

Shoo fly! Using Species Distribution Models to inform climate change-driven shifts in fruit fly distributions

ASSOC PROF LINDA BEAUMONT

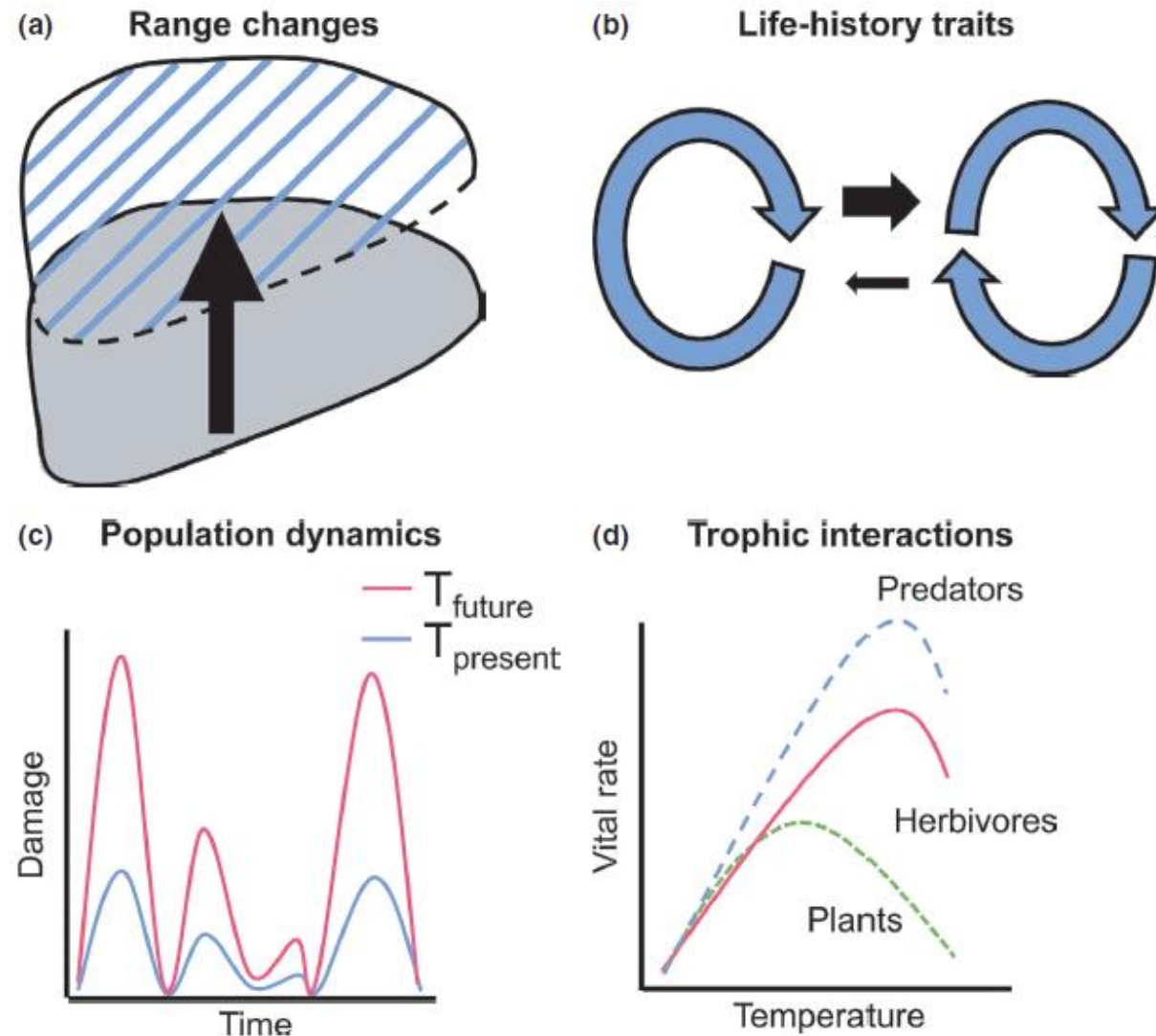
6 September 2021



