

Collaboratory on Adaptation to Climate Change

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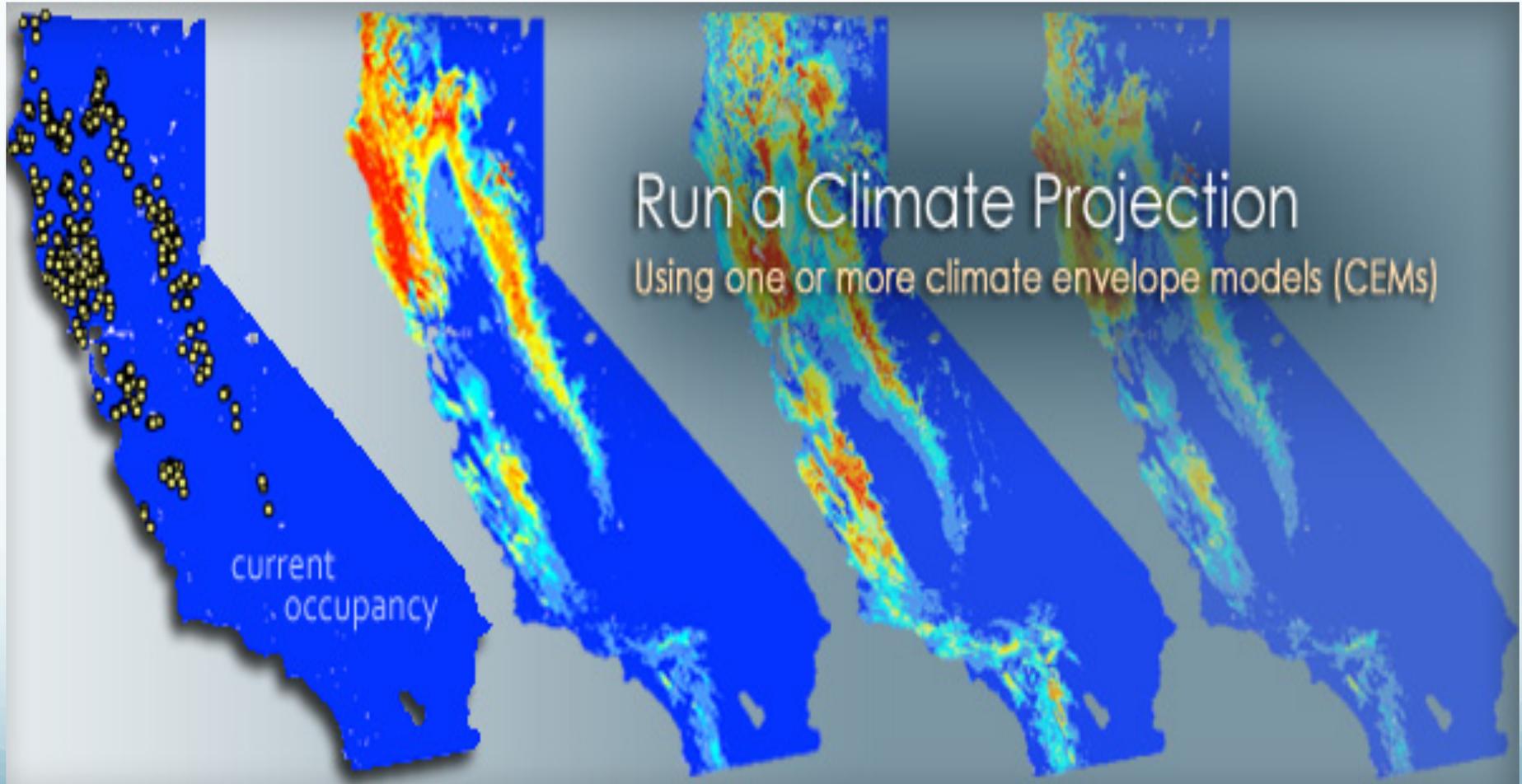


NatureServe

”Adaptation is adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities”, IPCC

Climate change adaptation raises fundamental questions about the relationship of humans to natural systems, questions that transcend disciplinary boundaries.

