UNIVERSITY OF NOTRE DAME

ENVIRONMENTAL CHANGE INITIATIVE

iCeNSA
Interdisciplinary Center for Network Science & Applications

Collaboratory on Adaptation to Climate Change

Nitesh Chawla
University of Notre Dame
nchawla@nd.edu

Partners

The Field Museum

The Nature Conservancy
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NatureServe

Support

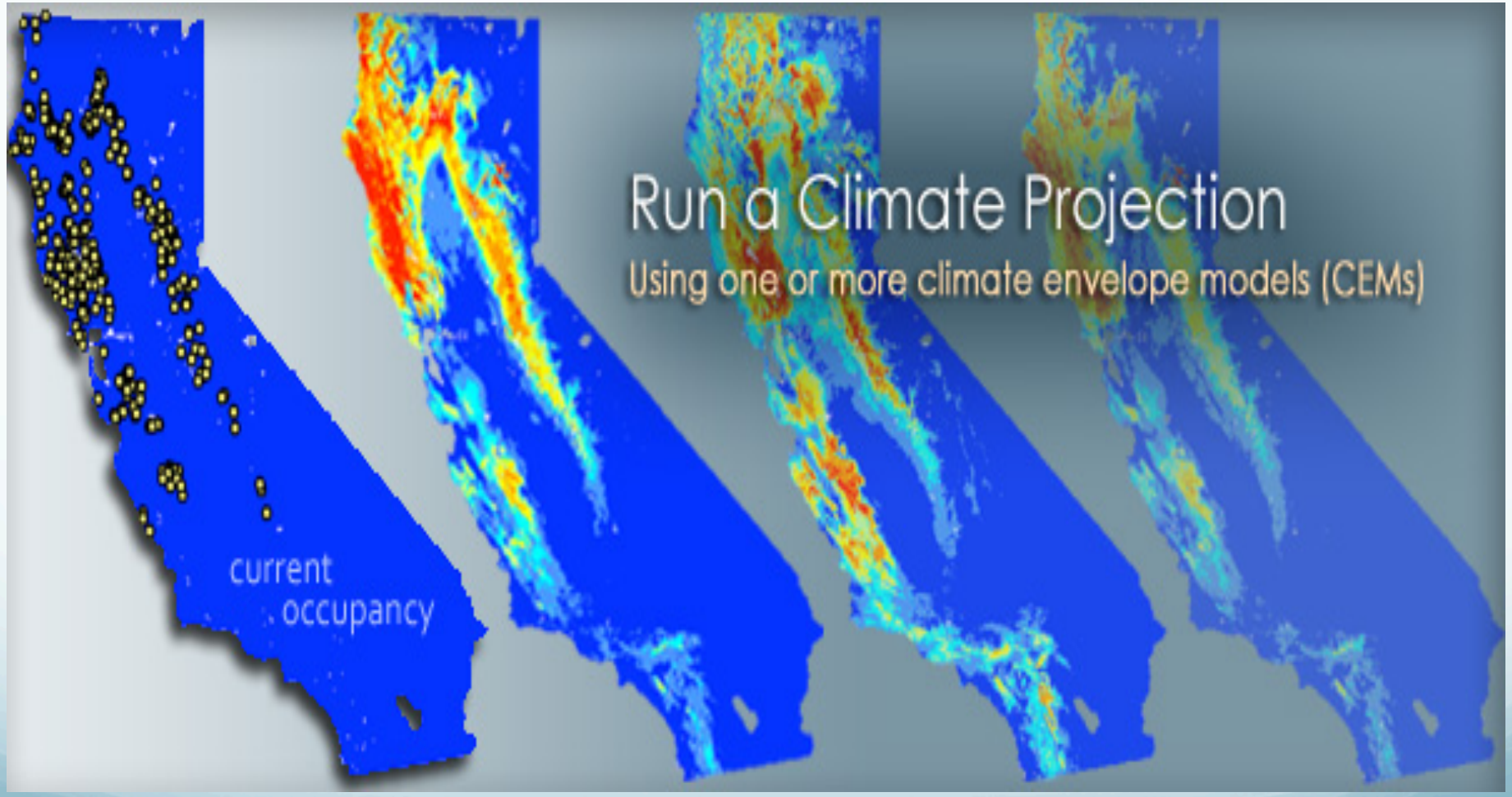
National Science Foundation
WHERE DISCOVERIES BEGIN