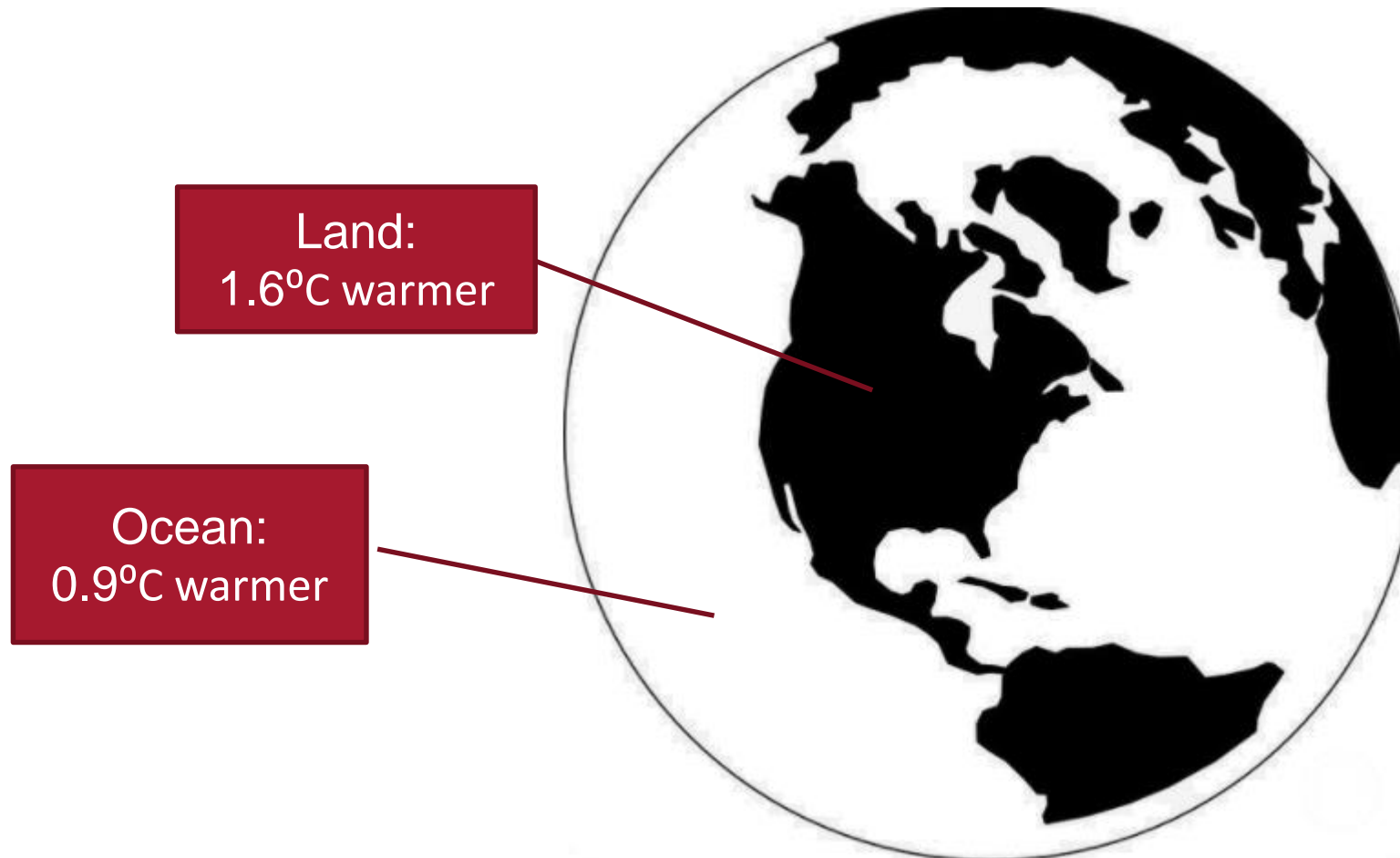
Please excuse
barking dogs and
interrupting kids



There is already a clear biological fingerprint of climate change



1.1°C of warming and counting...