Science



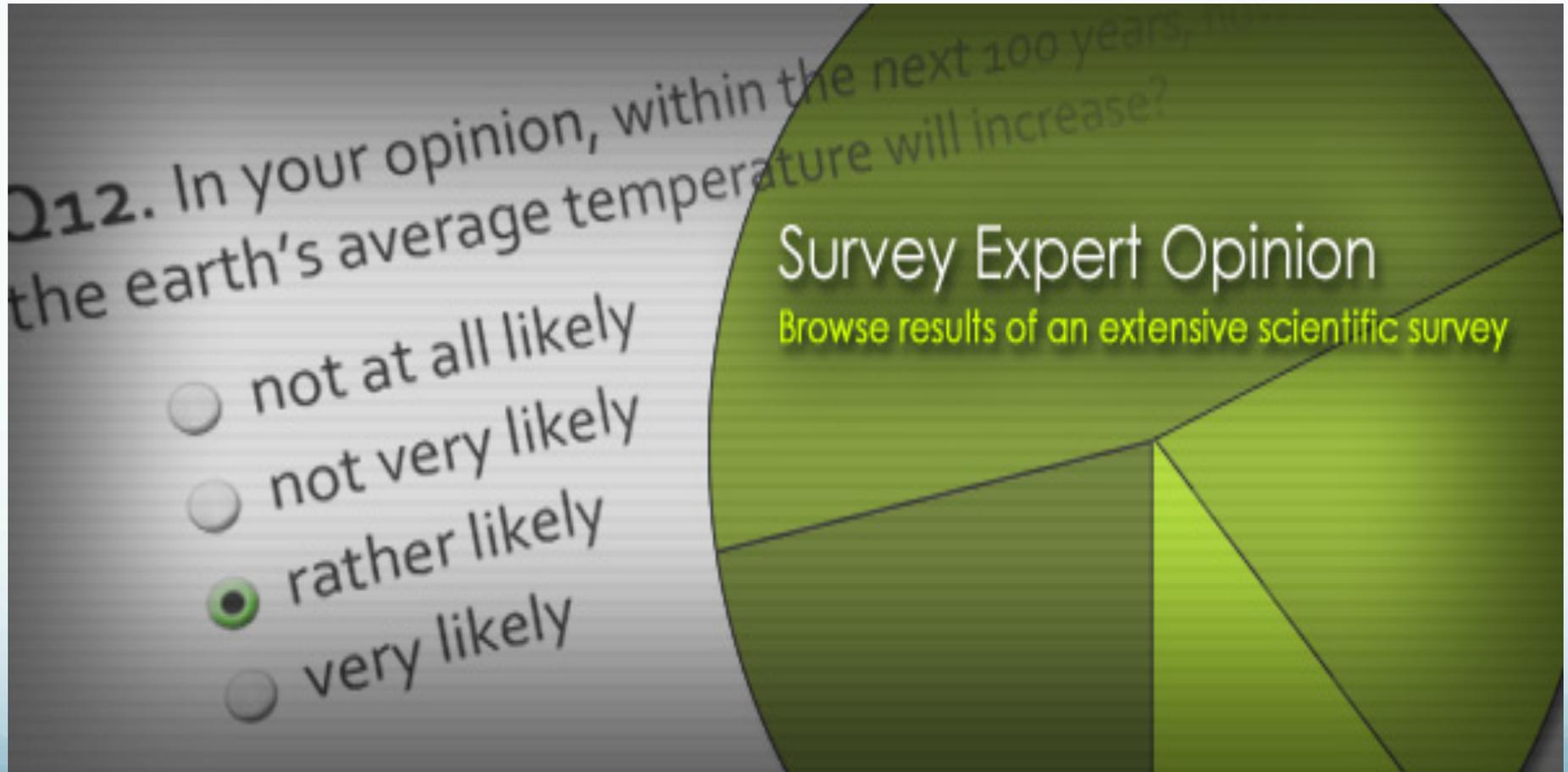
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A clearinghouse of scientific, legal
and regulatory information relevant
to adaptation planning

