Terrestrial Biodiversity Vulnerability to Climate Change

Dr. Matt Fitzpatrick
Associate Professor
University of Maryland Center for Environmental Science

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Abu Dhabi, UAE

University of Maryland
Center for Environmental Science

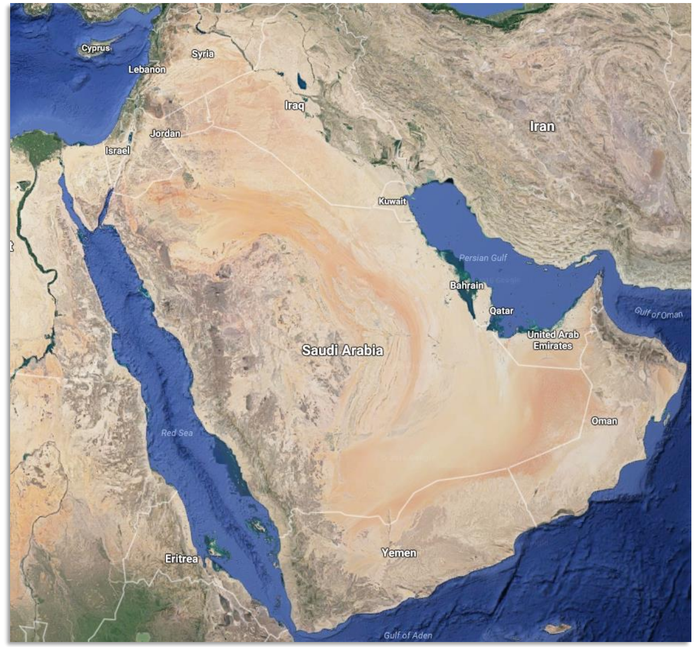
Climate Change Research Group

AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

Objectives

Assess the potential vulnerability of terrestrial biodiversity to 21st century climate change



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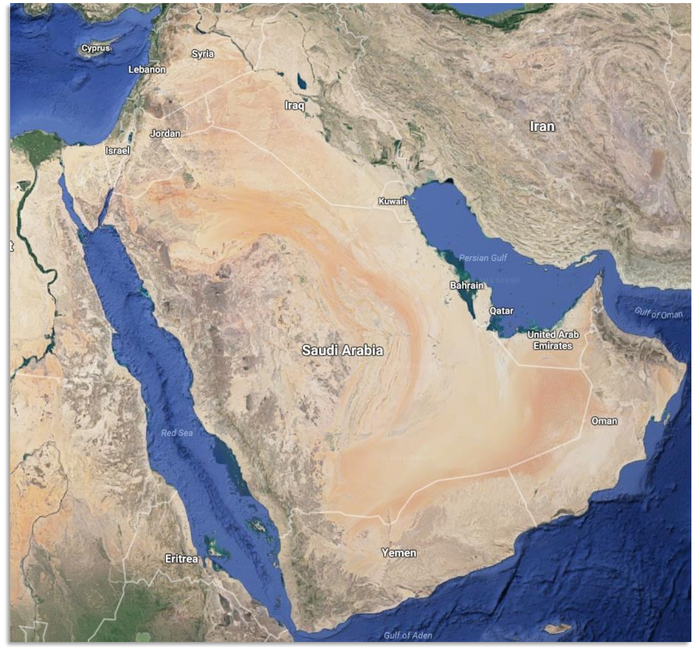
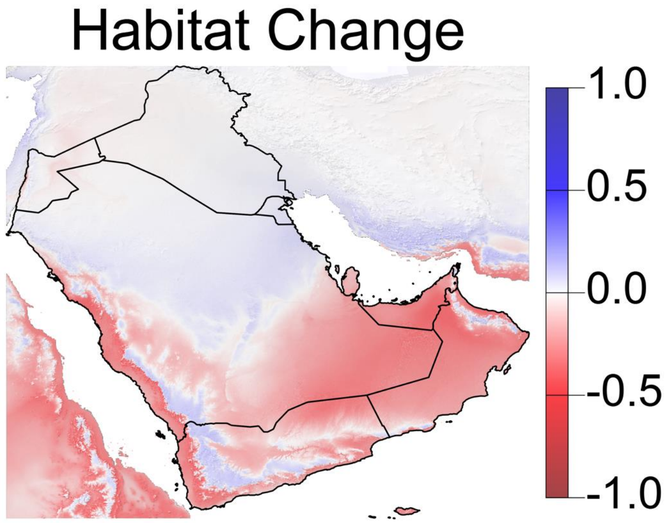
- Map changes in climate suitability for priority species





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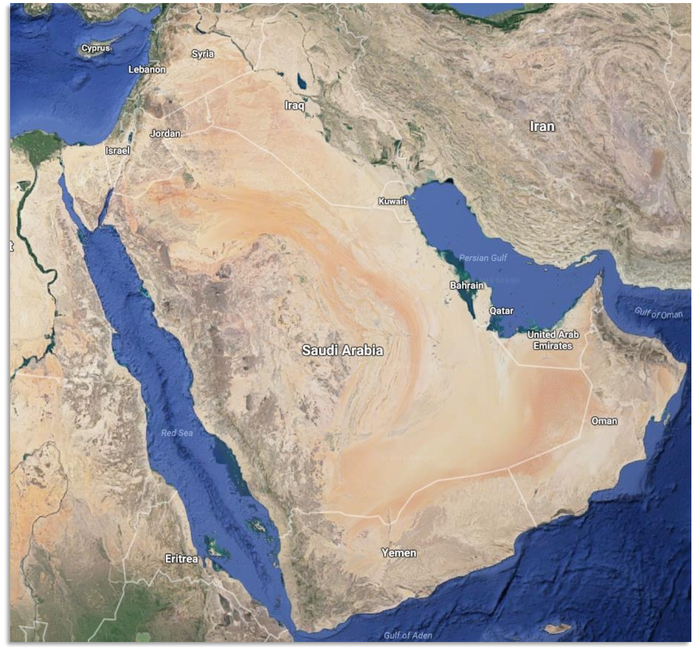
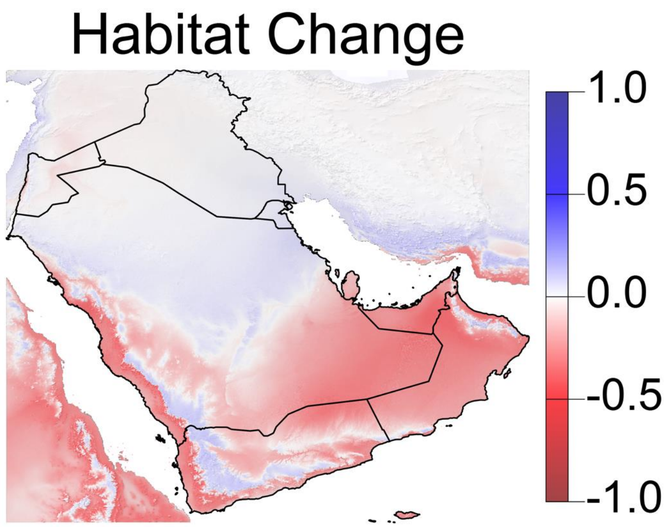
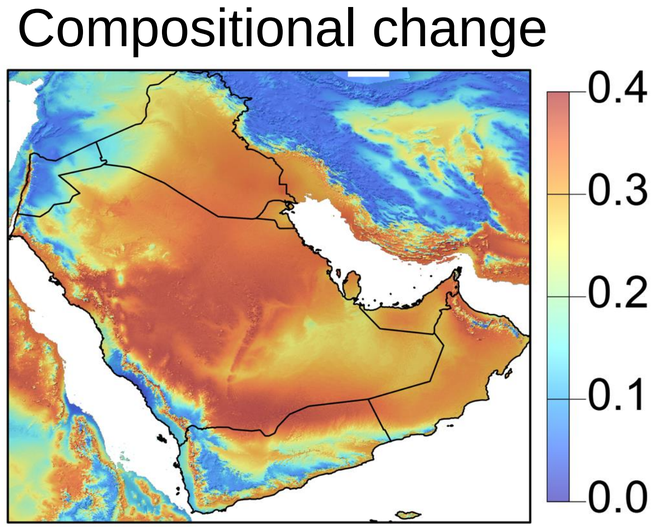
- Map changes in climate suitability for priority species
- Map vulnerability of biodiversity as a whole



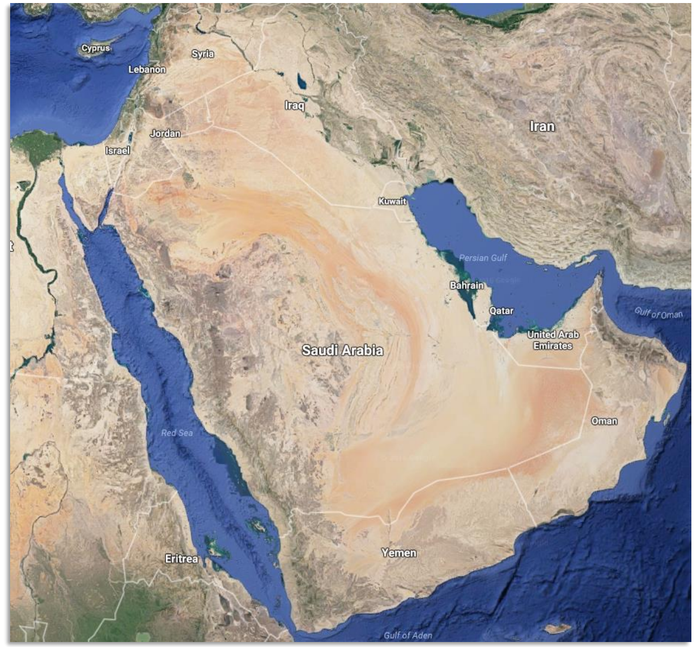


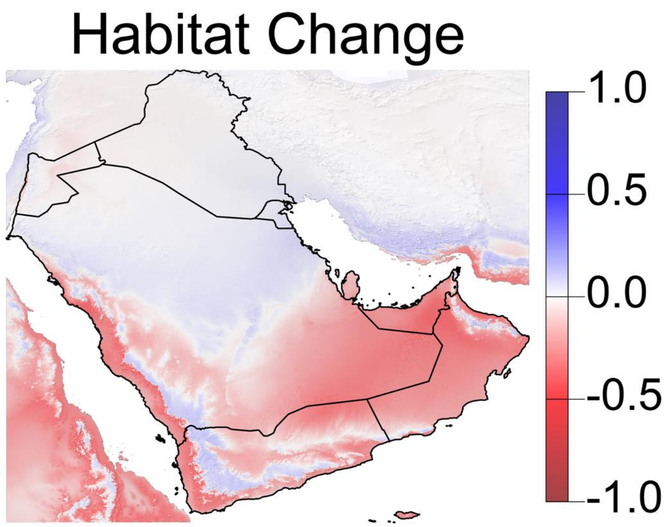


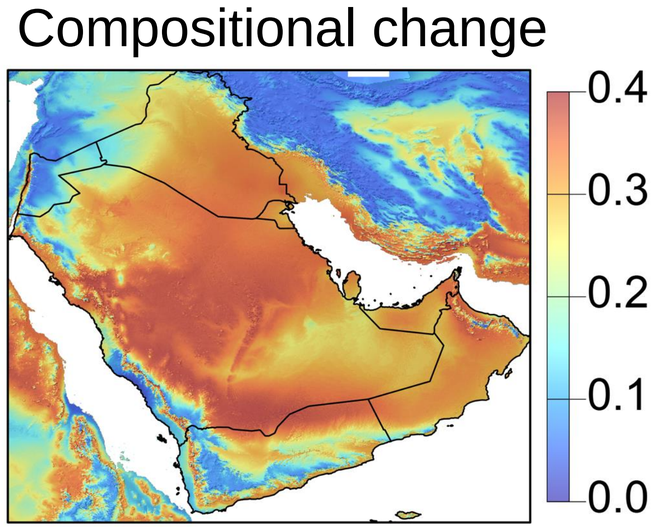
Objectives

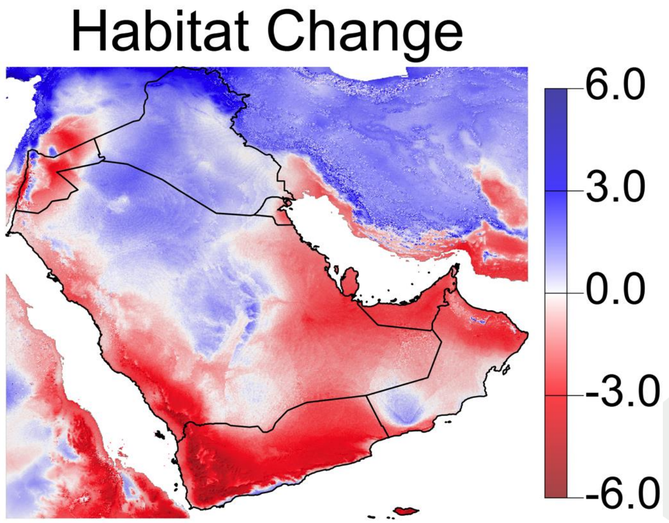
Assess the potential vulnerability of terrestrial biodiversity to 21st century climate change

- Map changes in climate suitability for priority species
- Map vulnerability of biodiversity as a whole
- Identify taxonomic groups and regions expected to be most vulnerable to climate change









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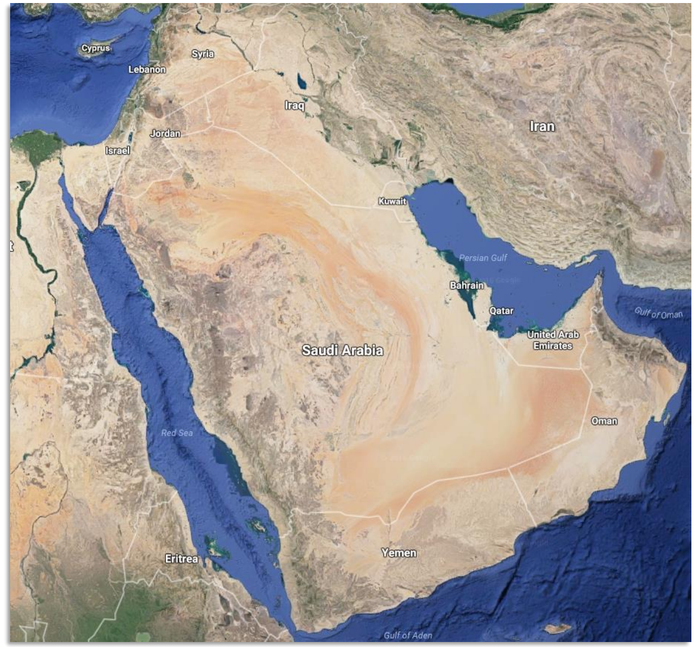
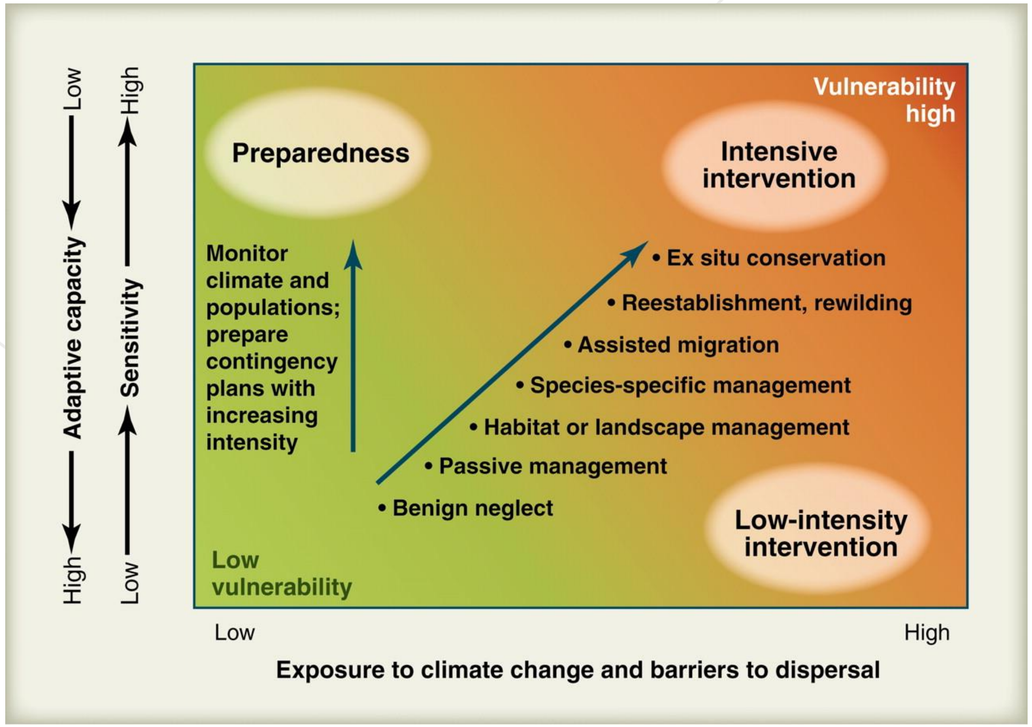
Assess the potential vulnerability of terrestrial biodiversity to 21st century climate change

