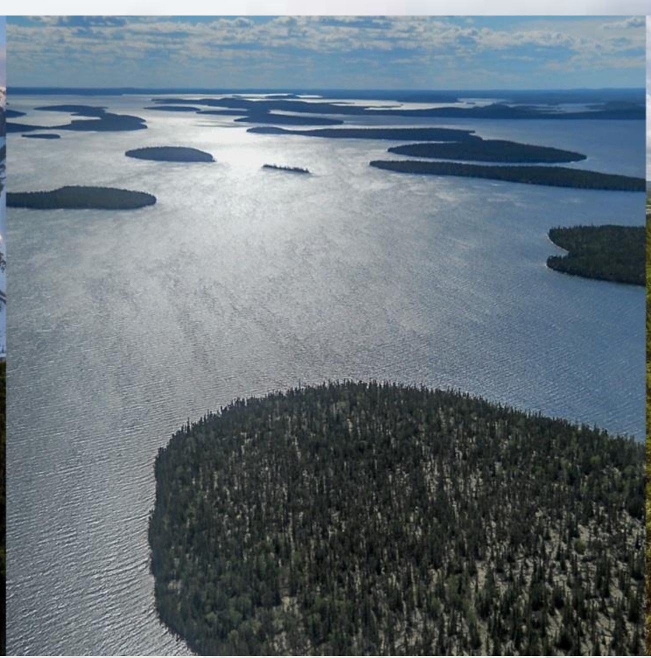
Translating climate adaptation science into effective conservation outcomes

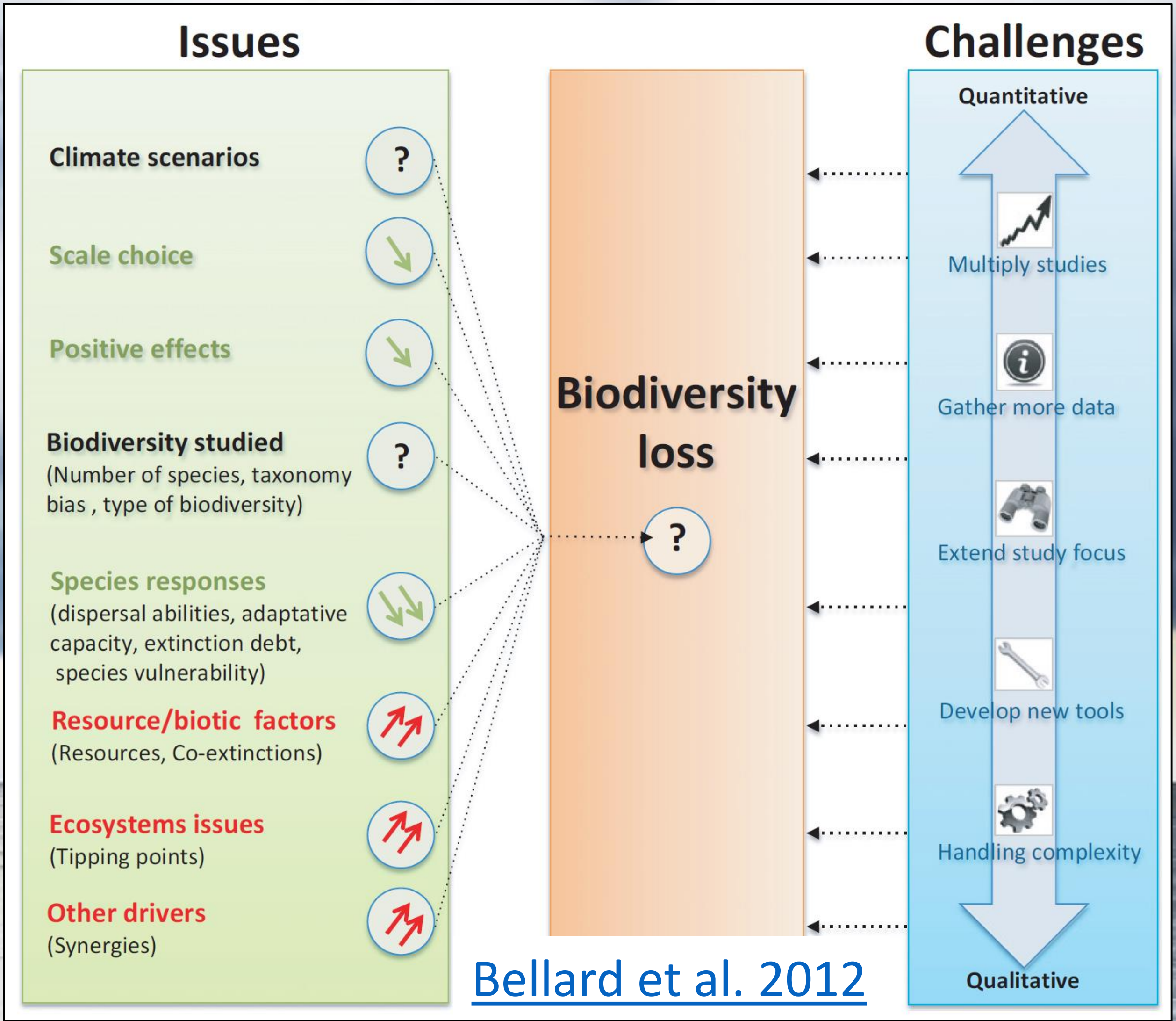
https://adaptwest.databasin.org

Carlos Carroll, Klamath Center for Conservation Research

Addressing barriers to use of climate resilience data in planning and management

- Increase understanding of link between metric and biotic response;
- Develop tools for managing under uncertainty;
- Increase familiarity with concepts, methods, and practice of planning for climate resilience via case studies