Perception



Citizen Science



Community Discussion

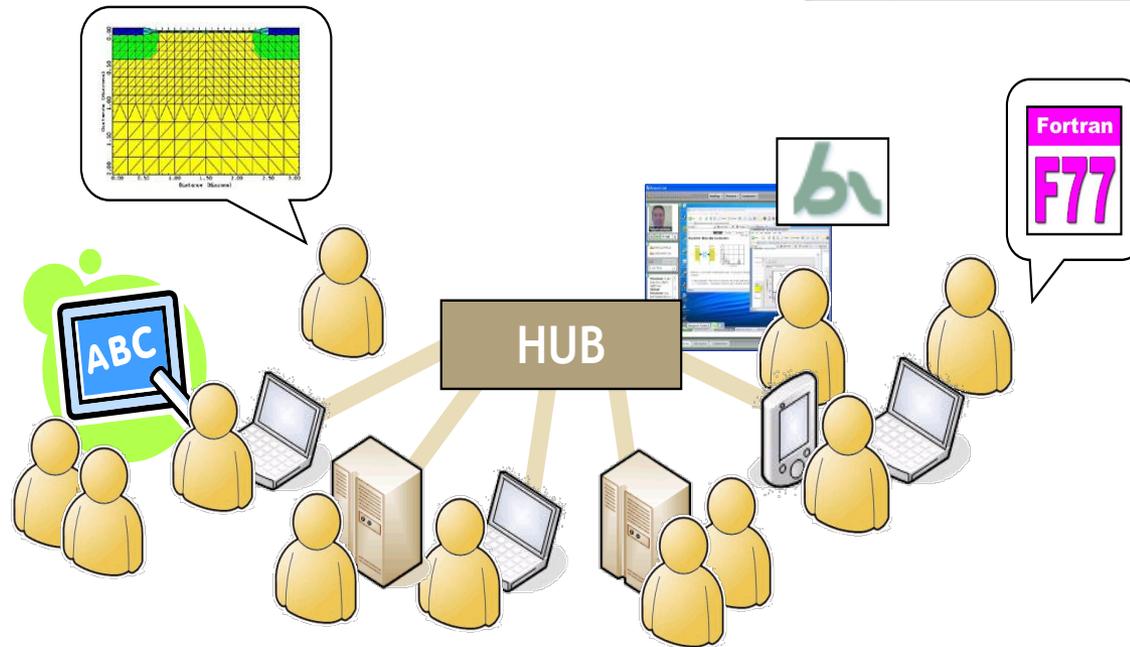
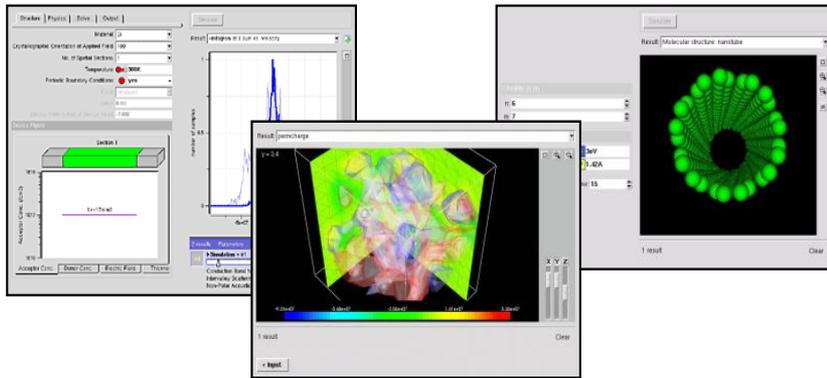
Ask a question or browse answers in our public forum