UNIVERSITY OF NOTRE DAME

”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


Run a Climate Projection
Using one or more climate envelope models (CEMs)
current
occupancy

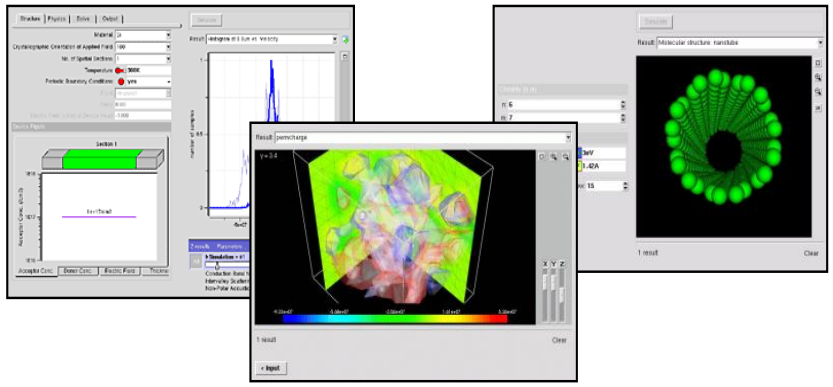
Legal/Policy

Perception

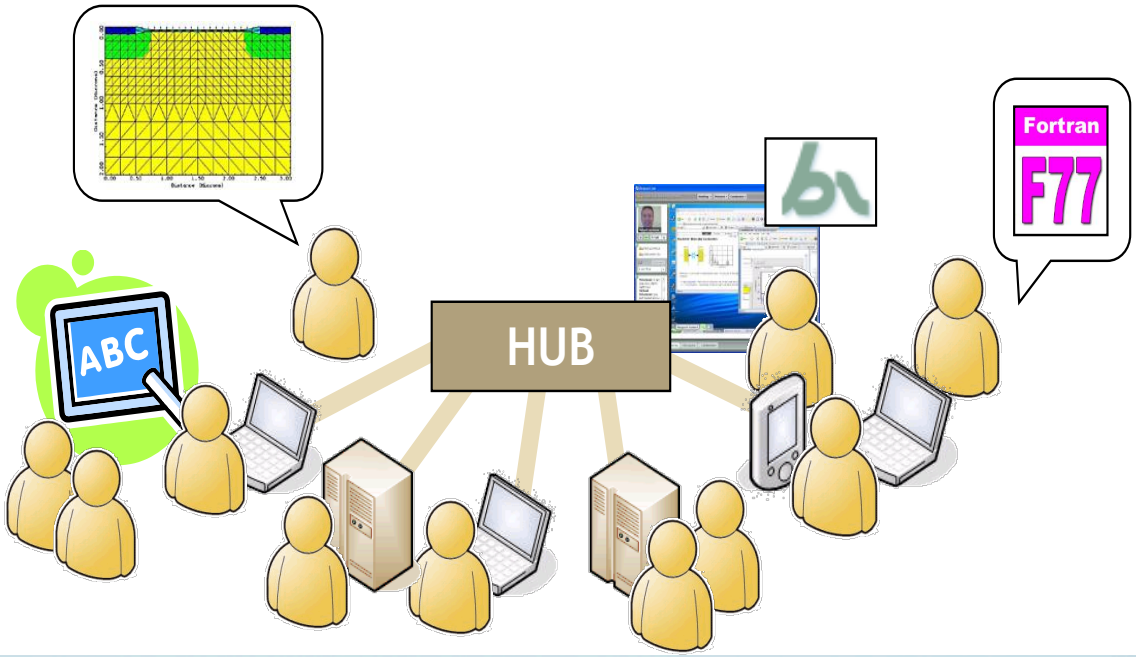

Q12. In your opinion, within the next 100 years, how
the earth's average temperature will increase?
not at all likely
not very likely
rather likely
very likely
Survey Expert Opinion
Browse results of an extensive scientific survey