- Inform management / conservation planning



Dawson et al. (2011)



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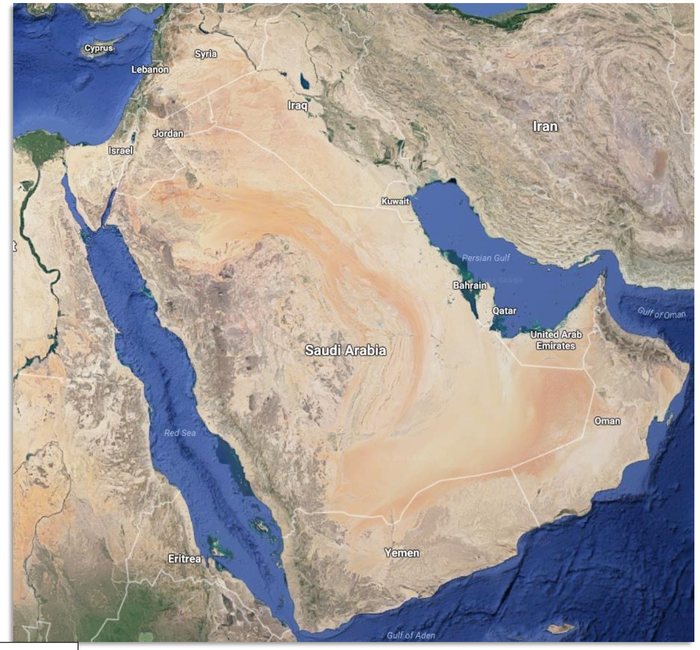
Assess the potential vulnerability of terrestrial biodiversity to 21st century climate change

- Inform management / conservation planning
- Inform research needs / knowledge gaps going forward



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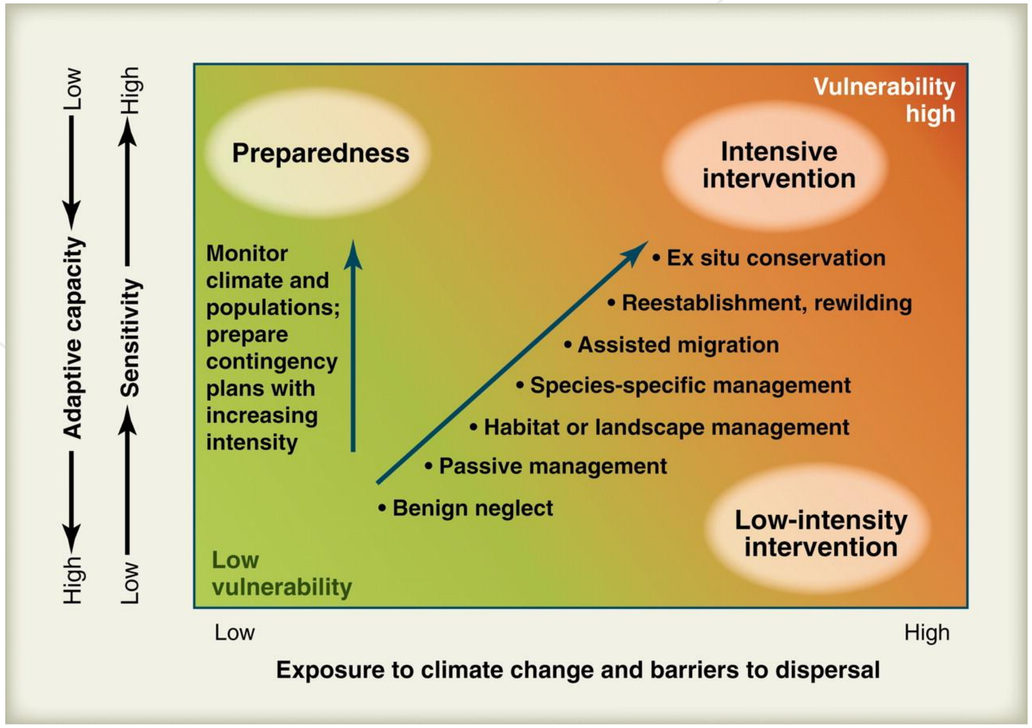

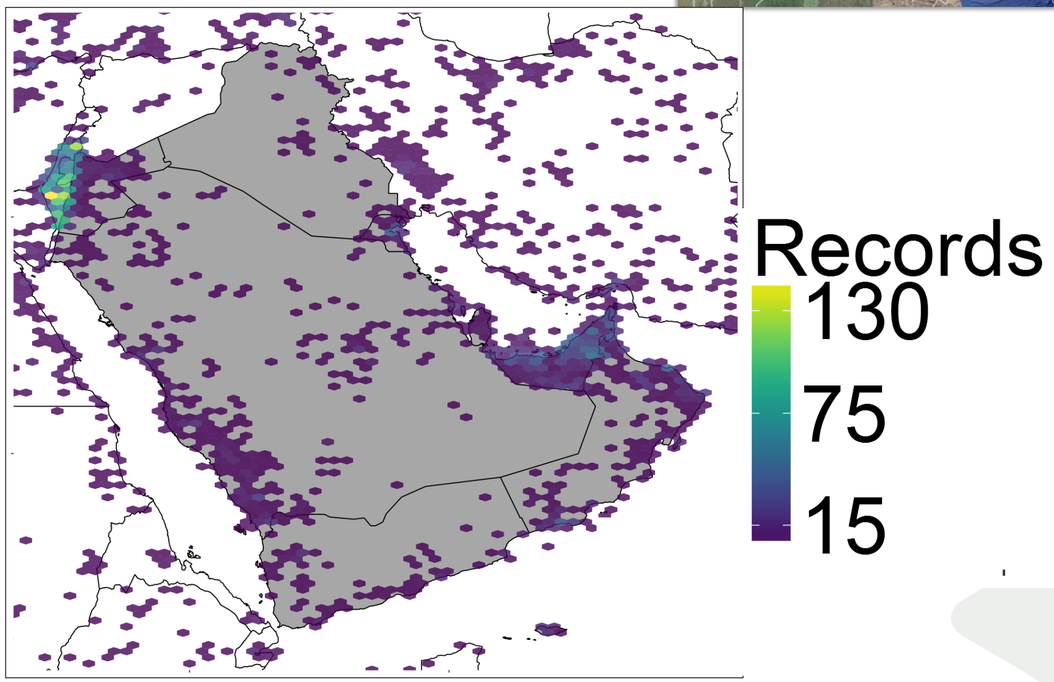

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Methodological Background

Two complimentary spatial modeling methods were used

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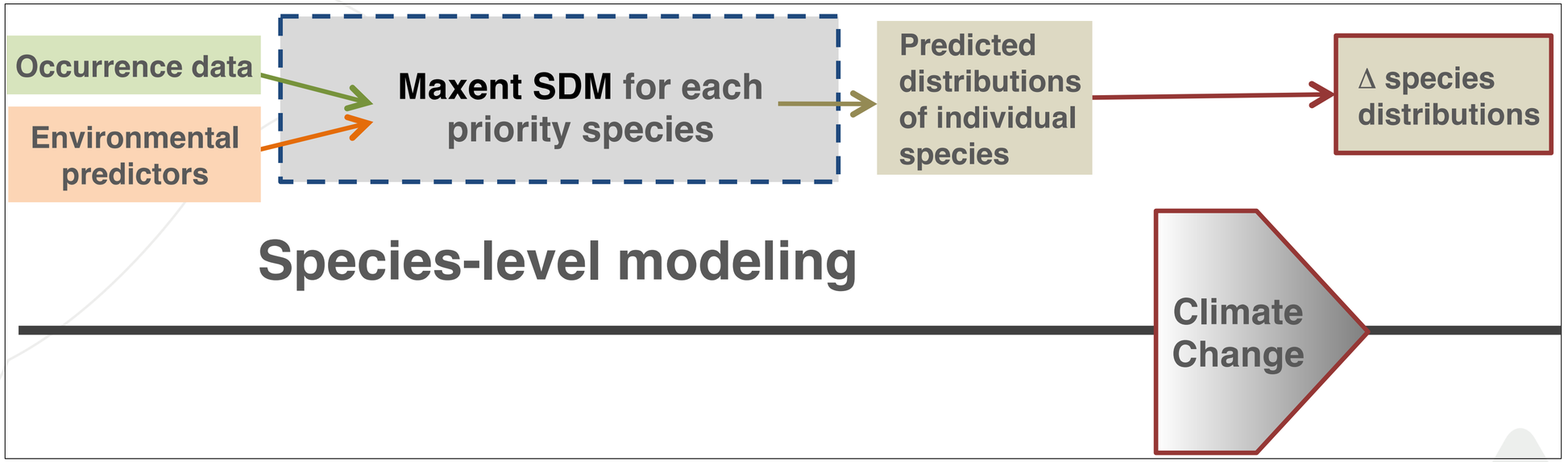
Species-level models for priority species



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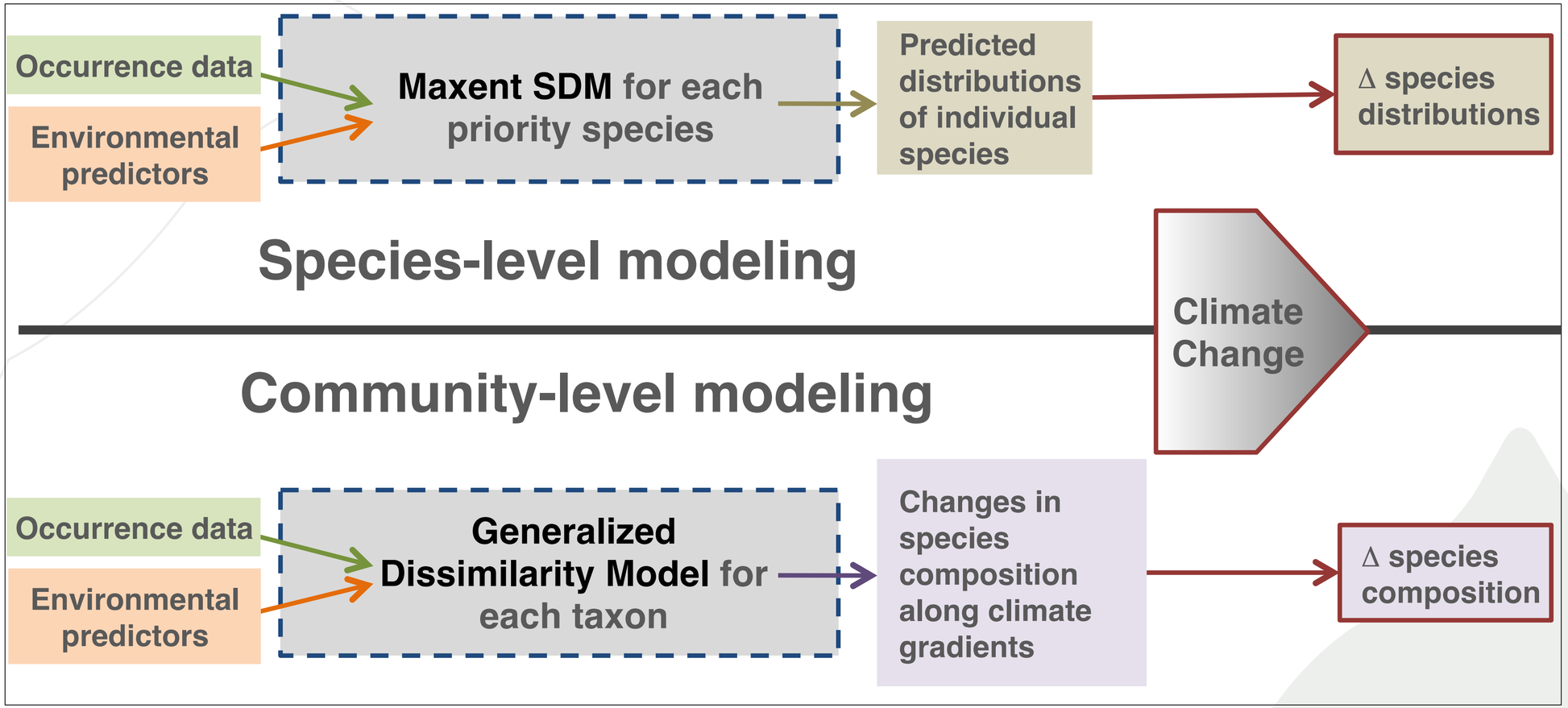
Species-level models for priority species

Community-level models for overall patterns of biodiversity by major taxonomic group



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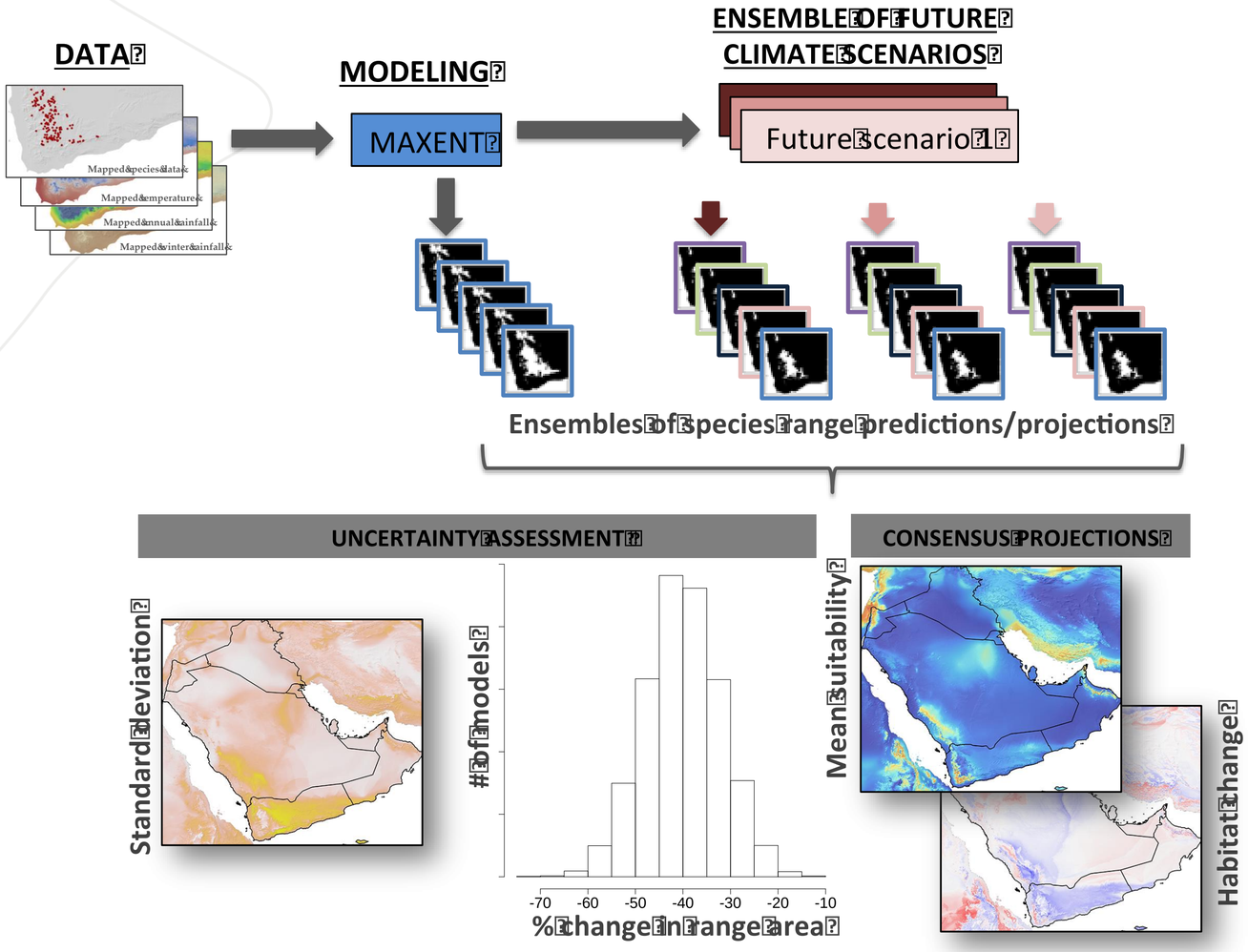
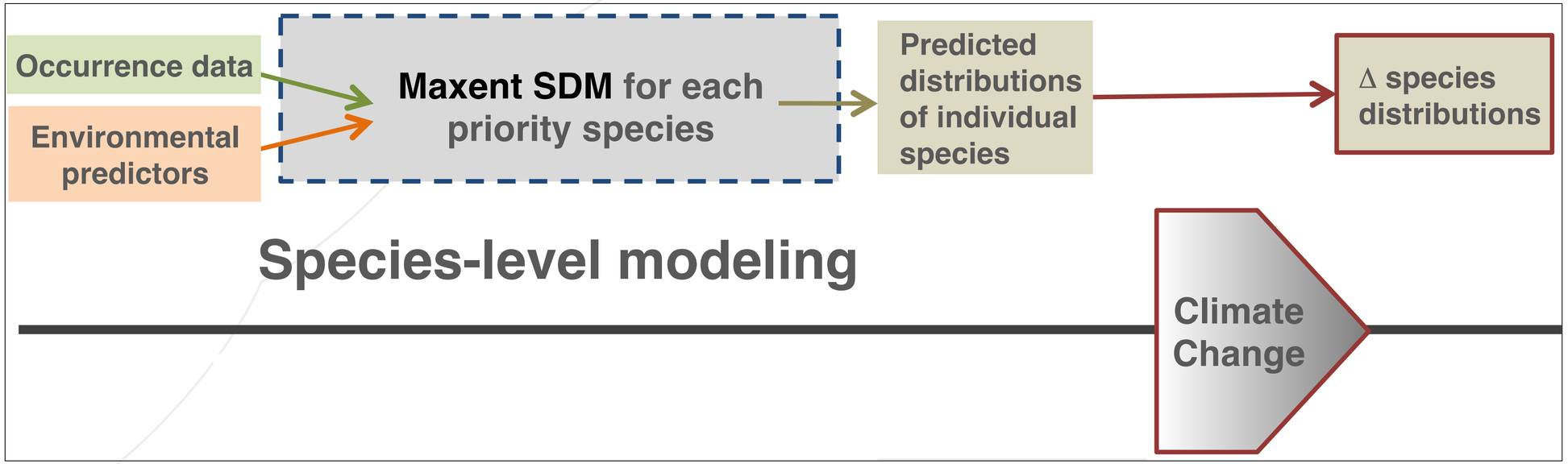
Methodological Background

Forecasts from spatial models were combined into ***ensembles*** across future climate projections.