Decision Making



Use Tools to Make Decisions

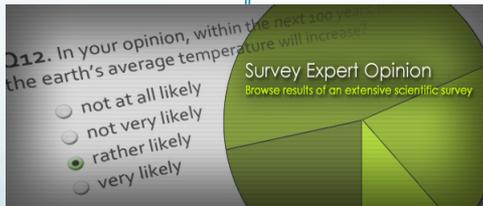
• Navigating the uncertainty



data to knowledge to insight to action



<http://adapt.nd.edu>



“Collaboratory is a virtual organization relying on cyber infrastructure for data sharing and modeling, shared computational resources, networking, community building, expert advise and to pursue pioneering inter-disciplinary integration and sound policy development.”

A decision flow

The screenshot displays the website for the Collaboratory for Adaptation to Climate Change. The main content area features a decision flow diagram with seven steps:

- Understand Potential Impacts
- Formulate Ecological Hypotheses
- Explore Human Responses
- Determine Climate-Induced Threats
- Evaluate Climate Impact
- Develop Adaptation Strategies
- Develop Measures, Implement, Adapt, and Learn

The flow starts with 'Understand Potential Impacts', moves to 'Formulate Ecological Hypotheses', then 'Explore Human Responses', and 'Determine Climate-Induced Threats'. From 'Determine Climate-Induced Threats', the flow goes to 'Develop Measures, Implement, Adapt, and Learn', then 'Develop Adaptation Strategies', and finally 'Evaluate Climate Impact'. There is also a feedback loop from 'Evaluate Climate Impact' back to 'Understand Potential Impacts'.

The website header includes the logo for the Collaboratory for Adaptation to Climate Change, a search bar, and buttons for 'Login' and 'Register'. The navigation menu includes 'Home', 'my Adapt', 'Resources', 'Members', 'Explore', 'About', 'Support', and 'Help!'. The footer contains links for 'Get Started', 'Get Involved', and 'About Adapt', along with the University of Notre Dame logo.

A decision flow

The screenshot shows a web browser window with the URL `adaptold.crc.nd.edu/index.php?option=com_workflow2`. The page features a green and blue header with the logo for the 'COLLABORATORY for ADAPTATION to CLIMATE CHANGE'. A search bar and 'Login'/'Register' buttons are visible. The main content area is a decision flow with two steps: 'Understand Potential Impacts' and 'Evaluate Climate Impact'. A modal window is open for the first step, providing detailed instructions, an example, and resources. The footer includes a 'Get Started' menu and the University of Notre Dame logo.

Understand Potential Impacts

Consider how changing climatic conditions will affect essential ecosystem features or their components, including representative habitats, select species and ecological processes.

Example:

Climate models predict that the shrub-steppe habitat in Eastern Washington, USA will experience increases in temperature and altered precipitation patterns.

Tools:

- [Climate Wizard](#)

Resources:

- [Publications](#)
- [Case Studies](#)
- [Online Resources](#)

Discussion:

- [View Responses](#)
- [Post Response](#)
- [Discuss this Step](#)

[Next Step](#)

Species vulnerability

- Determining the most vulnerable species of plants and/or animals to climate change

NatureServe Climate Change Vulnerability Index **can help identify plant and animal species that are particularly vulnerable to the effects of climate change.**

Climate Change Vulnerability Index (CCVI) Tool

CCVI Notebook

Home Section A Section B Section C Section D Section Result Database Access Existing Feedback Documentation

The NatureServe Change Vulnerability Index

Release 2.1 © 7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder
 With input from: Jay Cordeiro, Kristin Szabo
 Funding for Release 2.0 generously provided by the Duke Energy Corporation.

