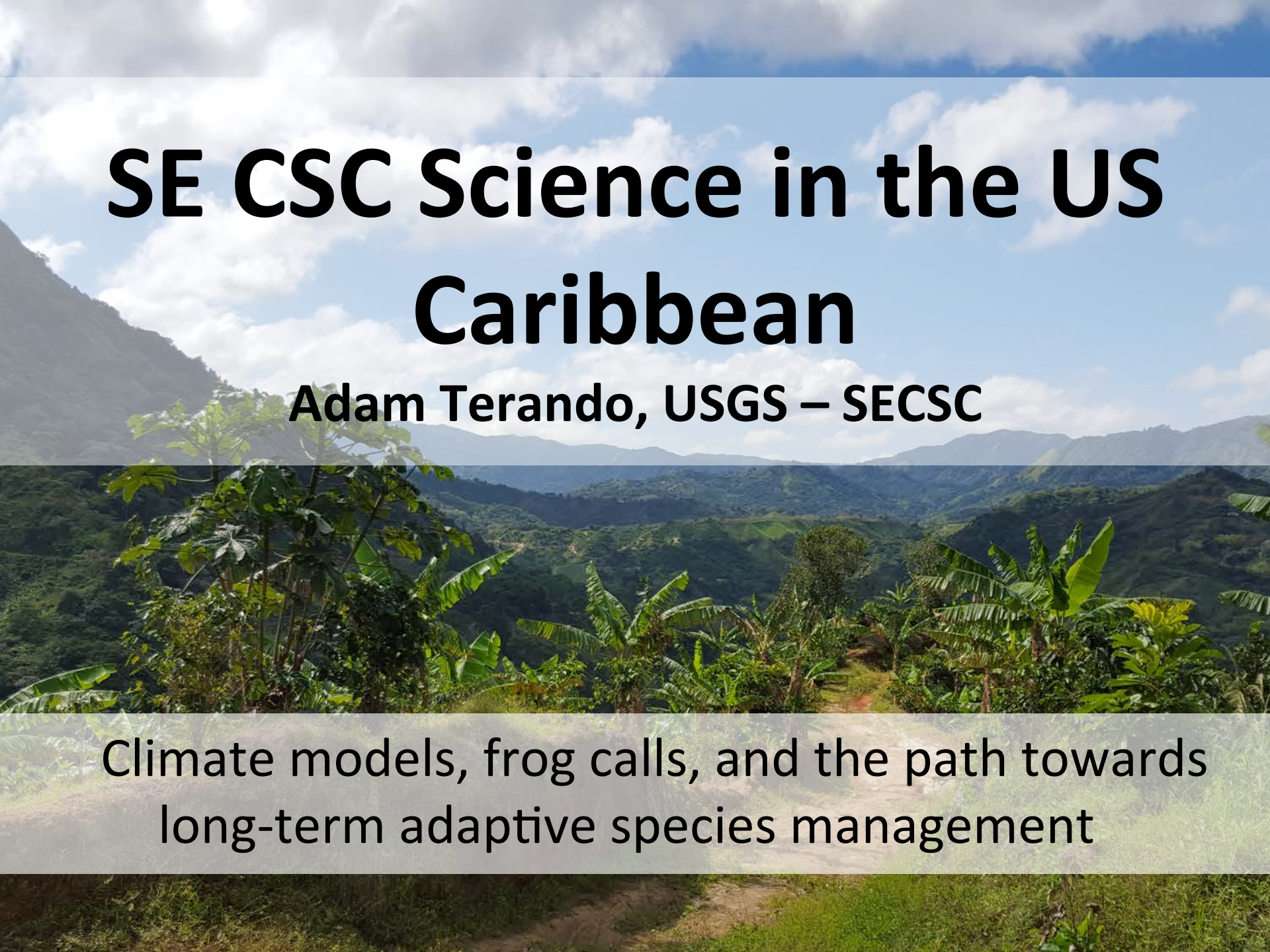
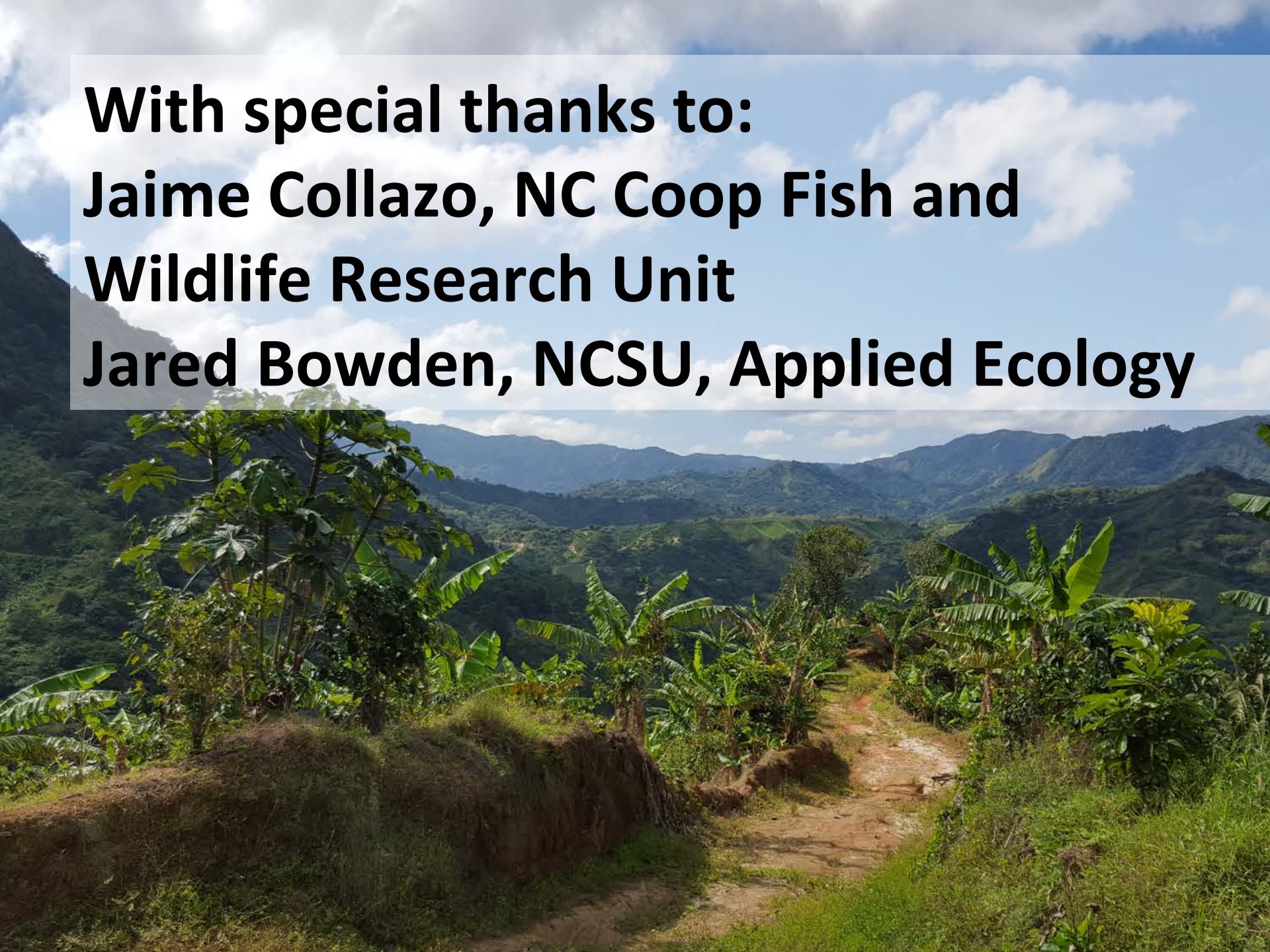