Citizen Science

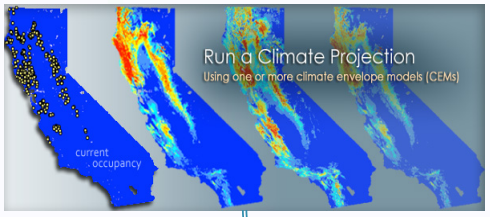
Decision Making

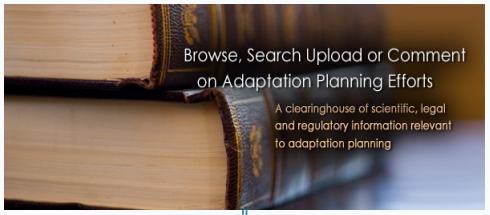



A Gentle Introduction to Nanotechnology and Nanoscience
Rayleigh Light-Scattering of Nanocrystals: Shape, Size, and Composition Matter


ABC
HUB
Fortran
F77

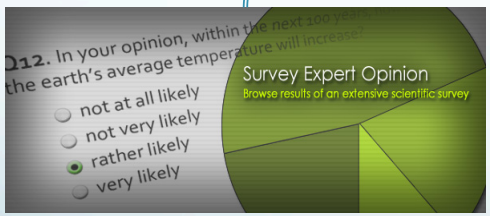
data to knowledge to insight to action

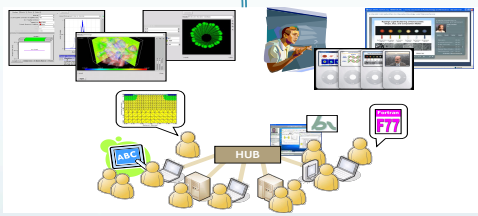


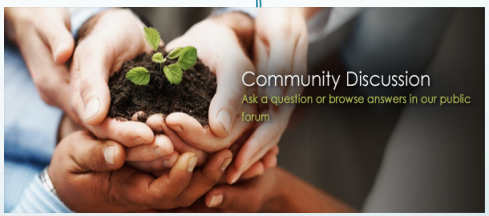


COLLABORATORY for ADAPTATION to CLIMATE CHANGE

http://adapt.nd.edu



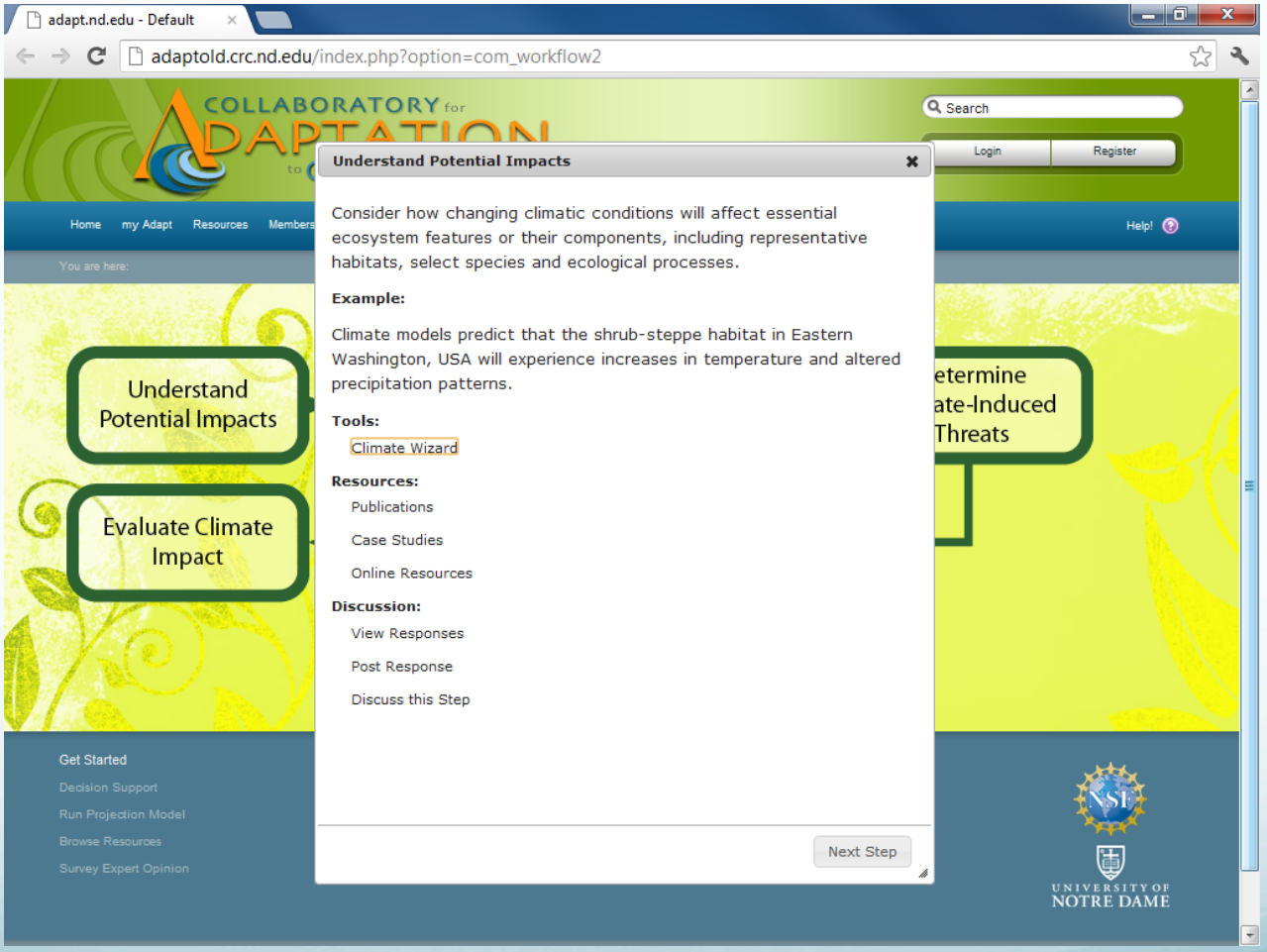




"Collaboratory is a virtual organization relying on cyber infrastructure for data sharing and modeling, shared computational resources, networking, community building, expert advise and to pursue pioneering inter-disciplinary integration and sound policy development."