Results: Species-level modeling (Priority species)



Results: Species-level modeling (Priority species)

Results: Priority species

Spatial models were fit for nearly 100 priority species identified on the basis of stakeholder consultations, literature searches, and within data availability constraints

Plants

29 species

Breeding Birds

Non-breeding / Resident Birds

26 species

Mammals

25 species

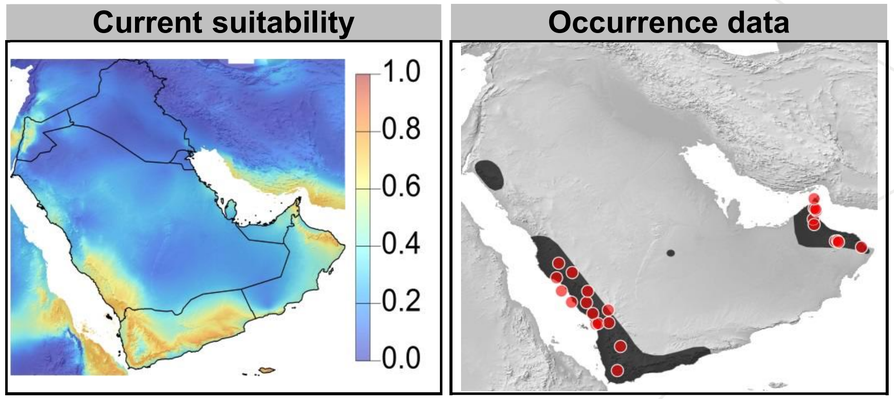
Reptiles

12 species

Amphibians

3 species

Results: Priority Species Example – Arabian Toad (*Bufo arabicus*)



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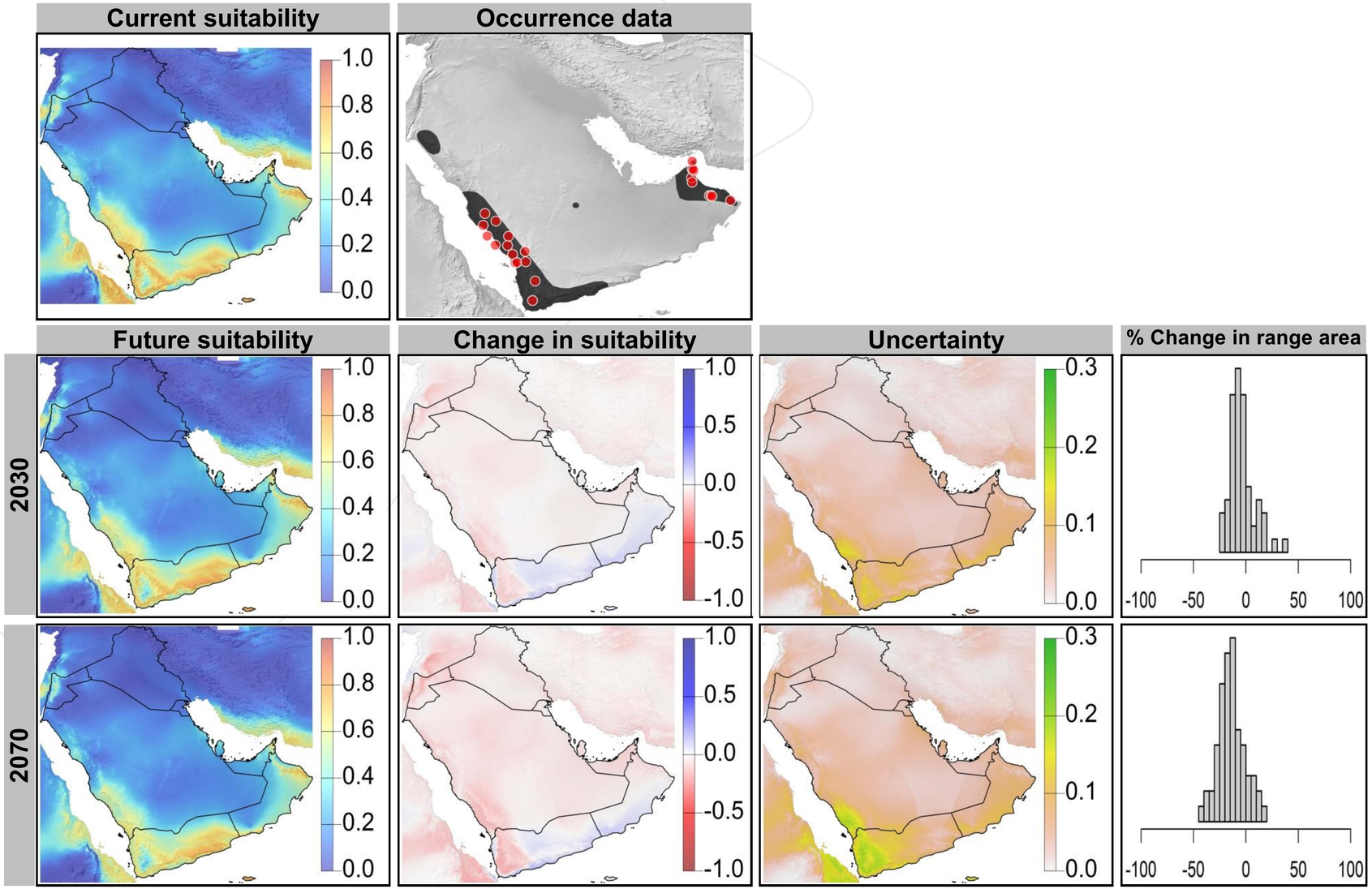
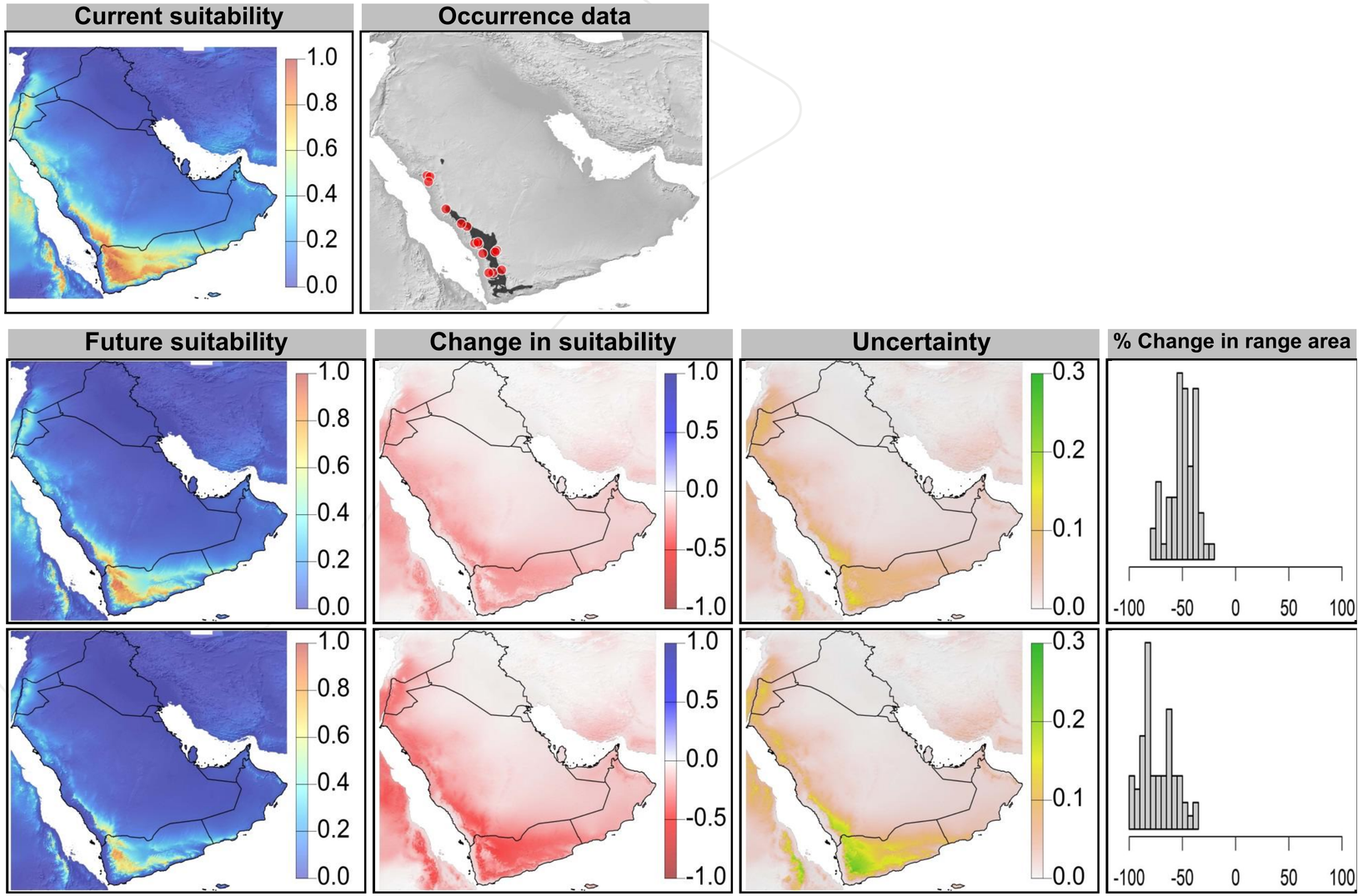


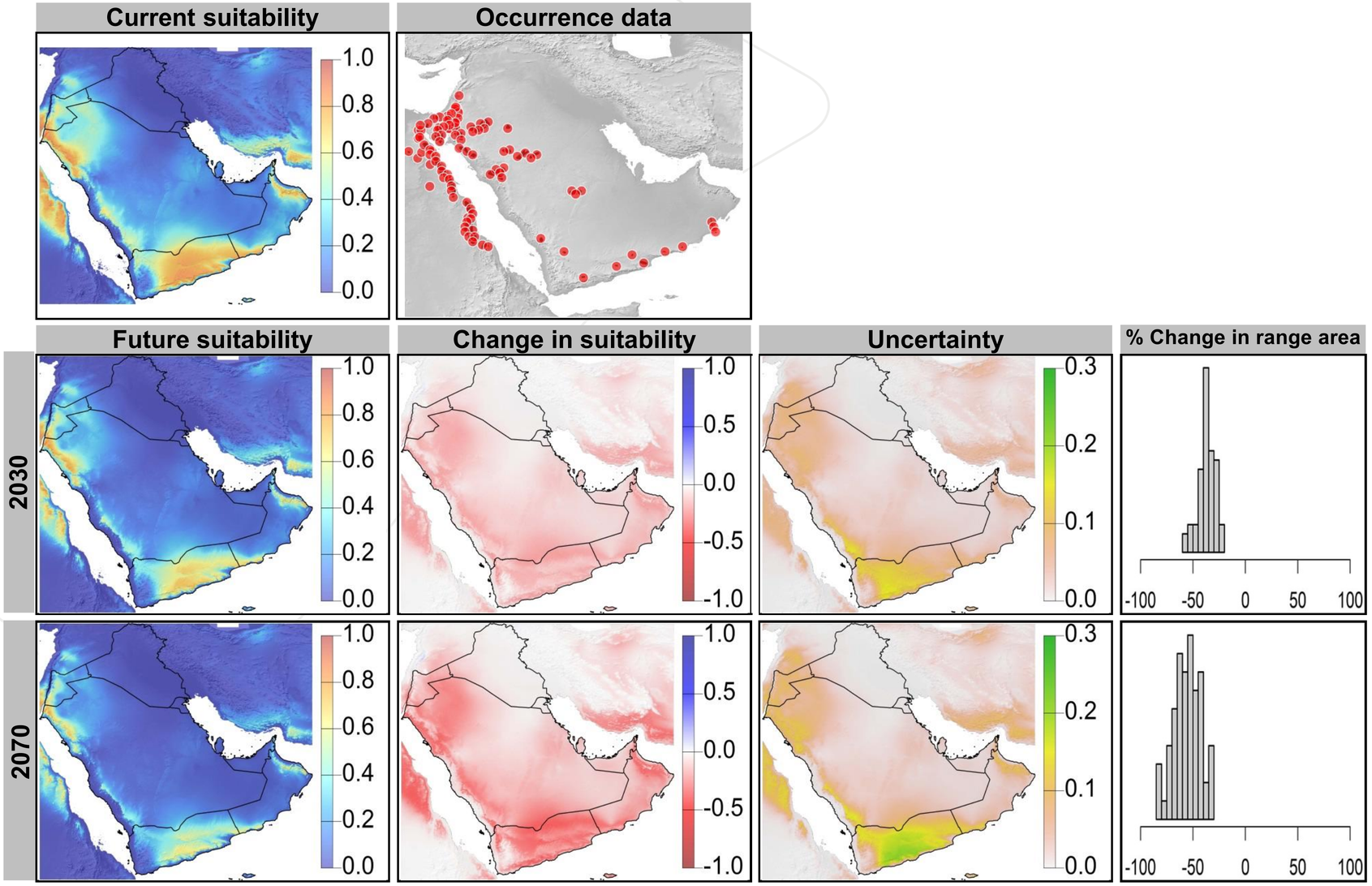
2030

2070

Results: Priority Species Example – Arabian Serin (*Crithagra rothschildii*)



Results: Priority Species Example – Nubian Ibex (*Carpra nubiana*)



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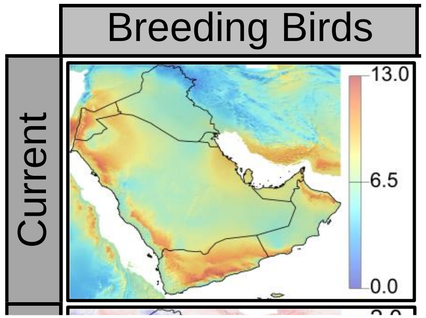
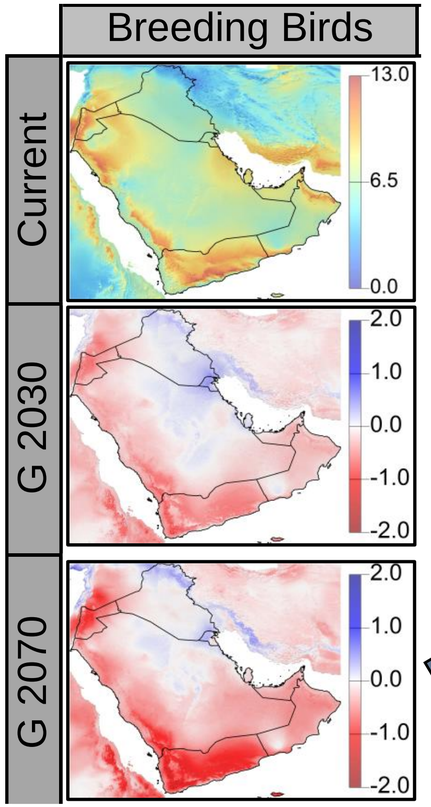
Results: Priority Species



Summed current habitat suitability across all priority breeding bird species

Results: Priority Species



Ensemble of 62 future scenarios (global) for all priority breeding bird species

Blue shading – Locations where models forecast **increases** in habitat suitability for one or more species

Red shading – Locations where models forecast **decreases** in habitat suitability for one or more species