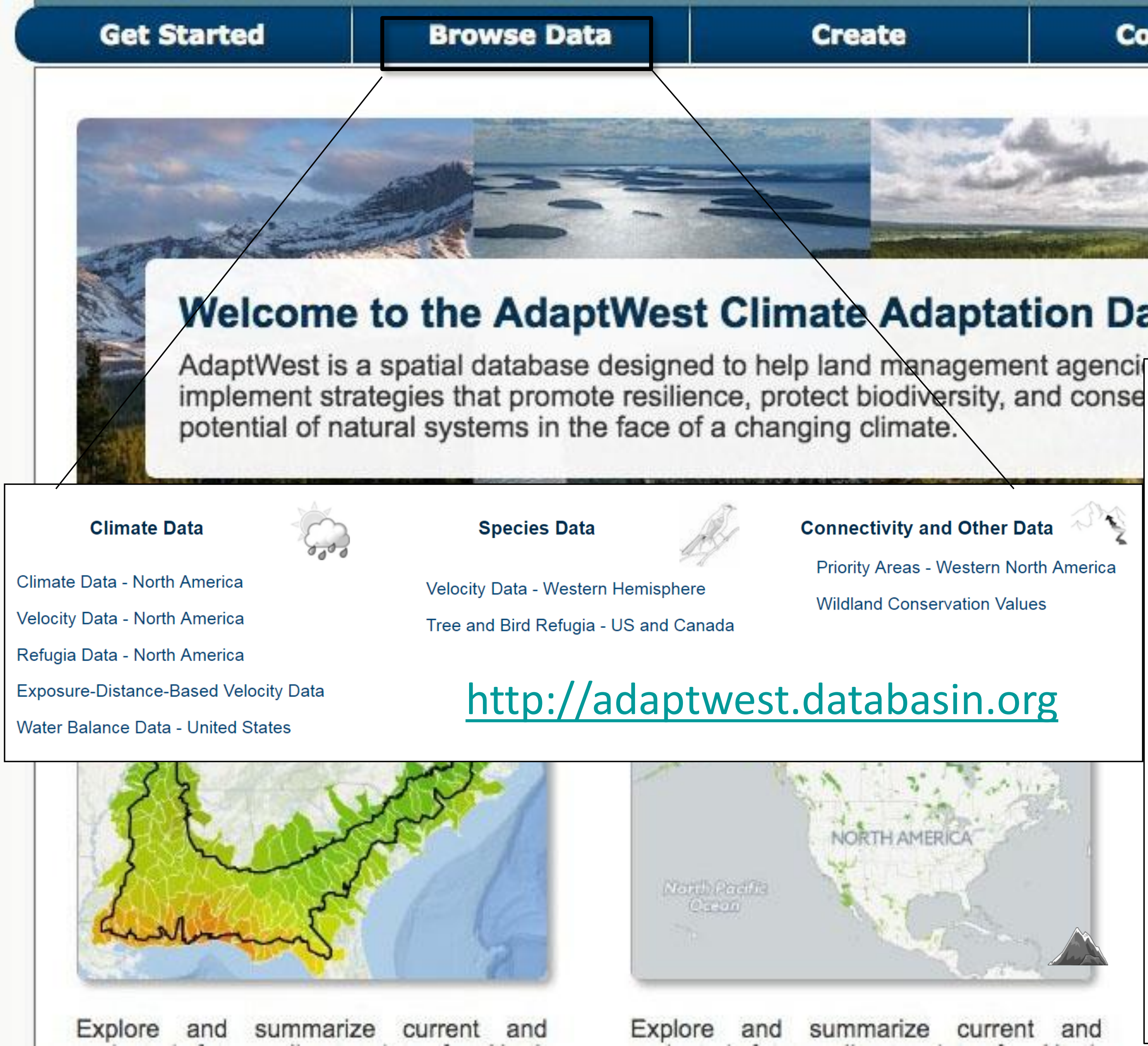
Bellard et al. 2012

Translating climate adaptation knowledge into effective conservation outcomes: What is needed to address the challenge?

1) Relevant and open science;

2) Translation and communication of science in the form of accessible concepts;

3) Networks of practitioners who have the tools and resources to implement concepts.



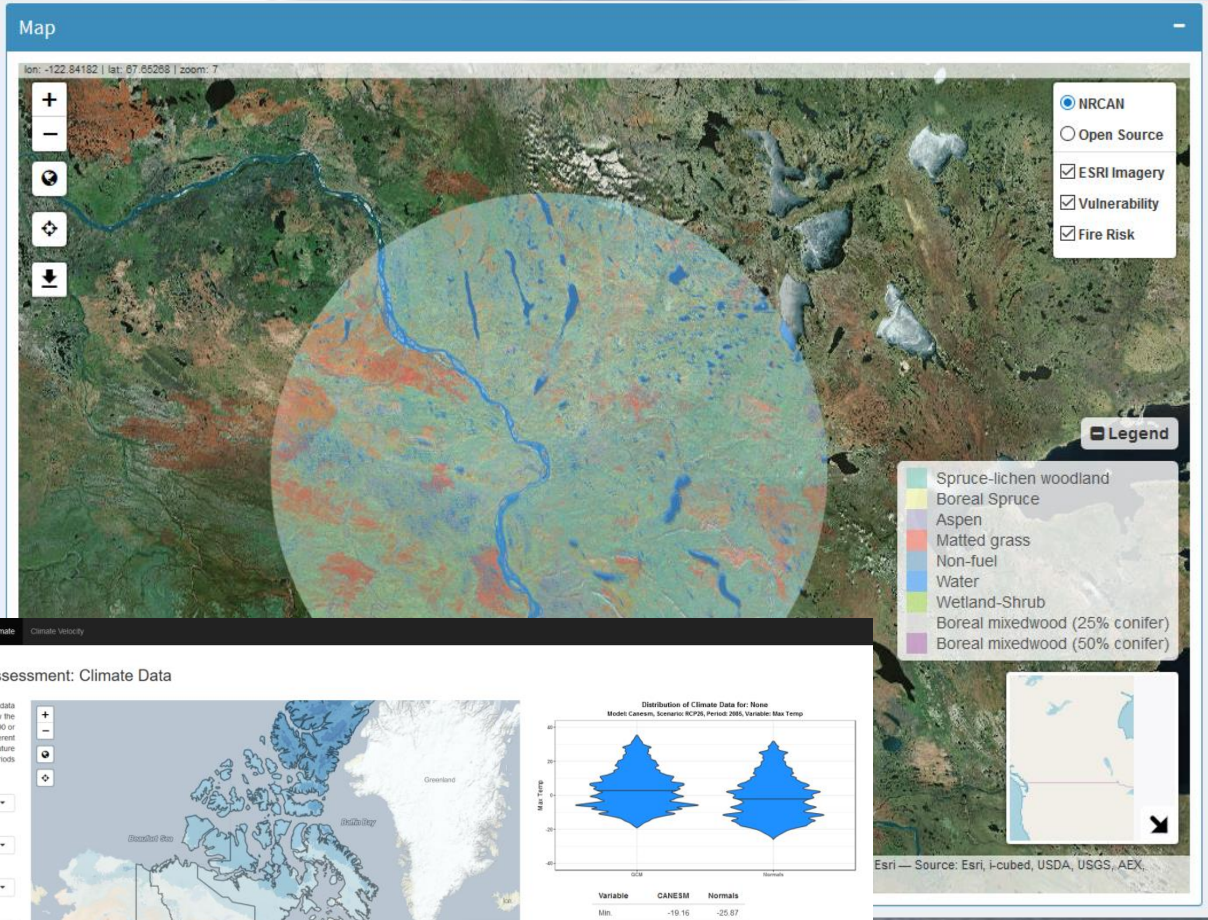
http://adaptwest.databasin.org

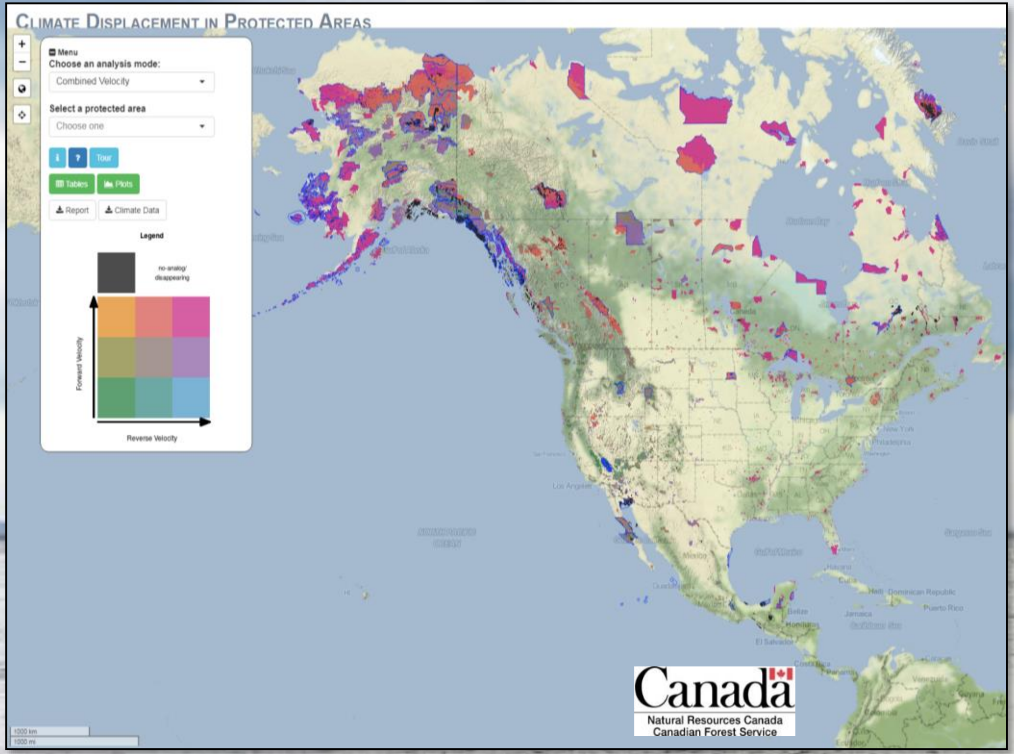
AdaptWest data represent multiple dimensions of climate exposure,
but is primarily