A decision flow

A decision flow

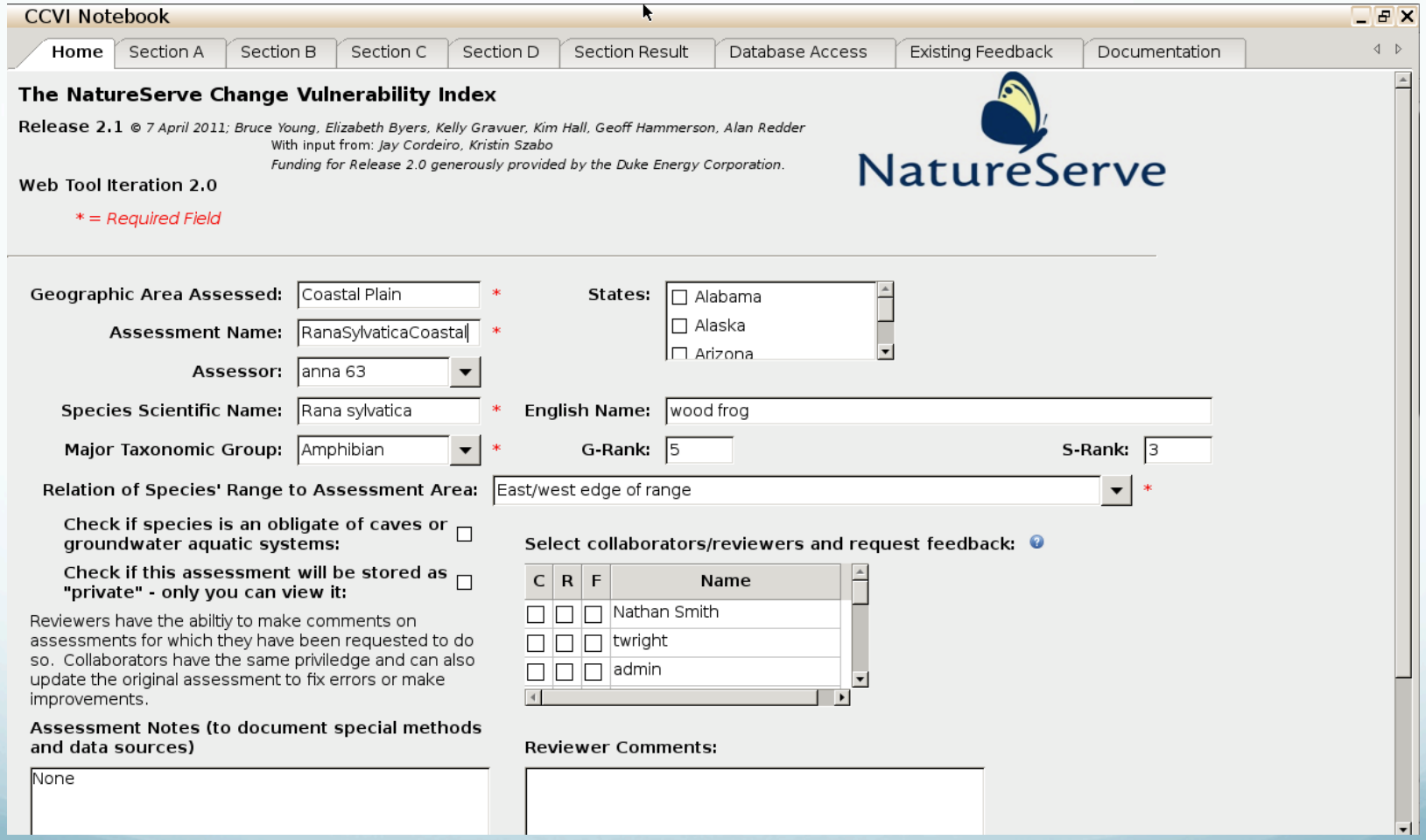


Species vulnerability