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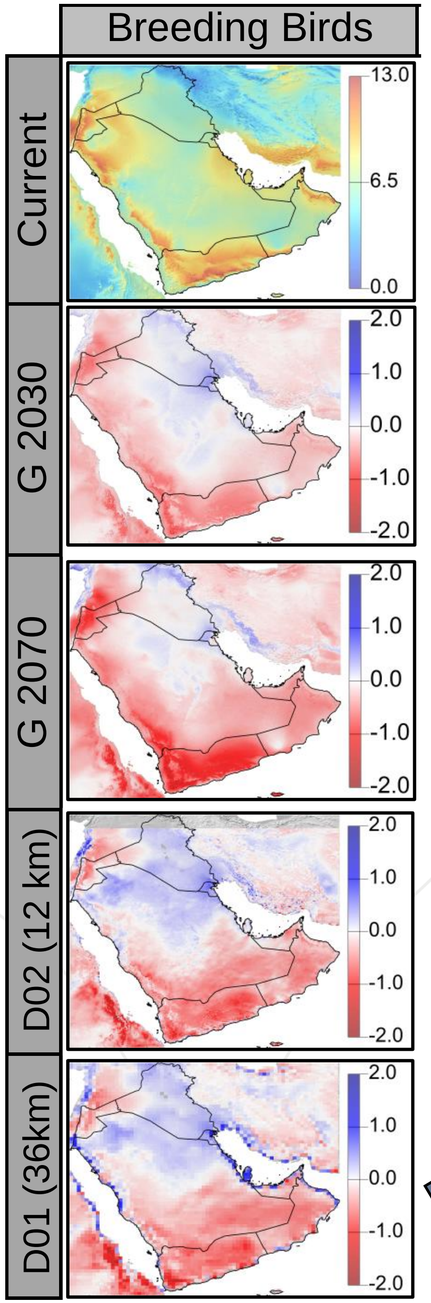
Results: Priority Species



Blue shading – Locations where models forecast **increases** in habitat suitability for one or more species

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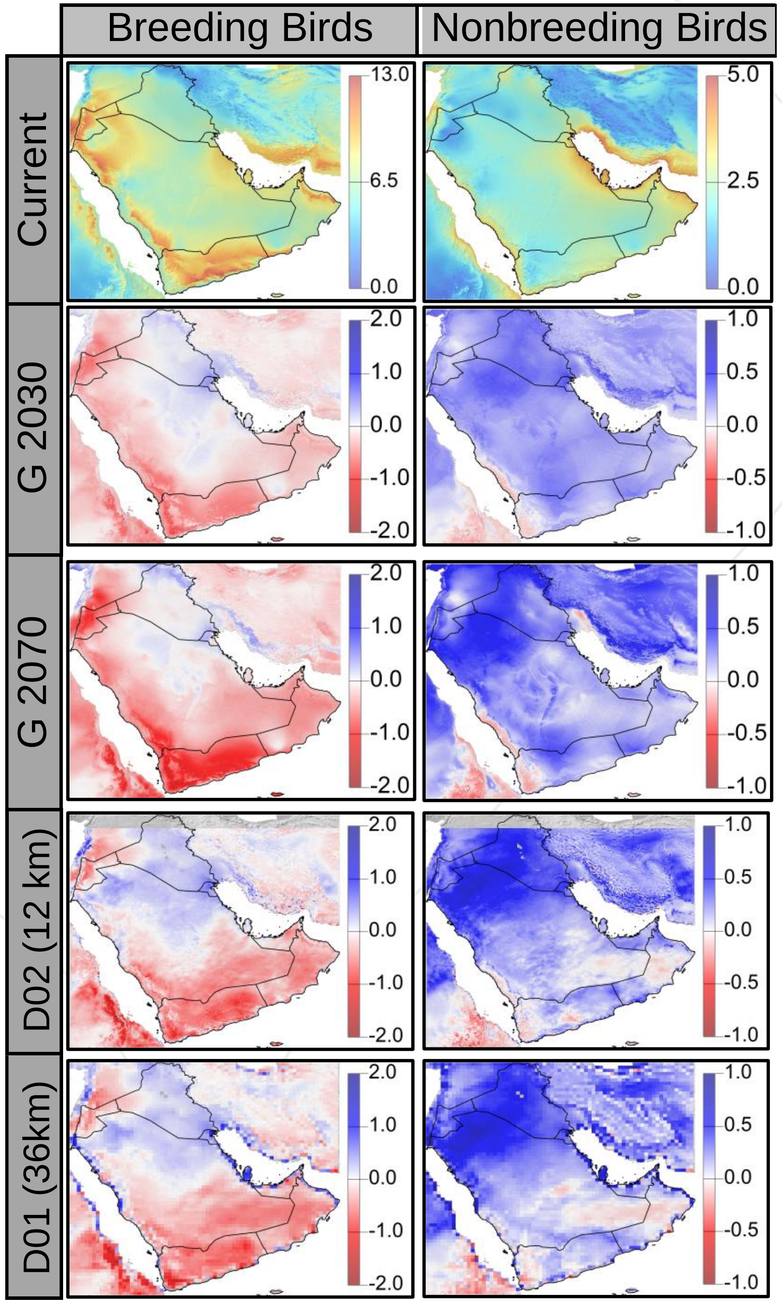
Ensemble of 2 future scenarios (regional) for all priority breeding bird species

Results: Priority Species



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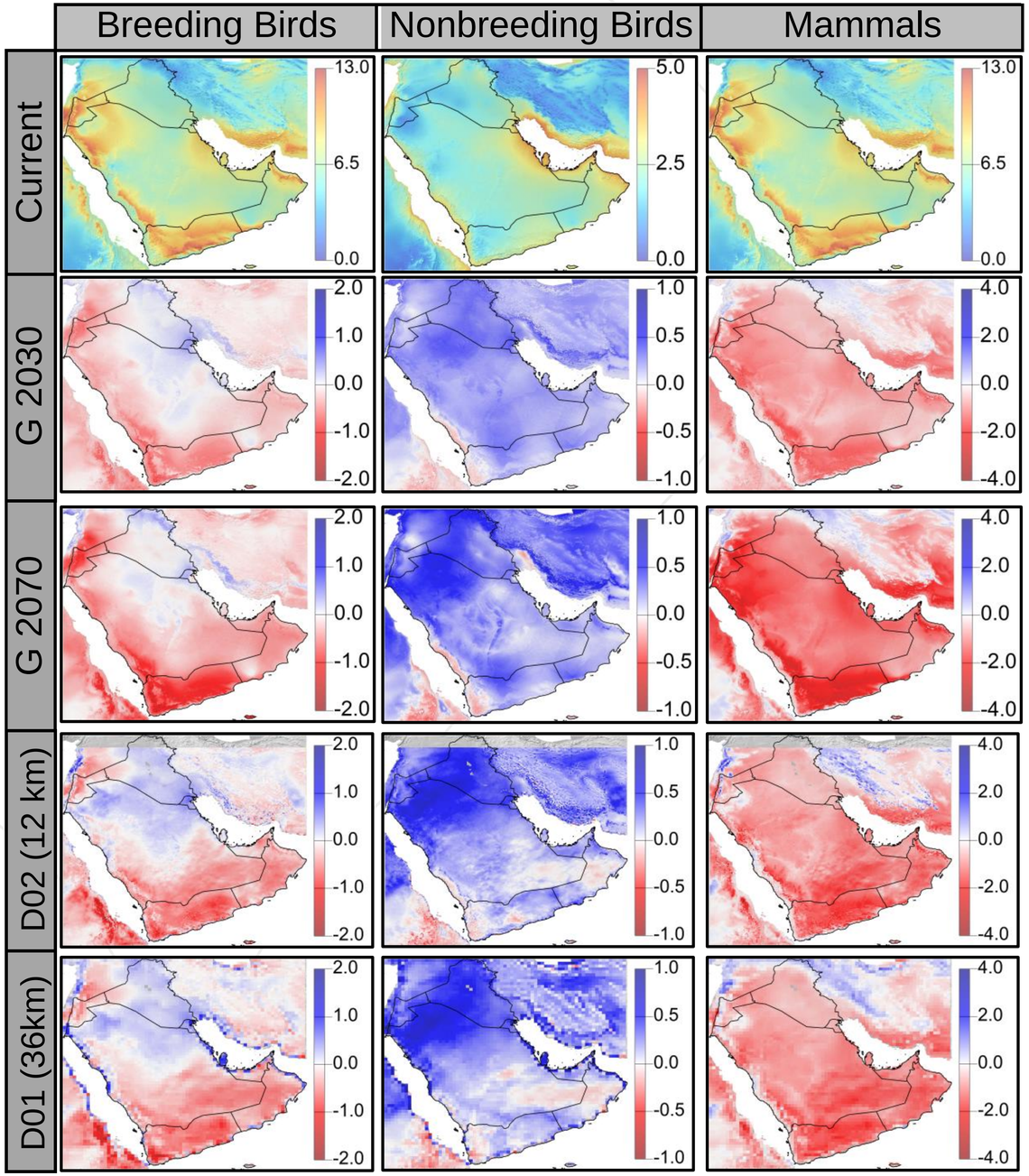

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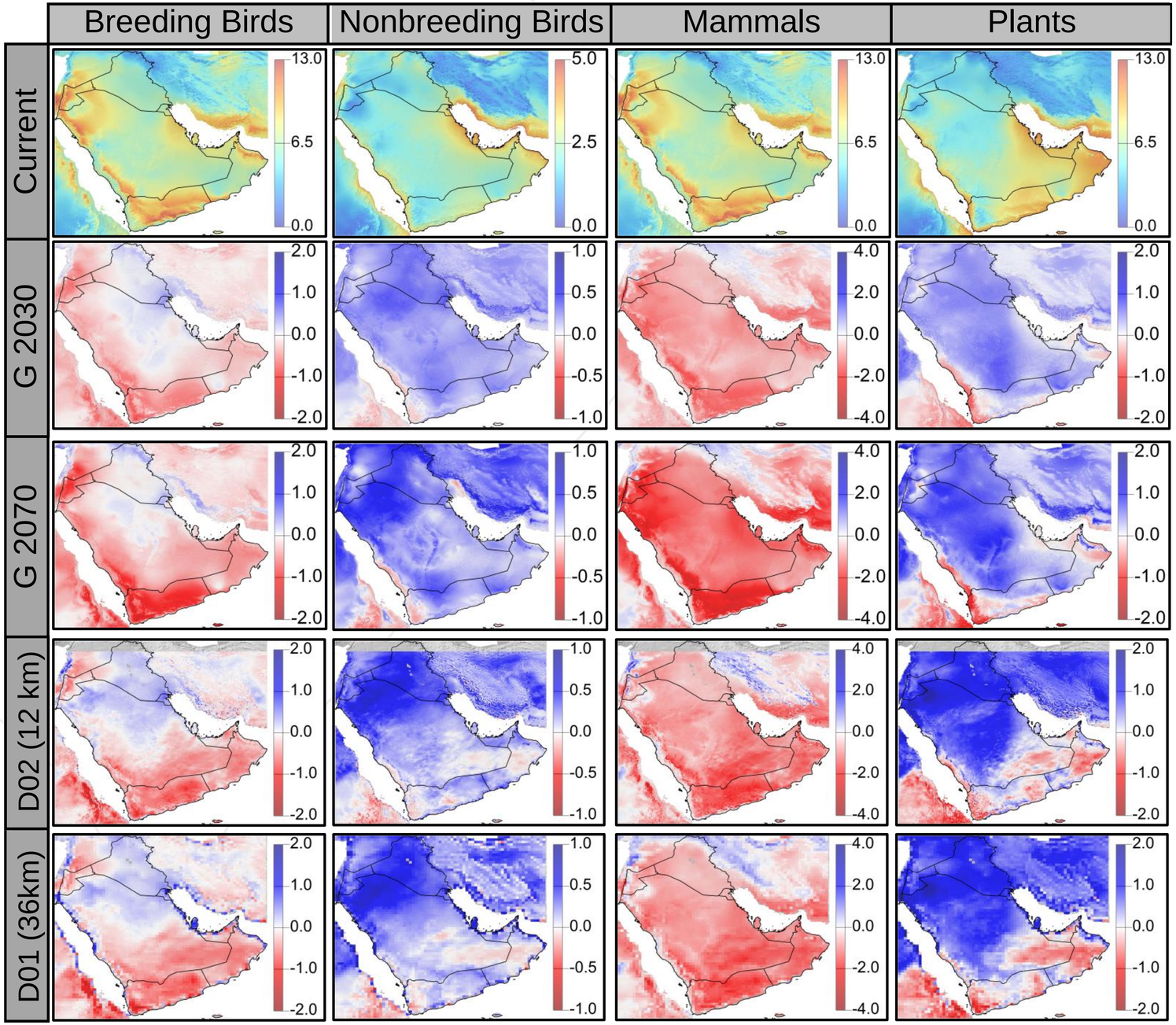

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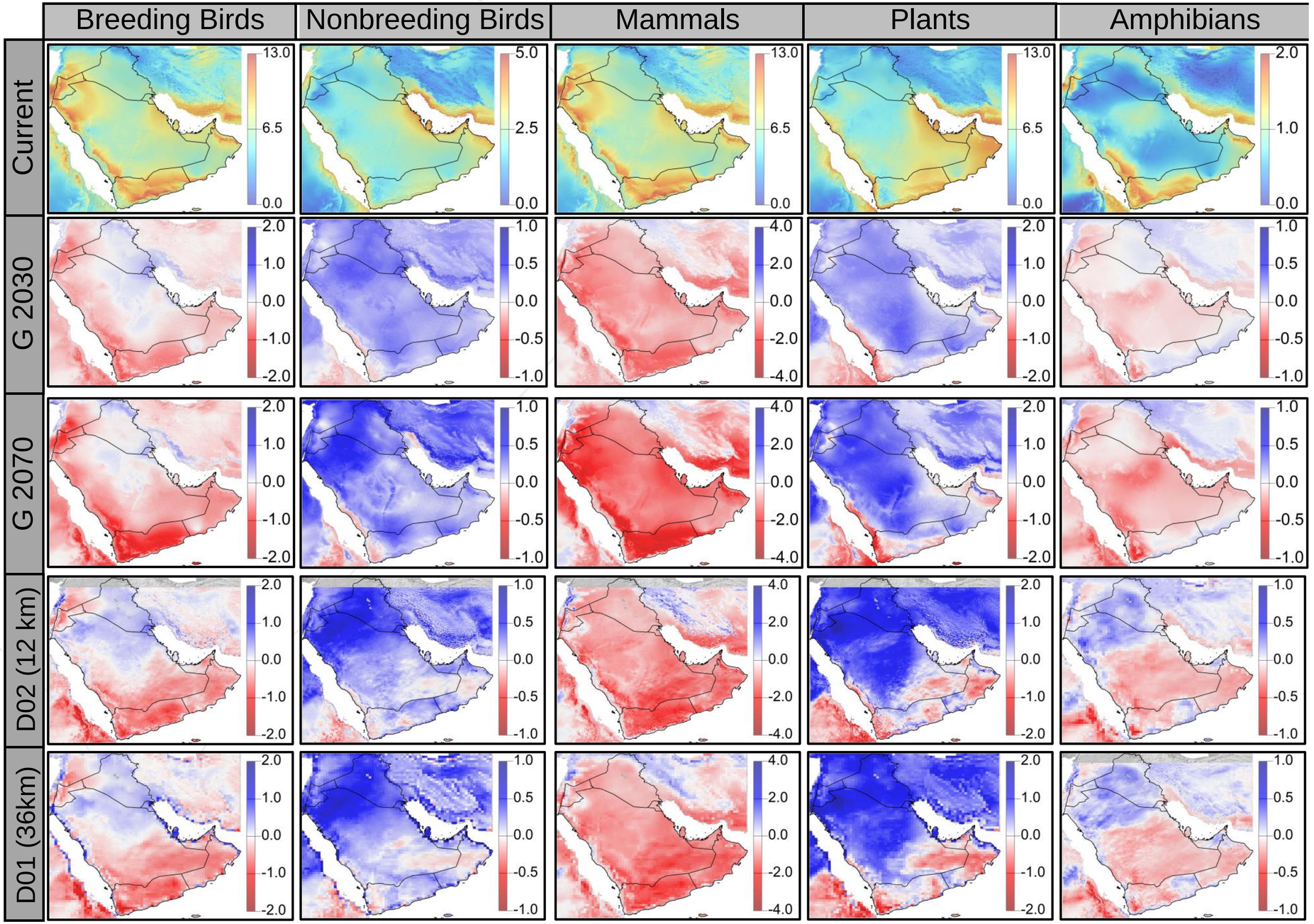