2021-2040:
0.4 to 0.5°C

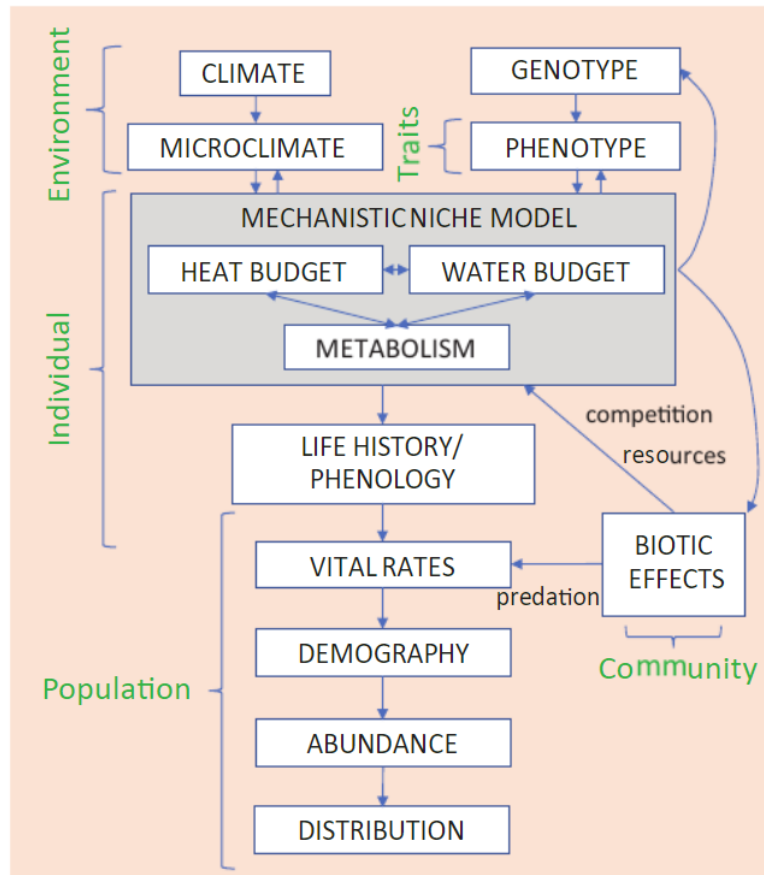
2041-2060:
0.9 to 1.5°C

Species distribution models

- What are SDMs?
- How do they work?
- What do they indicate about range shifts of pest species?
- What are their limitations and potential extensions?

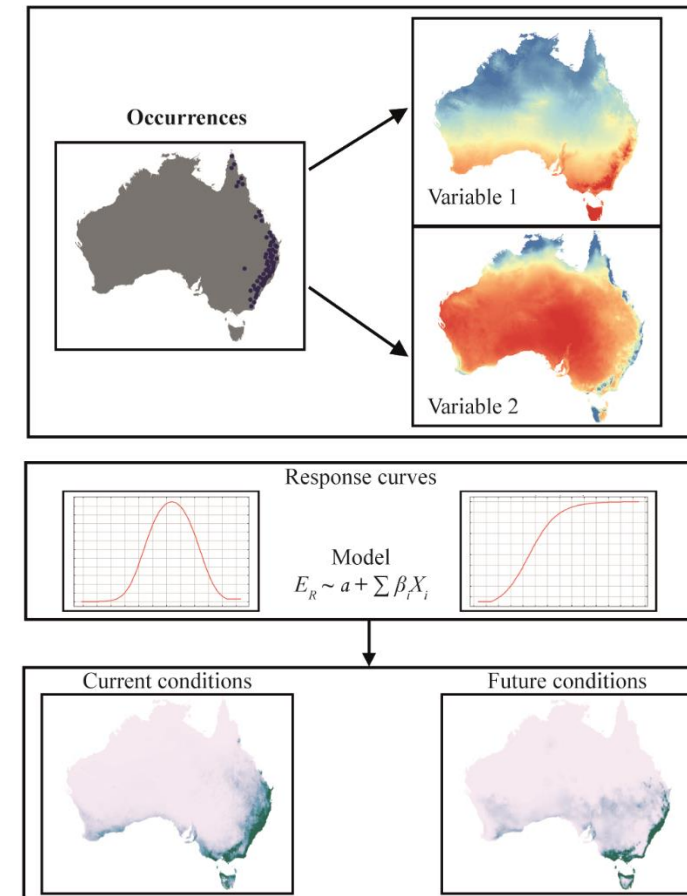
What are SDMs?

