Hot models: projecting future climate-driven distributions of two ambush bug species, *Phymata americana* and *Phymata pennsylvanica*

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Climate change …and ambush bugs?

- Changes in Earth's climate, resulting in new, long-term weather patterns
  - Can be due to internal variability or human activity
- Increased CO_2 from human activity
  - Increased temperature
  - Heavier rainfall

Two *Phymata* species in S. Ontario

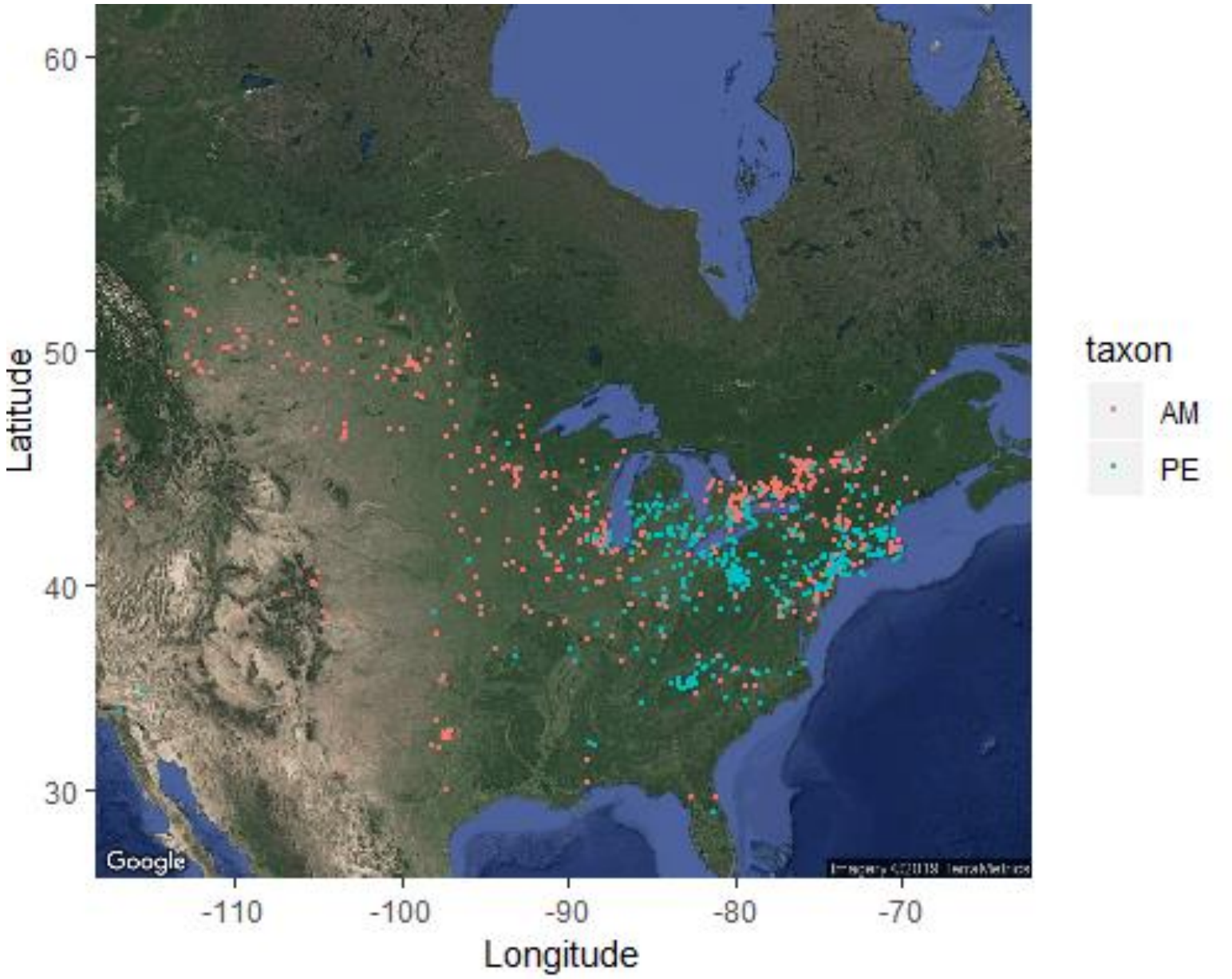
- Jagged ambush bugs
- Generalist
- Sit-and-wait predation
- Eggs laid on plants and overwinter
- Nymphs and adults lie

P. americana

P. pennsylvanica

P. pennsylvanica with common aerial yellowjacket

In Ontario, *P. americana* and *P. pennsylvanica* are found in overlapping distribution



Maxent, a species distribution modeling software

Species distribution data:

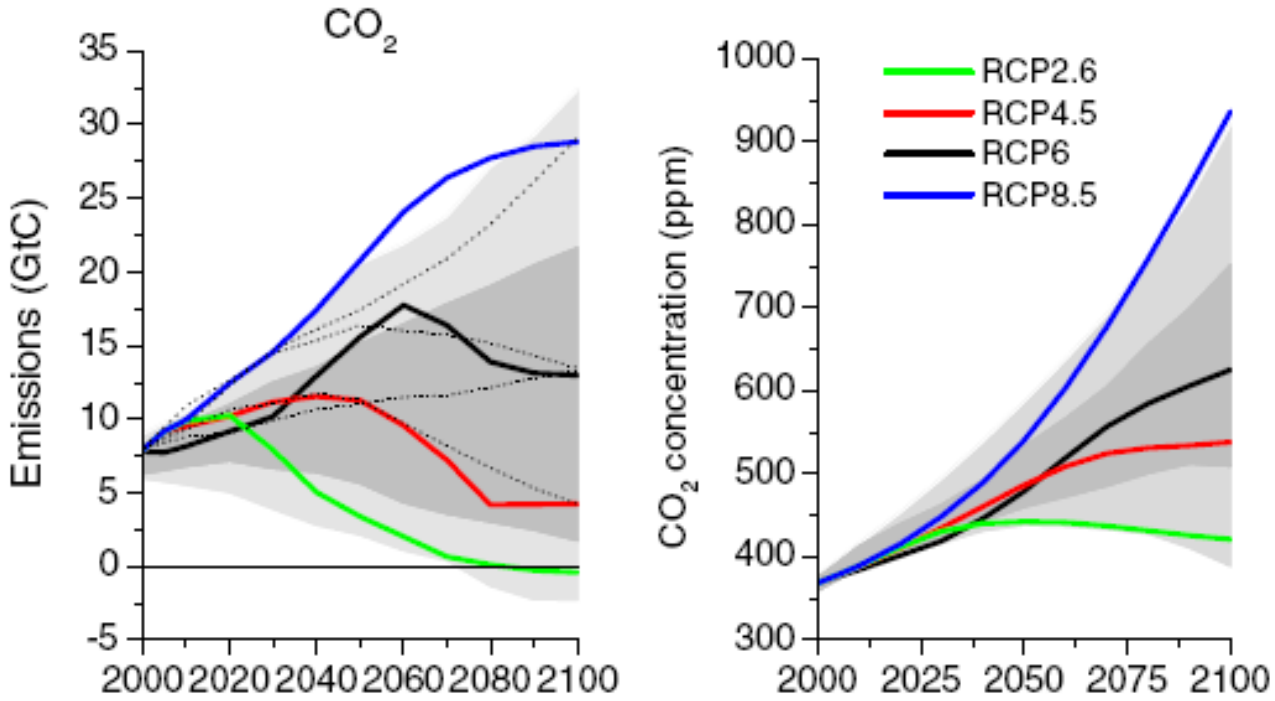
- Museum data
- BugGuide.net
- iNaturalist.com

