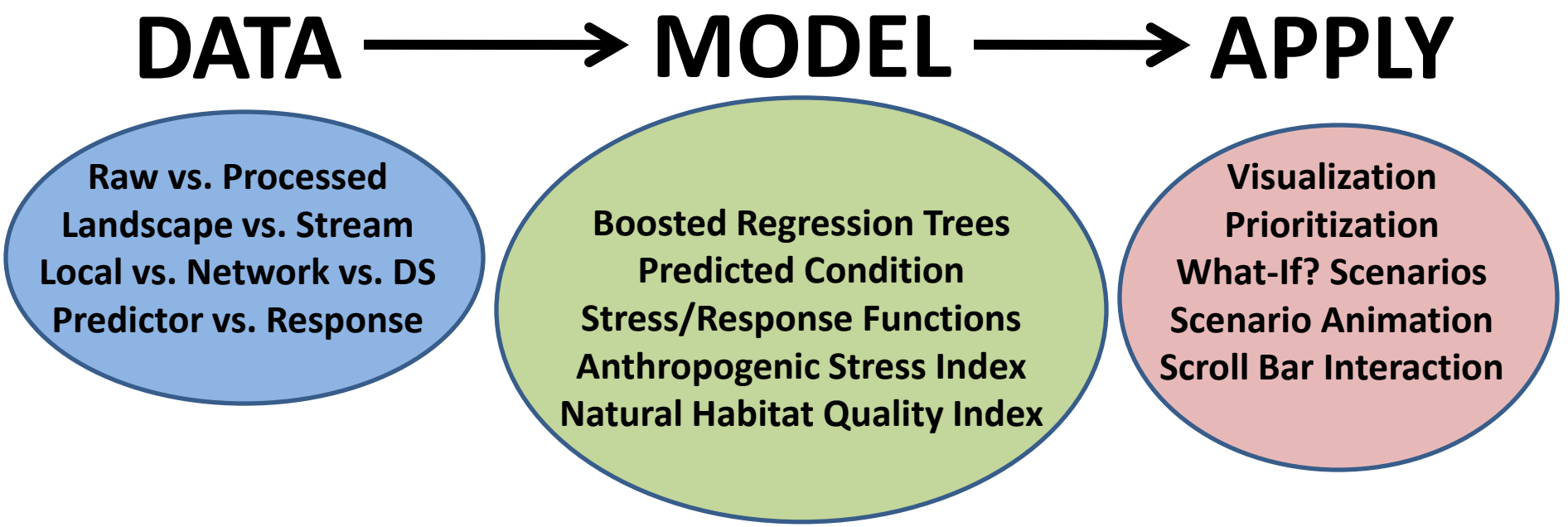
Habitat assessment models and decision support tools for aquatic habitats



Downstream Strategies & West Virginia University

Downstream Strategies

Seven FHP/Partnership Assessments– 2010-2013

Seven FHP/Partnership Assessments

35 Separate Models

- *Ohio River Basin/Southeast Aquatic Resource Partnership (7)*
- *Driftless Area Restoration Area (5)*
- *Great Lakes (5)*
- *Midwest Glacial Lakes (5)*
- *Fishers and Farmers (5)*
- *Great Plains(5)*
- *Midwest Regional (3)*

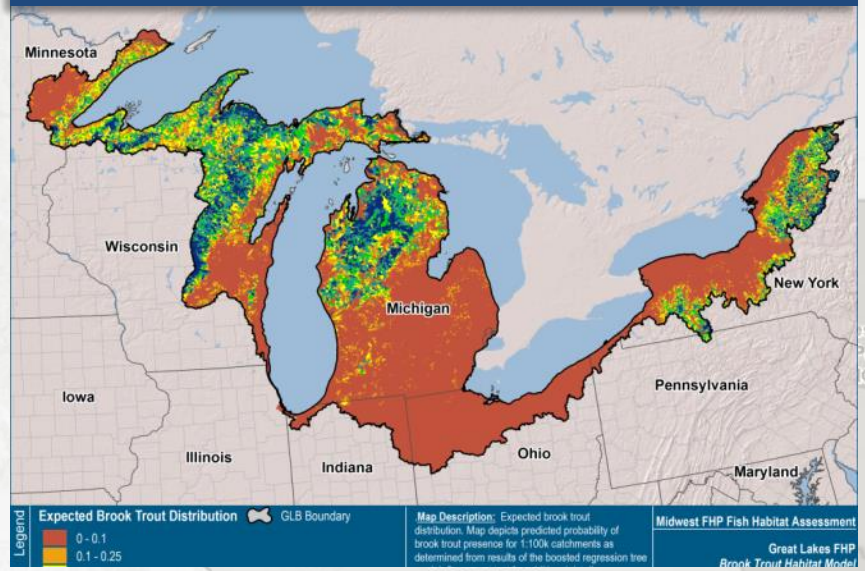
Species Model Examples

- Brook trout
- Walleye
- Smallmouth bass
- Large river species
- Intolerant mussels
- Redhorse
- Long nose dace

