# Geographic Manifestation of Spanish Moss Physiology Across The Americas

Narayani Barve
Ecology and evolutionary biology
University of Kansas

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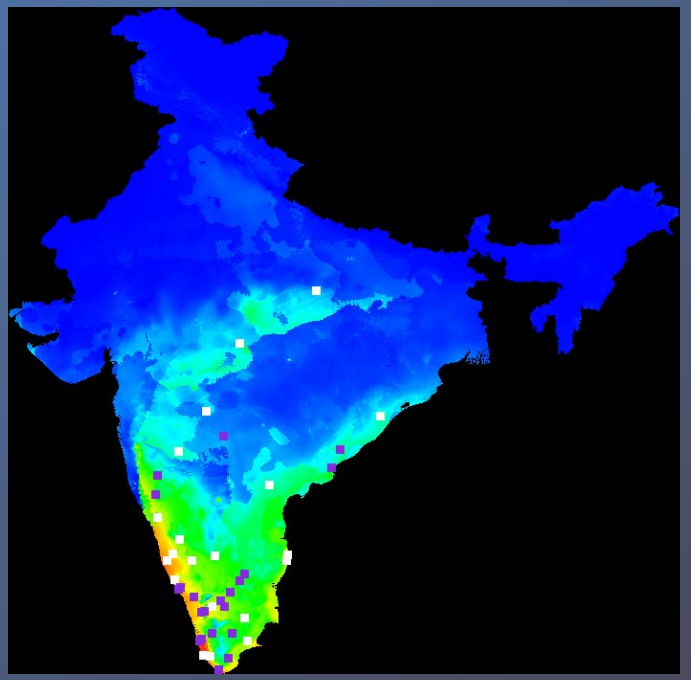
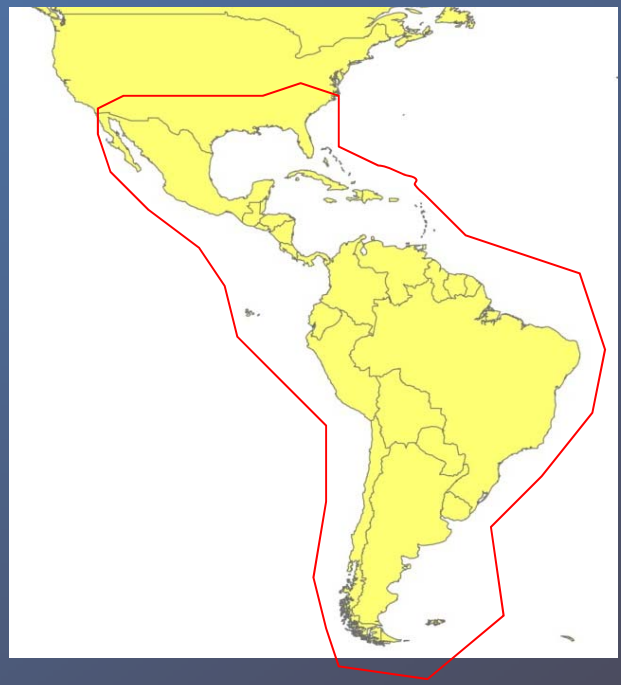
# Problem

- Ecological niche models use known occurrences and background climatic information to predict potential distribution of species on the geography.
- Used in conservation, biogeography, invasive species spread etc.
- But ENMs do not consider organisms' physiological limits explicitly.
- Explore occurrence representation in the geography taking into account its physiological limits.