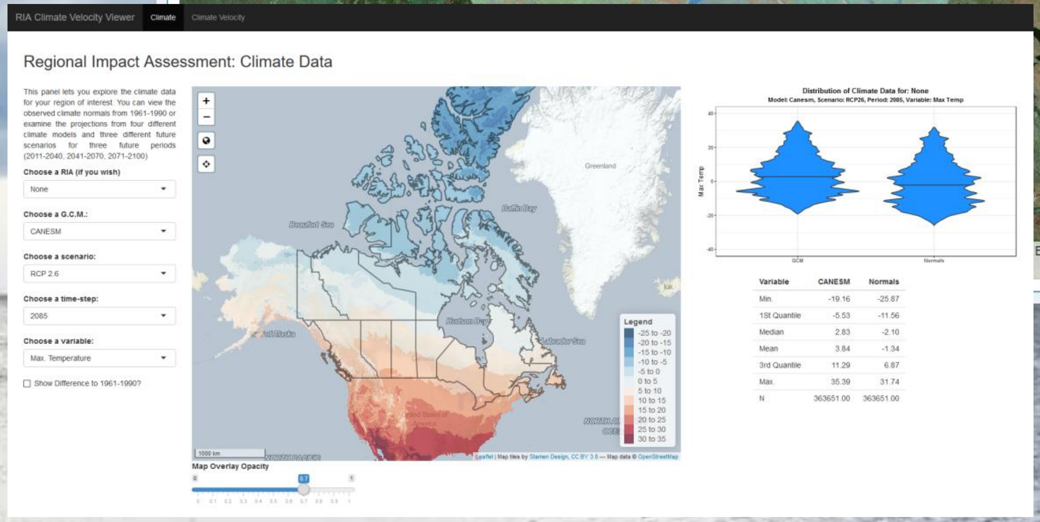
- Macro-scale
- Coarse-filter.

Translate and communicate science effectively: via web app development and other means

Web app development for data visualization is one effective means of making data more accessible.





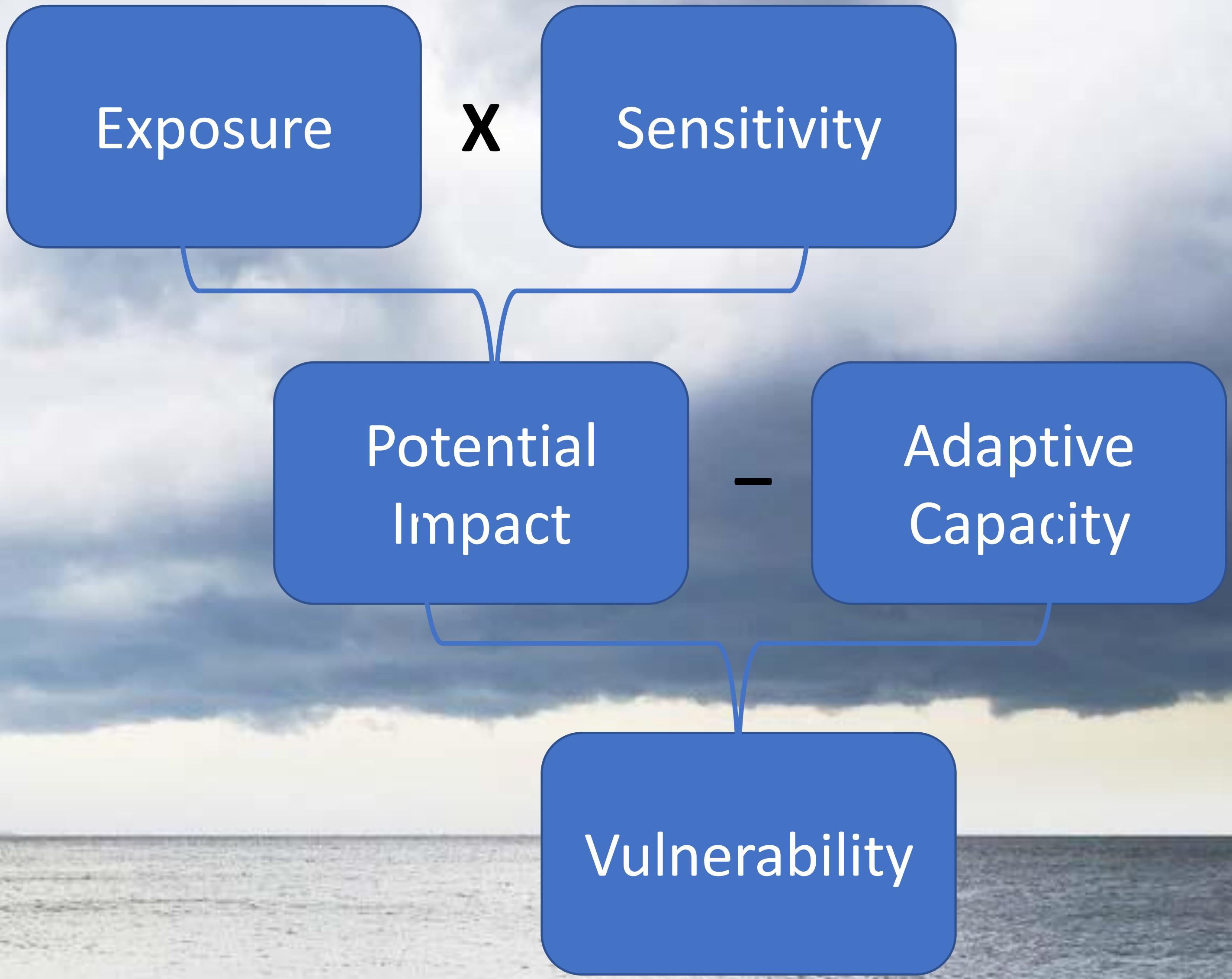


Assessing and Addressing Landscape-Level Vulnerability to Climate Change

The ultimate goal of landscape-level conservation planning under climate change is to facilitate persistence of species and ecosystem processes by increasing the adaptive capacity of landscapes and regions.

The ESAC framework, developed by the IPCC (McCarthy et al. 2001), proposes that climate Exposure and Sensitivity interact and are mediated by Adaptive Capacity, resulting in the degree of Vulnerability of the system to climate change.