Web Tool Iteration 2.0

* = Required Field

Geographic Area Assessed: *

Assessment Name: *

Assessor:

States: Alabama Alaska Arizona

Species Scientific Name: *

English Name:

Major Taxonomic Group: *

G-Rank: **S-Rank:**

Relation of Species' Range to Assessment Area: *

Check if species is an obligate of caves or groundwater aquatic systems:

Check if this assessment will be stored as "private" - only you can view it:

Reviewers have the ability to make comments on assessments for which they have been requested to do so. Collaborators have the same privilege and can also update the original assessment to fix errors or make improvements.

Assessment Notes (to document special methods and data sources)

Select collaborators/reviewers and request feedback:

C	R	F	Name
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Nathan Smith
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	twright
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	admin

Reviewer Comments:

Climate Change Vulnerability Index (CCVI) Tool

CCVI Notebook

Home Section A Section B Section C Section D **Section Result** Database Access Existing Feedback Documentation

Climate Change Vulnerability Index
for *Rana sylvatica* in Lower Mississippi River Bottomlands

Moderately Vulnerable

Confidence in Species Information **Low**

Notes:

Confidence in Species Information

Category	Percentage
EV	0.0%
HV	22.9%
MV	59.2%
PS	17.9%
IL	0.0%

To save this projection with results to the database, go to "General Information tab", click "Save to DB" button

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.

Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

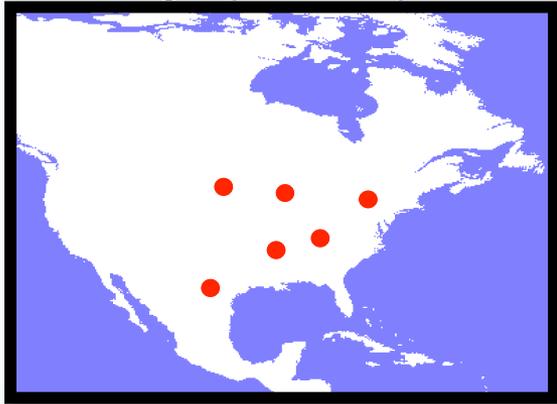
CCVI Notebook

Species Distribution Modeling

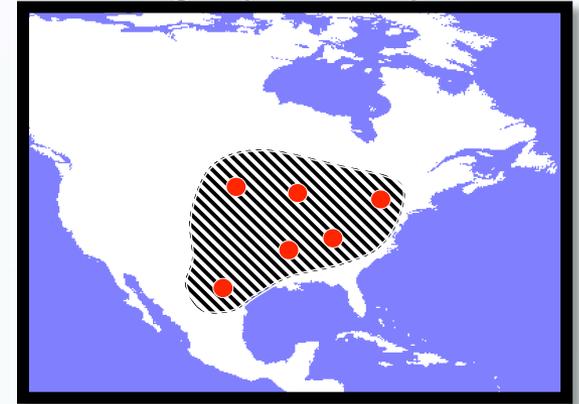
- Generate niche-based models from species data.
- Typical input:
 - species occurrences
 - environmental variables
- Tasked with predicting environmental suitability for species (species niche).
- Applications include:
 - Guiding field surveys
 - Projecting impacts of climate change
 - Guiding reintroduction of endangered species

Forming knowledge of the factors that determine where species live and predictions about their distributions is important for developing strategies in the realms of ecological conservation and sustainability.

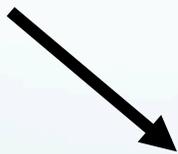
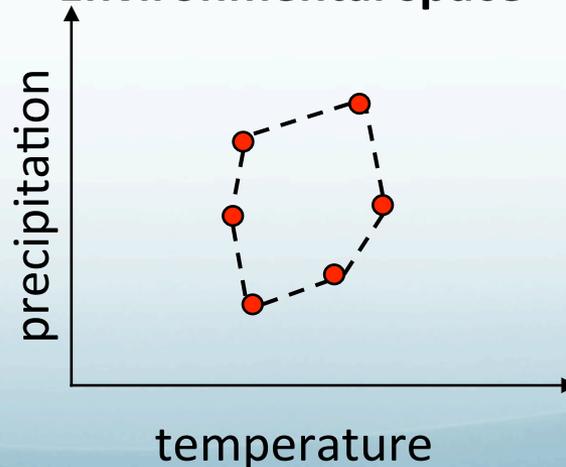
Geographical space