Process-based model



Kearney and Porter 2020

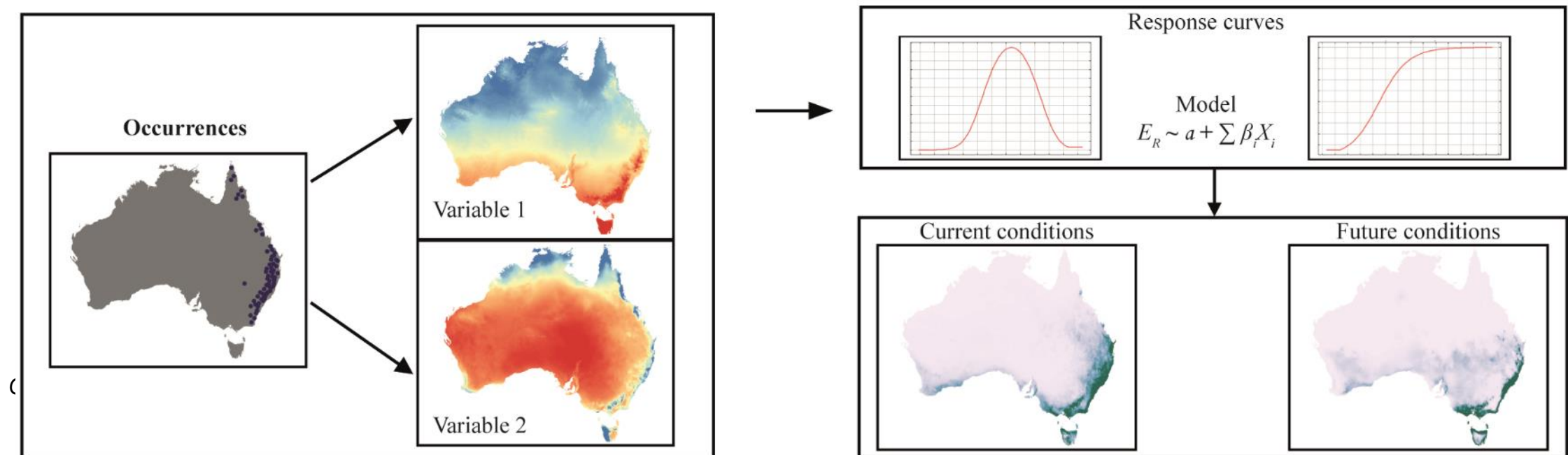
Correlative model



Ooi et al. 2018

Correlative SDMs

Numerical tools that combine observations of species occurrence or abundance with estimates of environmental parameters.

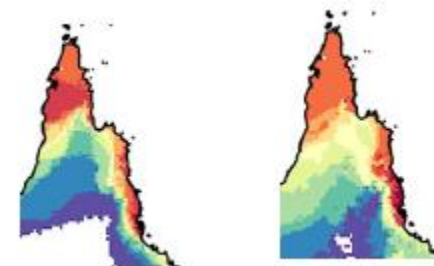


What patterns emerge from SDMs of insect pests across Australia under a changing climate?