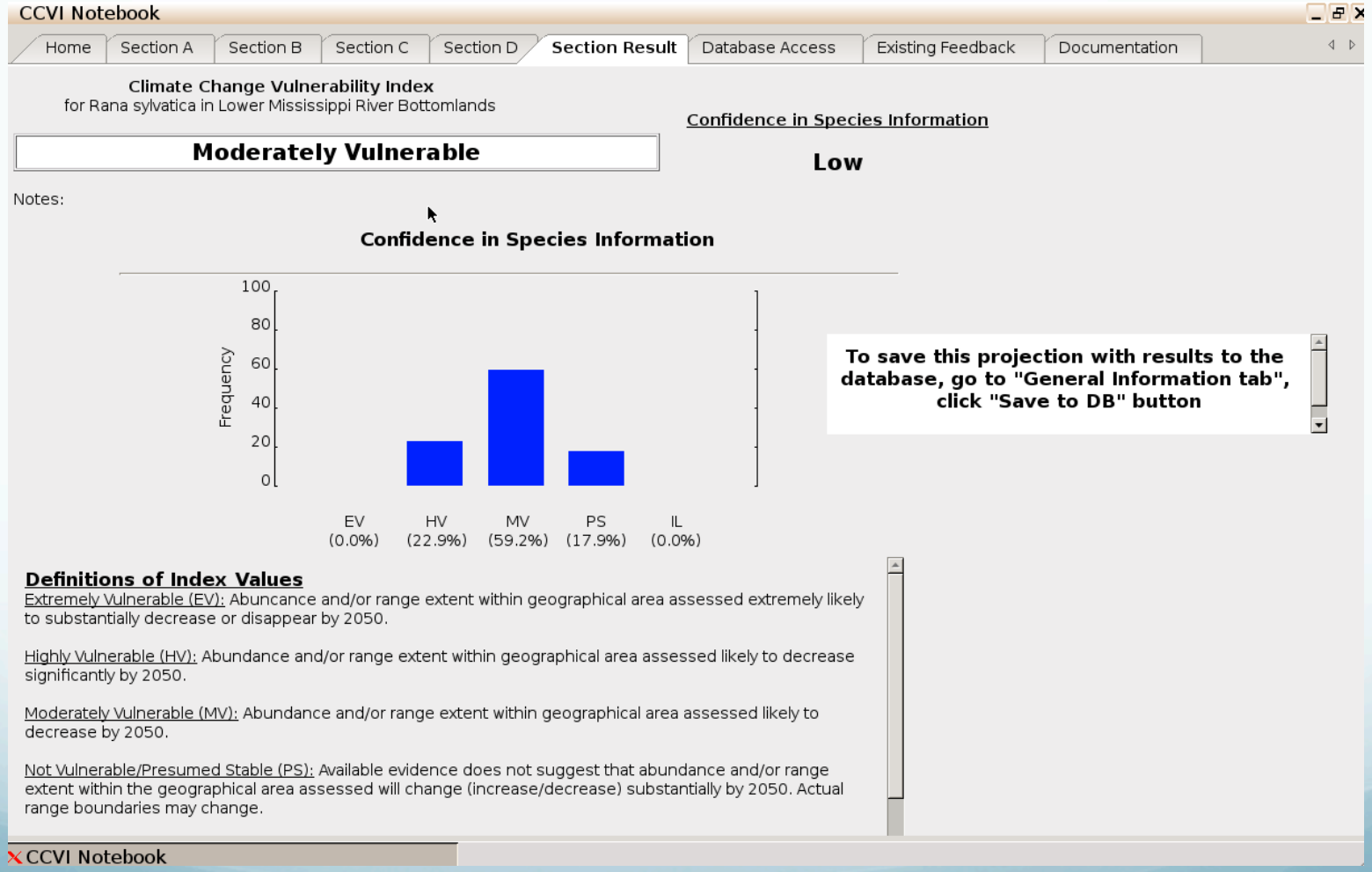
- Determining the most vulnerable species of plants and/or animals to climate change