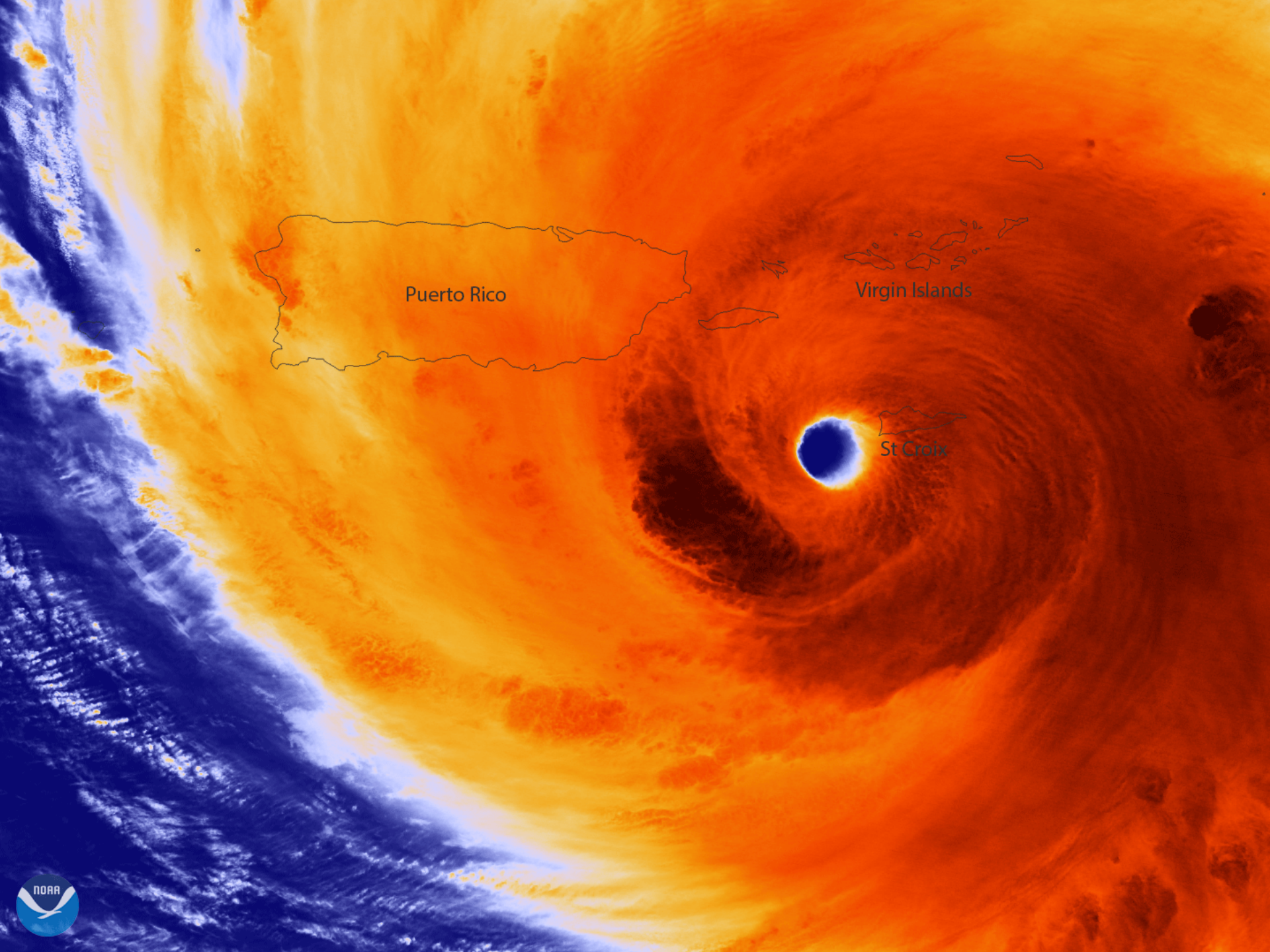
SE CSC Science in the US Caribbean

Adam Terando, USGS – SECSC

Climate models, frog calls, and the path towards long-term adaptive species management



With special thanks to:
Jaime Collazo, NC Coop Fish and Wildlife Research Unit
Jared Bowden, NCSU, Applied Ecology


Puerto Rico
Virgin Islands
St Croix
NOAA

Guajataca Dam, Quebradillas, PR. Source: The Atlantic

Utuado, PR. Source: NY Times

Corozal, PR. Source: The Atlantic

Yabucoa, PR. Source: The Atlantic

San Juan, PR. Source: The Atlantic

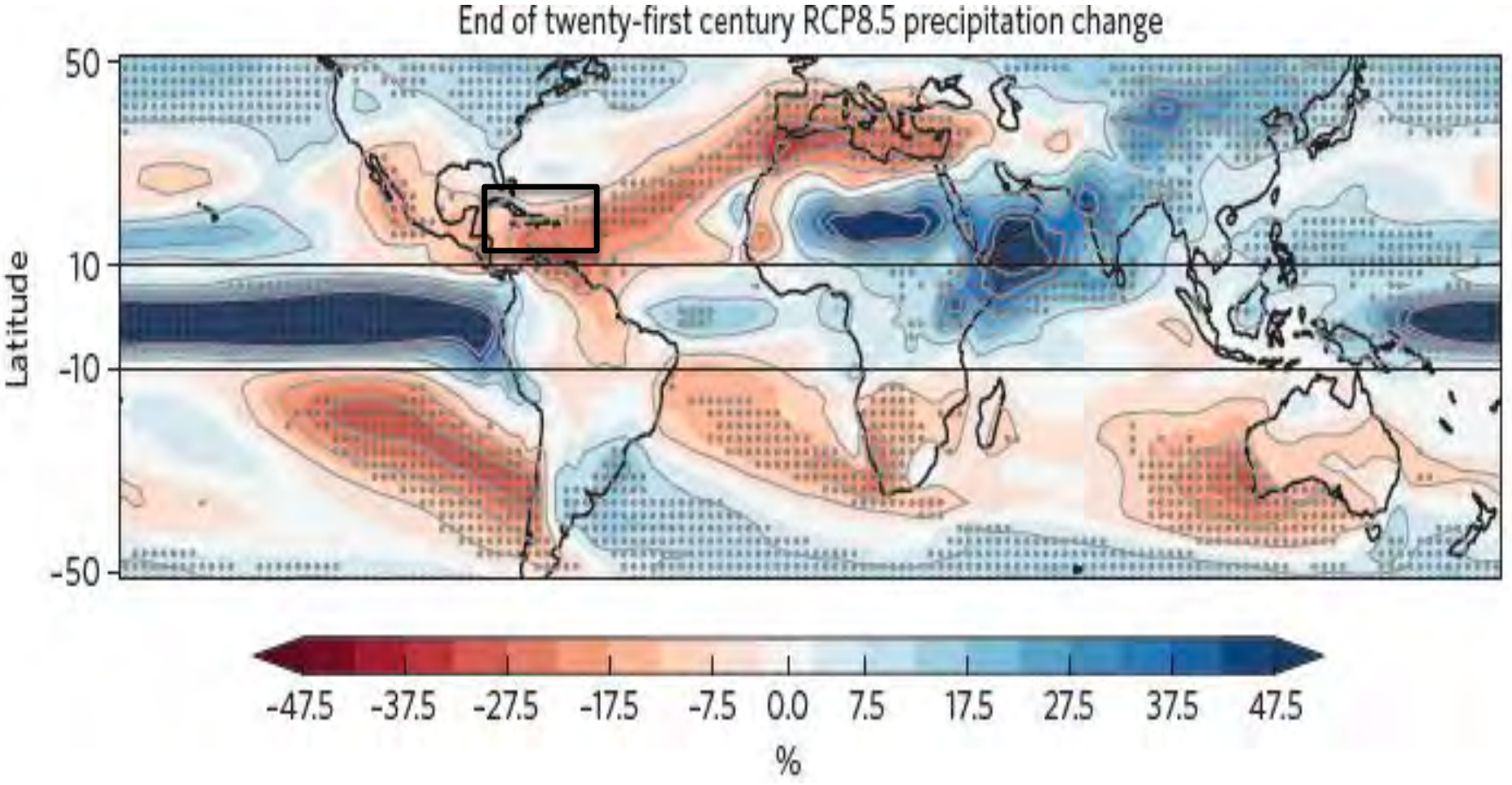
Toa Alta, PR. Source: The Atlantic

Toa Baja, PR. Source: The Atlantic

Naranjito, PR. Source: The Atlantic


Puerto Rican Parrot (*Amazona vittata*)
P Torres, FWS

MOTIVATION



Chadwick, R. 2016. Sub-tropical drying explained. *Nat. Clim. Change*.