Environmental data:

- Temperature
- Precipitation

Representative Concentration Pathways (RCP)

- RCP2.6: best-case scenario
  - peak CO_2 emissions in 2025
  - Low greenhouse gas (GHG) emissions
- RCP4.5: peak CO_2 emissions in 2045
- RCP6: peak CO_2 emissions in 2060
- RCP8.5: worse-case scenario
  - continuously increasing emissions
  - High GHG emissions



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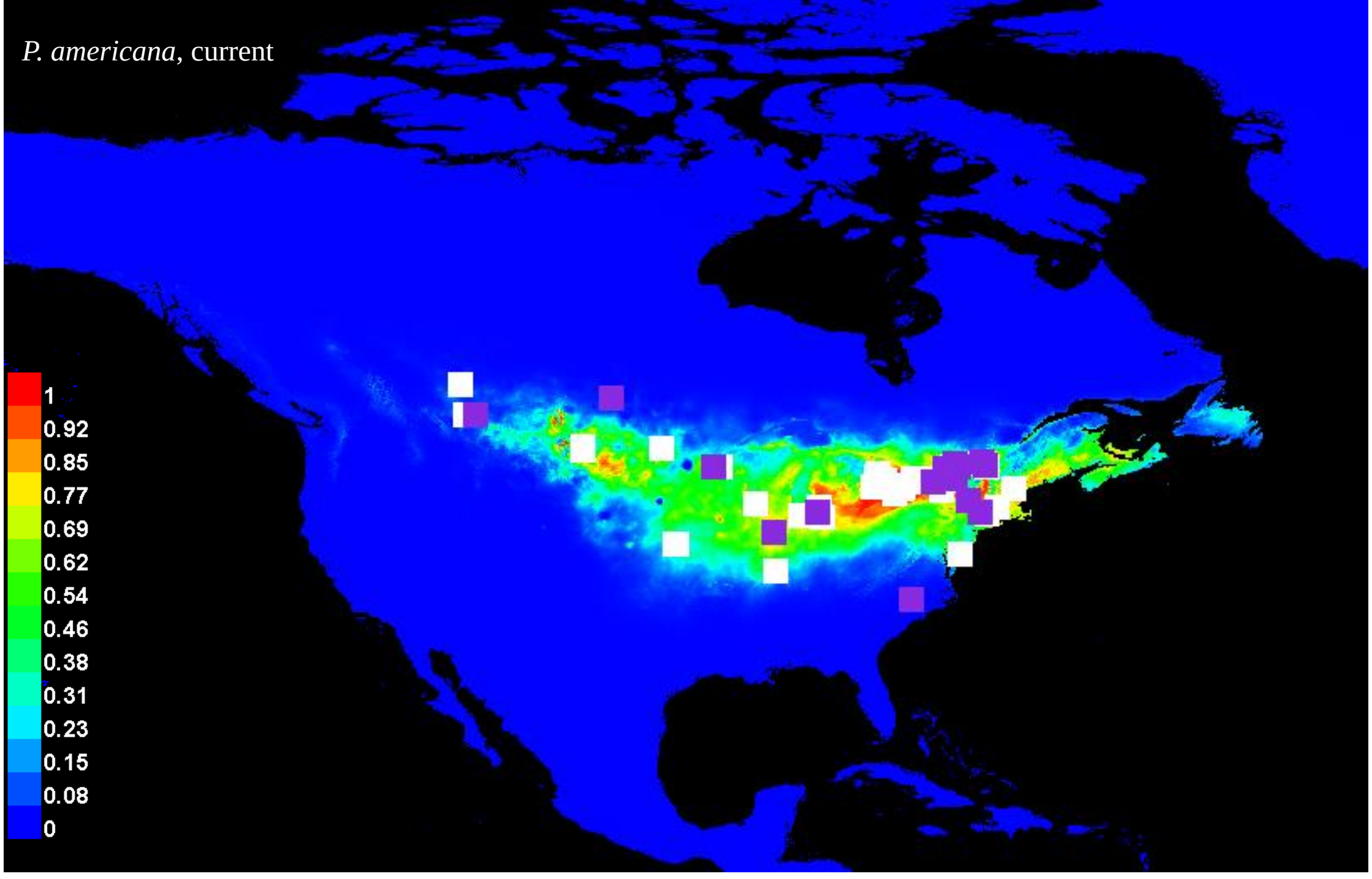
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Outline

What do future distributions look like?

Why do future distributions look the way they do?