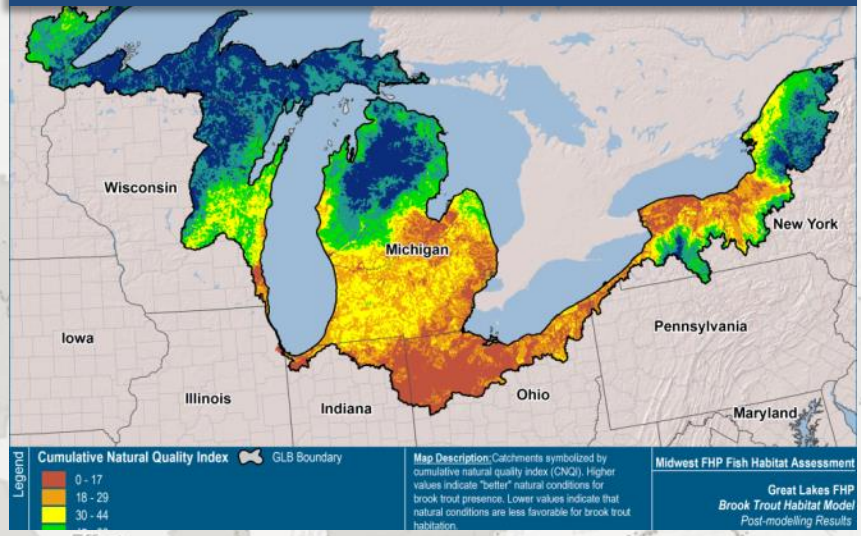
Aquatic Endpoint Examples

- Coldwater index
- Water quality (total summer phosphorous)
- Species richness
- Lithophilic species richness
- Modified index of centers of diversity score
- Small streams signature fish index score