25 species

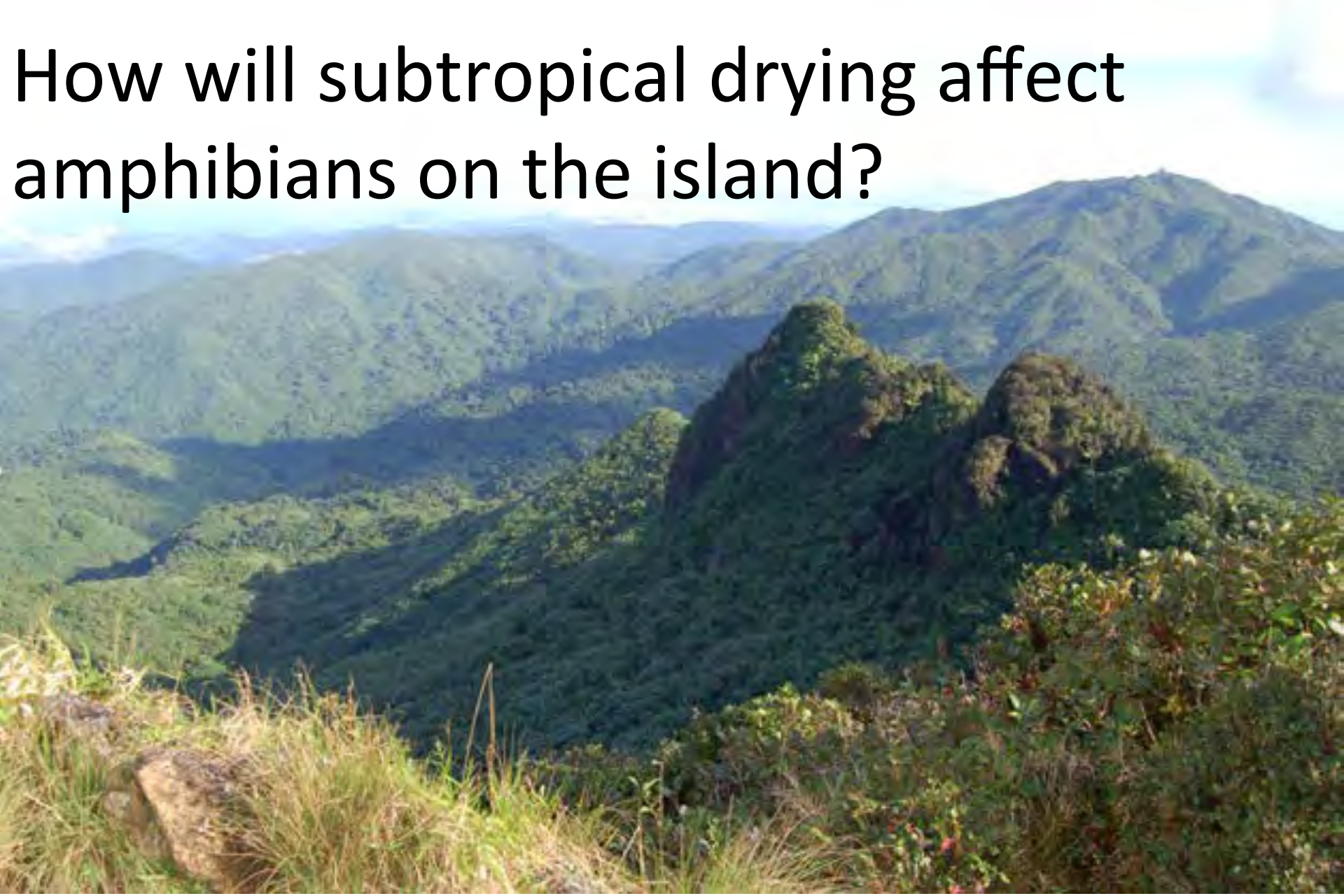
Endangered PR Crested Toad

17 *Eleutherodactylus*

- 2 endangered
- 14 at risk

Amphibians in Puerto Rico

How will subtropical drying affect amphibians on the island?

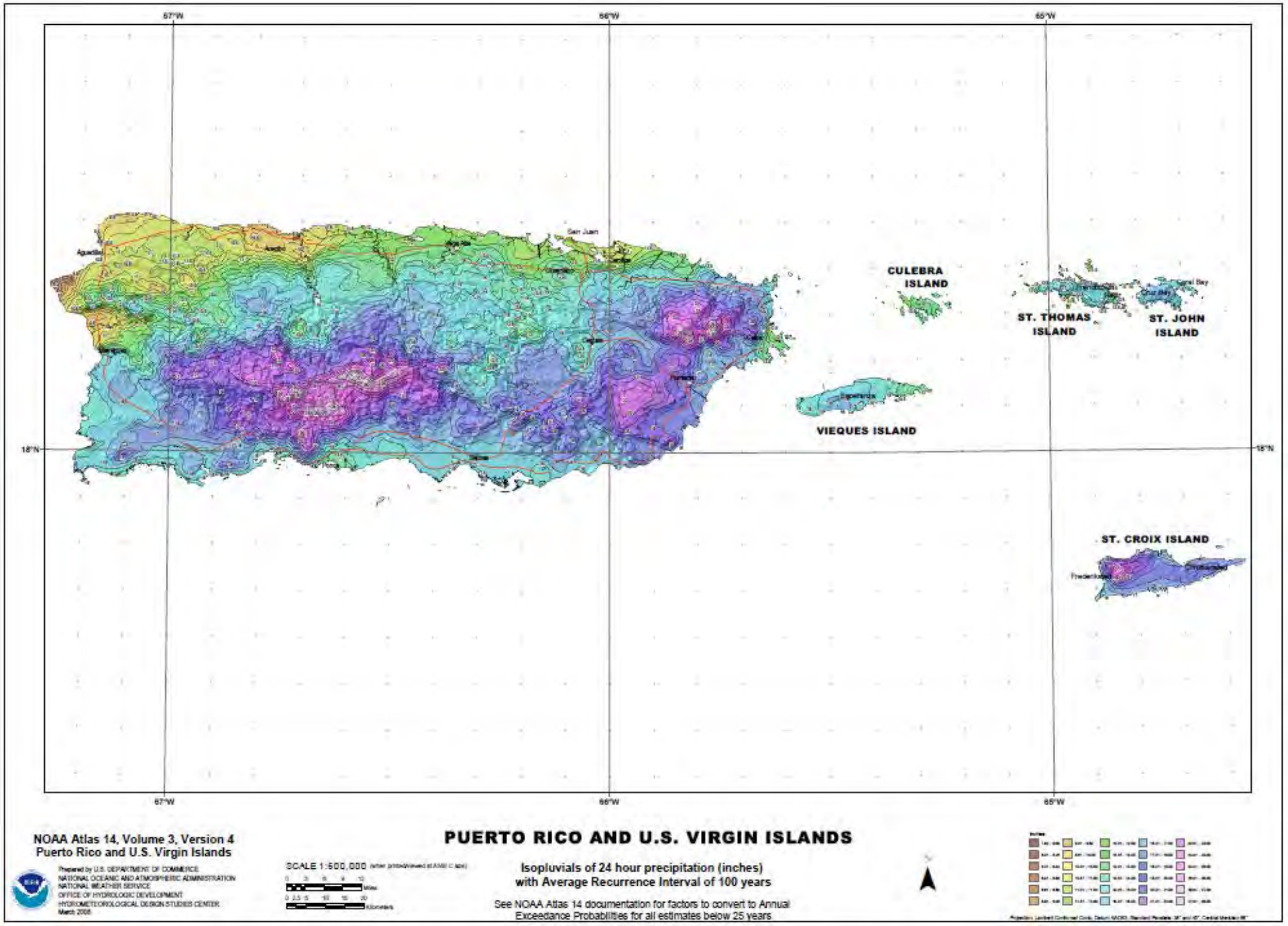


El Yunque Rainforest

How will subtropical drying affect amphibians on the island?

Guánica Dry Forest

How will subtropical drying affect amphibians on the island?



PUERTO RICO AND U.S. VIRGIN ISLANDS

Isopluvials of 24 hour precipitation (inches)
with Average Recurrence Interval of 100 years

See NOAA Atlas 14 documentation for factors to convert to Annual Exceedance Probabilities for all estimates below 25 years