Geographical space



Environmental space



- Species distribution modeling
 - Process of combining occurrence data with ecological and environmental variables to create a model for species niche requirements

Challenges:

Number of actual observations are often quite small relative to the size of the geography that they occupy (*class imbalance*)

Non-occurrences can either be genuine absences or more commonly areas lacking occurrence information (*how to evaluate?*)

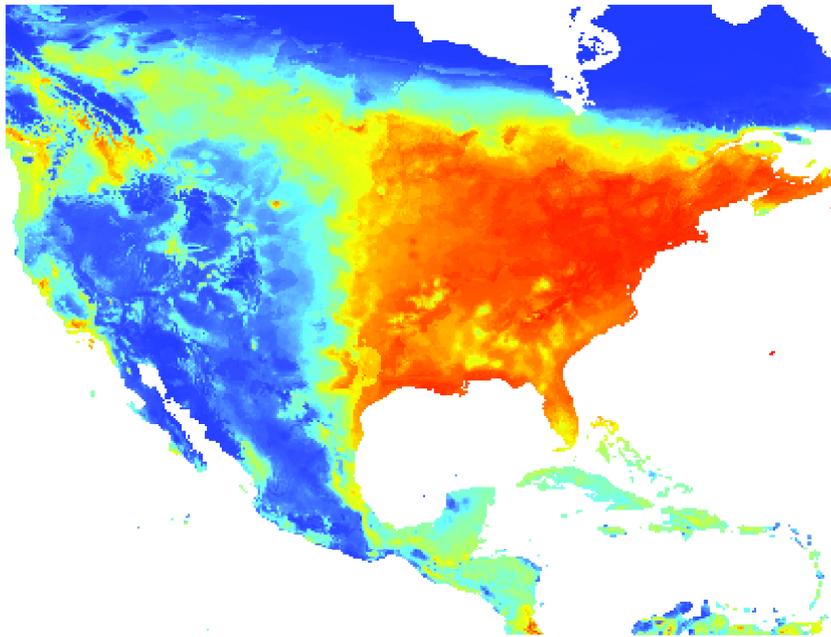
Evaluation Considerations

- Evaluated using: the area under the Receiver Operating Characteristic curve (AUROC), and the area under the Precision-Recall curve (AUPR)
 - AUROC can present an overly optimistic view of an algorithm's performance if there is a large skew in the class distribution
 - AUPR captures the natural trade-off between successfully identifying positive instances while remaining parsimonious in predictions.