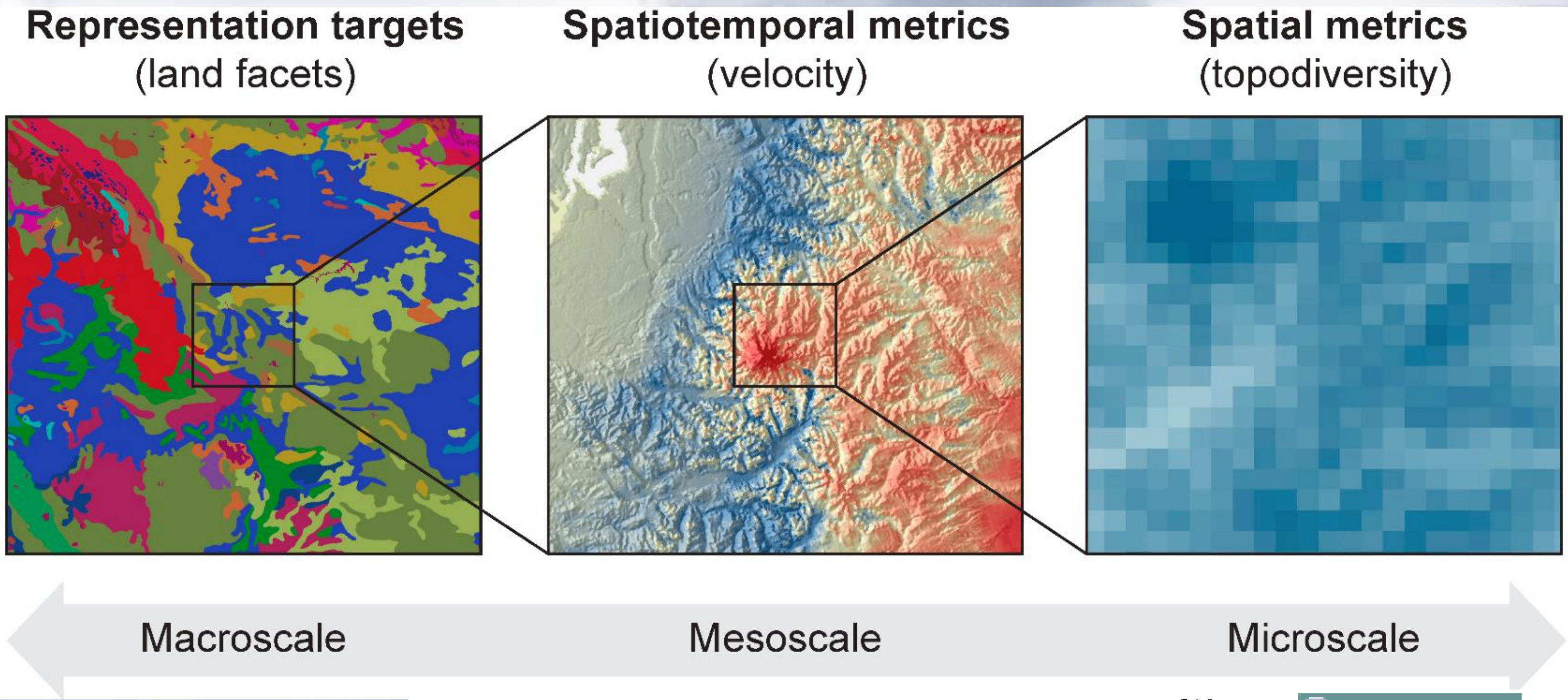
Most of the data considered here are measures of climate **exposure**. Data, such as the location of climate refugia for individual species, which incorporates information on a species' climatic tolerances or niche, also addresses climate **sensitivity**. The ultimate goal of providing such information to planners is to support conservation management that, by protecting key areas identified by the data, increases the **adaptive capacity** of the landscape and its ability to support native species and ecosystems into the future.



Integrating metrics across spatial scales

There are several ways to integrate information from diverse metrics.

Coarse-resolution velocity metrics can be combined with fine-resolution diversity metrics in order to identify potential macro- and microrefugia.



PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

Scale-dependent complementarity of climatic velocity and environmental diversity for identifying priority areas for conservation under climate change

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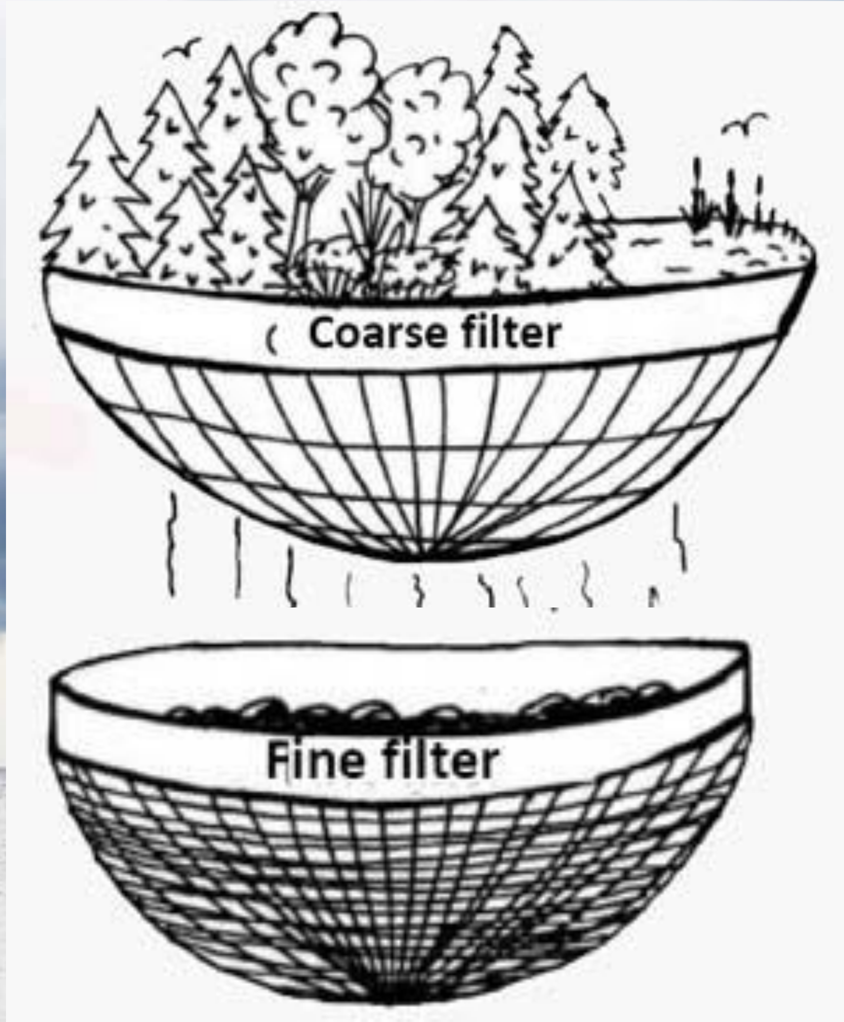
Carroll et al. 2017

Coarse-filter metrics complement fine-filter information

<u>Why use fine-filter targets?</u>
Coarse-filter surrogates imperfectly protect individual species

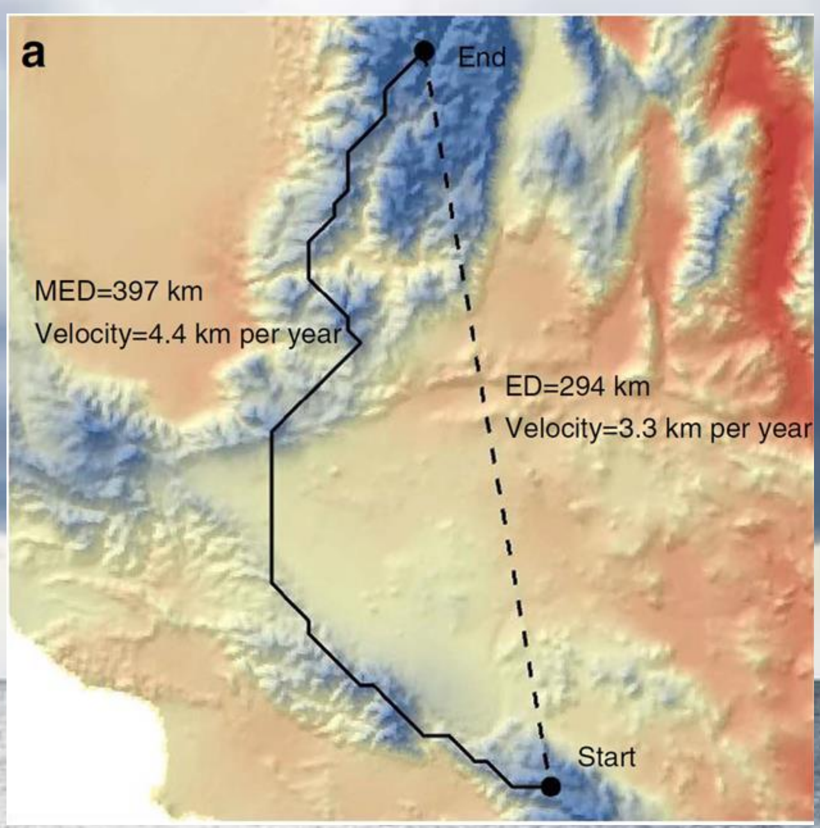
<u>Why use coarse-filter targets?</u>
Lack of information about most species and locally-adapted populations