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



Climate Change Vulnerability Index (CCVI) Tool



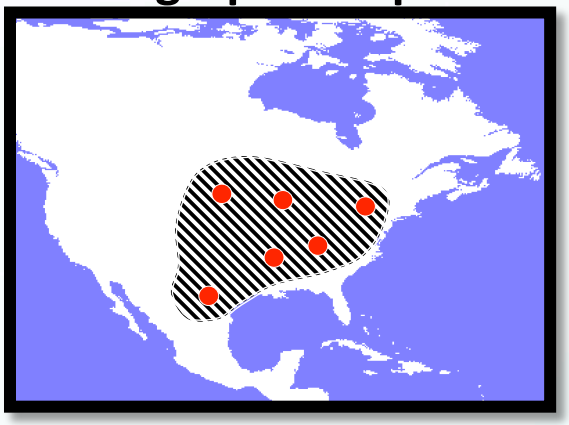
Species Distribution Modeling

- 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

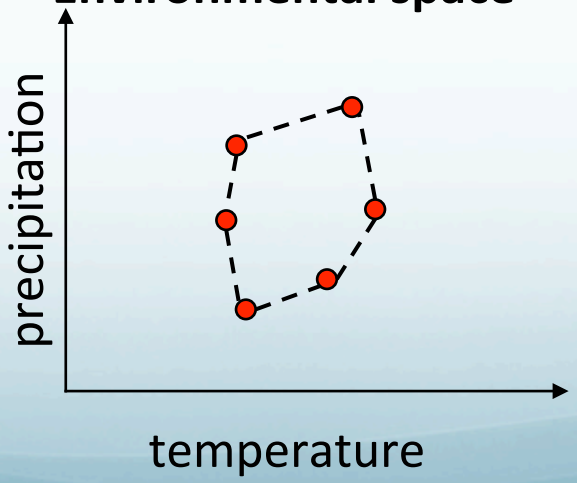
Forming knowledge of the factors that determine where species live and predictions about their distributions is important for developing strategies in the realms of ecological conservation and sustainability.