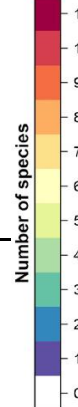
- Broad biogeographic patterns of change
- Variation across climate scenarios
- Variation across SDM

1960-1990

c. 2070



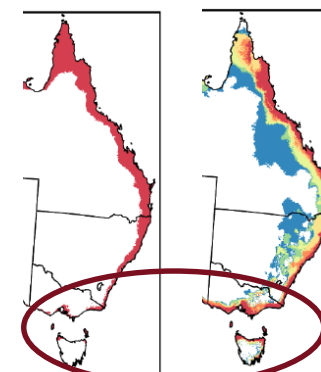
Number of species



Sultana et al. 2020

1960-1990

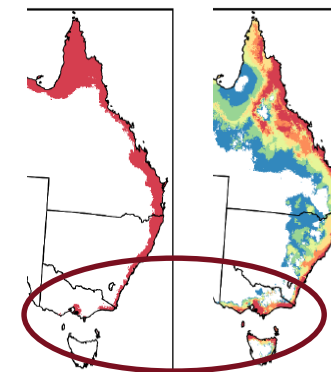
c. 2070



B. bryoniae

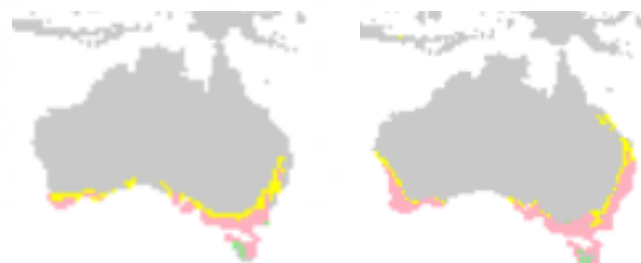
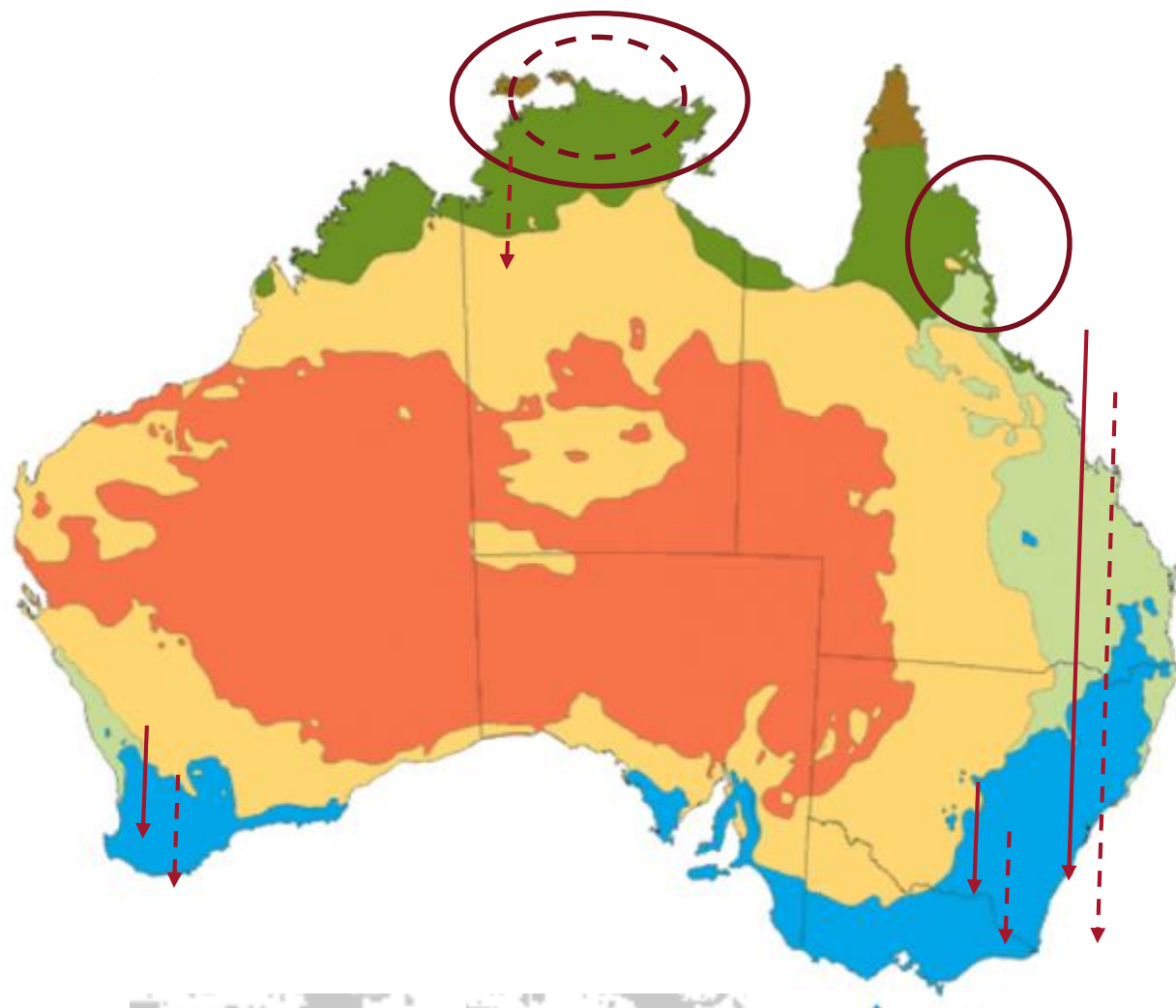
1960-1990