How do we interpret coarse-filter metrics: Tradeoffs between realism and comprehensibility

Example of metrics of increasing complexity:

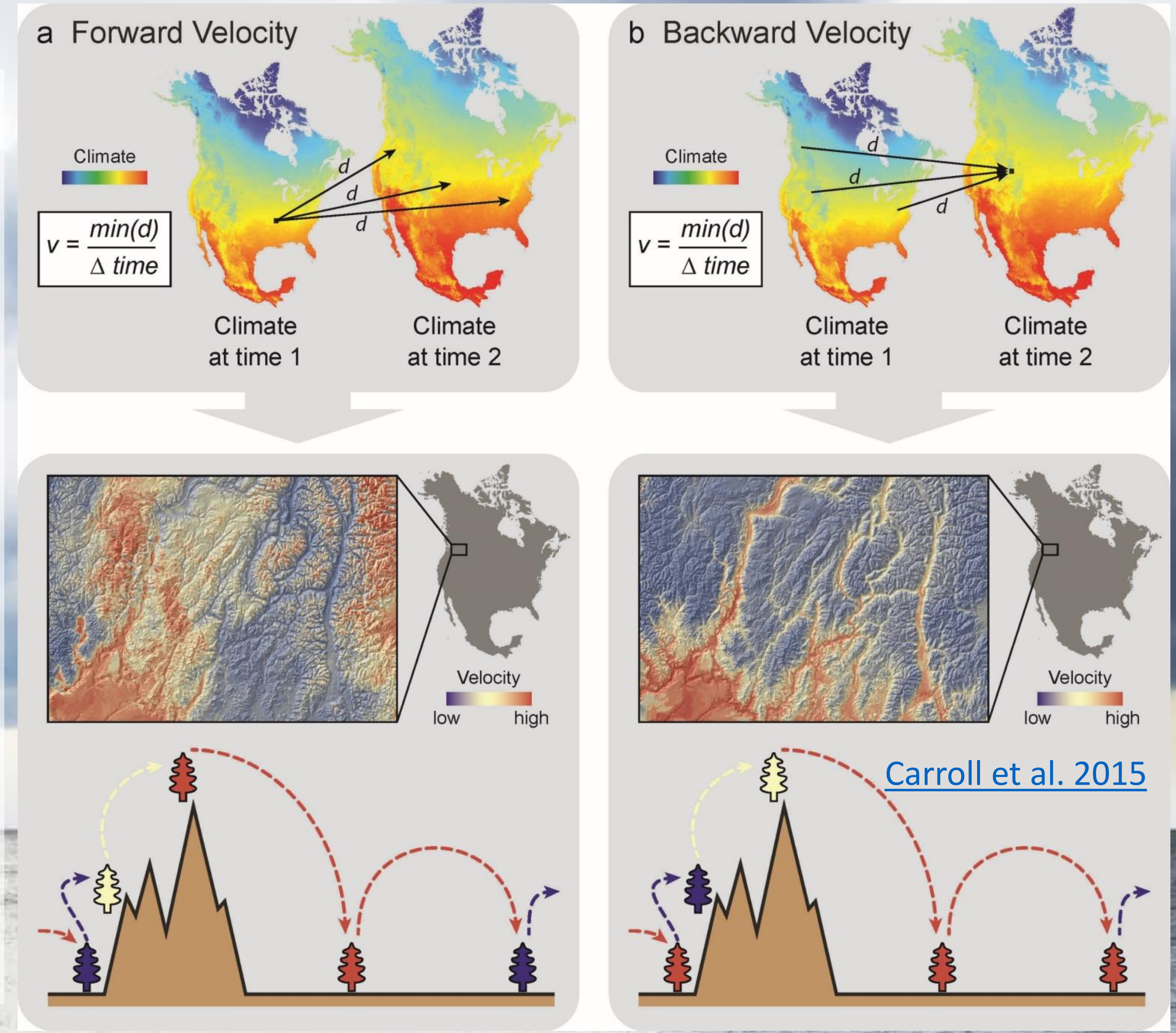
- Climatic dissimilarity;
- Climatic velocity;
- Climate connectivity;
- Biotic velocity.



Forward vs. backward climatic velocity

Forward climatic velocity represents the rate at which an organism currently at a location must move to find future suitable climate.

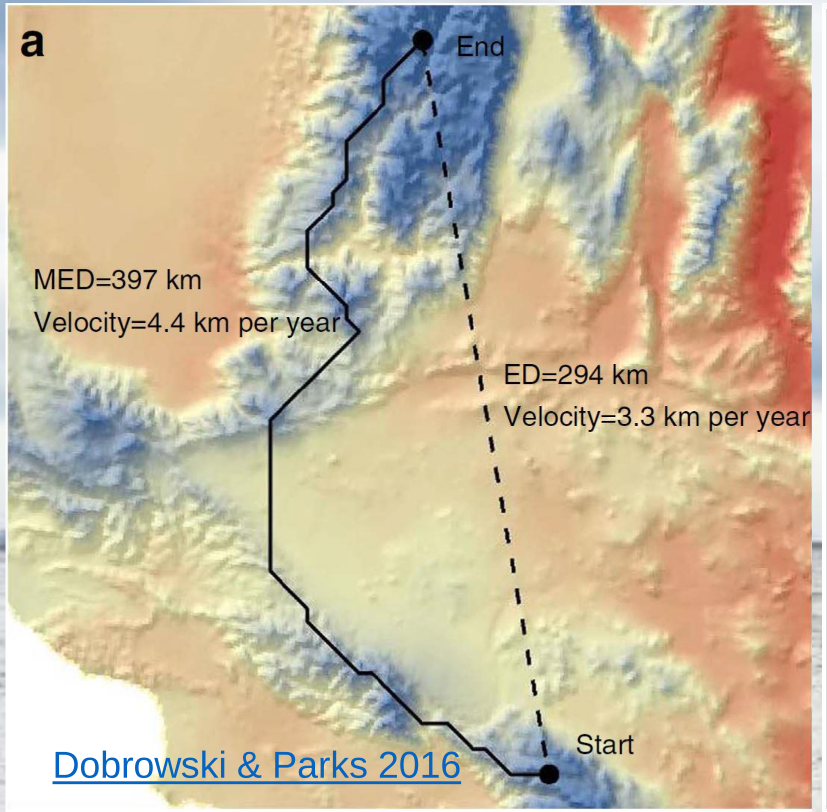
Backward climatic velocity represents the rate at which organisms adapted to a location's future climate will need to move to colonize that location.