NOAA Atlas 14, Volume 3, Version 4
Puerto Rico and U.S. Virgin Islands

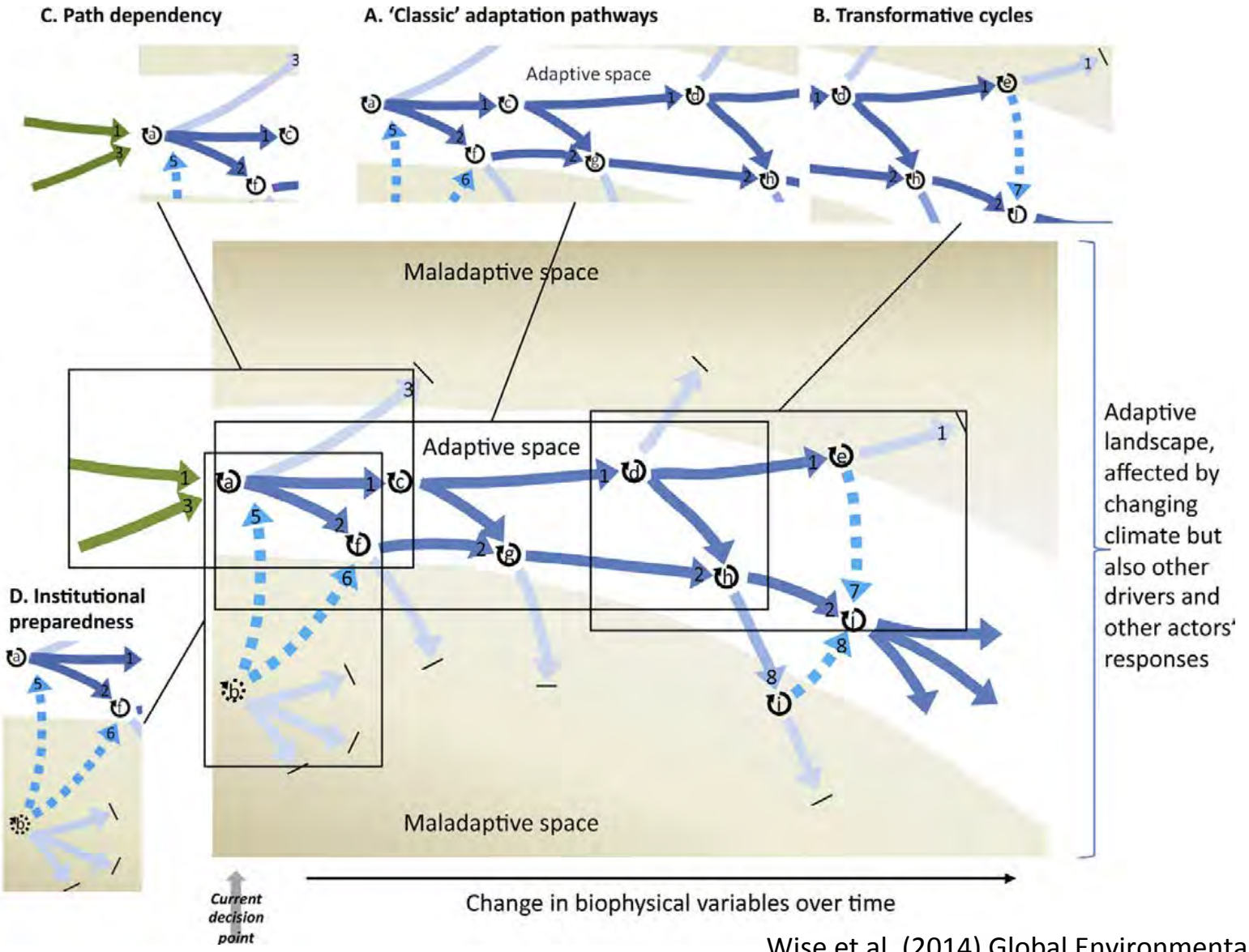
Prepared by U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF HYDROLOGIC DEVELOPMENT
HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
March 2006

SCALE 1:600,000 (when printed/viewed at ANSI C size)

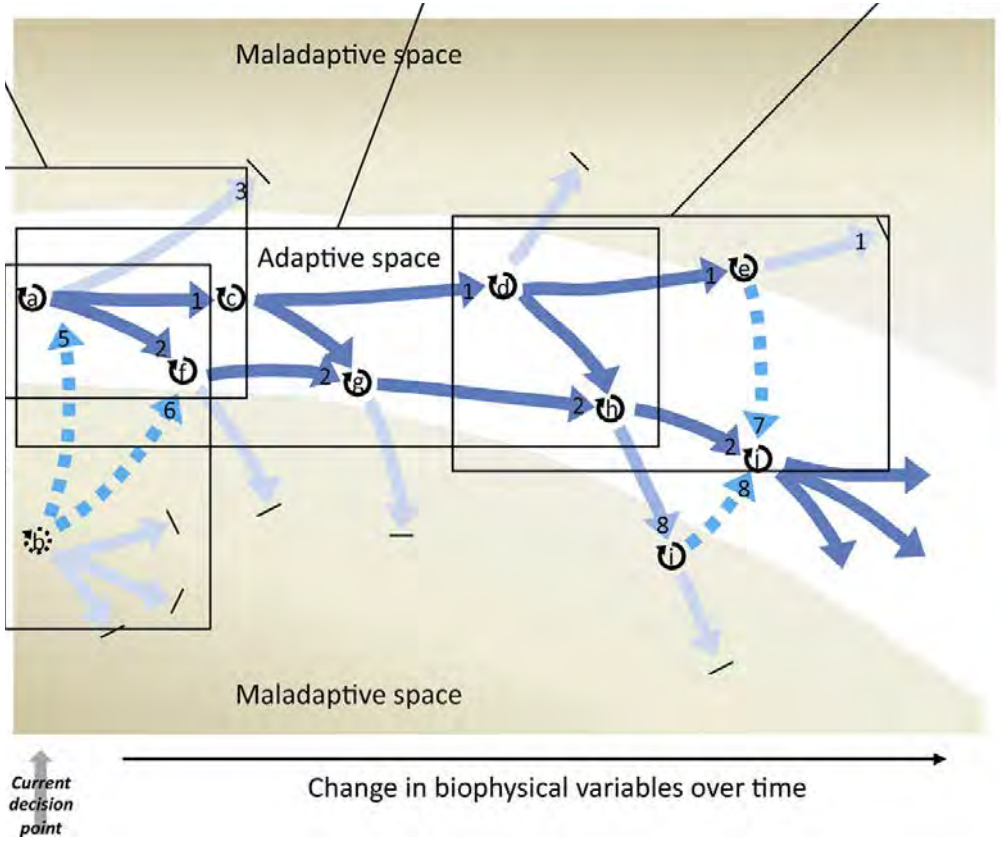
Miles

Kilometers

BROADER CONCEPTUALIZATION



Wise et al. (2014) Global Environmental Change.