c. 2070



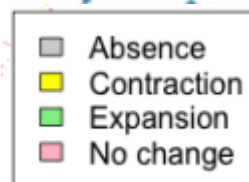
B. jarvisi

Sultana et al. 2020



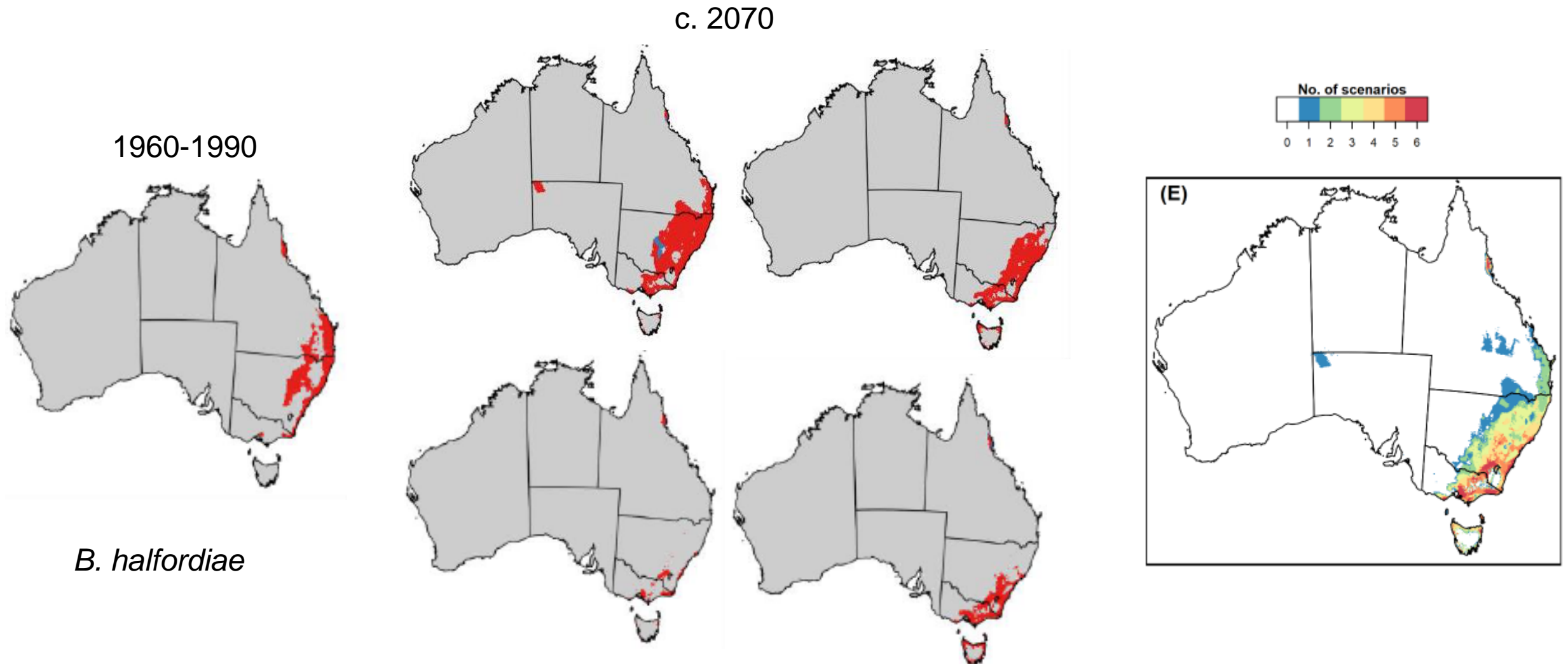
R. indifferens

R. pomonella



Hill et al. 2016

Variation across climate scenarios



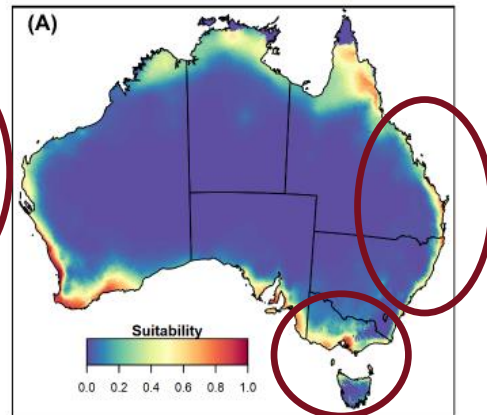
Variation across SDMs

Medfly

CLIMEX