P. americana, current
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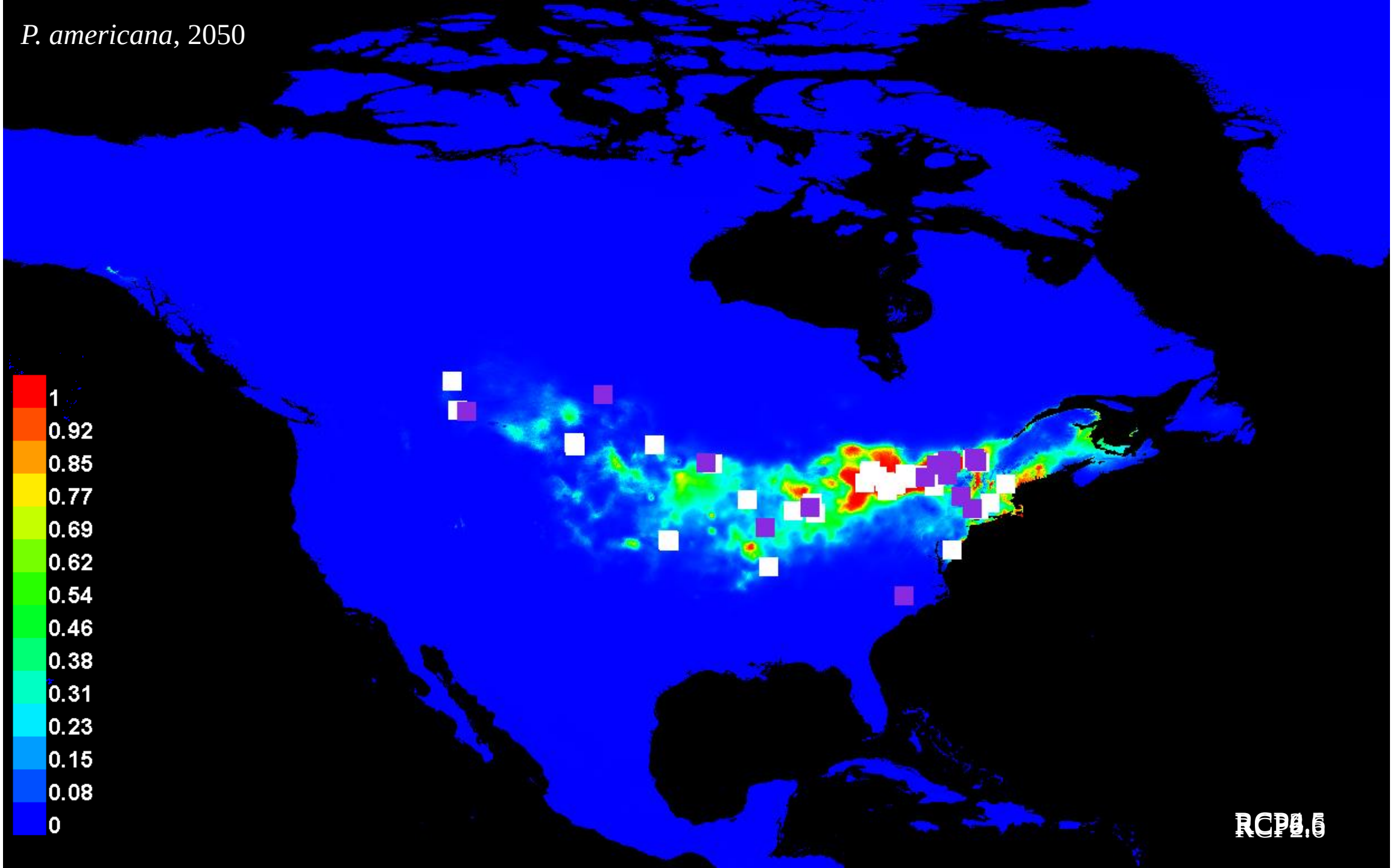
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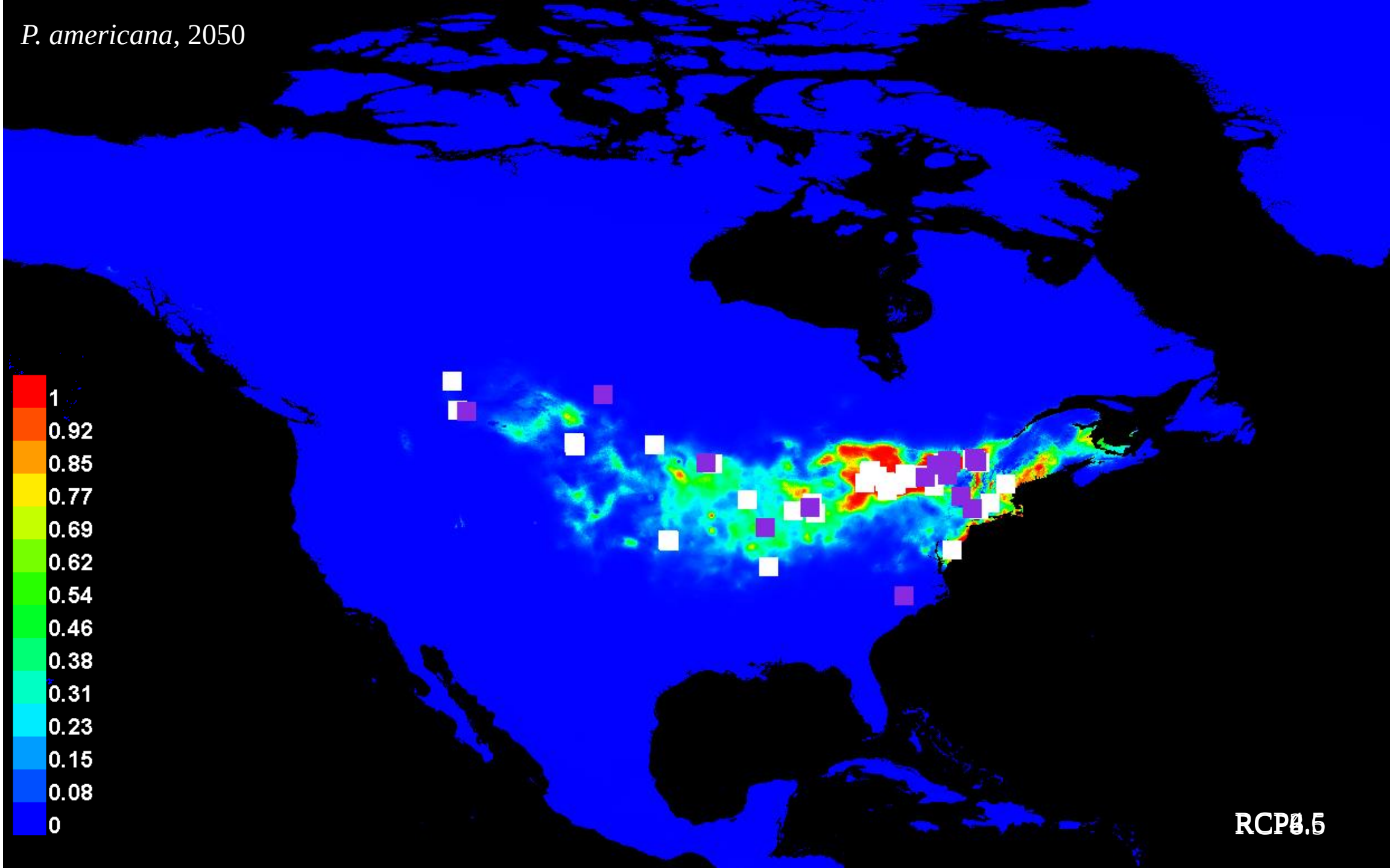