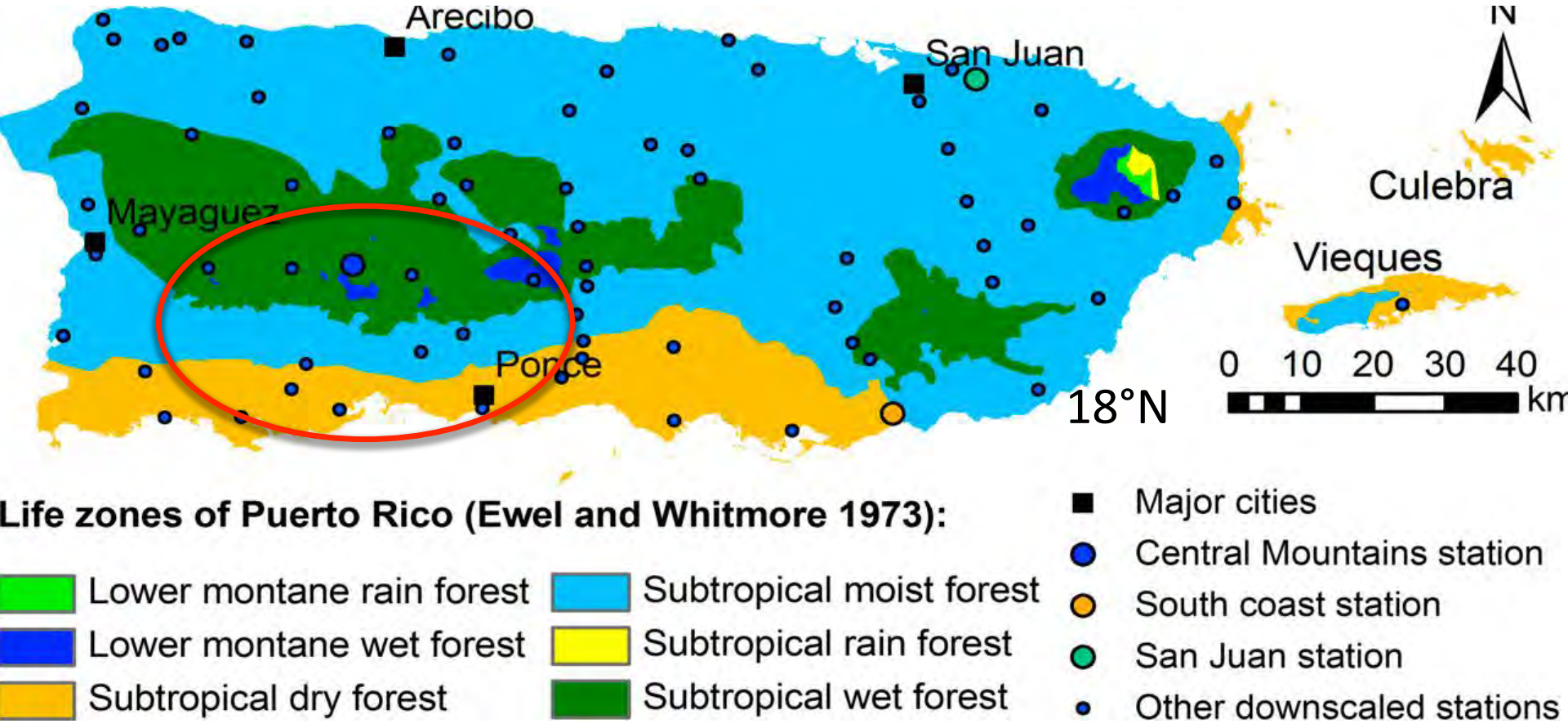


How wide is this space? VULNERABILITY

What is it's trajectory? FORCING

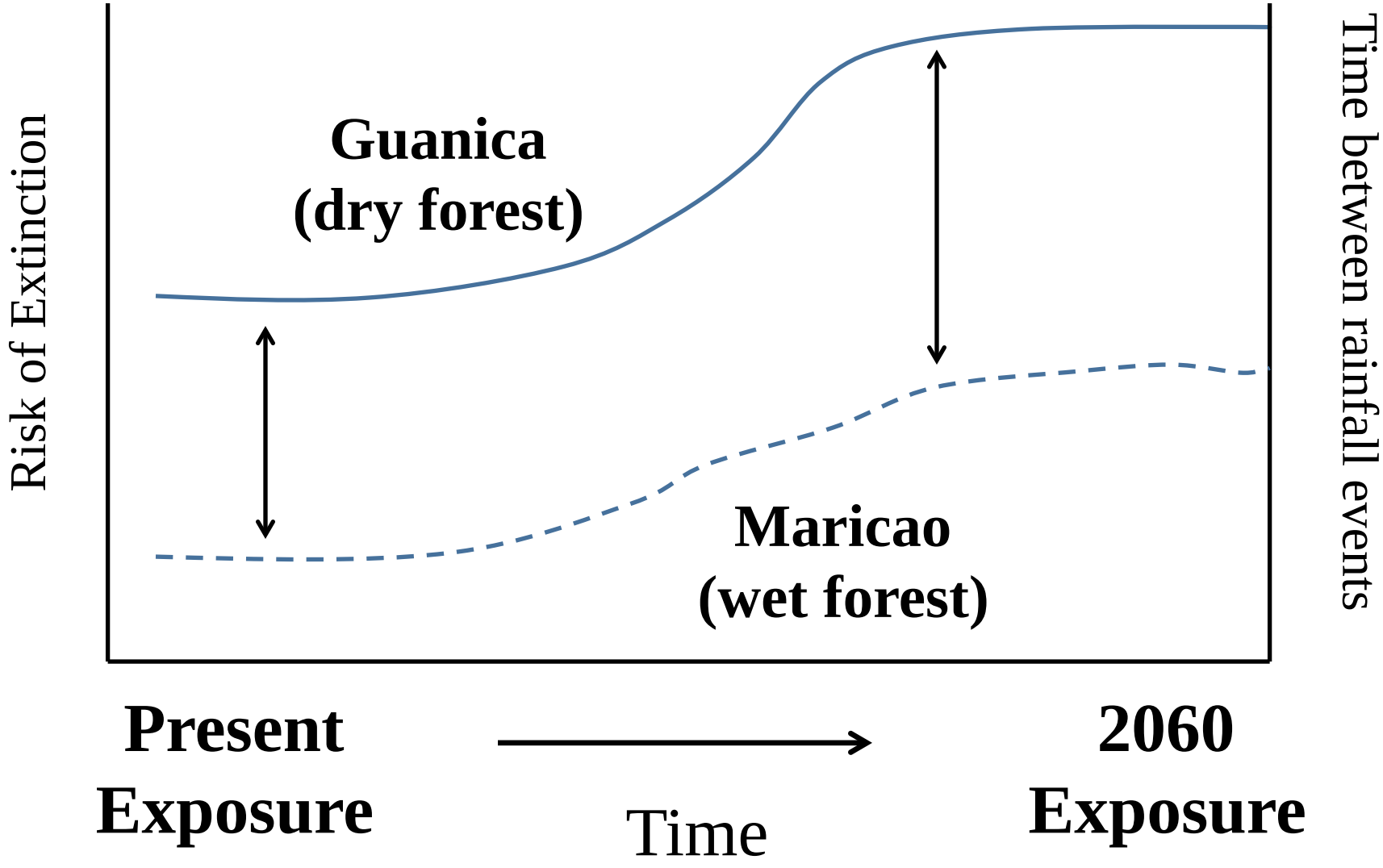
Ultimately, trying to evaluate candidate strategies for adaptive management

- Passive management in marginal habitats
- Translocate Populations
- Habitat acquisition

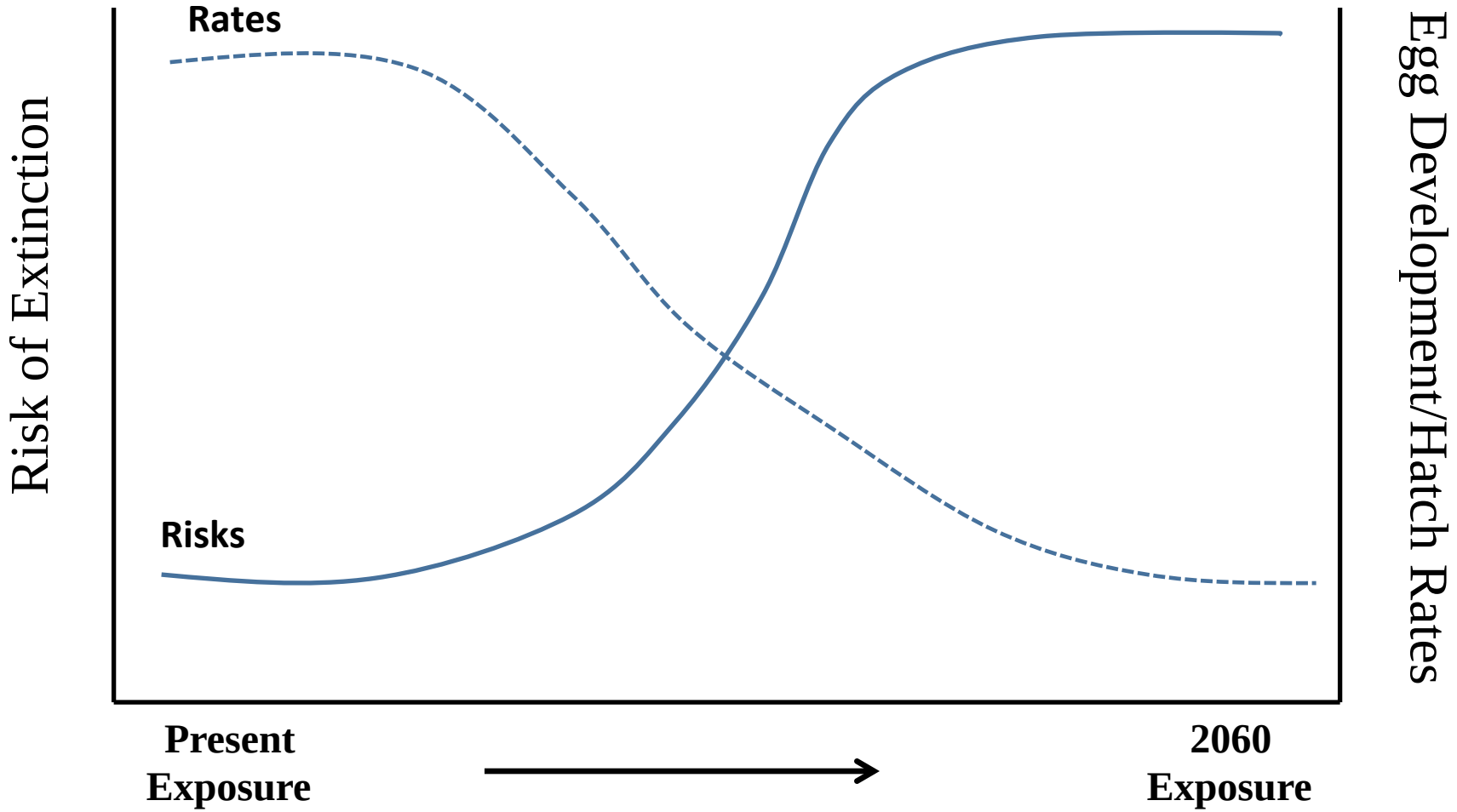


Khalyani et al. (2016)

