Southern Florida to Northern Maryland in scope.



Figure 5: A) Cuban Tree frog B) A native Green tree captured by a Cuban tree frog (Images courtesy of University of Florida)

Results: Potential Spread of *Osteopilus septentrionalis*

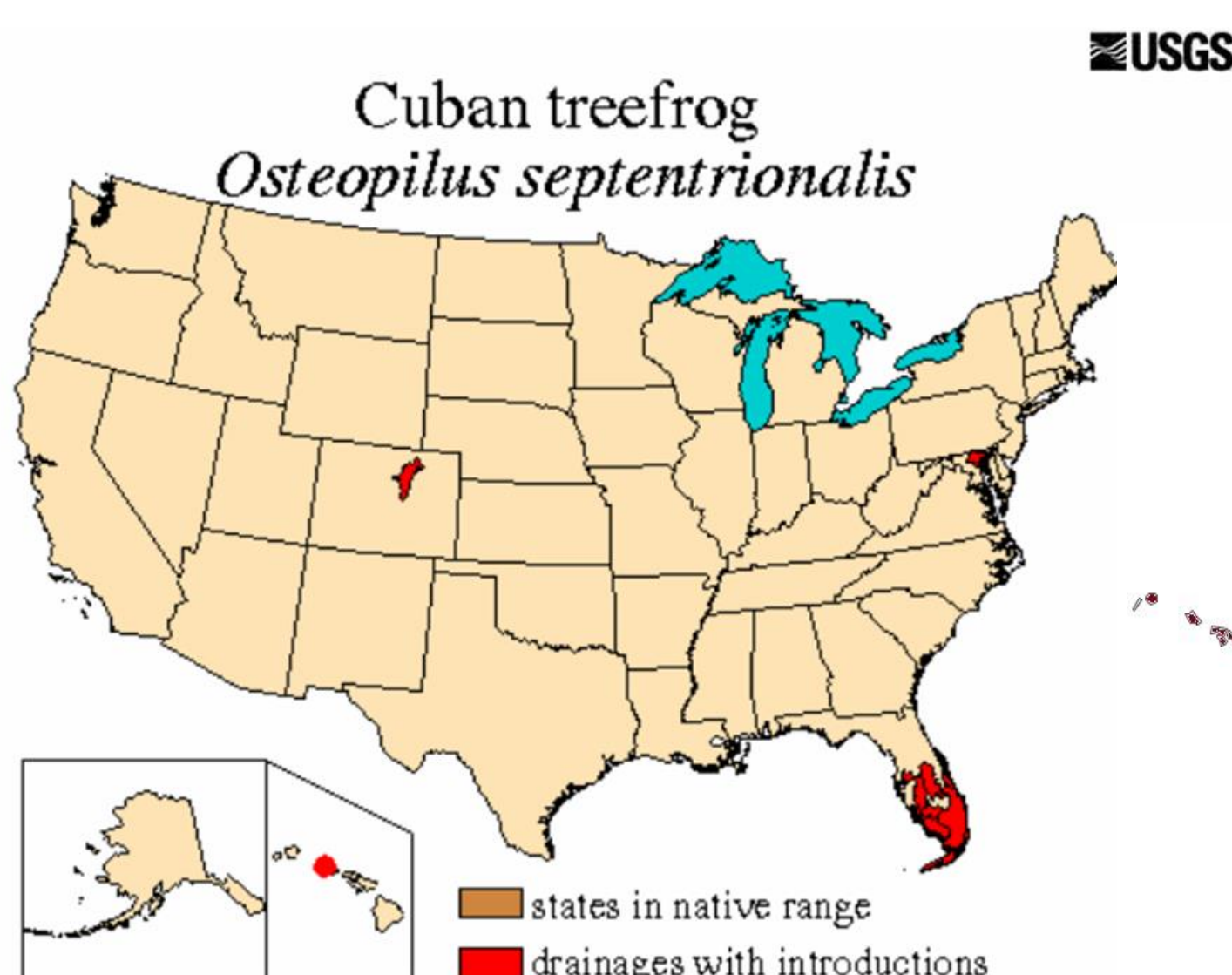


Figure 1: Current Range of *Osteopilus septentrionalis*

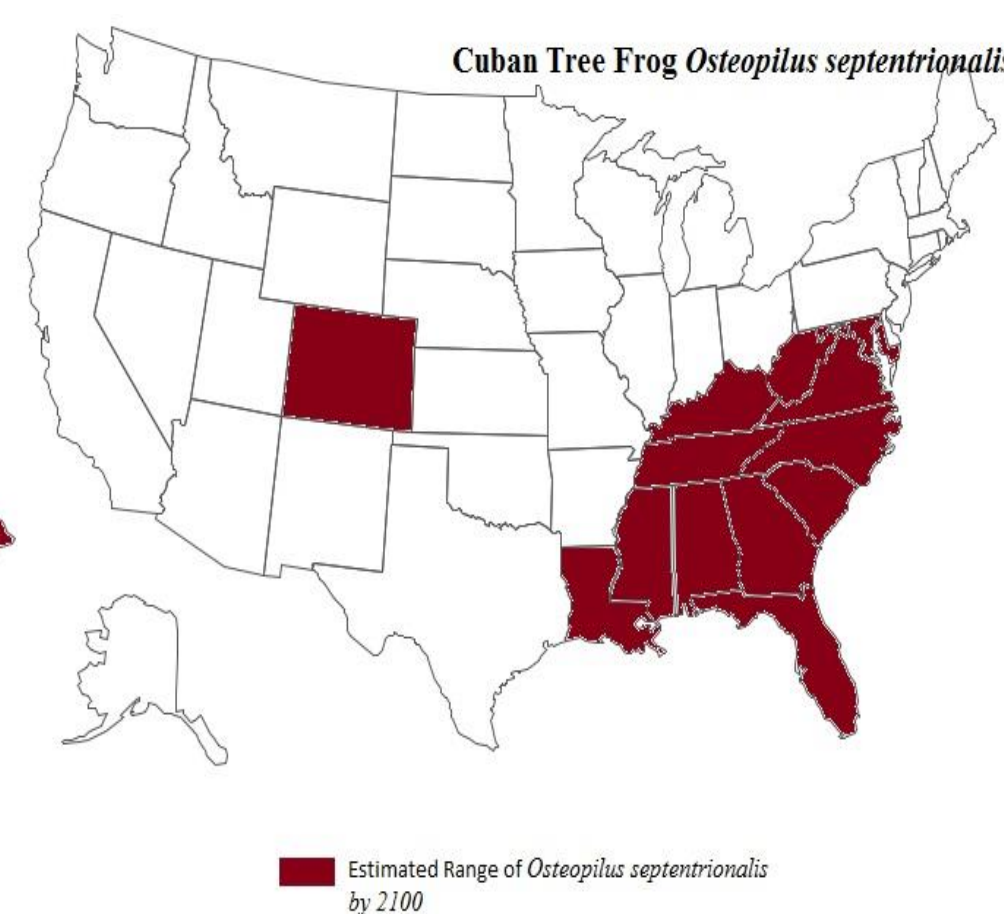


Figure 2: Estimated Range of *Osteopilus septentrionalis* by 2100.