Data

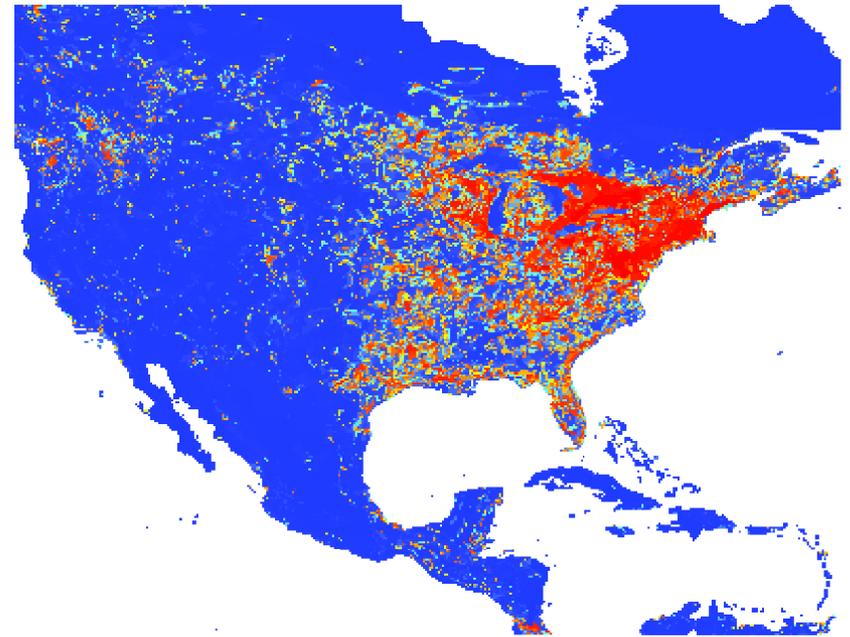
- Environmental coverage:
 - Constitute North American grid with 10 arc-minute square cells.
 - Consist of 18 bioclimatic variables derived from monthly temperature and rainfall values during the period 1950 to 2000.
 - Each coverage is defined over a 302 x 391 grid, of which 67,570 points have data for all coverages.
- Species presence data:
 - Pertains to North America and is derived from the Global Biodiversity Information Facility (GBIF).

Species Projections – *V. olivaceus*



MaxEnt

AUROC: 0.842
AUPR: 0.400



**Hellinger Distance Decision Trees
(HDDT)**

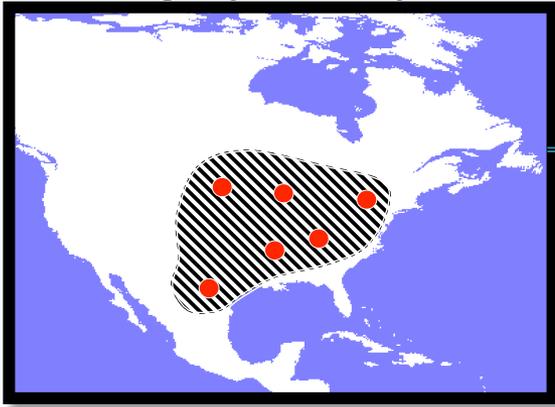
AUROC: 0.890
AUPR: 0.604

Species Projections – Model Comparison

Species	Mean AUPR							
	MAXENT	HDDT	C4.5	LR	NB	RF	RF-SMT	CART
<i>Vireo bellii</i>	0.185	0.212	0.151	0.101	0.050	0.161	0.149	0.100
<i>Vireo cassinii</i>	0.320	0.417	0.321	0.343	0.062	0.248	0.224	0.150
<i>Vireo flavifrons</i>	0.258	0.445	0.347	0.330	0.147	0.325	0.293	0.197
<i>Vireo griseus</i>	0.346	0.564	0.412	0.450	0.132	0.342	0.315	0.265
<i>Vireo huttoni</i>	0.430	0.512	0.326	0.351	0.035	0.298	0.236	0.144
<i>Vireo olivaceus</i>	0.400	0.604	0.080	0.424	0.201	0.346	0.295	0.233
<i>Vireo philadelphicus</i>	0.210	0.192	0.204	0.153	0.094	0.180	0.174	0.128
<i>Vireo solitarius</i>	0.396	0.468	0.320	0.365	0.171	0.316	0.283	0.186
<i>Vireo vicinior</i>	0.163	0.107	0.086	0.077	0.011	0.085	0.100	0.047
Average	0.301	0.391	0.250	0.288	0.100	0.256	0.230	0.161

Regulatory Frameworks also Matter

Geographical space



Constraints



Regulatory + Scenarios



Browse, Search Upload or Comment on Adaptation Planning Efforts

A clearinghouse of scientific, legal and regulatory information relevant to adaptation planning

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Welcome to the Adaptation Collaboratory!