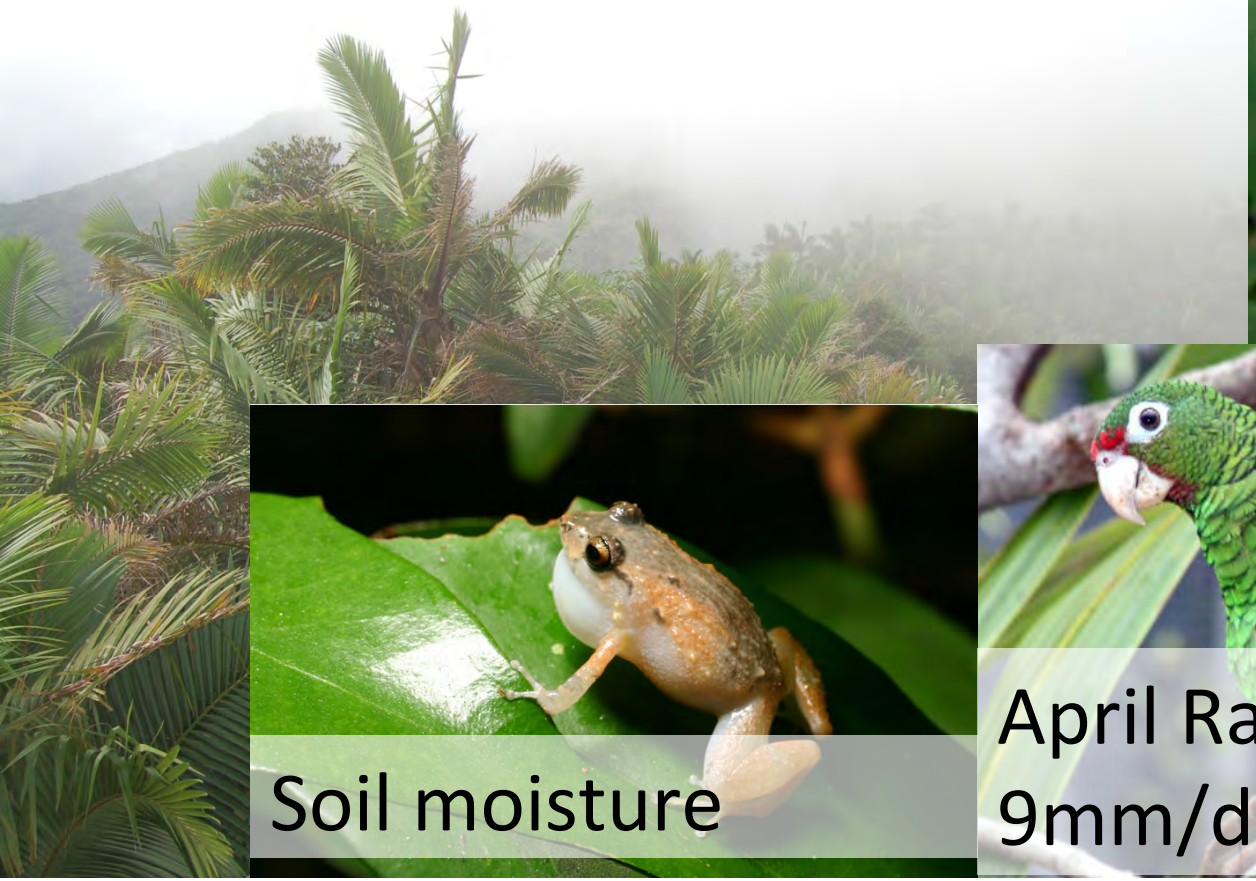
Exposure/Response Functions



Exposure/Response Functions



Cloud-based height



Ground heat flux

Soil moisture

April Rainfall > 9mm/day

Need information about the *climate-response function* of species and systems of interest.

Climate Science Centers & National Climate Change and Wildlife Science Center

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Modeling Future Temperature and Precipitation for Puerto Rico and the U.S. Caribbean

Project Summary

While 21st century temperatures are projected to increase in Puerto Rico and the broader U.S. Caribbean (whose geography is contained within the Caribbean Landscape Conservation Cooperative, or CLCC), the low variability and already high annual average temperatures suggest that the largest climate-related impact on ecosystems and water resources is more likely to be through changes in the timing, pattern, and availability of moisture. The development of adaptation strategies that respond to anthropogenic climate change for the CLCC, and particularly for Puerto Rico, is currently hindered by the lack of local-scale climate scenarios that resolve the complex topographical and meso-scale

...dynamically downscaled, nonhydrostatic climate model ...lobal tropics with a highly dynamic climate regime. The ...ranges of species' thermal/moisture optima. This ...bbean LCC.

CLIMATE MODELING

Adam Terando (U.S. Geological Survey)

Start Date: 2013
End Date: 2016
Status: In Progress
Science Topics(s): Education, Modeling and Tools
Science Subtopics(s): Climate and Ecosystem Modeling
Fiscal Year: 2013

Publications and Other

Final Project Memorandu
PRDownscalingFinalMemo

Climate Change Implicati
Khalyani et al. 2016; Journ

ScienceBase Link: https://

USGS science for a changing world

Climate Science Centers & National Climate Change and Wildlife Science Center

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Climate Change Implications for the Conservation of Amphibians in Tropical Environments

Project Summary

FIELD ECOLOGY

...y birds and threatened and endangered species). The ...regions of the world because of the limited size of their ...opical environments will experience greater changes in ...that could impact the health of important natural ...ts. To help address this problem, the SE CSC project ...ironmental Resources (PRDNER), University of Puerto ...ctions to help advance the recovery and conservation of amphibians in Puerto Rico. The USFWS and PRDNER seek to implement an adaptive conservation strategy to achieve recovery of three endangered frog species (of the genus Eleutherodactylus) and prevent federal listing of 14 other amphibians considered at risk. Implementation of the strategy requires identifying suitable habitat for the species at present and in the future, and ensuring the availability of field-tested protocols for locally supplementing, introducing, and translocating species as necessary. The main objectives of this project are: (1) to develop an understanding of the eco-physiological limits of these species and the influence of those limits on extinction rates in local patches (i.e., heterogeneous micro-habitats within an ecosystem), and (2) to assess their adaptive capacity (i.e. the ability of the amphibians to adapt to changing environmental conditions). This will inform implementation of the conservation strategy, which is partly constrained by the availability of conservation areas that meet required eco-physiological conditions. This research will contribute to a decision framework developed by NCSU scientists that can assist decision makers in determining when and where to implement conservation actions to maximize species persistence. The framework

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Modeling Future Temperature and Precipitation for Puerto Rico and the U.S. Caribbean

Ryan Boyles and Adam Terando, USGS DOI Southeast Climate Science Center
Jaime Collazo, USGS NC Cooperative Fish and Wildlife Research Unit
Jared Bowden, UNC Institute for the Environment
William Gould, USDA Forest Service International Institute of Tropical Forestry
Vasu Misra, Florida State University