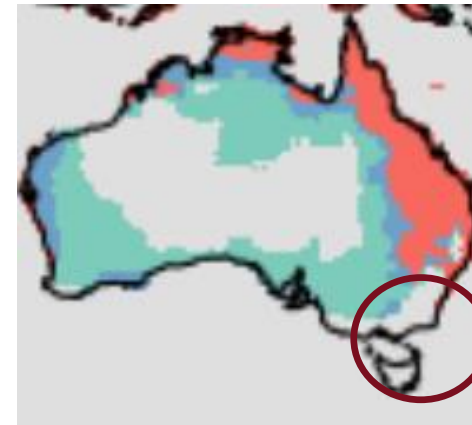


MaxEnt

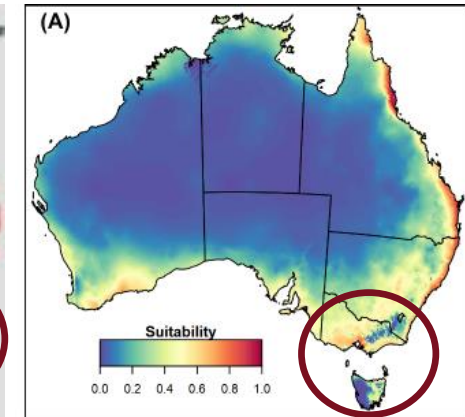


Qfly

CLIMEX



MaxEnt



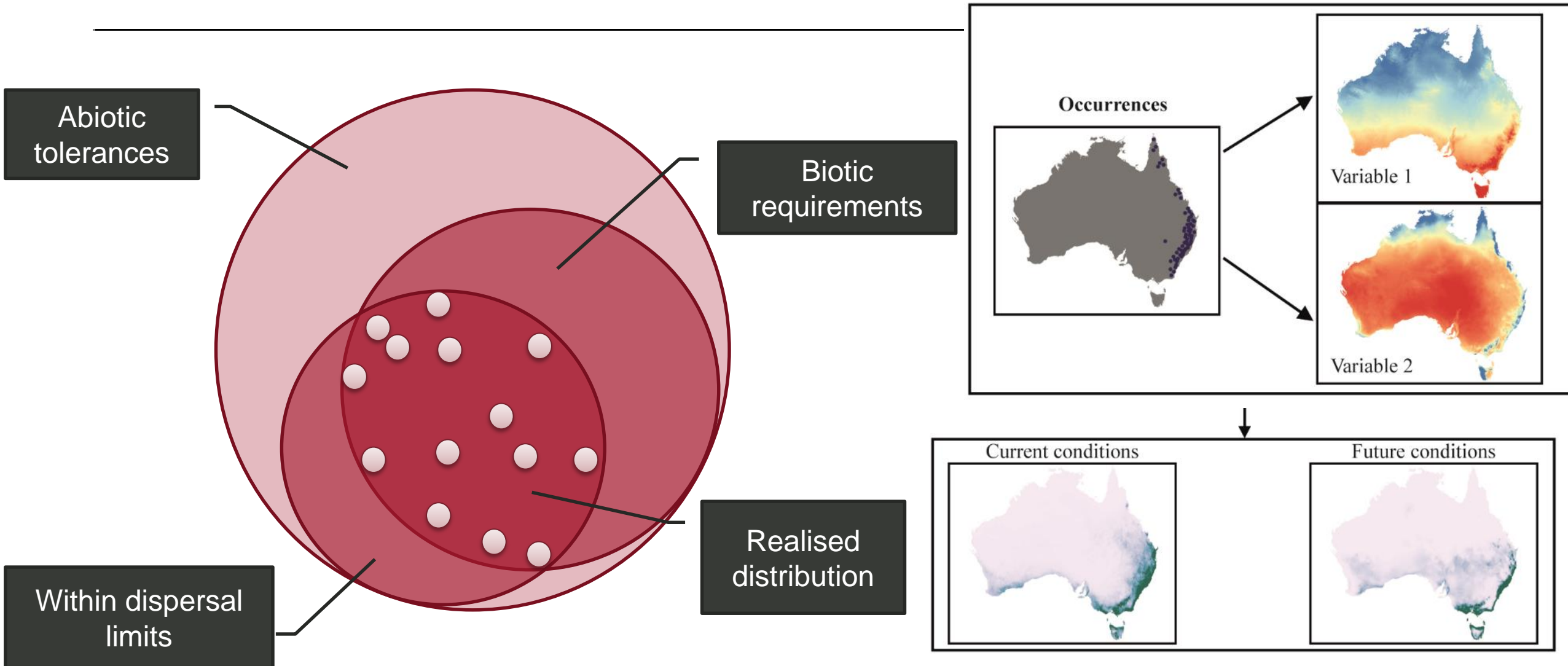
Ecoclimatic Index



Hill et al. 2016

Sultana et al. 2020

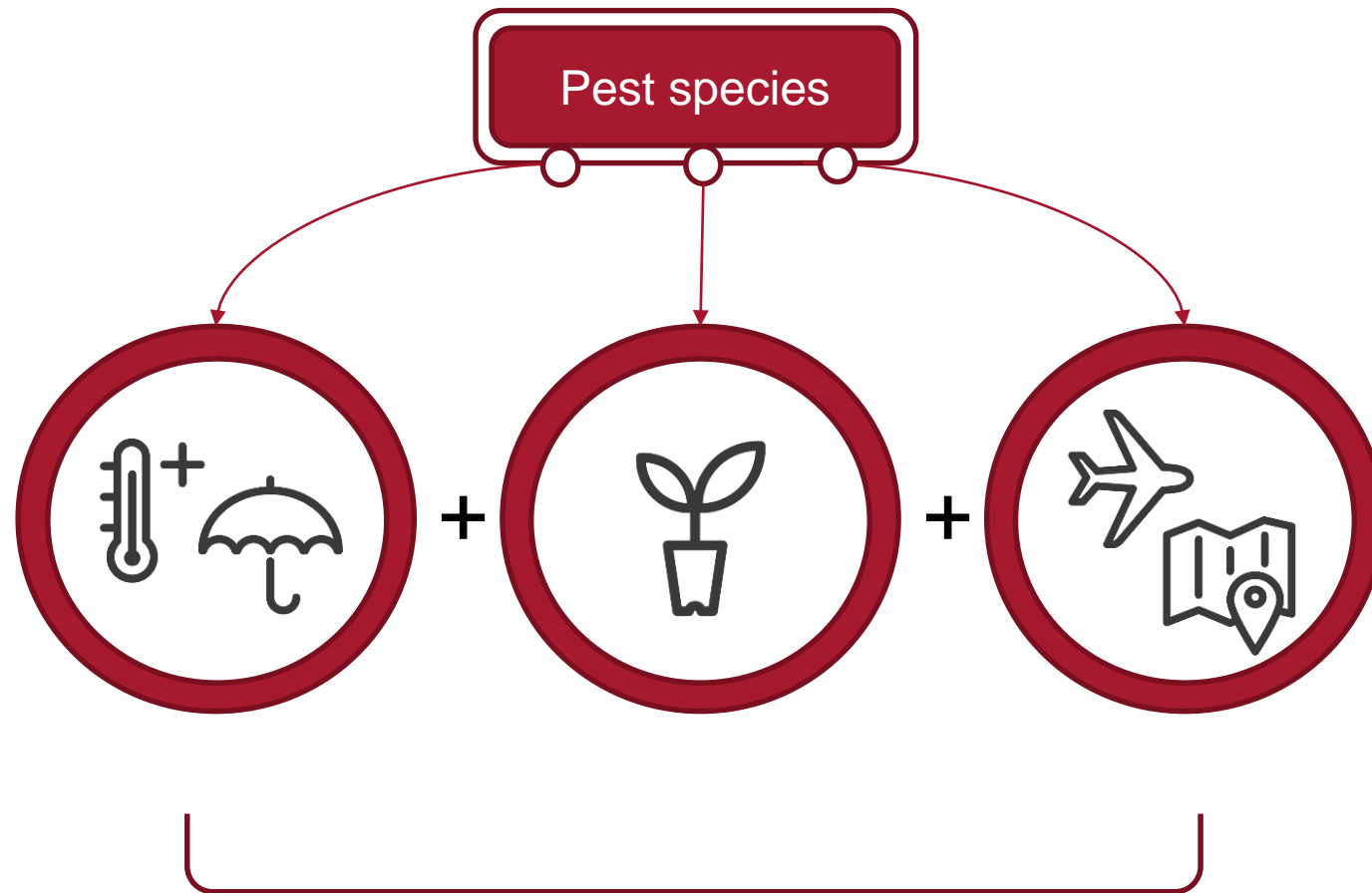
Realised vs fundamental niches



Extending SDMs