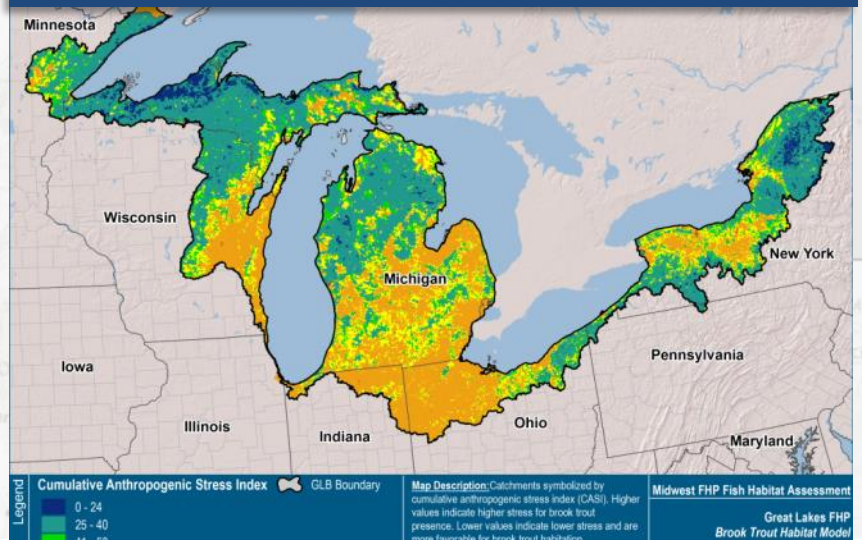
Predictions



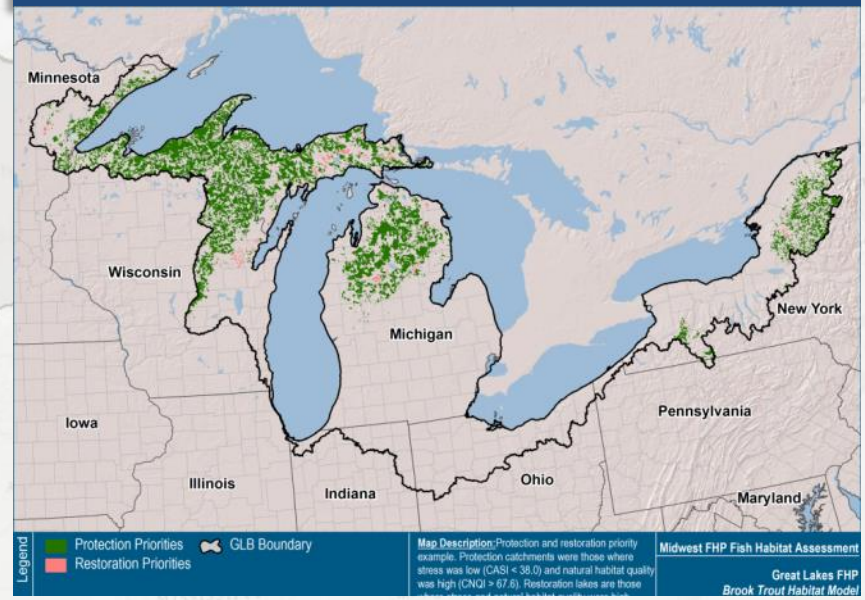
Cumulative Natural Quality Index (CNQI)



Cumulative Anthropogenic Stress Index (CASI)



Restoration Protection Priorities



Assessment Outputs

Technical Reports

- Project background
- Overview of assessment process
- Modeling inputs
- Modeling process
- Post-modeling
- Mapped results

Data and Maps

- Geodatabase of model inputs and outputs
- Metadata and data dictionaries
- Processing notes and documentation
- Response (fish) database
- HUC-8 Mapbooks of prediction maps, at the catchment scale