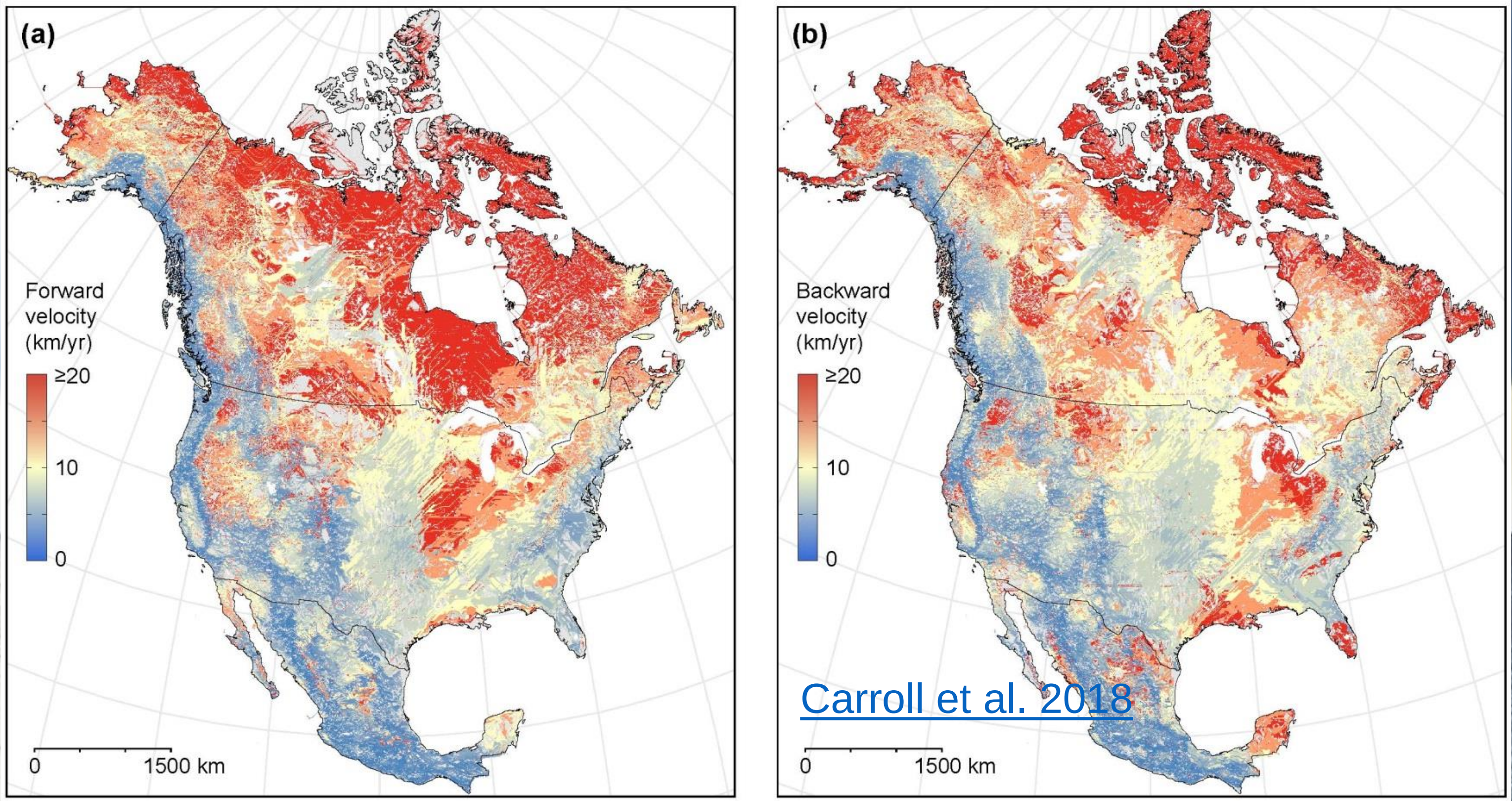
Carroll et al. 2015

Least-cost-path-based climate velocity

Dispersal routes between current climate types and where those climates will occur in the future will rarely be straight-line paths. Because organisms will need to avoid hostile climates, these routes will often be circuitous. Dobrowski and Parks 2016 developed a measure of climatic velocity based on this circuitous route.



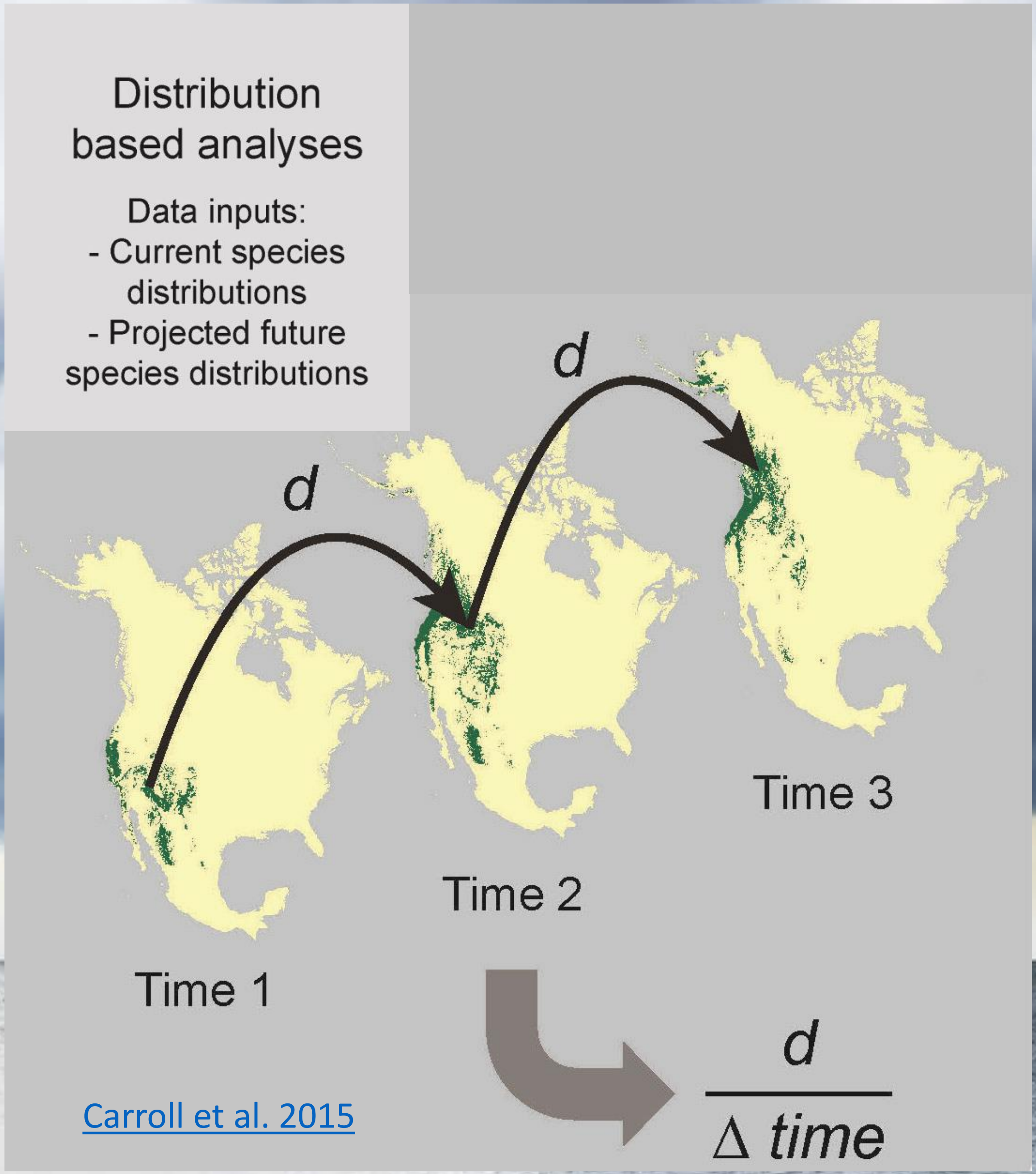
Dobrowski & Parks 2016



Carroll et al. 2018

Biotic velocity

Biotic velocity represents the distance between a site and the nearest site projected to be climatically suitable for the species under future projected climates.