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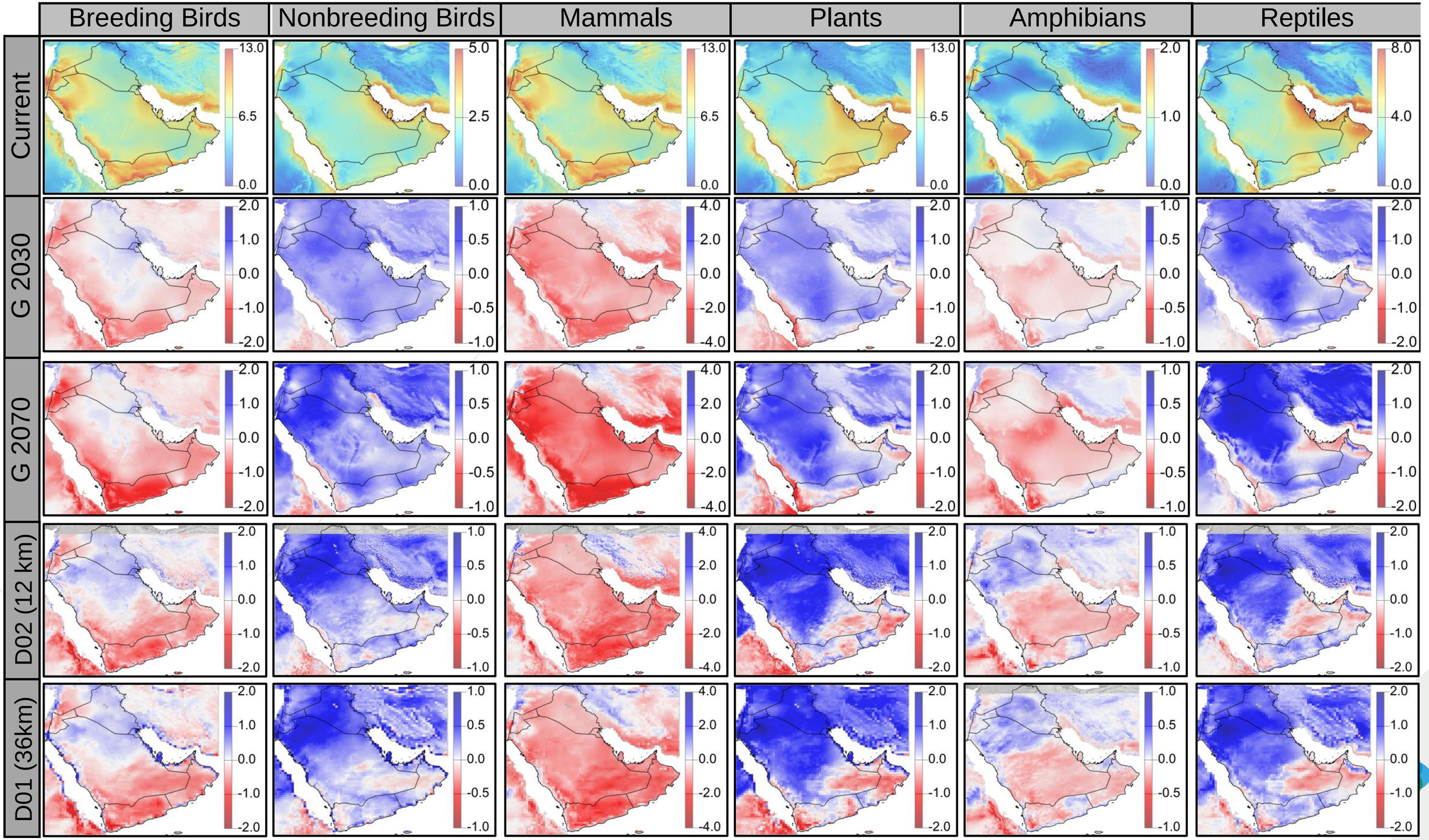

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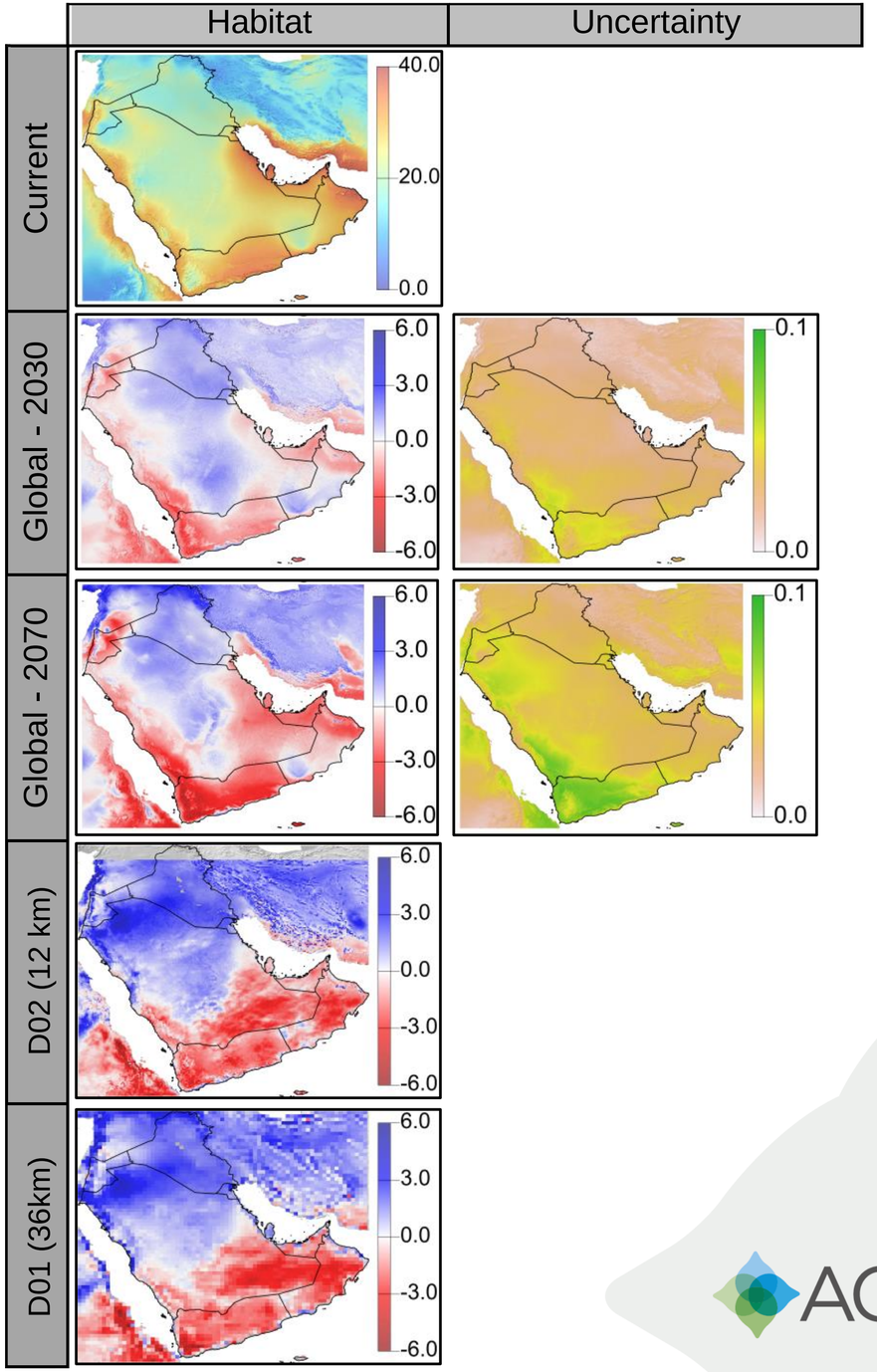
Major Conclusions: Priority Species

Reductions in habitat suitability concentrated in western and southeastern Saudi Arabia and throughout Yemen, Oman, Qatar, the UAE, and Jordan



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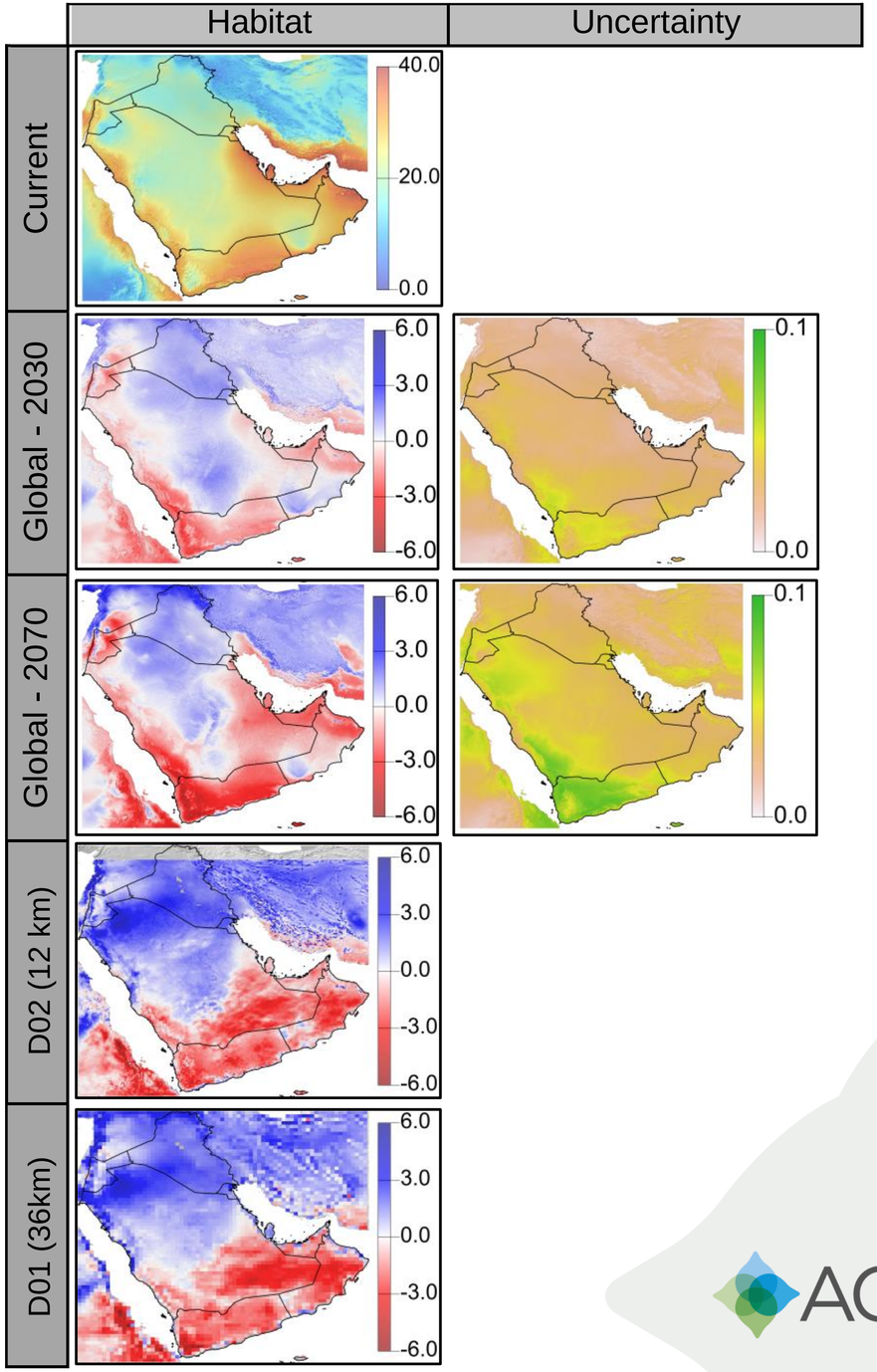

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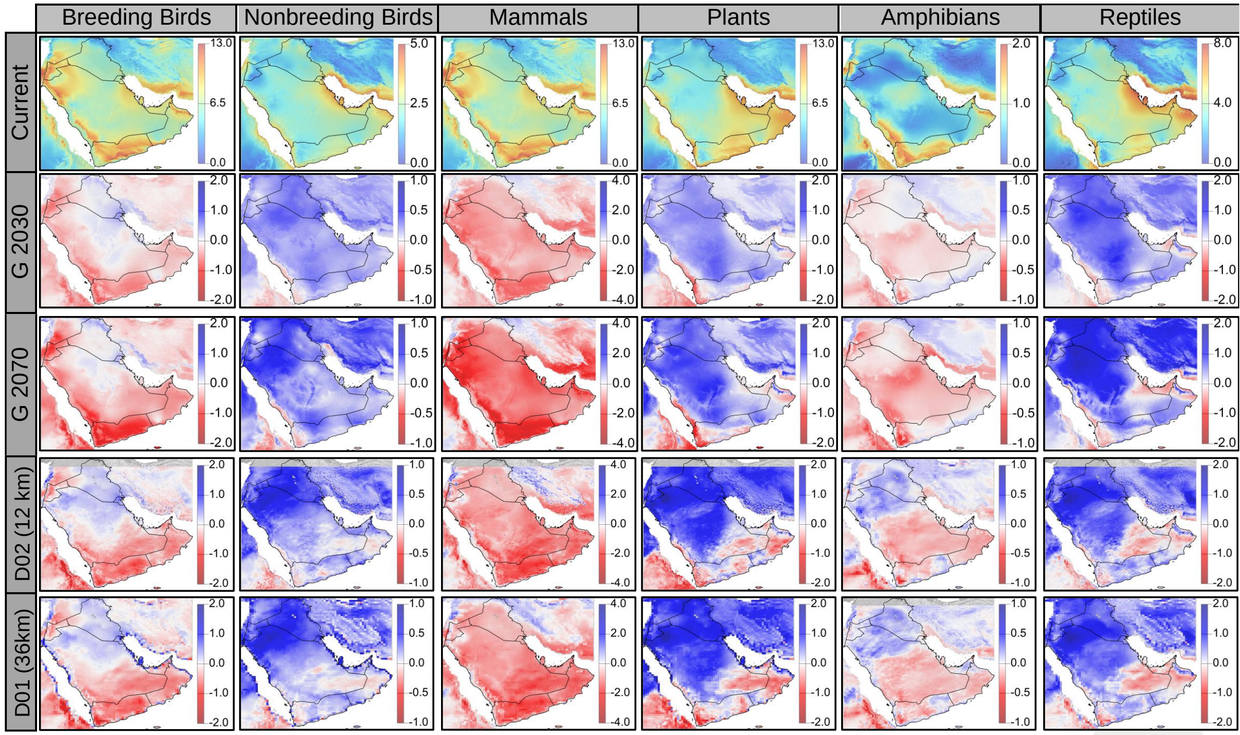
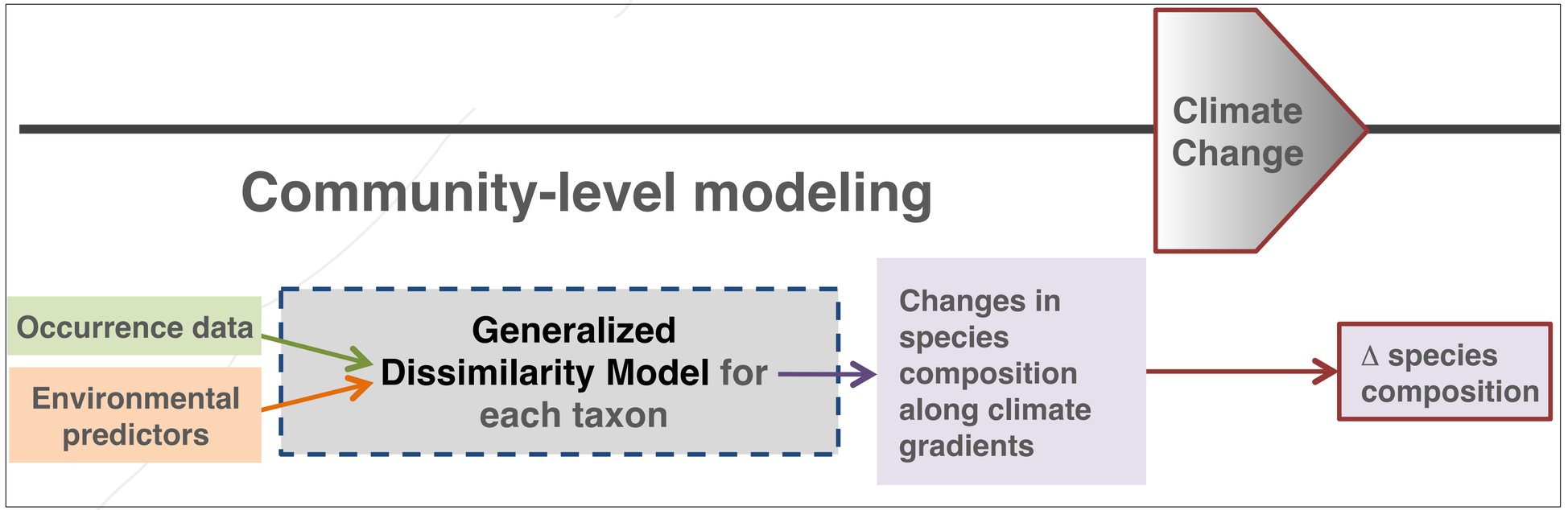
Breeding birds, **mammals**, and **amphibians** forecasted to be most vulnerable to climate change in the region