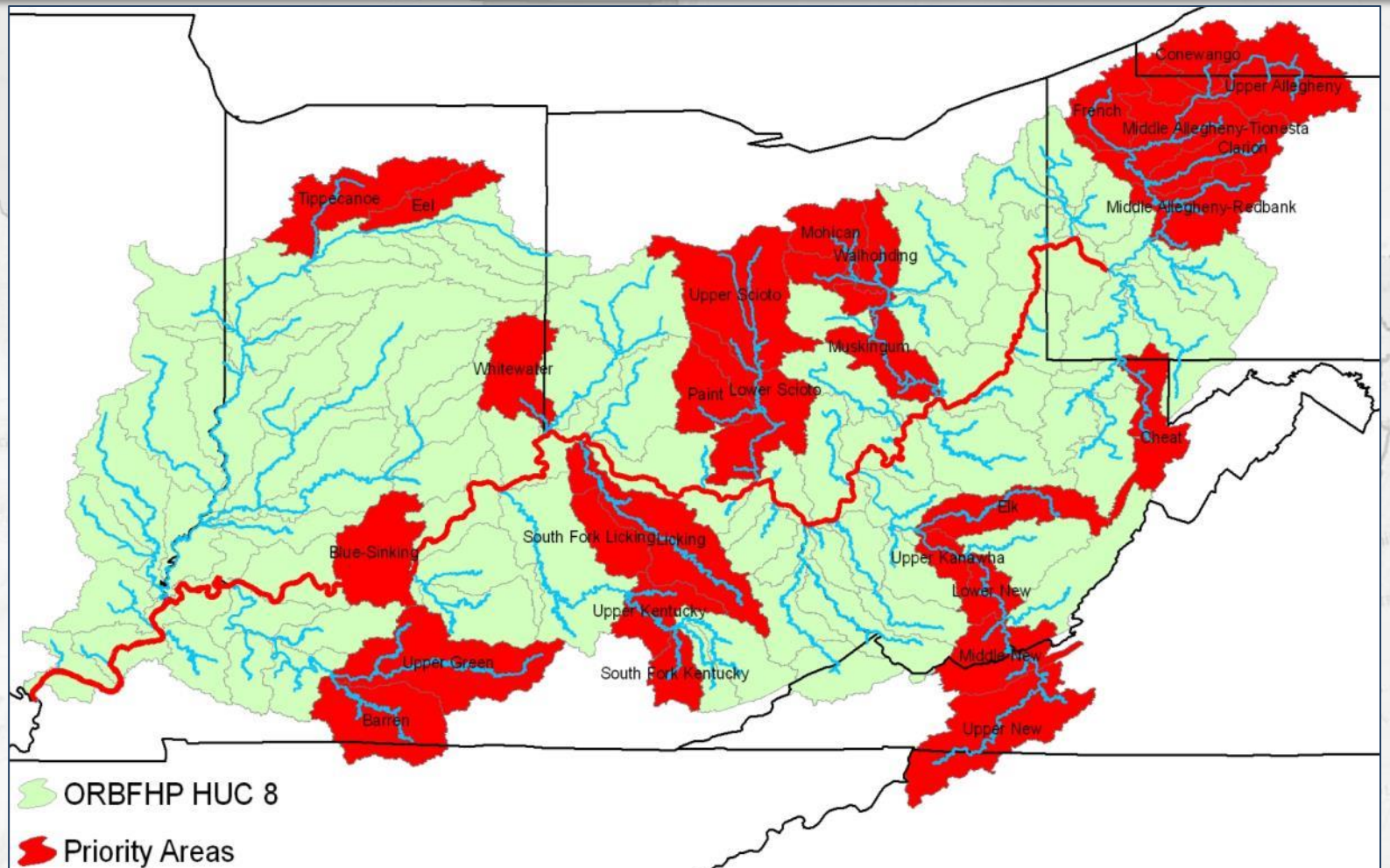
GIS Decision Support Tool

- Integrate ArcMap 10 toolbar
- Visualization and Zoom-to features
  - Landscape variables
  - Predictor datasets
  - CASI and CNQI metrics
  - Predictions
  - Socioeconomic data
- Ranking model
  - Weight datasets based on criteria or preference
  - Comprise programming model
  - Identify catchments most / least like criteria
- Futuring tool (new for 2013)
  - Change current conditions at the local level
  - Propagate changes downstream
  - Visualize the impact of that change, locally and downstream

Application Example

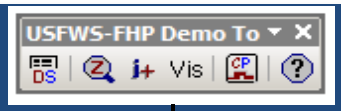
Ohio River Basin Priorities

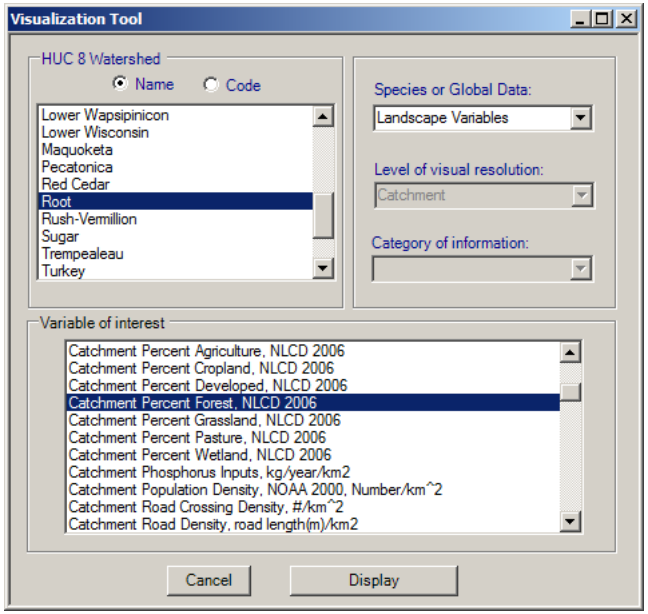
Using the model results, combined and scored all the models to develop a list of priority watersheds. This list was integrated as a factor for project selection