Fossil-fuel emissions

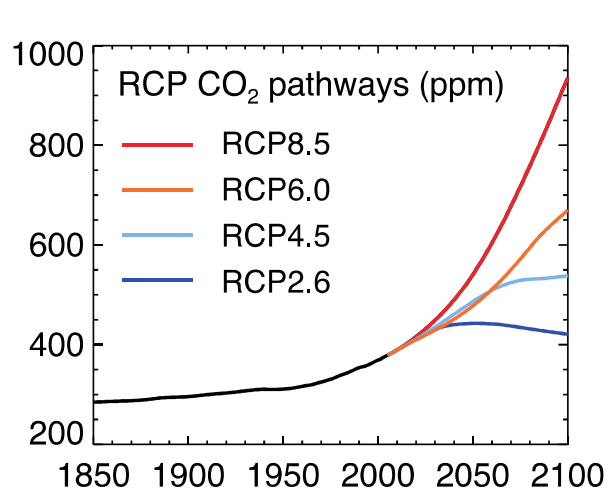


Figure 3: Carbon dioxide levels in Temperature Predictions

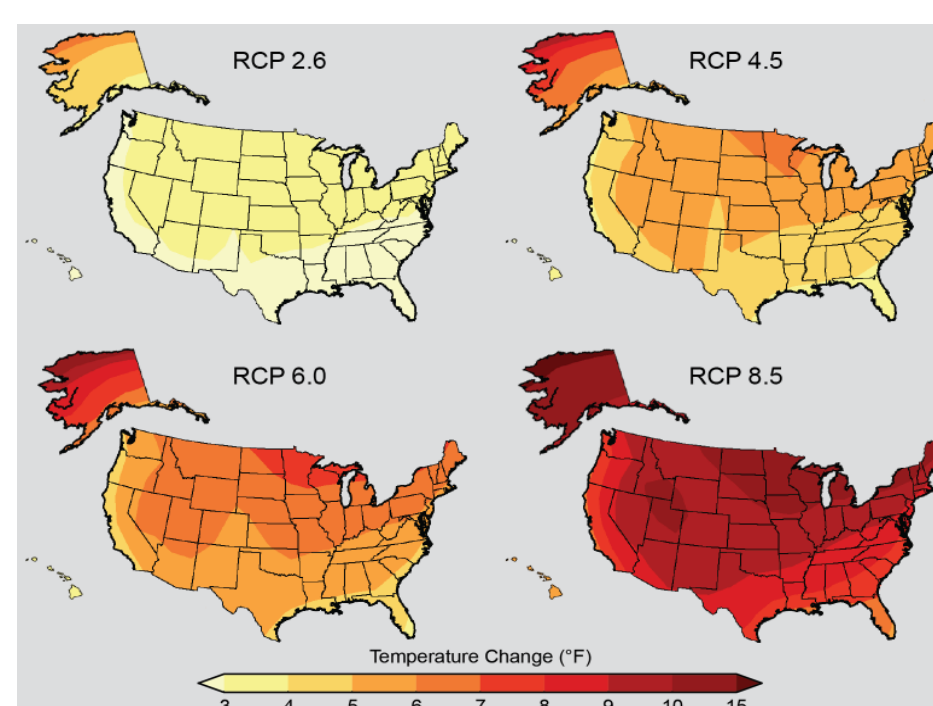


Figure 4: Estimated Change In United States Temperature in °C

Results of the meta-analysis show that indeed there will be a spread of *Osteopilus septentrionalis* into Maryland exposing these communities to a new invasive species.

Discussion & Conclusion

In summary Results of the meta-analysis show that indeed there will be a spread of *Osteopilus septentrionalis* into Maryland exposing these communities to a new invasive species. The implications of such a conclusion though are detrimental.

Invasive non-native species threaten native animal and plant species, natural ecosystems, and infringe upon and disrupt human activities (Simberloff et al., 1997). The resulting control costs, native species losses, and agricultural damages total billions of dollars in damages worldwide (Pimentel, Lach, Zuniga, & Morrison, 2005). In the United States alone, there are over 50,000 non-native invasive species, and they are estimated to cause \$137 billion per year in damages (Pimentel, Lach, Zuniga, & Morrison, 2005). The area in question is the Southeastern United States. This area is home to several crucial ecosystems and exposing them to new invasive species that can outcompete the native species could cause ecosystem collapses (Simberloff et al., 2005).

This study should be extended to include other Invasive Species and highlights a concern that is often overlooked when discussing Sea Level Rise and Climate Change This Information could prove to be helpful in mitigating for the effects of Sea Level Rise and Climate change.

References

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 Pimentel, D., R. Zuniga, D. Morrison. (2005) Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics*, 52, 273-288