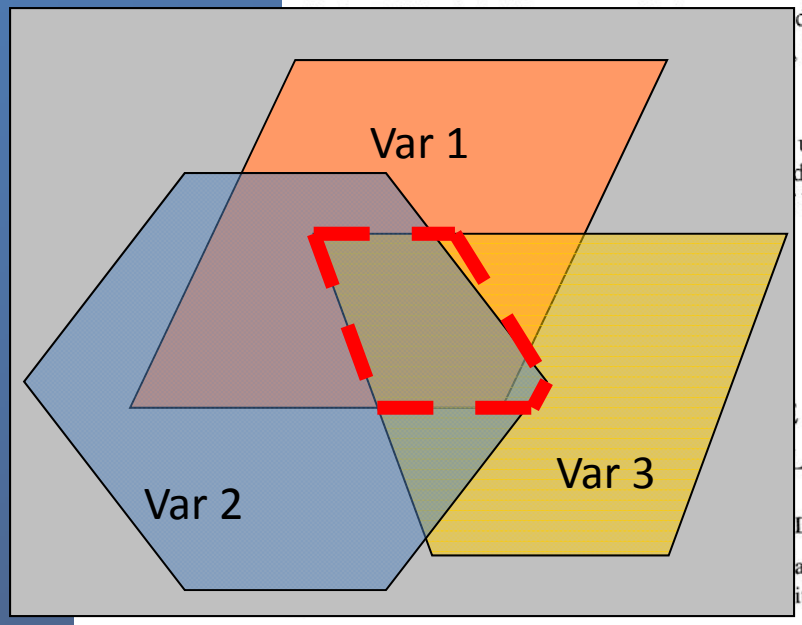
# Spanish Moss *(Tillandsia Usneoides)*

- South-eastern United States to South America
- Large geographical area
- Heterogeneous landscape
- Varied climatic conditions
- CAM plant, no roots



# Data, Schema & Parameters

- Physiological thresholds
  - Minimum temperature > 5 C
  - Maximum temperature < 35 C
  - Rainless days < 16



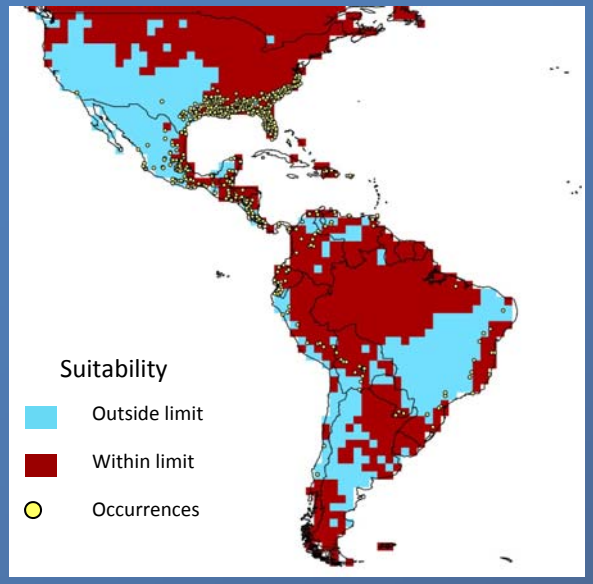

- ERA-Interim
  - Global atmospheric reanalysis by ECMWF (European Center for Medium-Range Weather Forecast)
  - Based on observations and model data
  - 6 hourly data from 1 Jan 1989 to 31 July 2011 ☺
  - Spatial resolution is 1.5˚ x 1.5˚ ☹
- GBIF occurrence data
  - Spanish Moss occurrences download from GBIF.
  - Curated GBIF data for obvious problems: no georeference, remove wrongly georeferenced points.

(Total occurrences 1631, Geocoded 776, 295 from United States)

- R Script and GIS analysis
  - NCDF and SP package in R to process data from NetCDF format.
  - Marked cell as unsuitable OR suitable as per the physiological parameter.

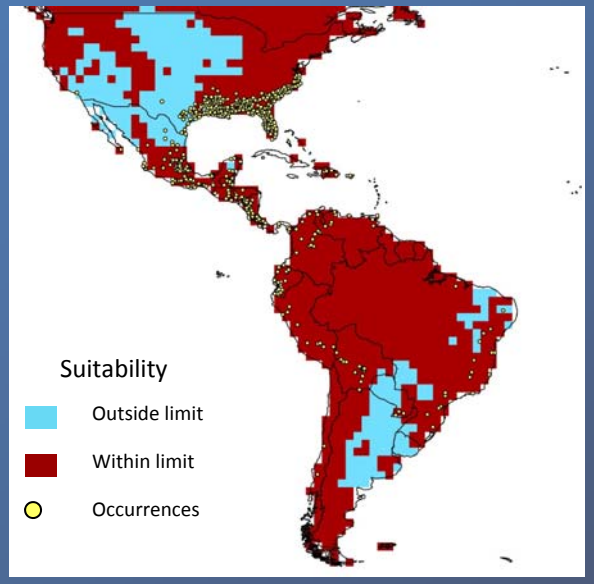
# Results

## Rainless days




- Not suitable if all 4 daily observations indicate no rain
- Seek sets of 15 consecutive days