Carroll et al. 2015

Three types of applications

Prioritization

Vulnerability assessment
(sites or species)

Management
strategies

Watson & Venter 2017

The AdaptWest Project team

- Carlos Carroll, Klamath Center for Conservation Research
- Diana Stralberg, University of Alberta
- Scott Nielsen, University of Alberta
- Andreas Hamann, University of Alberta
- Dave Roberts, University of Alberta
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For more information:

- New web app: https://tinyurl.com/adaptwest
- Main website: http://adaptwest.databasin.org
- Follow @adaptwest on Twitter for updates on newly available data and webinars
- Contact via email: carlos (at) klamathconservation.org

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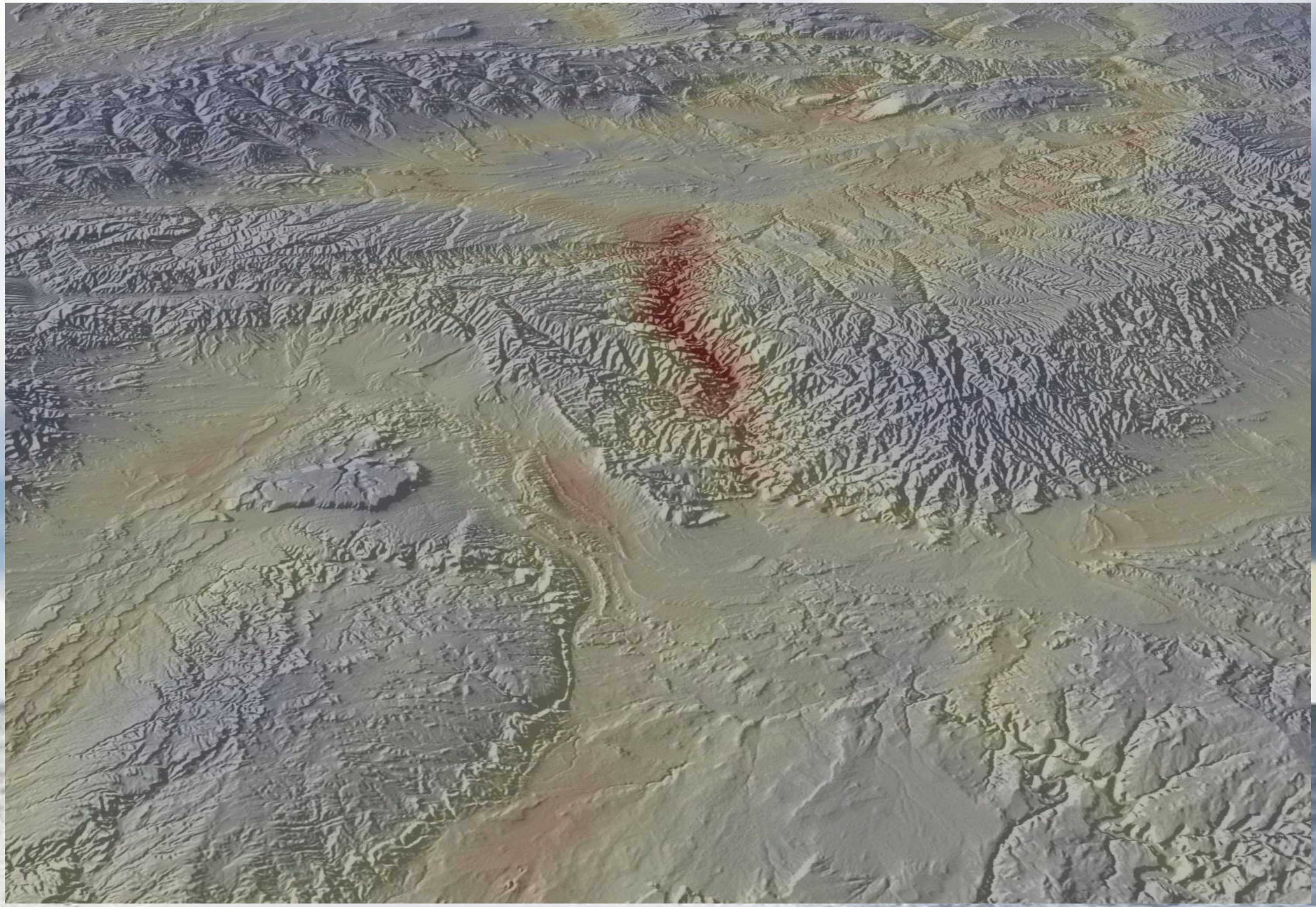
Broad-scale topography and climate influence connectivity paths

Dispersal paths are often funneled by topography into north-south trending passes and valley systems, such as the pass on the right in northern Utah.

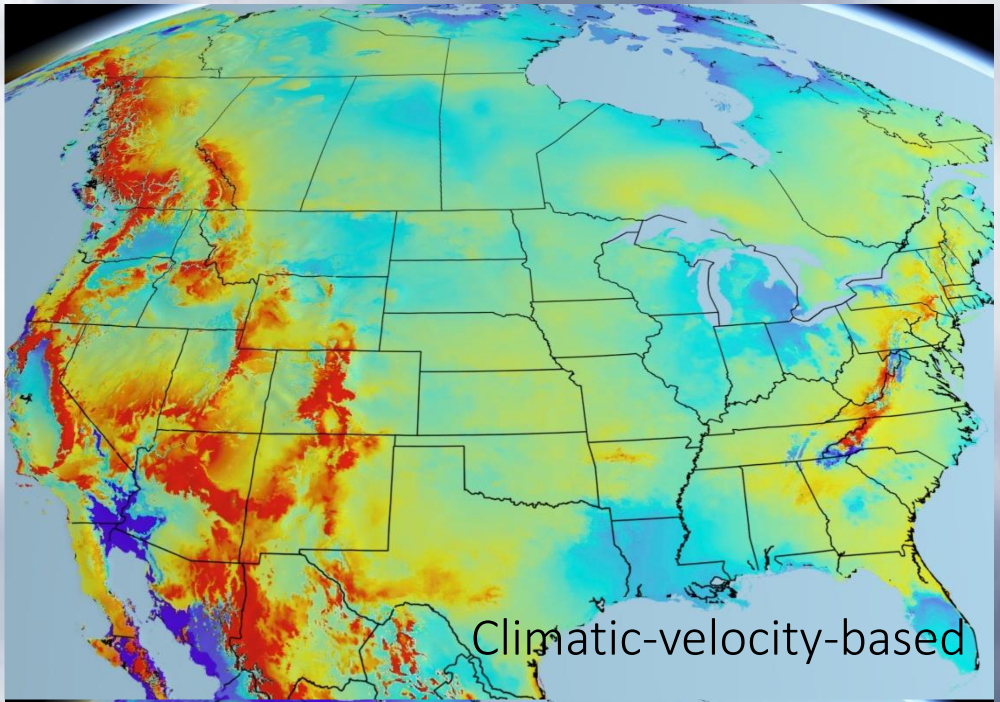
Human landuses may further constrain the ability of species to disperse through these areas.