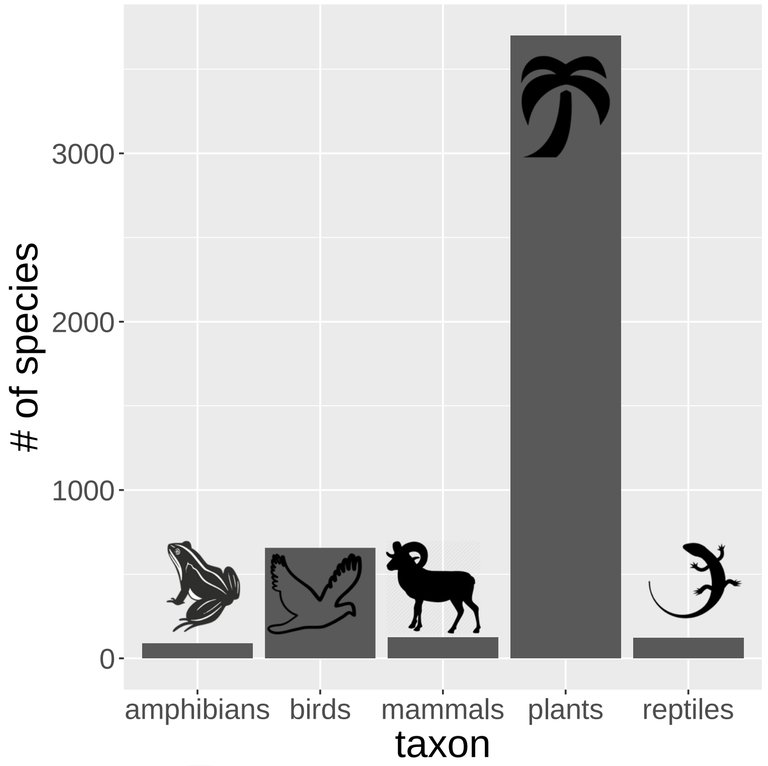


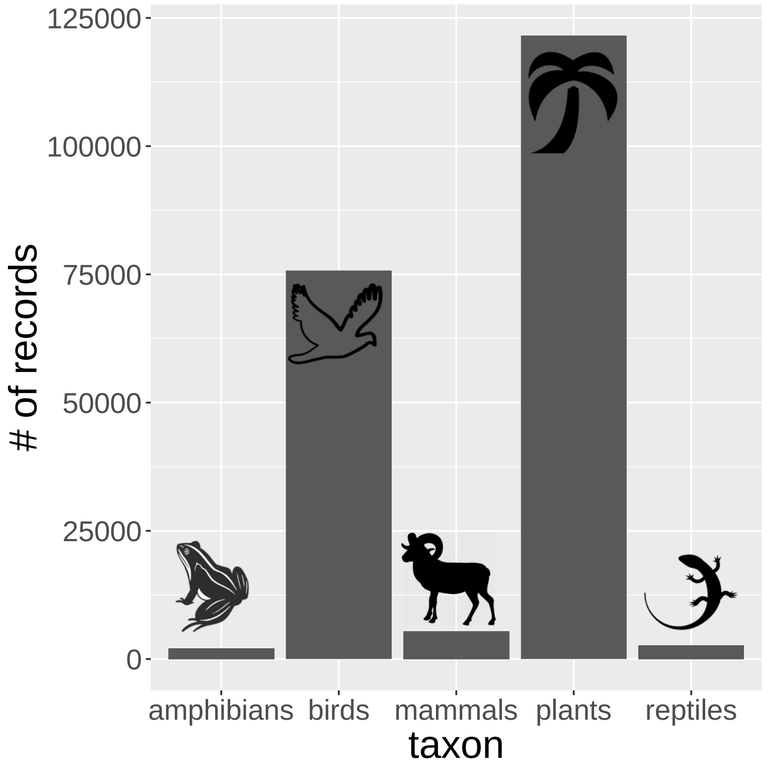
Results: Community-level modeling

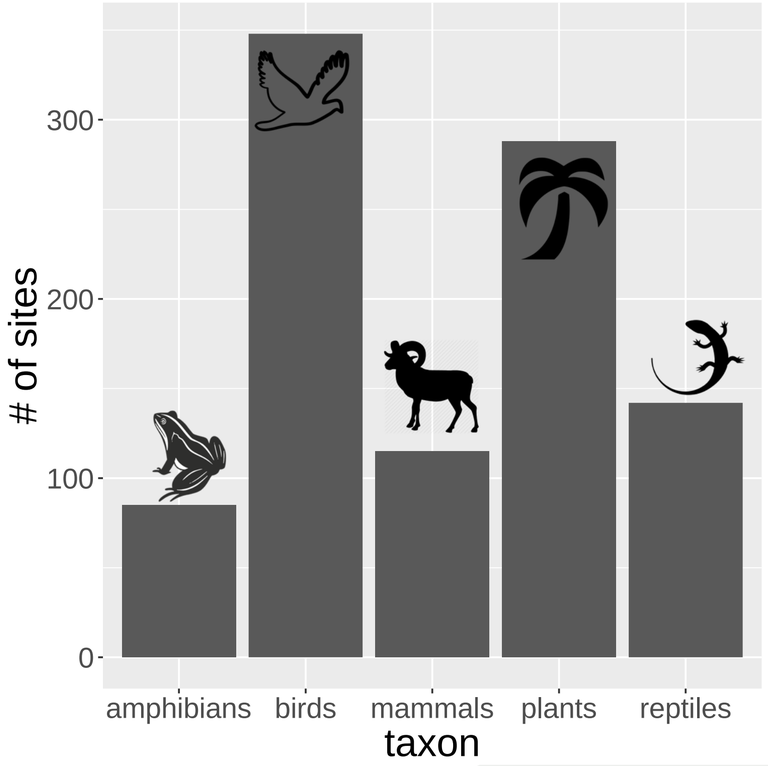


Results: Community-level

Community-level models incorporated over 200,000 data points for more than 5,600 species







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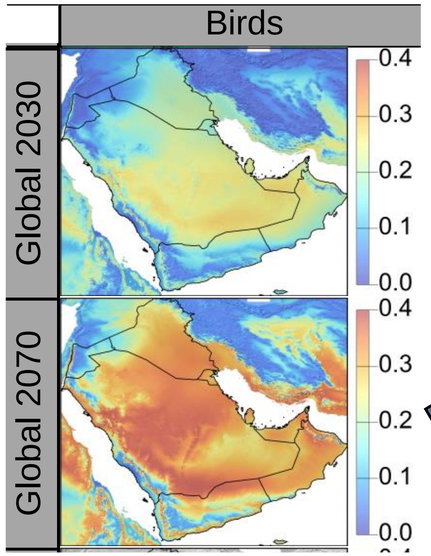
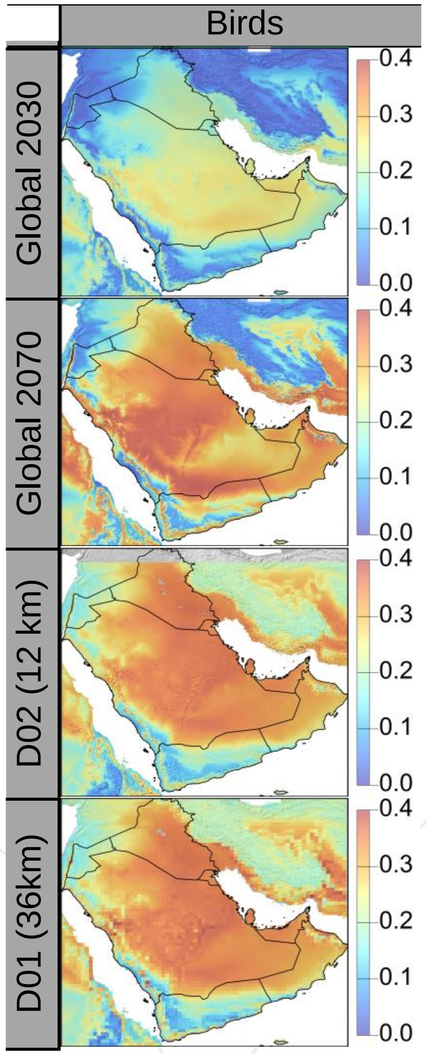


Ensemble projections of the expected magnitude of change in bird species composition between current and future climate (average of 62 global scenarios, 2030 and 2070)

Brown / orange shading indicate regions of greater climate stress.

Blue shading indicates areas of low climate stress

Results: Community-level



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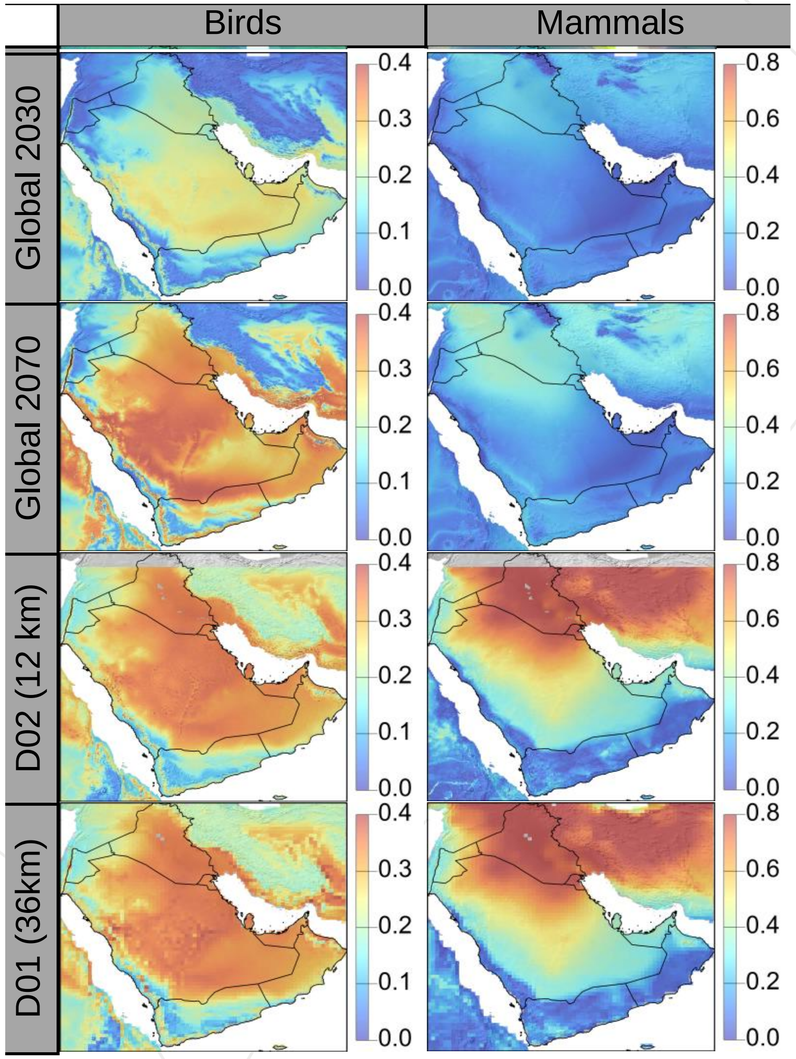
Ensemble projections of the expected magnitude of change in bird species composition between current and future climate (2 regional scenarios for 2070)

Results: Community-level



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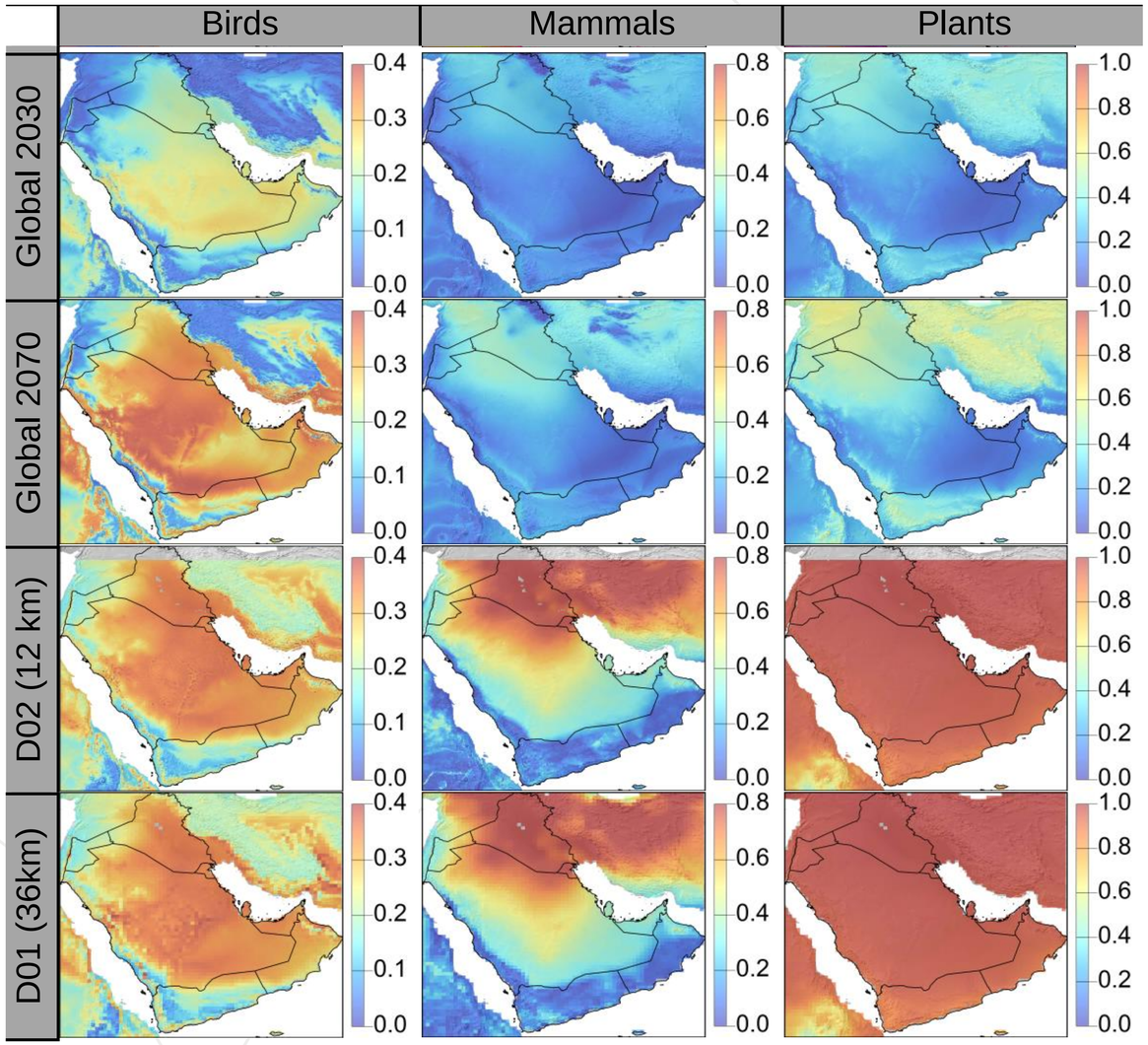

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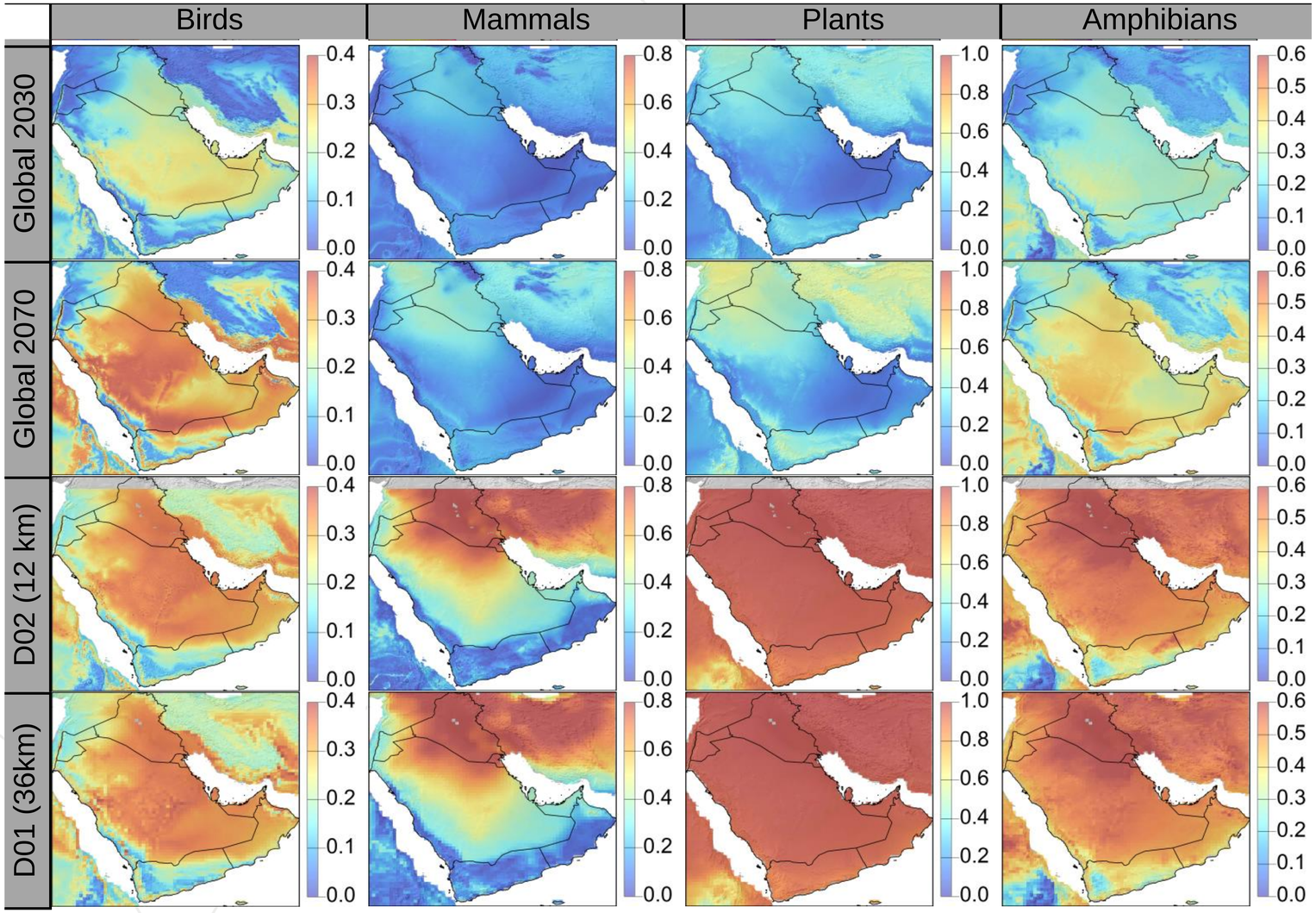