## Maximum temperature

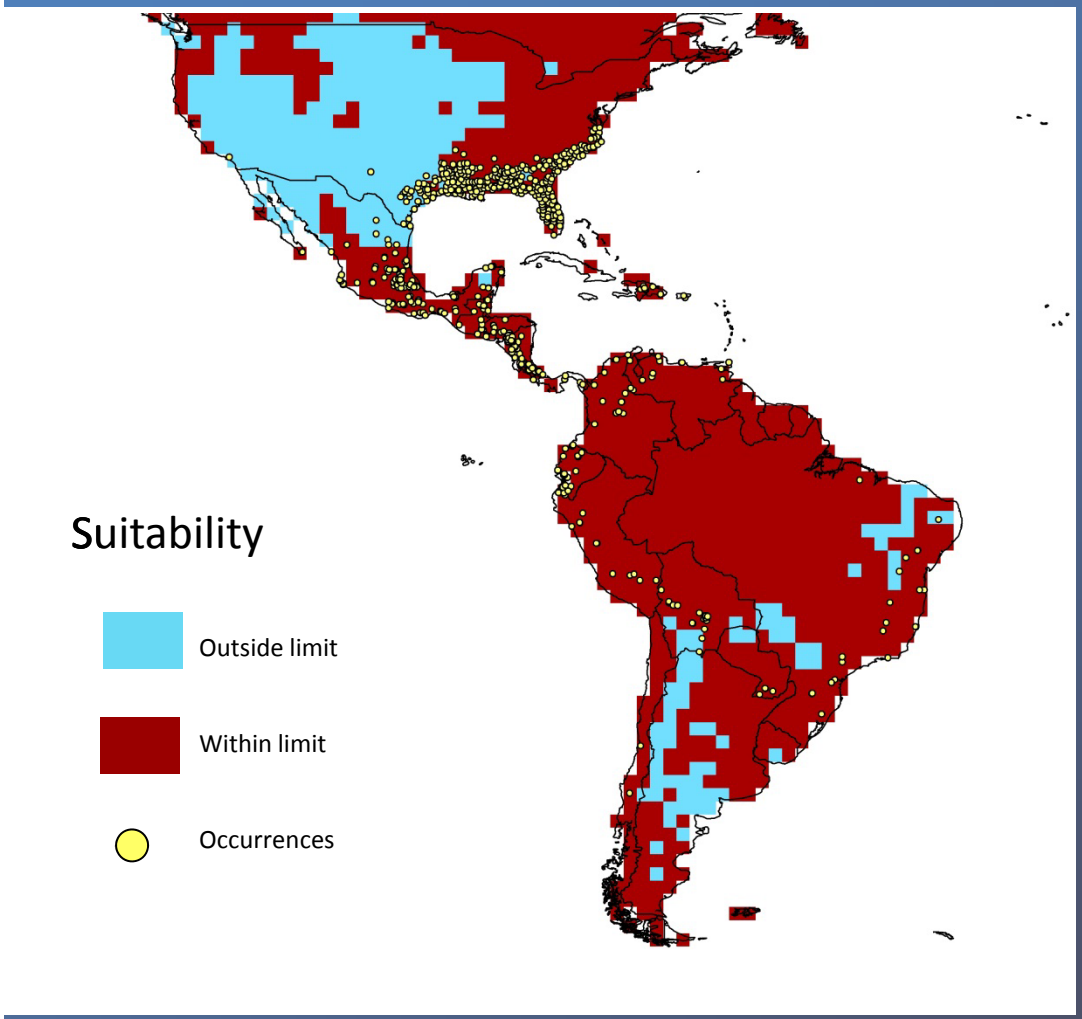



- Not suitable if any one observation > 35° C out of 4 daily observations

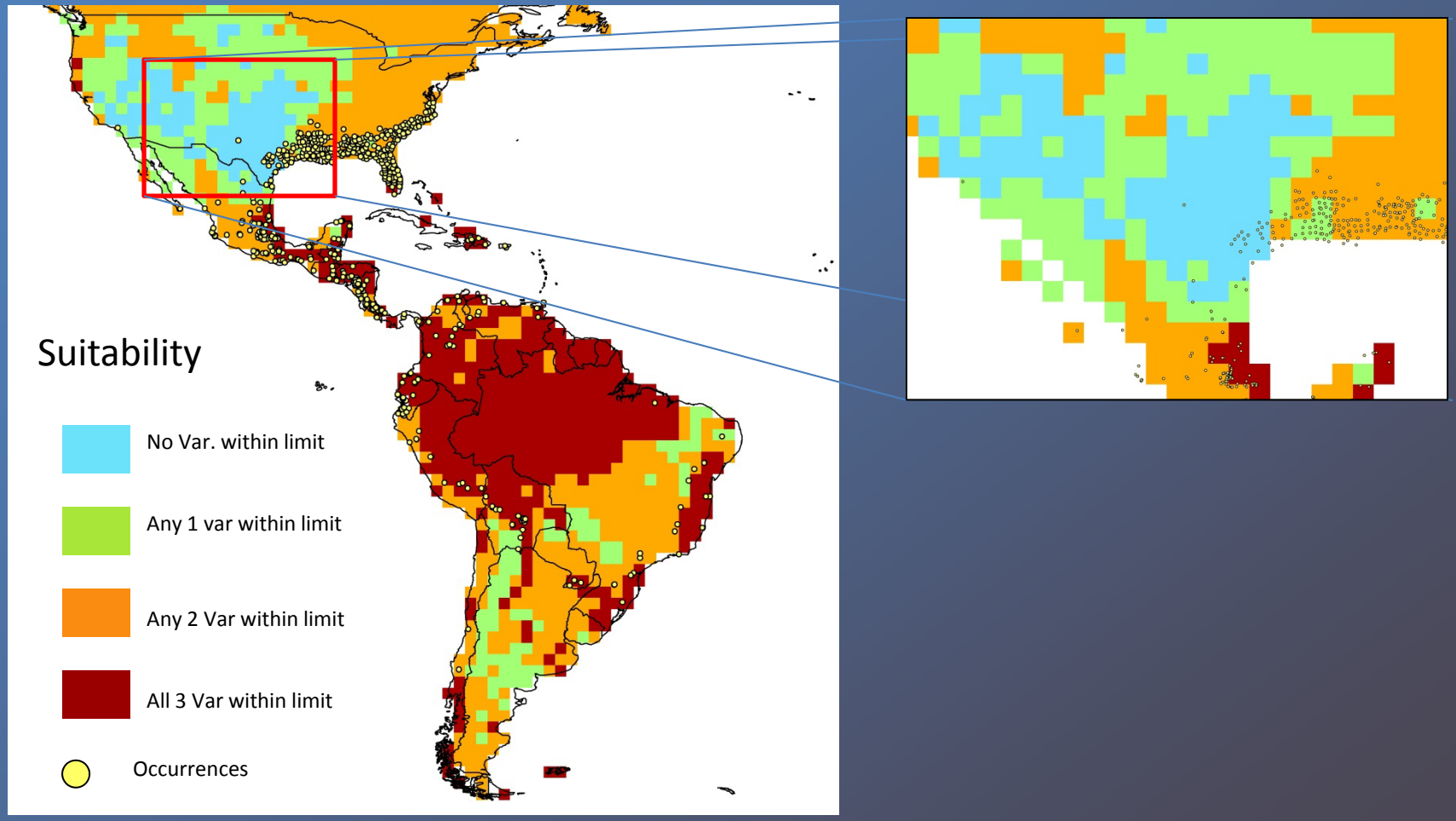
## Minimum temperature


- Not suitable if any two consecutive observations < -5° C out of 4 daily observations.

# Suitable in only 2 variables



# Combination of 3 variables



# Florida Citrus Mutual

*Michael W. Sparks, Executive Vice President/CEO*

## Citrus Freeze Fact Sheet

- Both citrus fruit and foliage can be damaged if temperature falls below freezing for a prolonged period. However, weather conditions prior to cold temperature, duration of cold, position of the tree in the grove or yard, maturity of the fruit, and health and age of the tree can affect tree and fruit hardiness.

- Trees are more cold hardy when exposed to cooler temperature over several weeks prior to freezes. Sudden cold snaps can be particularly damaging to citrus. Cold tolerance develops most readily when trees are not flushing. Warm temperatures at any time during the winter may cause citrus trees to resume growth and reduce their cold tolerance.

- Ice formation in citrus tissues – not low temperature – kills or damages citrus trees and fruit.

  - Fruit damage occurs when the temperature falls below 28°F for at least four hours.
  - Frozen fruit can be salvaged for juice.
  - Four hours at 20°F can kill 3/8 inch or smaller wood and temperatures below 28°F for 12 continuous hours may kill larger limbs and possibly the entire tree.

- The most popular method of freeze protection employed by growers is irrigation. Small micro-sprinklers at the base of the tree emit a mist that turns to ice and engulfs the trunk and lower canopy. As the water changes to ice it give off heat (called latent heat of fusion) which protects the tree. As long as water is constantly changing to ice the temperature of the ice-water mixture will remain at 32°F.

- The major problems in the use of irrigation for cold protection occur when inadequate amounts of water are applied or under windy (advective) conditions.

- Depending on the type of freeze (advective/windy freeze or radiation frost) water can provide protection in one situation and cause damage in another, it is important to know what principles are involved and understand that dew point and what can happen when using water during a freeze.

*Information provided by Mongi Zekri, multi-county citrus agent, University of Florida, IFAS, SW Florida Extension Service.*

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# Acknowledgements


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