This website is a resource for research, education, and collaboration in the area of adaptation and climate change. It is funded by the [National Science Foundation](#) and the [University of Notre Dame](#). Our team at Notre Dame, and our outreach partners at [The Nature Conservancy's Great Lakes Project](#), invite you to share your information needs, ideas, tools, and experiences in climate change adaptation. Click on a task in the slide show or choose an activity from the menus and start adapting!

If you are new to our site, you might start with our [Collaboratory Tutorial](#)

RESOURCES

- Popular Tags:
- climate change
 - adaptation
 - Policy
 - Government
 - legal
 - Government - State
 - Law
 - Adaptation Strategies
 - Legislation
 - regulation
 - environmental health
 - environmental
 - regulatory
 - environmental policy
 - great lakes
 - Government - Federal
 - Great Lakes coastal communities
 - mitigation
 - vulnerability
 - Wildlife
 - Conservation
 - Chicago
 - vulnerability assessment
 - fish and wildlife conservation
 - water resources
 - More tags >

Case Studies, Education and Community, Government Studies & Reports, Laws, Regulations & Plans, Other Online Resources

WHAT'S NEW IN RESOURCES

- West Virginia- Climate Change Vulnerability Index (CCVI) Results and Report in Case Studies, Jul 24, 2012
- Great Plains - Climate Change Vulnerability Index (CCVI) Results in Case Studies, Jul 24, 2012
- No Refuge from Warming: Climate Change Vulnerability of the Mammals of the Arctic National Wildlife Refuge in Case Studies, Jul 24, 2012
- Colorado - Proposed Rare Plant Addendum to to State Wildlife Action Plan in Case Studies, Jul 24, 2012
- Integrating climate change vulnerability assessments into adaptation planning: A case study using the NatureServe Climate Change Vulnerability Index to inform conservation planning for species in

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Our People



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Research Interests: Machine learning, data mining, network science/complex networks, climate data science, and prospective health care.



Jessica Hellmann

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Research Interests: The impacts of human activities such as global climate change, habitat loss and fragmentation, and invasive species on the distribution and abundance of life on Earth.



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Research Interests: Environmental law, regulatory reform, natural resource law and land use regulation.



Patrick Doran

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Research Interests: Prioritizing conservation areas and activities; developing and implementing conservation strategies and measuring their success.



Kimberly Hall

Great Lakes Climate Change Ecologist, The Nature Conservancy

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Research Interests: Assessing vulnerability of the Great Lakes region's species and systems to climate change, and updating conservation planning and actions to promote adaptation of both nature and people.



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Research Interests: Mass political behavior, survey research, the politics of post-Soviet and other post-commu



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Research Interests: Sociological theory, the sociology of culture, sociology of organizations, network theory, r



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Research Interests: The dynamics of plant populations faced with large scale environmental change.



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Conference on Intelligent Data Understanding 2012

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October 24 — 26, 2012
National Center for Atmospheric Research, Boulder, Colorado

The 2012 Conference on Intelligent Data Understanding (CIDU 2012) is organized under the theme of "**Bringing Data and Models Together**" and will attract top researchers and practitioners in the field of data mining focusing on applications to Earth & Environmental Systems, Space Science, and Aerospace & Engineering Systems. The Organizing Committee is soliciting theme-oriented papers that advance one of these areas through the use of data mining, machine learning, or computational intelligence techniques. We invite papers that include a clear link between the domain and analysis methods, and papers that give perspectives on methods to bring data-driven and model-based methods together are particularly sought. We also invite submission of 2-page extended abstracts for posters reporting new and interesting results, ideas, or work-in-progress.

All papers and posters will be peer-reviewed based on technical merit, significance, originality, relevance, and clarity. Papers should be no more than 8 pages and describe original work not previously published in a refereed conference or journal. The CIDU 2012 proceedings will be indexed by IEEE Xplore and DBLP. Selected papers will be invited to be extended for consideration in the journal Statistical Analysis & Data Mining.

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