RCP4.5
RCP2.6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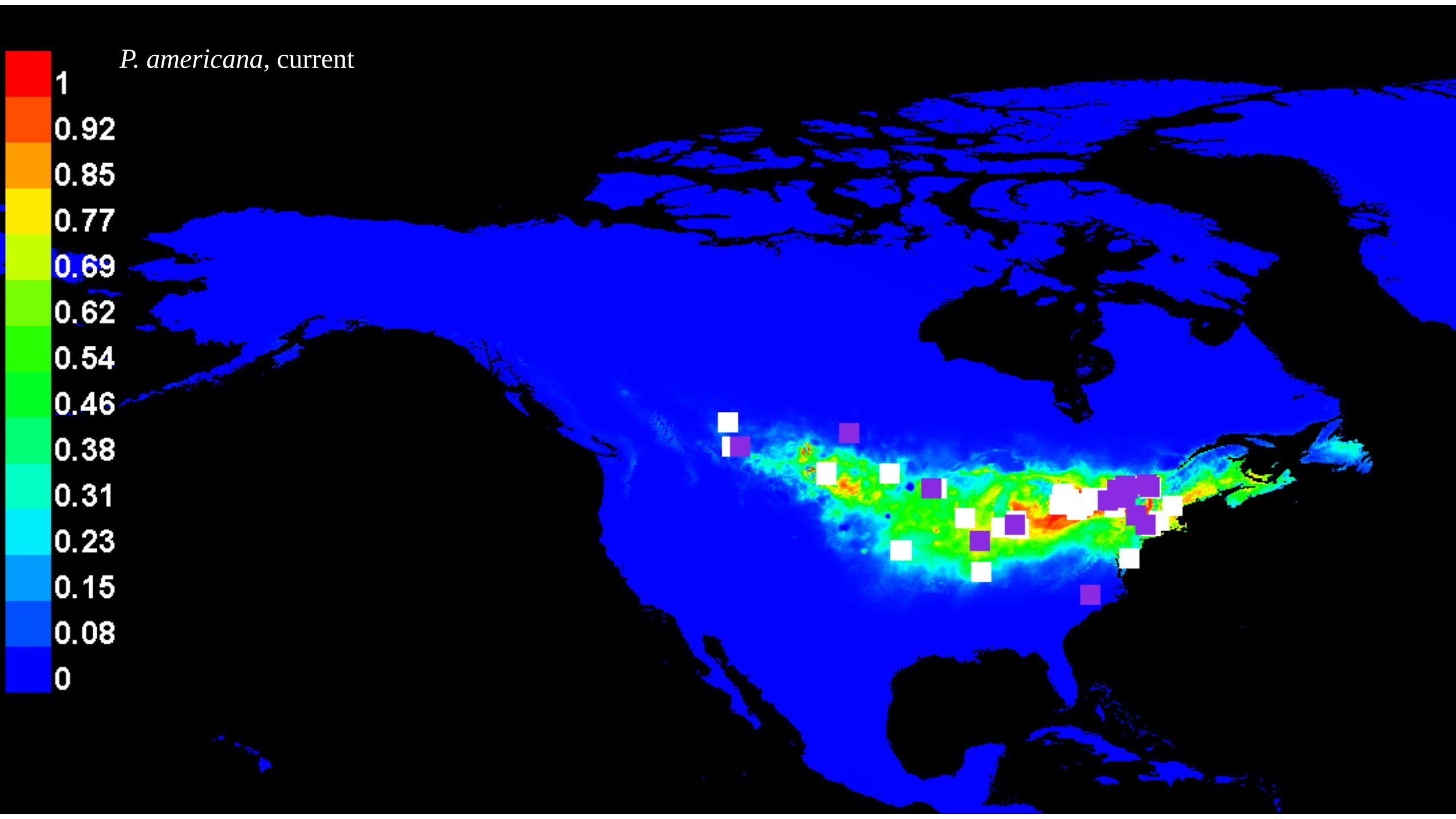
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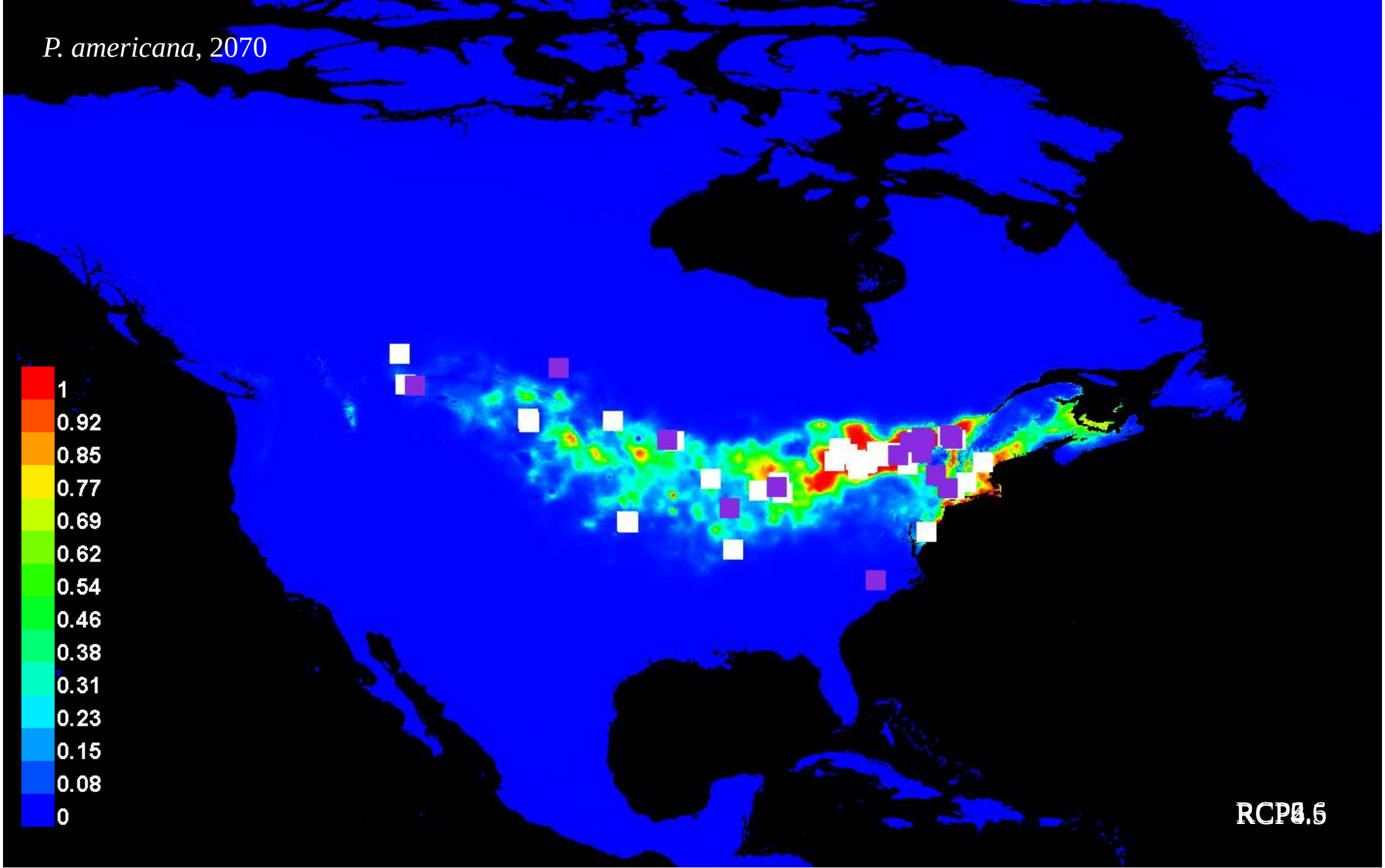