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

Evaluation Considerations

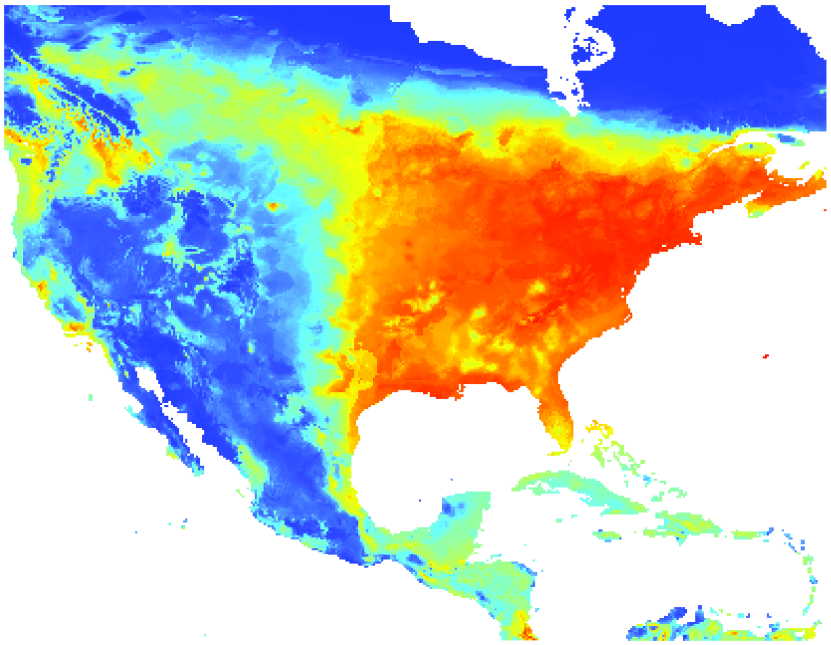
- Evaluated using: the area under the Receiver Operating Characteristic curve (AUROC), and the area under the Precision-Recall curve (AUPR)
  - AUROC can present an overly optimistic view of an algorithm's performance if there is a large skew in the class distribution
  - AUPR captures the natural trade-off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

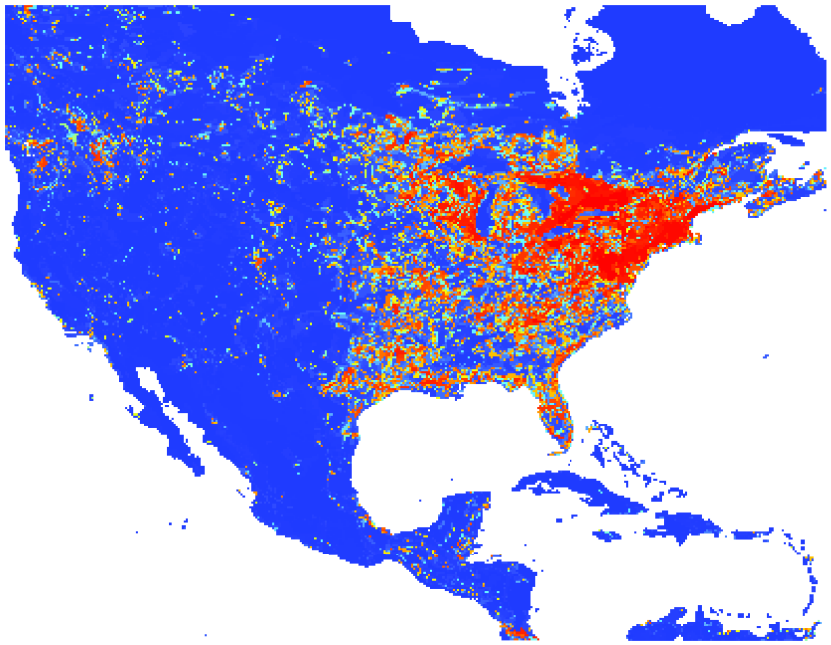
- Species presence data:
  - Pertains to North America and is derived from the Global Biodiversity Information Facility (GBIF).

Species Projections – V. olivaceus



MaxEnt

AUROC: 0.842
AUPR: 0.400



Hellinger Distance Decision Trees (HDDT)