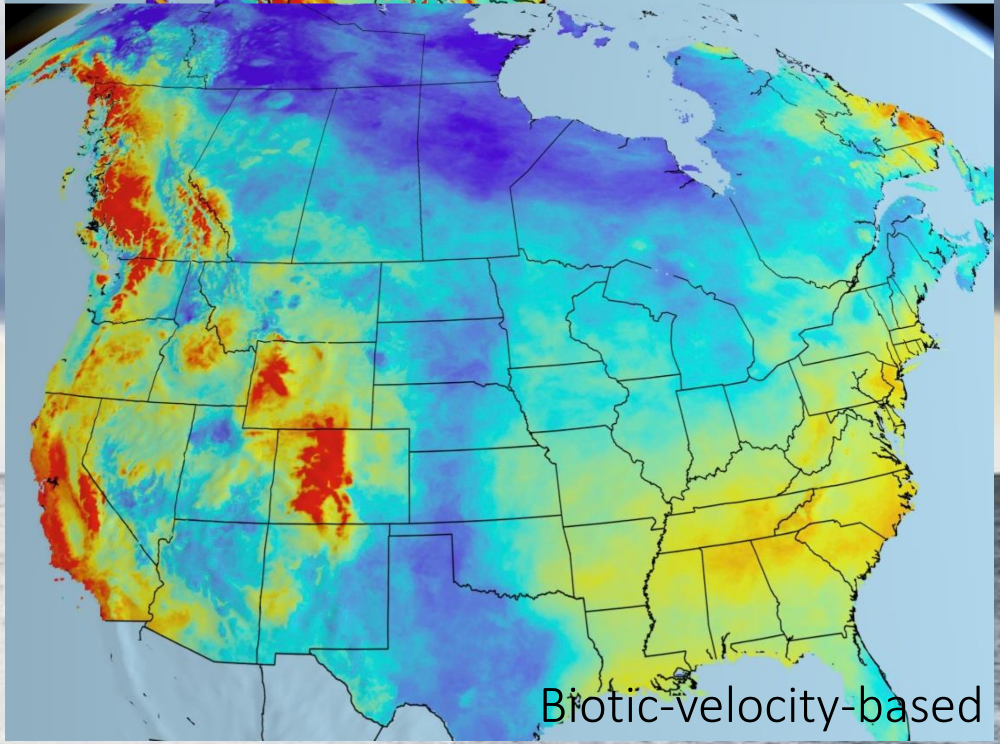


Climatic- vs biotic-velocity-based refugia

When compared to refugia defined by low climatic velocity, biotic velocity highlights the influence of biogeographic factors which have made certain regions more biodiverse than expected based on climate alone.

Biotic-velocity-based refugia vary depending on the species considered. They are shown here as based on the 592 songbird and tree species analyzed in Stralberg et al. 2018.

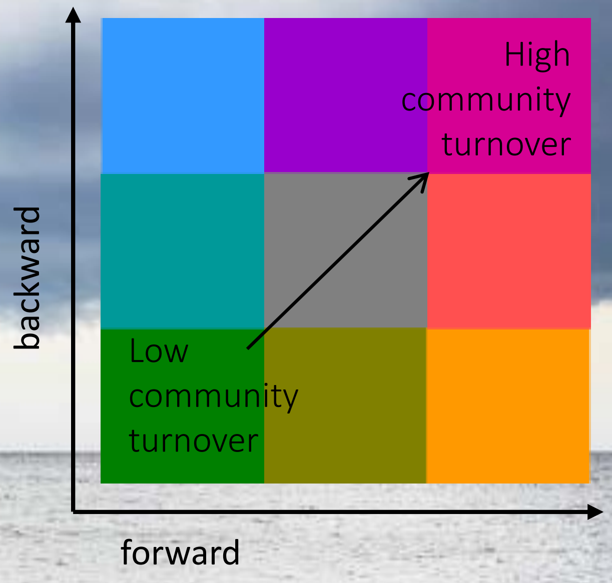




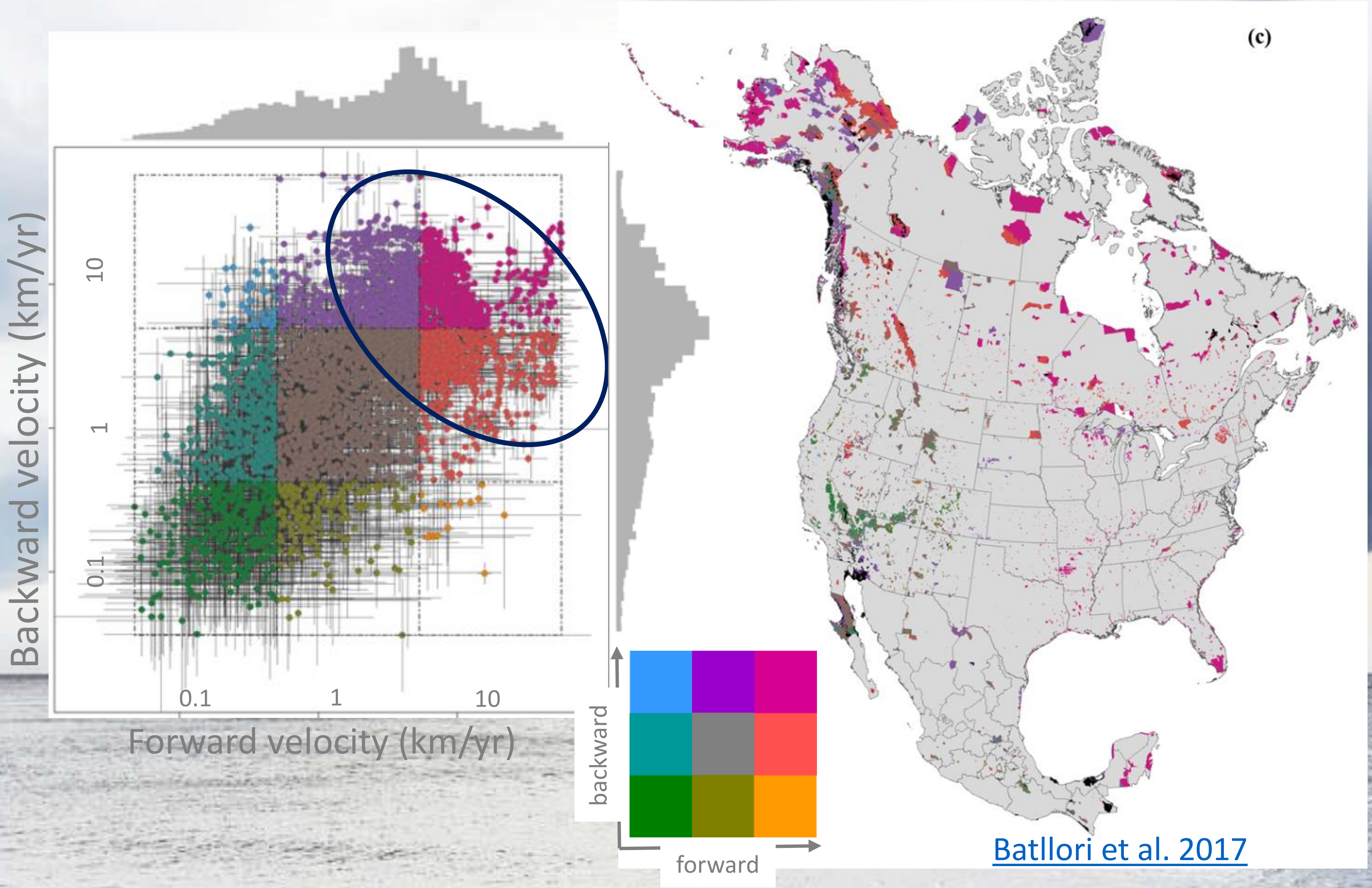
Integrating multiple metrics:
Velocity-based vulnerability assessment

Velocity metrics can inform:

- Ability of resident species and ecosystems to persist locally or regionally
- Locations of climatic refugia for species and ecosystems
- Likely degree of community turnover / displacement



Majority of North America's protected area network exposed to very high rates of climate displacement



Batllori et al. 2017