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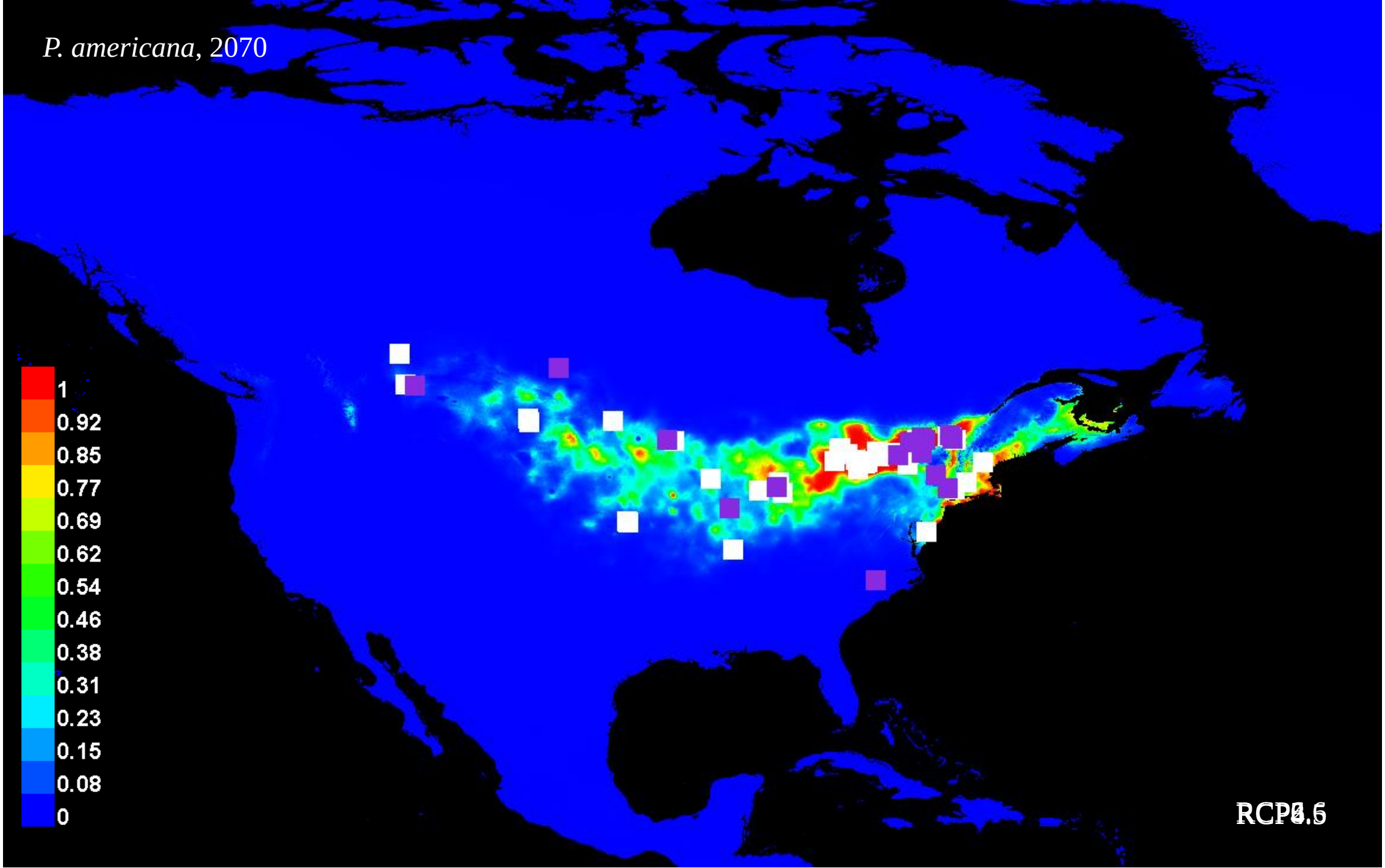
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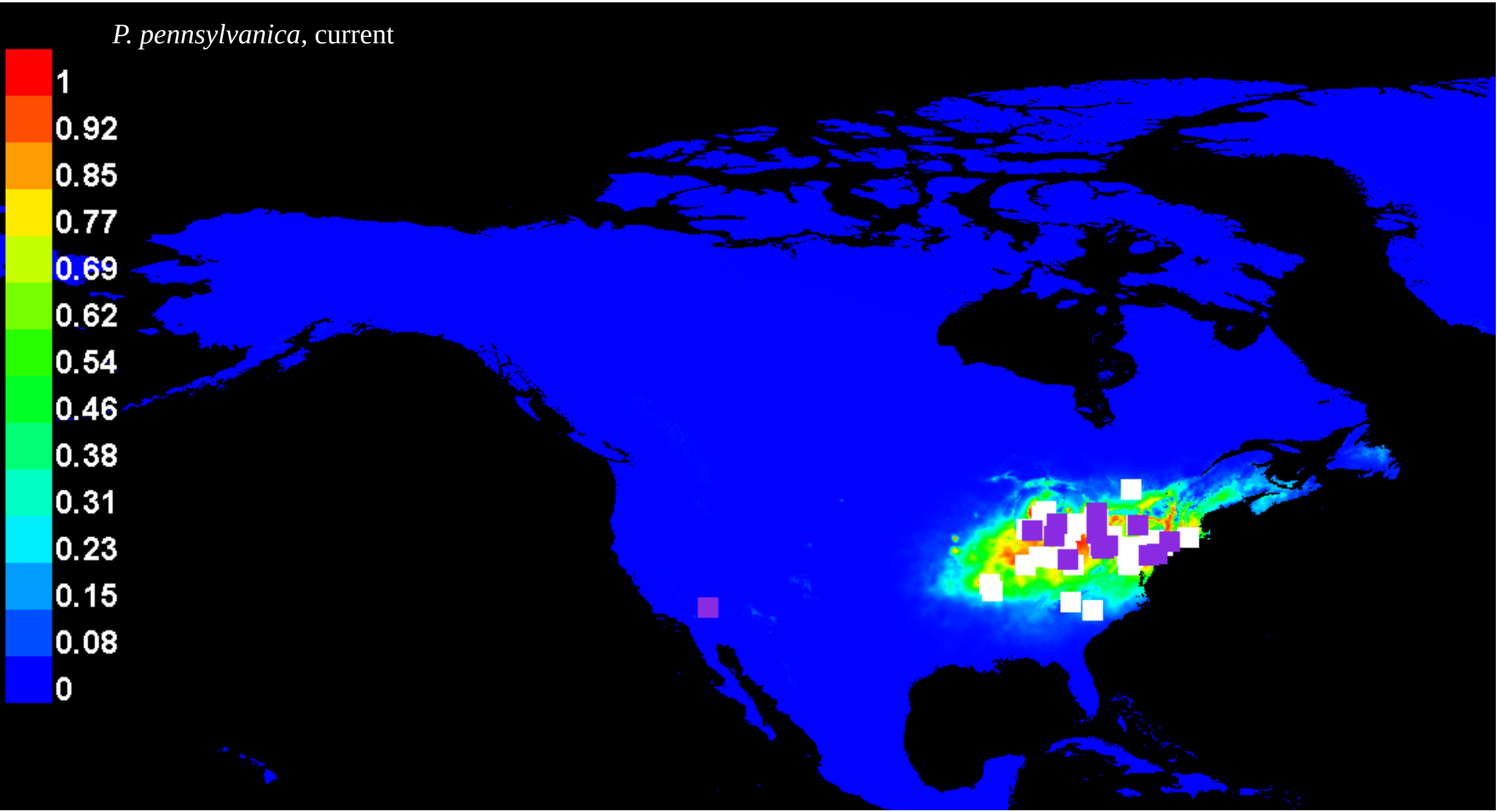
RCP8.5