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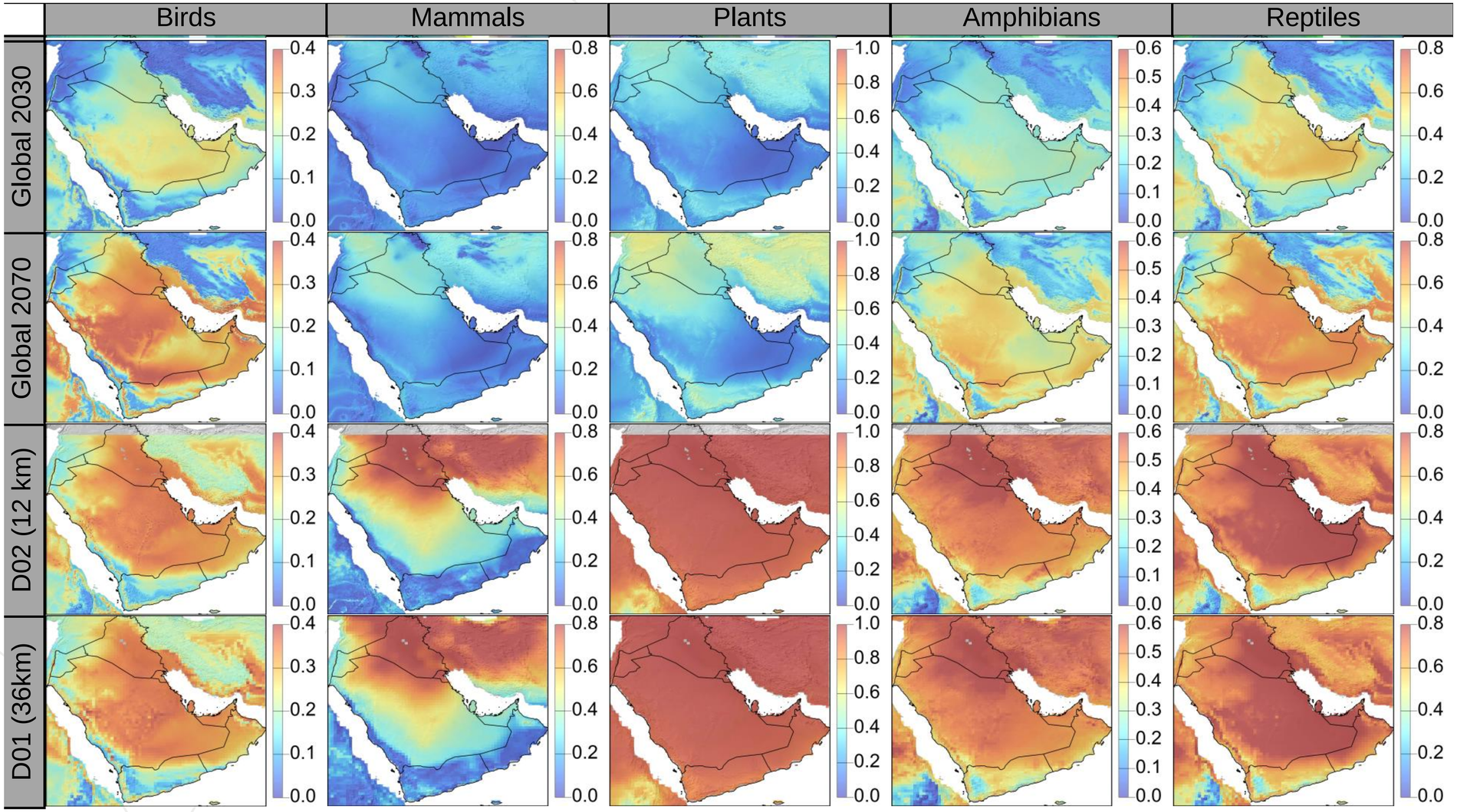
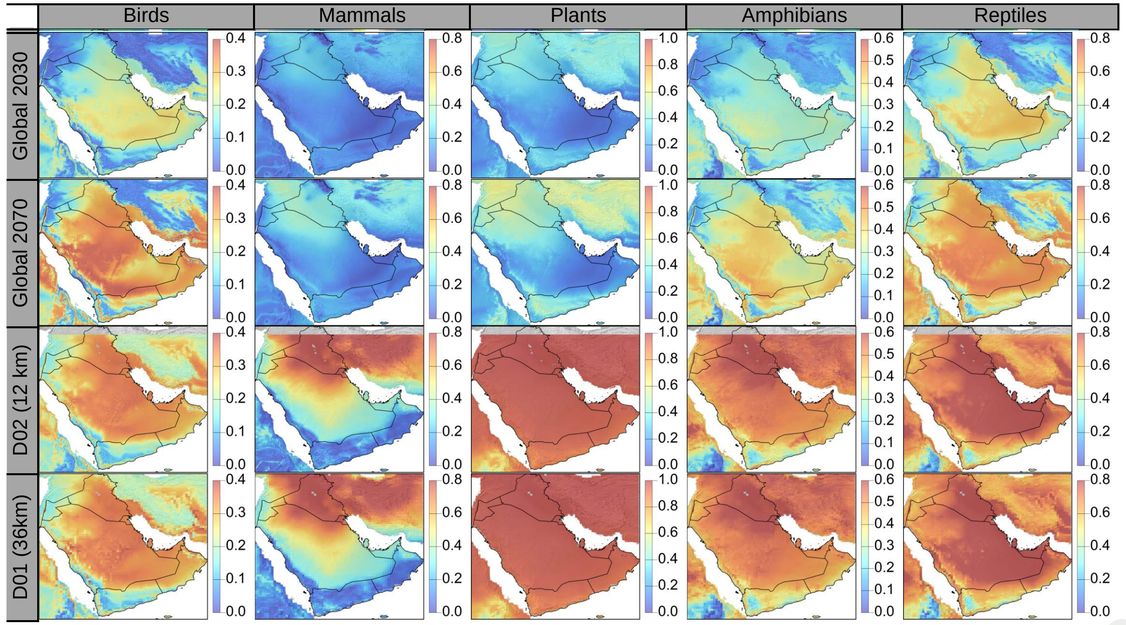


Major Conclusions: Community-level

Birds, amphibians, and reptiles predicted to be most vulnerable to climate change, but...



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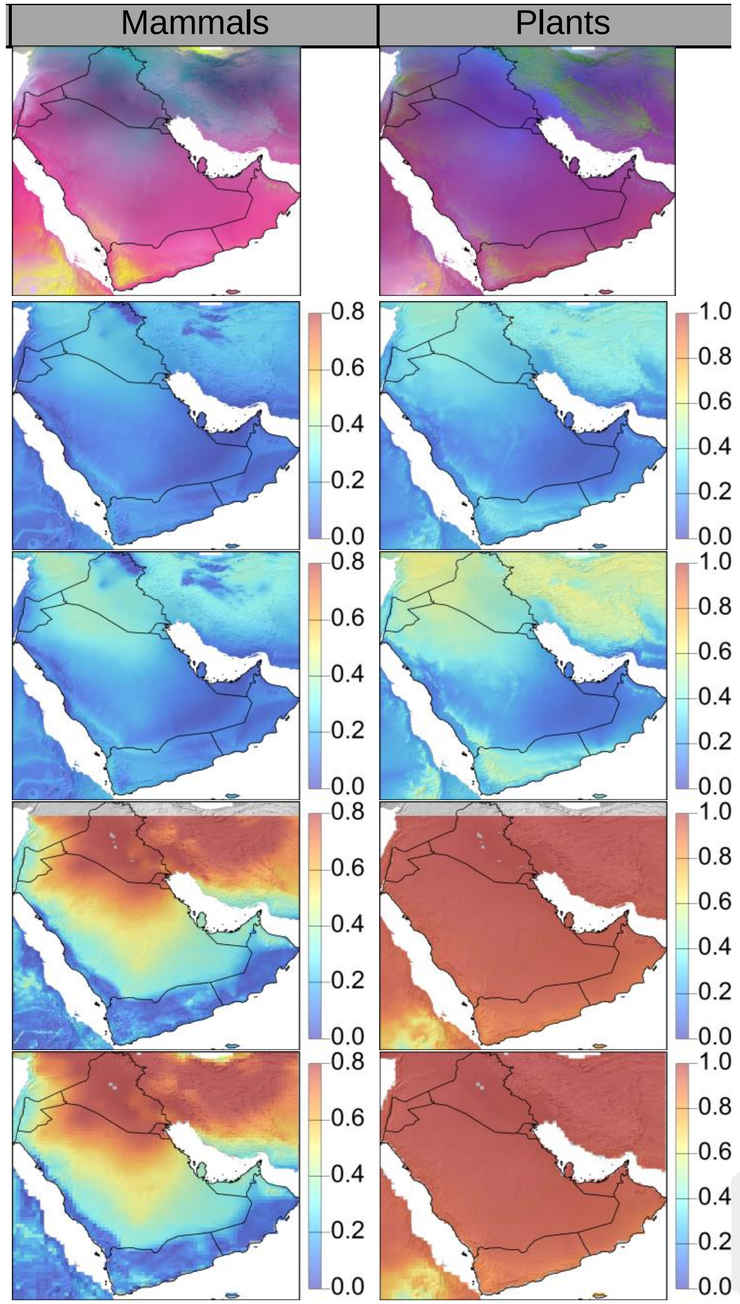
...forecasts differed between global and regional climate models, with regional models tending to predict greater vulnerabilities.



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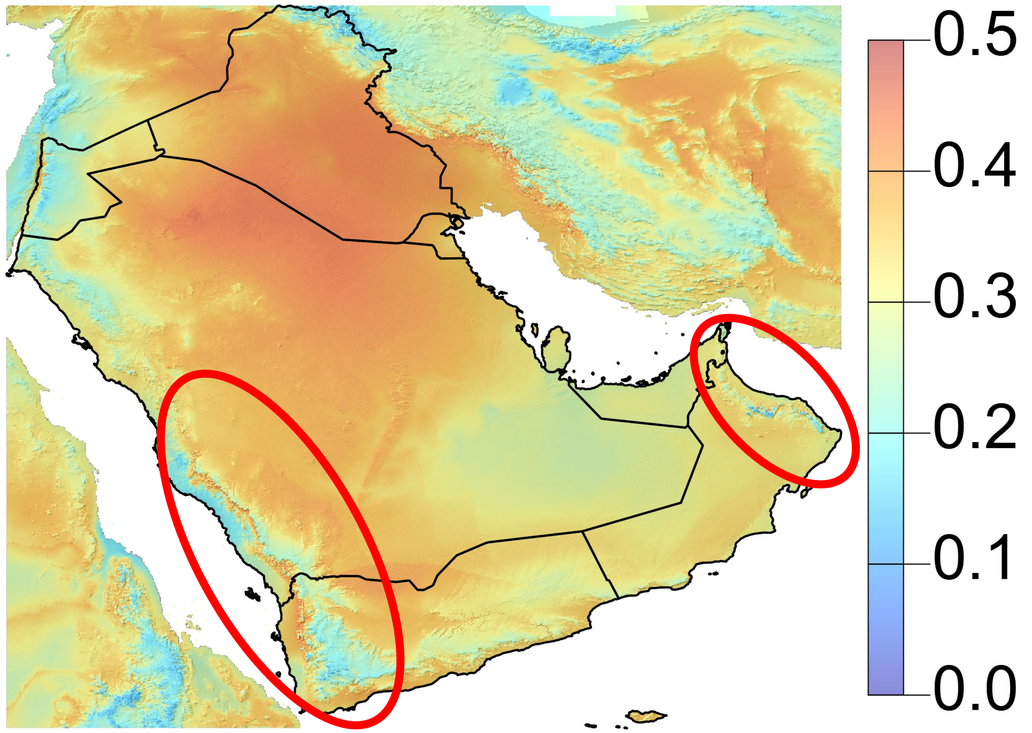
Several regions identified as potential climate refugia, including mountains (especially in the southwest). ***These represent places where climate stress may remain relatively low for several taxonomic groups.***



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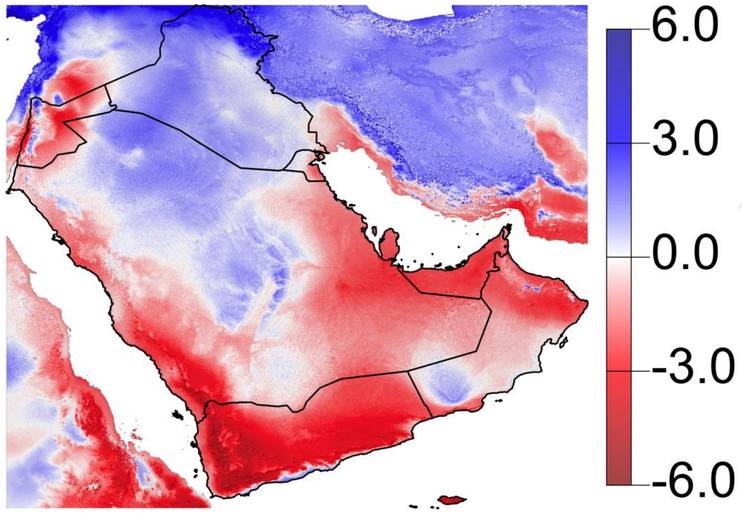
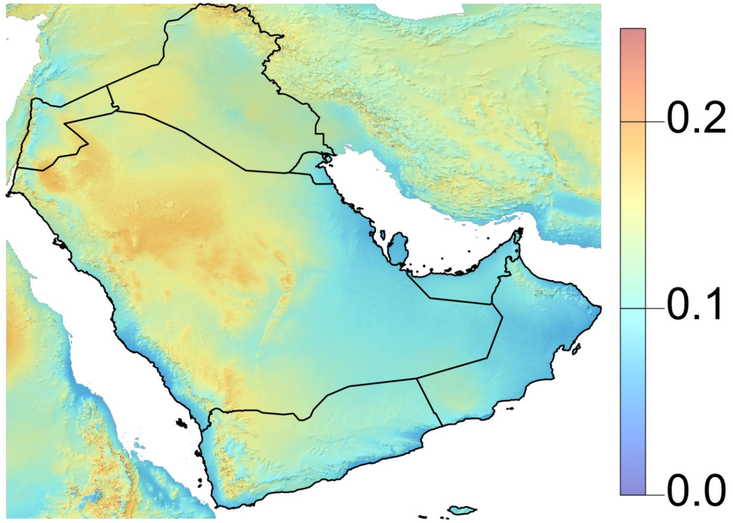
Major Conclusions:

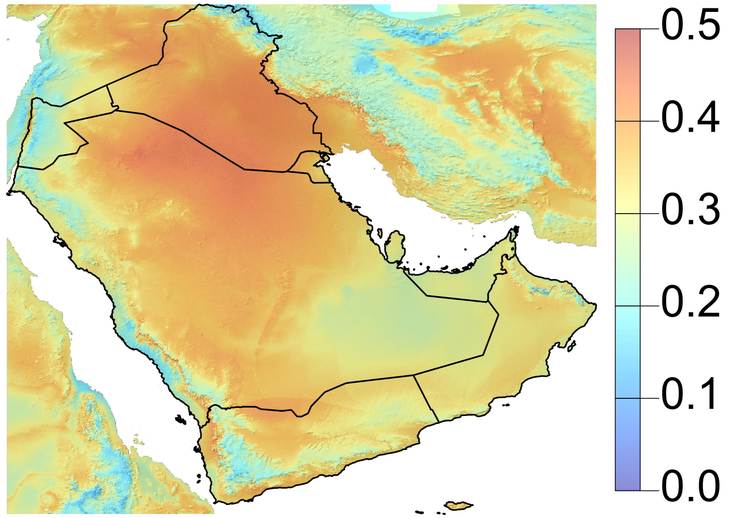
Habitat change
Priority species



Compositional change
Priority species



Compositional change
Community-level



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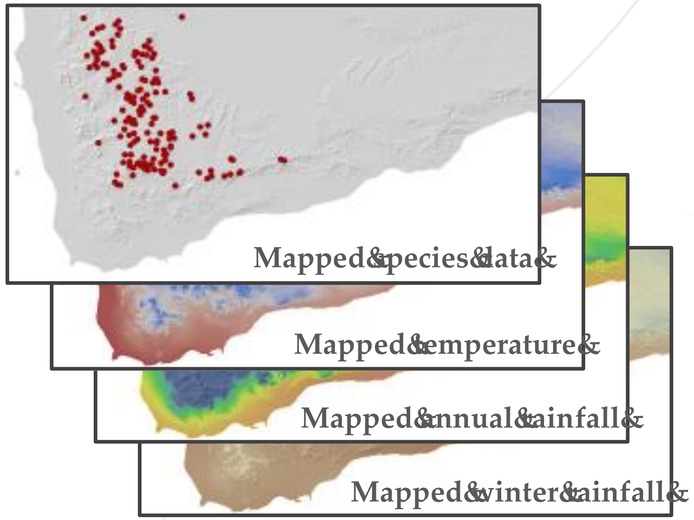
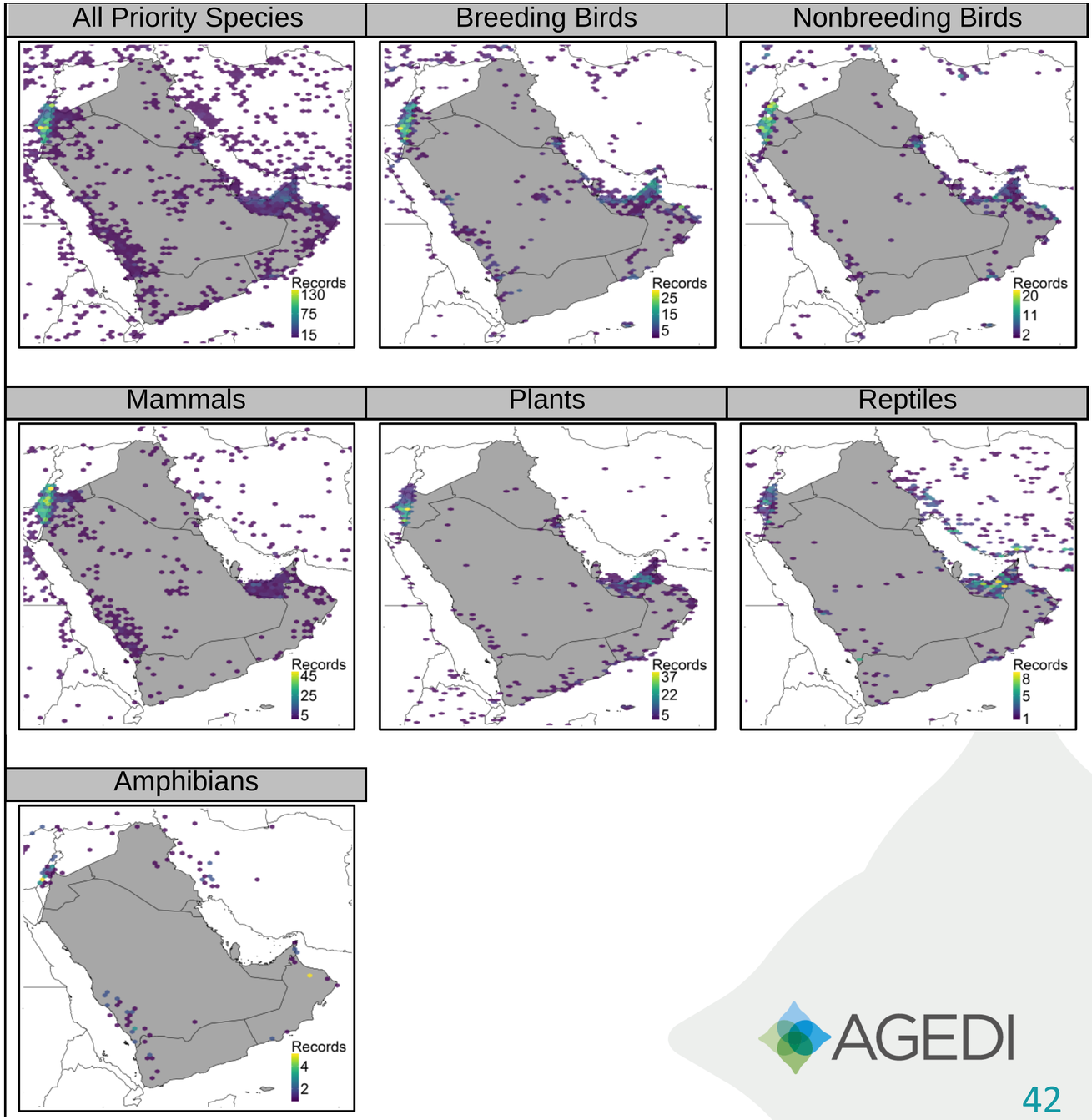
Recommendations going forward

Improve biodiversity & environmental data in the region





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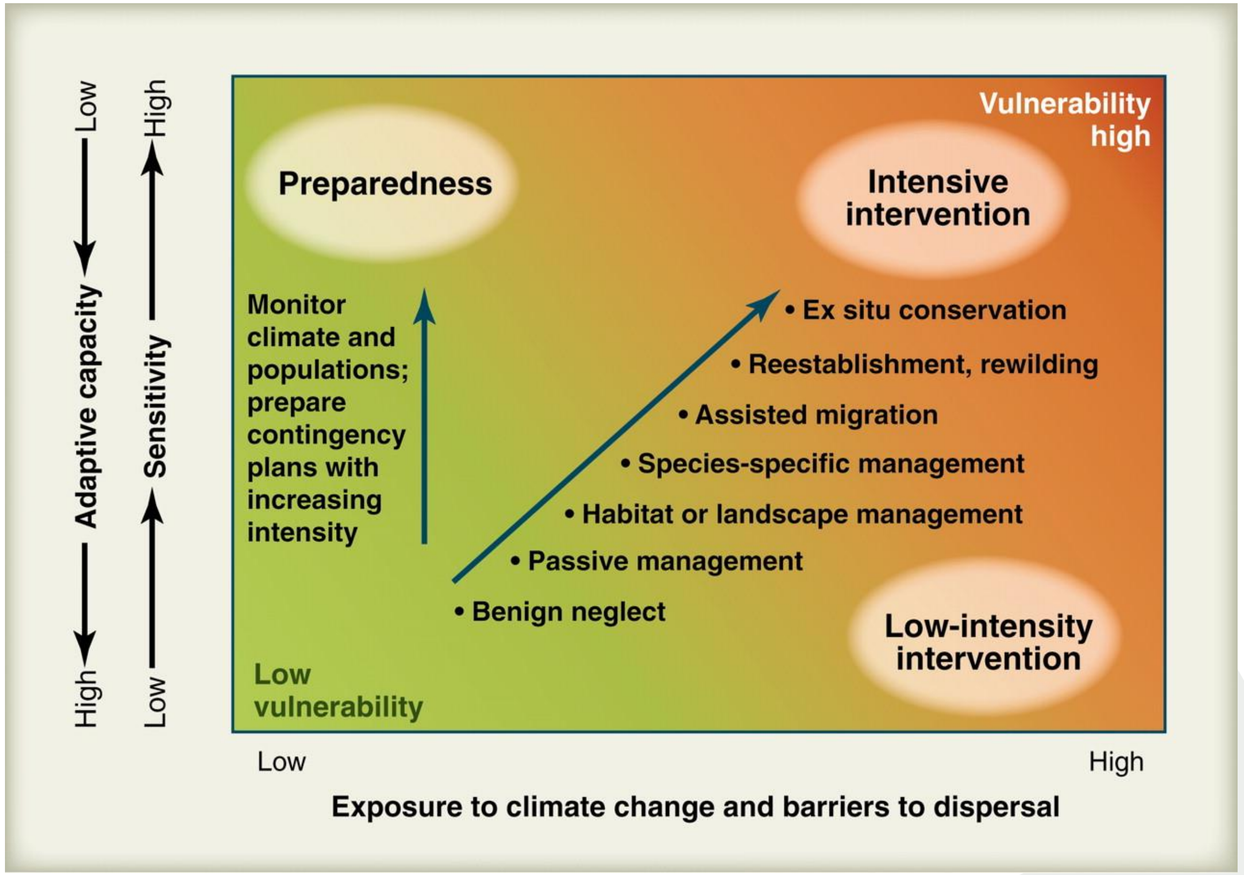
Recommendations going forward

Increase resilience and provide means for natural populations to move between habitats

Strategy - reduce other stressors



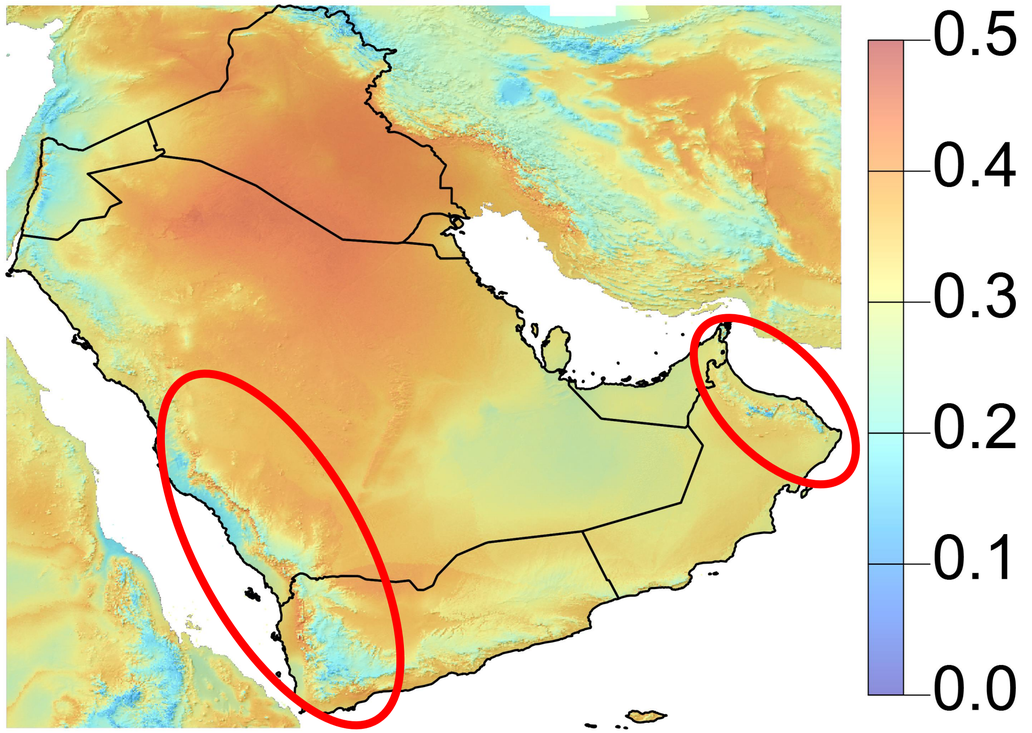
Dawson et al. (2011)

Recommendations going forward

Increase resilience and provide means for natural populations to move between habitats:

Focus on areas where forecasts agree vulnerabilities could be least / greatest

Identify and protect climate refugia as part of existing protected area networks

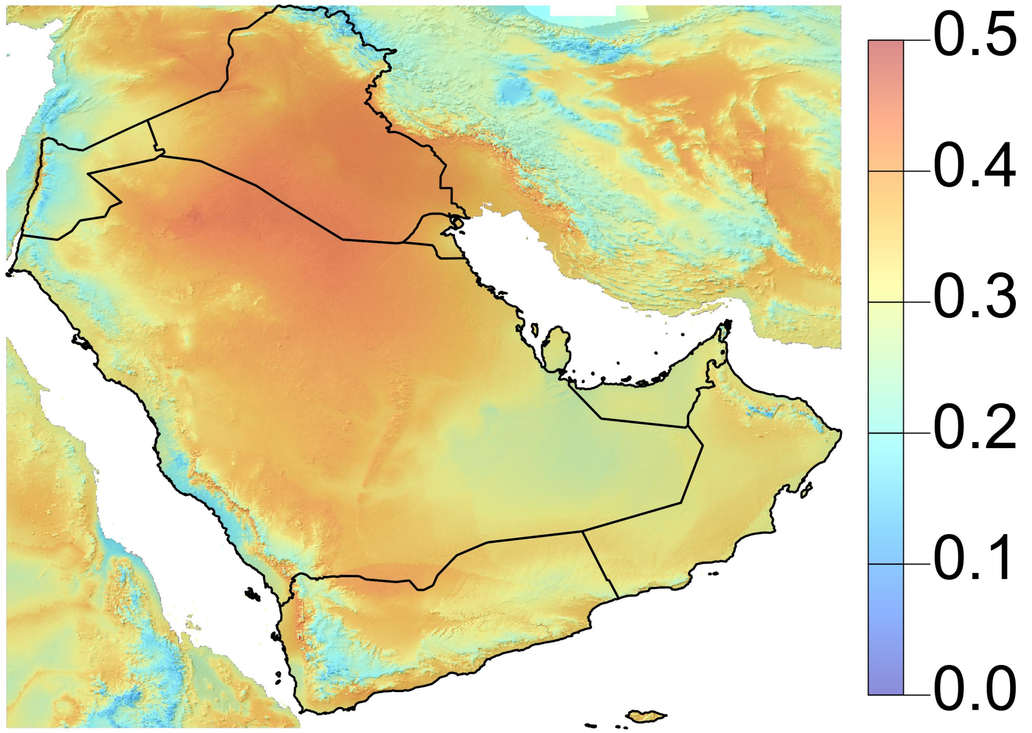


Recommendations going forward

Increase resilience and provide means for natural populations to move between habitats

Build off existing research results to:

- Incorporate forecasts into systematic / quantitative conservation planning (how well might existing networks of reserves conserve biodiversity under climate change?)
- Identify landscape processes and features that facilitate persistence and adaptability
- Identify key locations for monitoring for change



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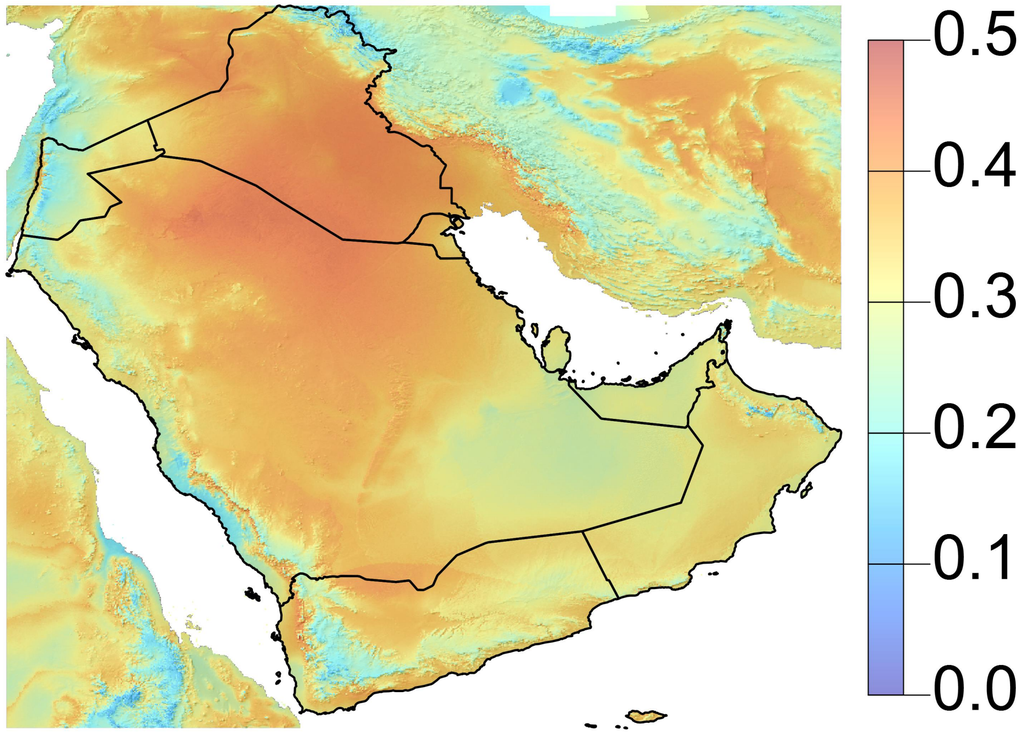
Recommendations going forward

Increase resilience and provide means for natural populations to move between habitats

Facilitate transboundary cooperation to:

- Promote data collection / sharing
- Planning reserve networks with connections across political boundaries
- Increase research capabilities in climate change biogeography



LNRClimateChange@ead.ae

AGEDI.ae

mfitzpatrick@umces.edu

AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

هيئة البيئة - أبوظبي
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