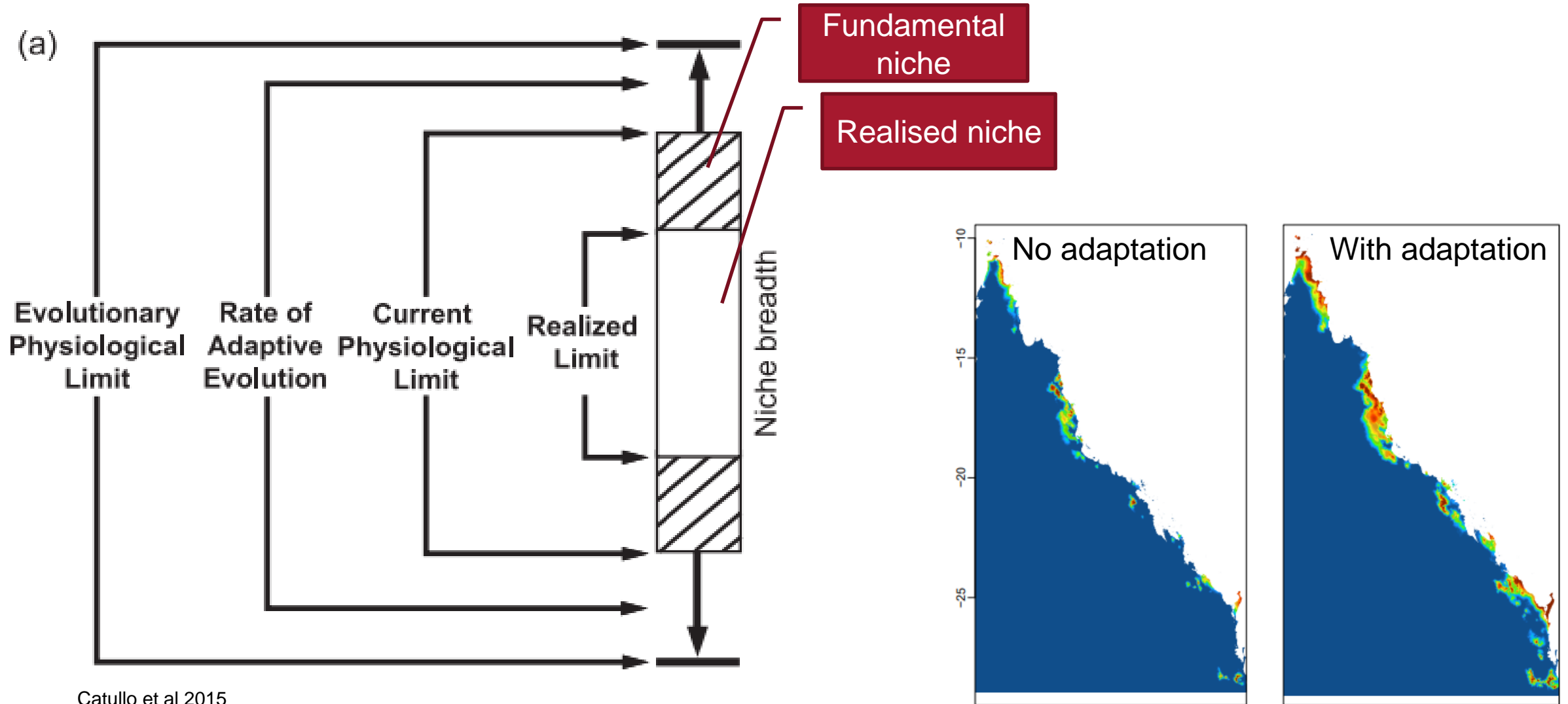
- Include other variables necessary for establishment
- Account for adaptation

Establishment likelihood



Establishment Likelihood

Adaptation to climate change



Catullo et al 2015

Bush et al 2016

To wrap up...

All models are wrong but
some models are useful –
George Box, circa 1976