Why is the range of *P. americana* shifting?

- RCP2.6:
  - Slightly warmer temperature increases ranges
  - More variable precipitation
- RCP4.5: temperatures rise until 2060s, in decline in 2070
- Temperatures that are too high affect colouration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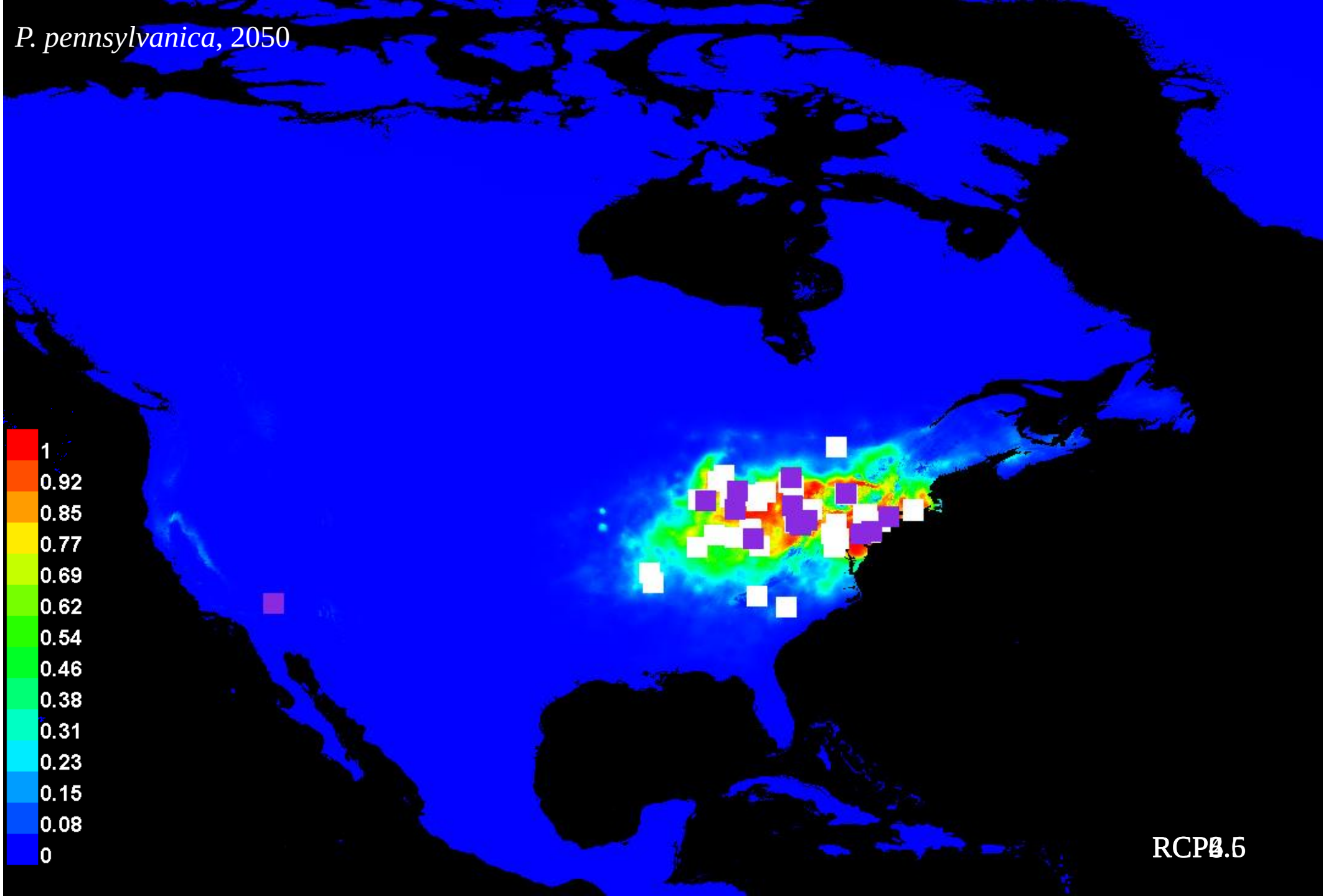
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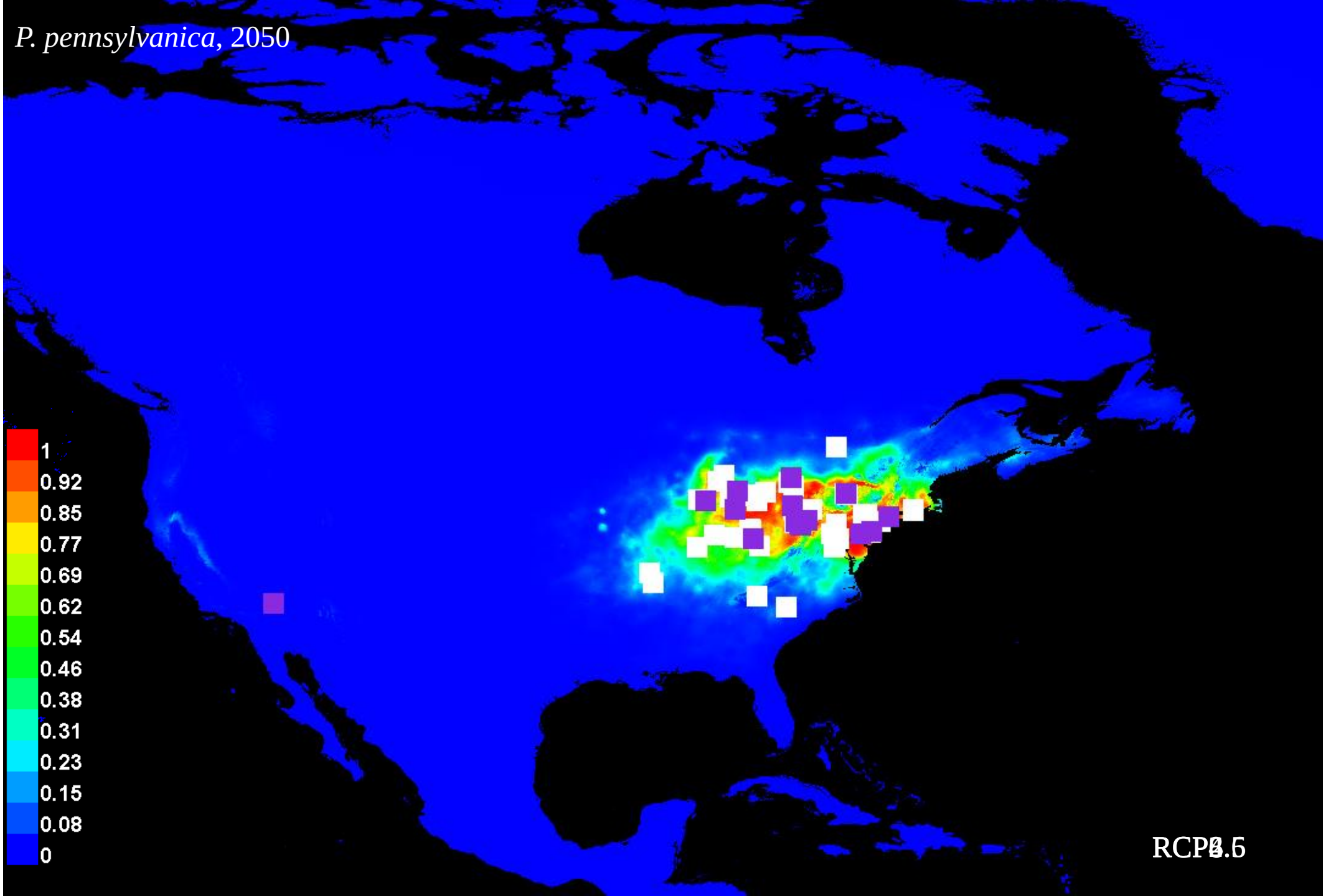
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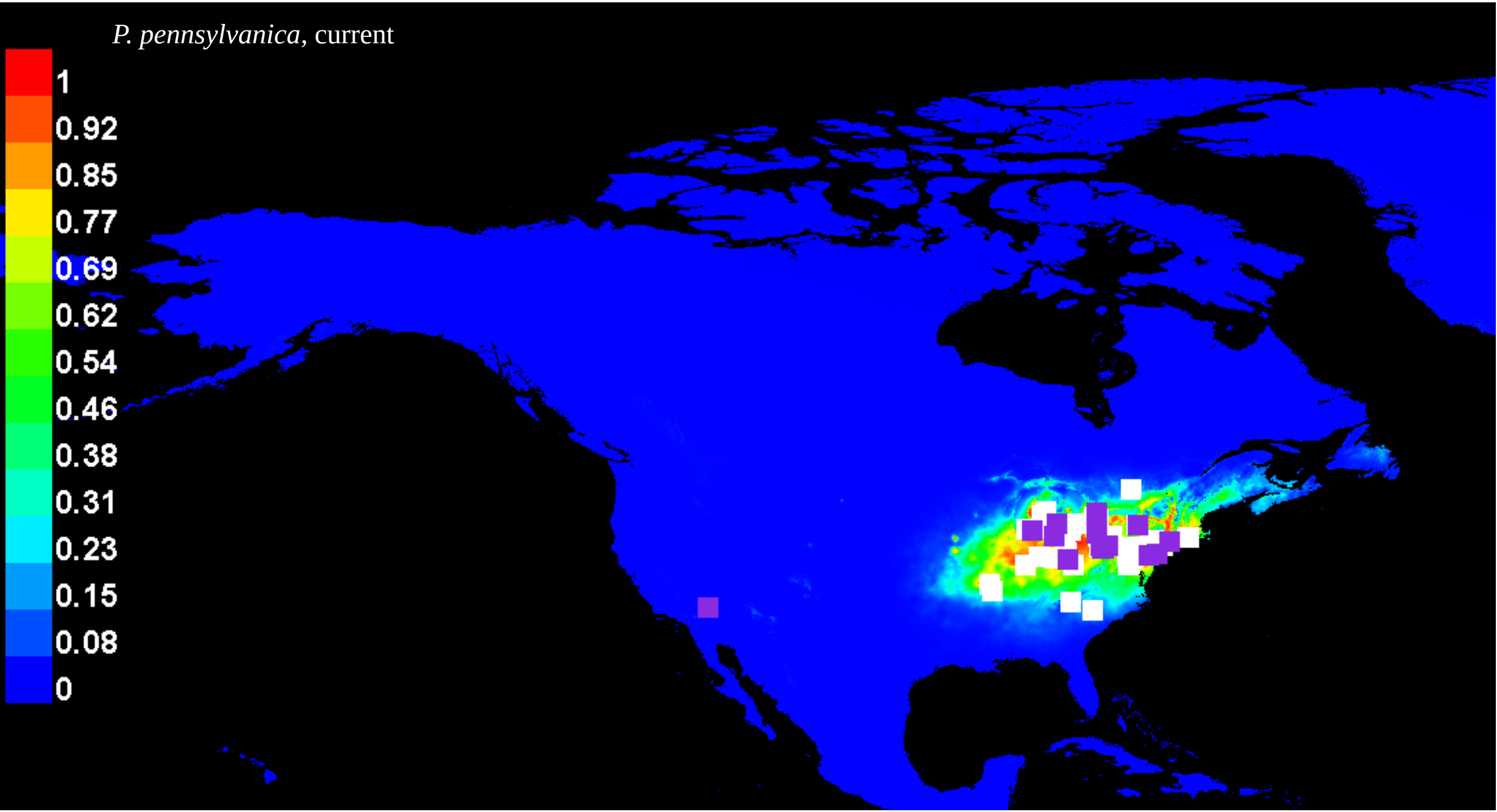