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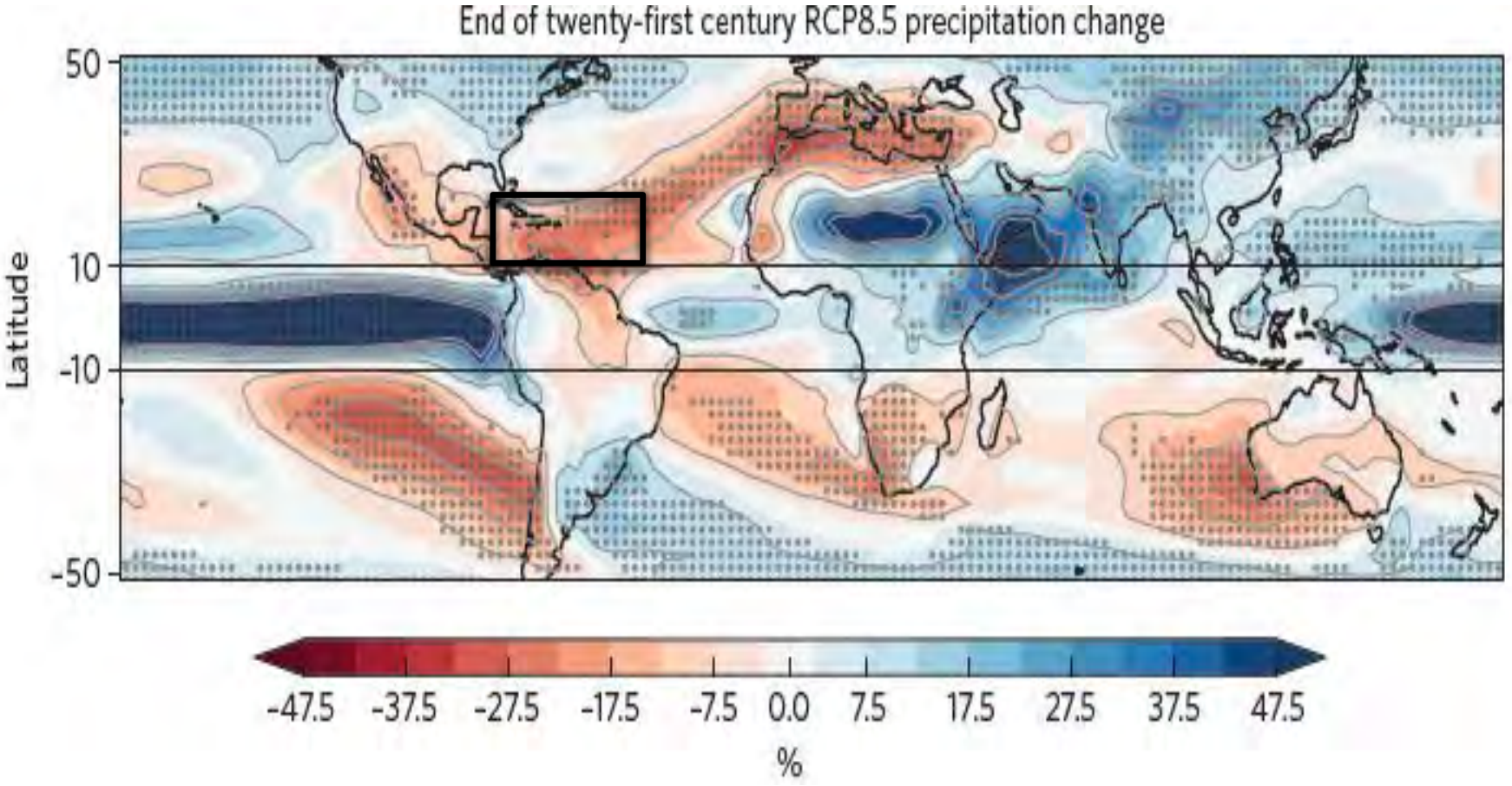
Climate Change Implications for the Conservation of Amphibians in Tropical Environments

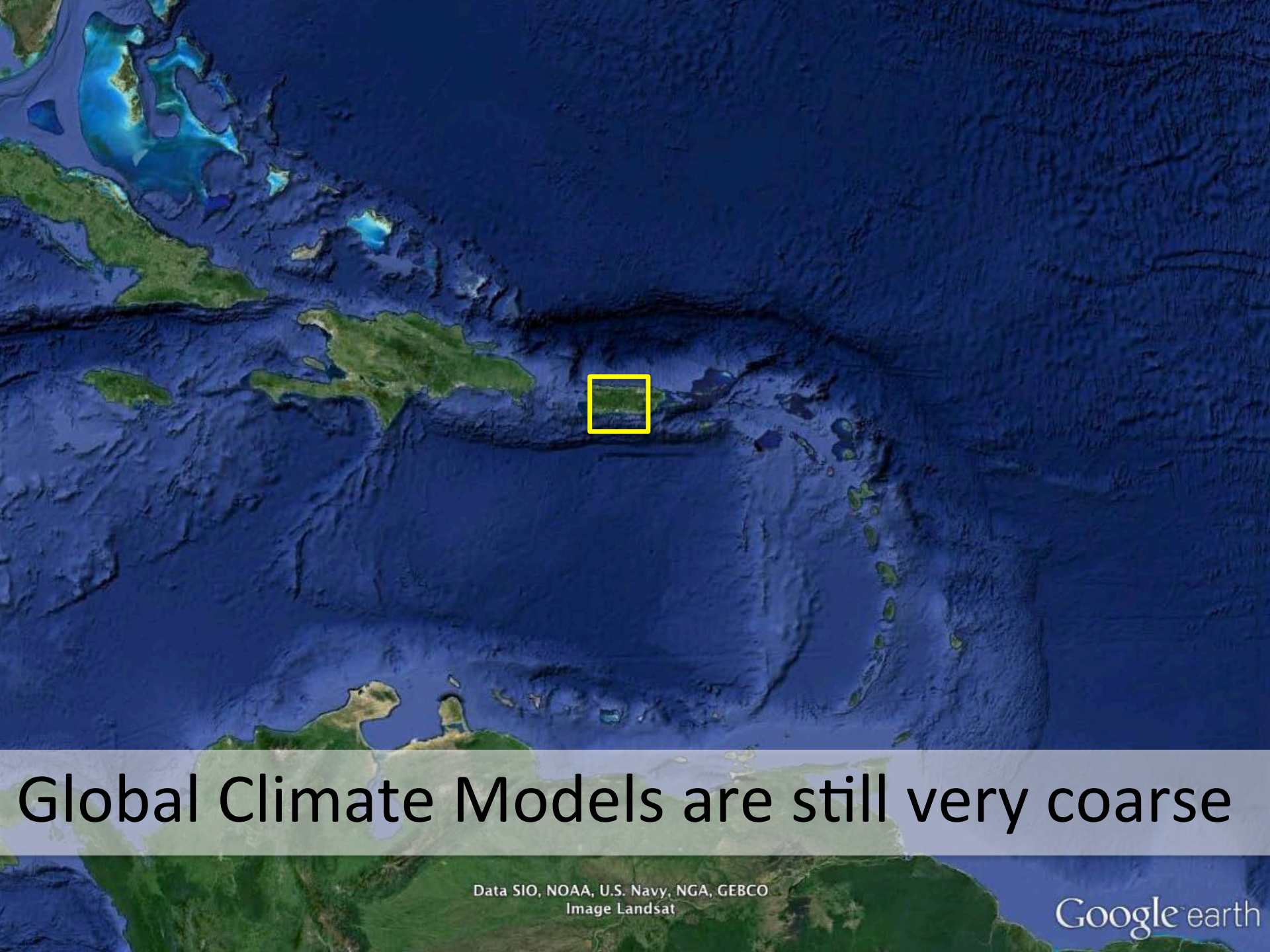
Jaime Collazo, Department of Applied Ecology and USGS Coop Unit, NC State University

Total Planned Funding: $140,000
Project Completion: August 2019
Implements Science Theme: 4
Co-PIs: Adam Terando, USGS Southeast Climate Science Center
Krishna Pacifici, Department of Forestry and Environmental Resources, NC State University
Jared Bowden, Institute of the Environment, UNC-Chapel Hill

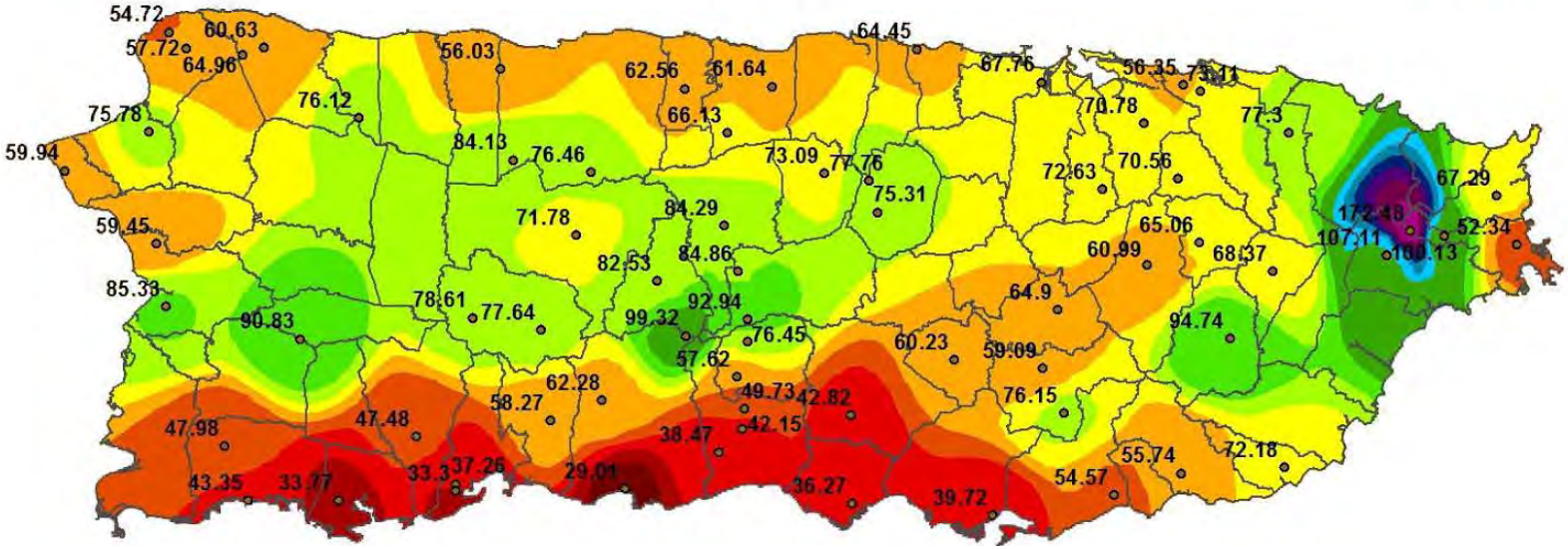
Expect Sub-tropical Drying in This Region



Chadwick, R. 2016. Sub-tropical drying explained. *Nat. Clim. Change*.