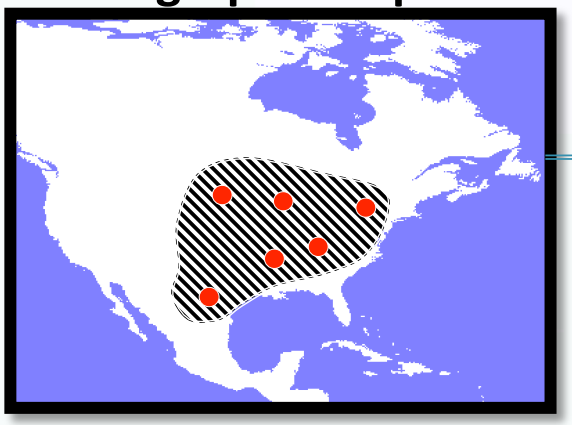
AUROC: 0.890
AUPR: 0.604

Species Projections – Model Comparison

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

https adapt.nd.edu — adapt - Home

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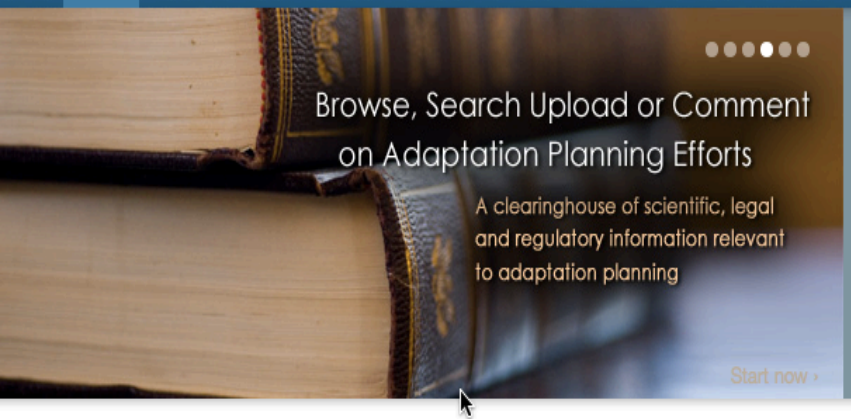

Welcome to the Adaptation Collaboratory!

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

Keyword or phrase: Search

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

Nitesh Chawla

Principal Investigator
Assistant Professor of Computer Science and Engineering, University of Notre Dame

nchawla@nd.edu

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

Jessica Hellmann

Principal Investigator
Associate Professor of Biological Sciences, University of Notre Dame

hellmann.3@nd.edu

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.

Alejandro Camacho

Professor of Law and Social Sciences, University of California Irvine Law School

acamacho@law.uci.edu

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

Patrick Doran

Director of Science for Michigan and the Great Lakes, The Nature Conservancy

pdoran@tnc.org

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

kimberly_hall@tnc.org

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.

Debra Javeline

Associate Professor of Political Science, University of Notre Dame

javeline@nd.edu

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

Omar Lizardo

Assistant Professor of Sociology, University of Notre Dame

olizardo@nd.edu

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

Jason McLachlan

Assistant Professor of Biological Sciences, University of Notre Dame

jmclachl@nd.edu

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

Jaroslaw Nabrzyski

Director of the Center for Research Computing, University of Notre Dame

Jaroslaw.Nabrzyski.1@nd.edu

Research Interests: Multi-objective project scheduling and resources management techniques for parallel and

Scientist Staff

Anna Alber

Research Programmer
Center for Research Computing
University of Notre Dame

aalber1@nd.edu

Kristina Davis, Ph.D.

Visualization Specialist
Center for Research Computing
University of Notre Dame

kristina.davis@nd.edu

Katherine Kahl

Climate Change Ecologist
The Nature Conservancy
Lansing, MI

kkahl@tnc.org

Timothy Wright, Ph.D.

Interactive Collaborative Environments Specialist
Center for Research Computing
University of Notre Dame

twright@nd.edu

Nolan Brubaker

Interim Lead Research Programmer
Center for Research Computing
University of Notre Dame

nbrubake@nd.edu

Jason Dzurisin

Laboratory Program Manager
Department of Biological Sciences
University of Notre Dame

jdzurisin@nd.edu

Dilkushi De Alwis Pitts, Ph.D.

Geographic Information Systems Specialist
Center for Research Computing
University of Notre Dame

dpitts@nd.edu

Graduate Students

Jennifer Carroll

Advisor: Jessica Hellmann
Biological Sciences
University of Notre Dame

jennifer.carroll.86@nd.edu

Dylan Johnson

Advisor: Alejandro Camacho
Notre Dame Law School
University of Notre Dame

dylan.johnson@gmail.com

Greg Shufeldt

Advisors: Benjamin Radcliff and Debra Javeline
Political Science
University of Notre Dame

gshufeld@nd.edu

Christopher Dalbey

Advisor: Alejandro Camacho
University of California,
Irvine School of Law

cdalbey@uci.edu

Reid Johnson

Advisor: Nitesh Chawla
Computer Science and Engineering
University of Notre Dame

reid.johnson.562@nd.edu

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Conference on Intelligent Data Understanding 2012

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CIDU Conference on Intelligent Data Understanding

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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