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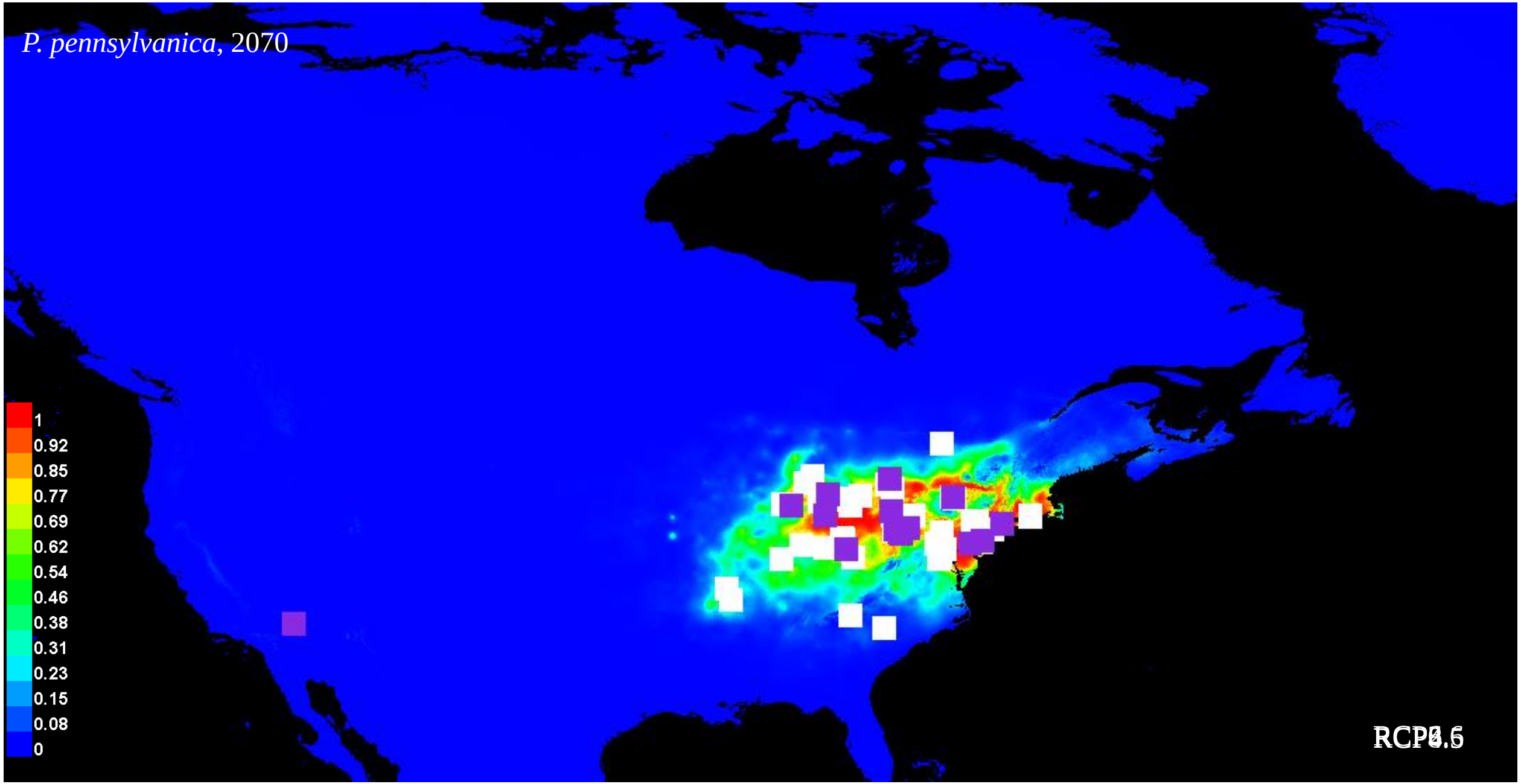
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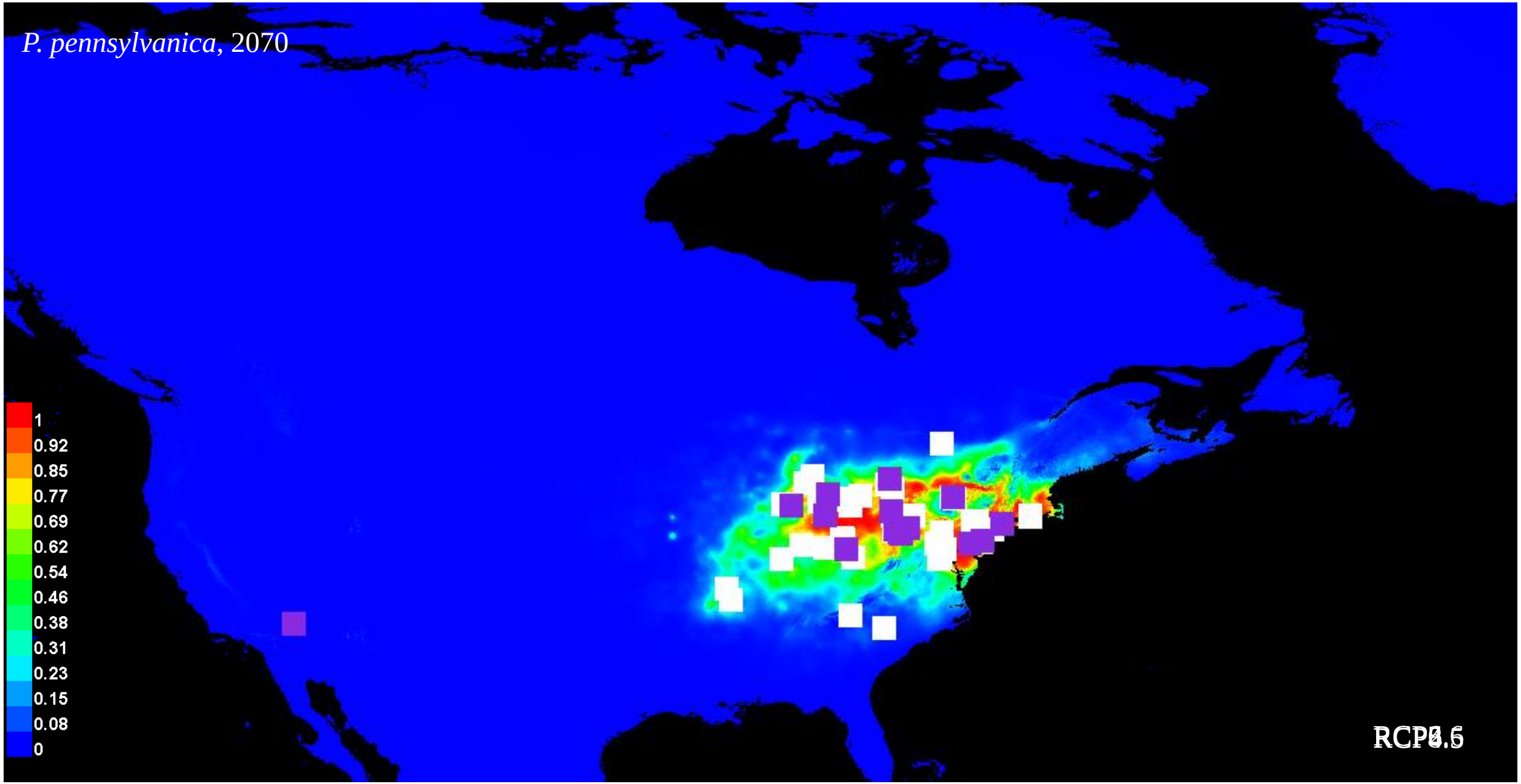
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RCP4.5

Why is the range of *P. pennsylvanica* shifting?

- Smaller ranges, but less affected by temperature and precipitation than *P. americana*
  - More obvious range shifts in 2070
- More eastward and westward shifts
- 2070: RCP4.5 has the greatest range

What does this mean?

- Predictions:
  - Slight latitudinal increase in ranges at lower RCPs
  - Decreases in ranges at higher RCPs
- Caveats
  - Actual distributions may be smaller than predicted
  - Other variables not captured by the model
- Future goals:
  - Pinpointing the effect of environmental/climatic variables on

Acknowledgements

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Rowe lab members
Douglas Currie
Members of TEA

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AM 2050
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