Global Climate Models are still very coarse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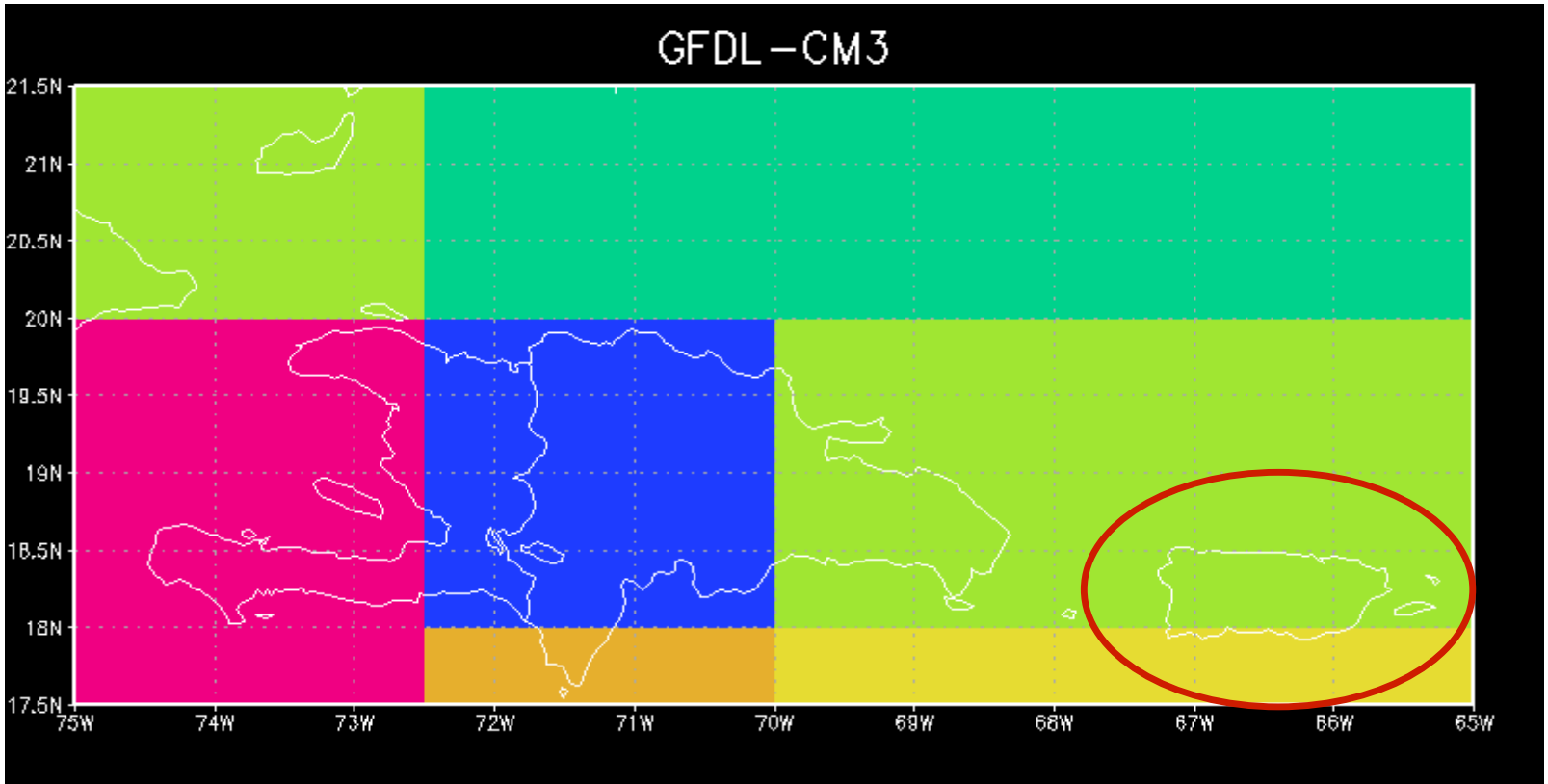
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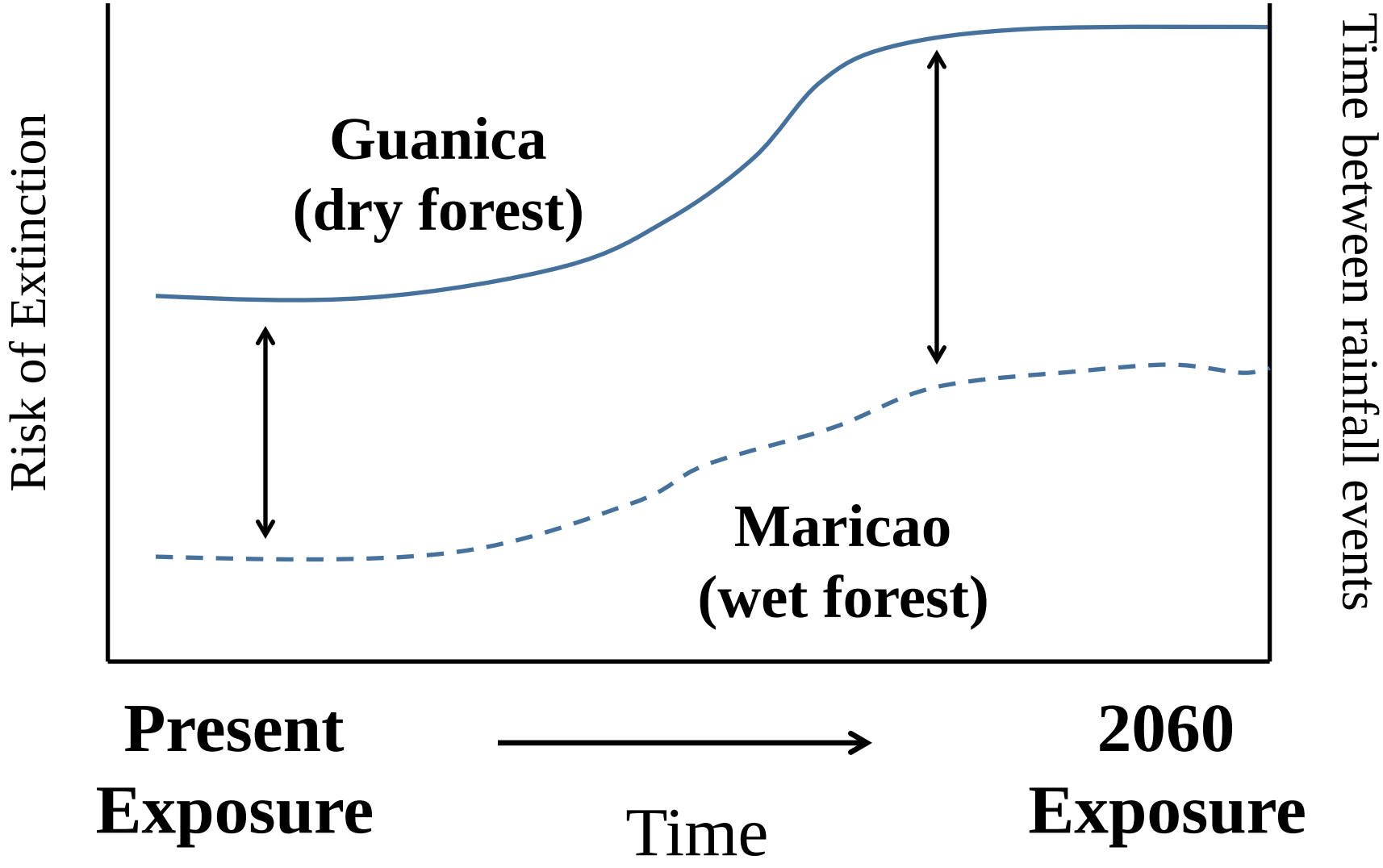
65W

Exposure/Response Functions



Insights from Downscaling