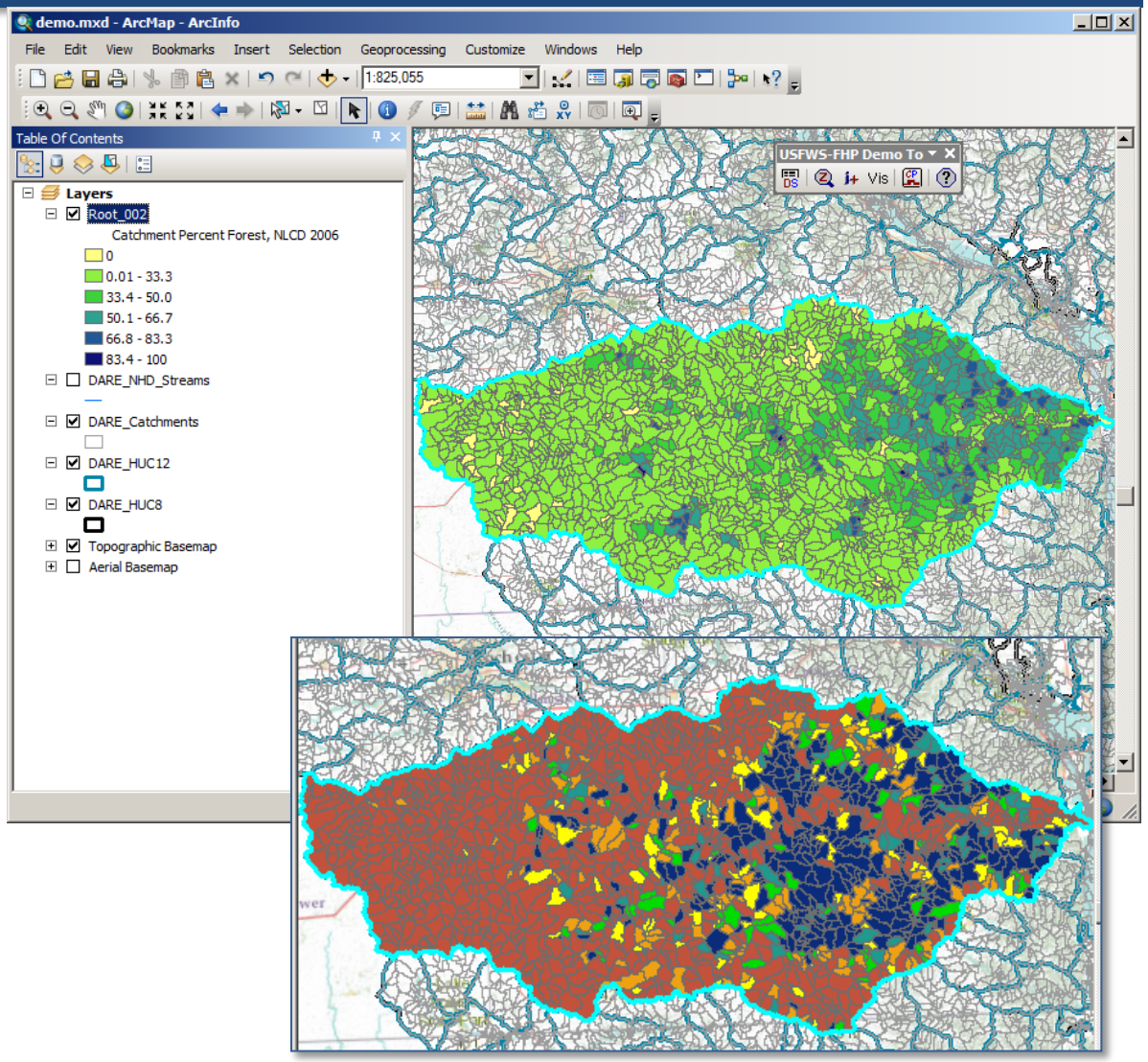


Decision Support Tools (v1)

Visualize the data

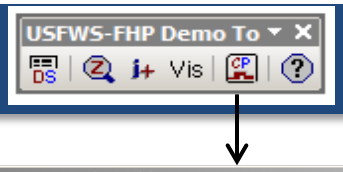


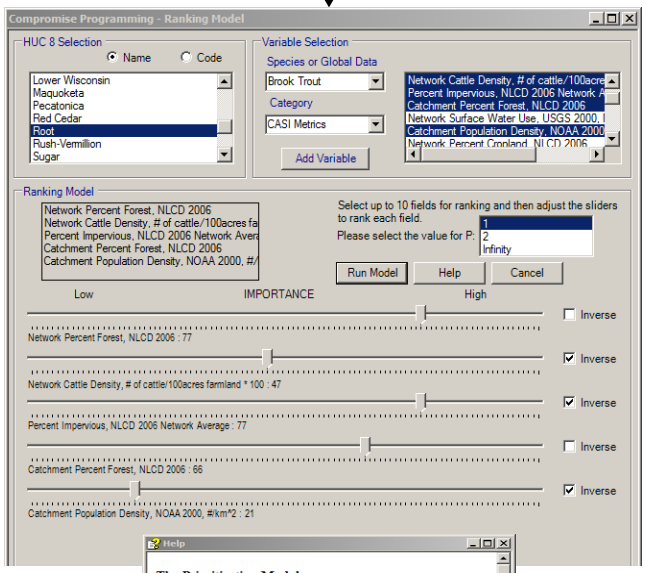


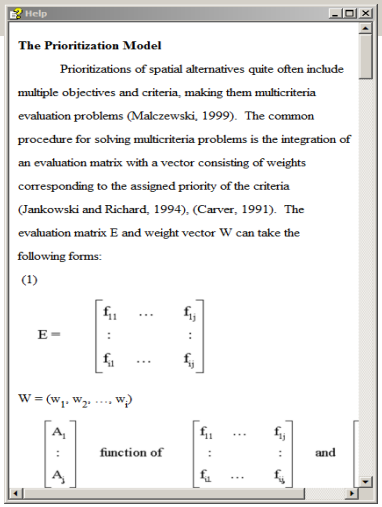


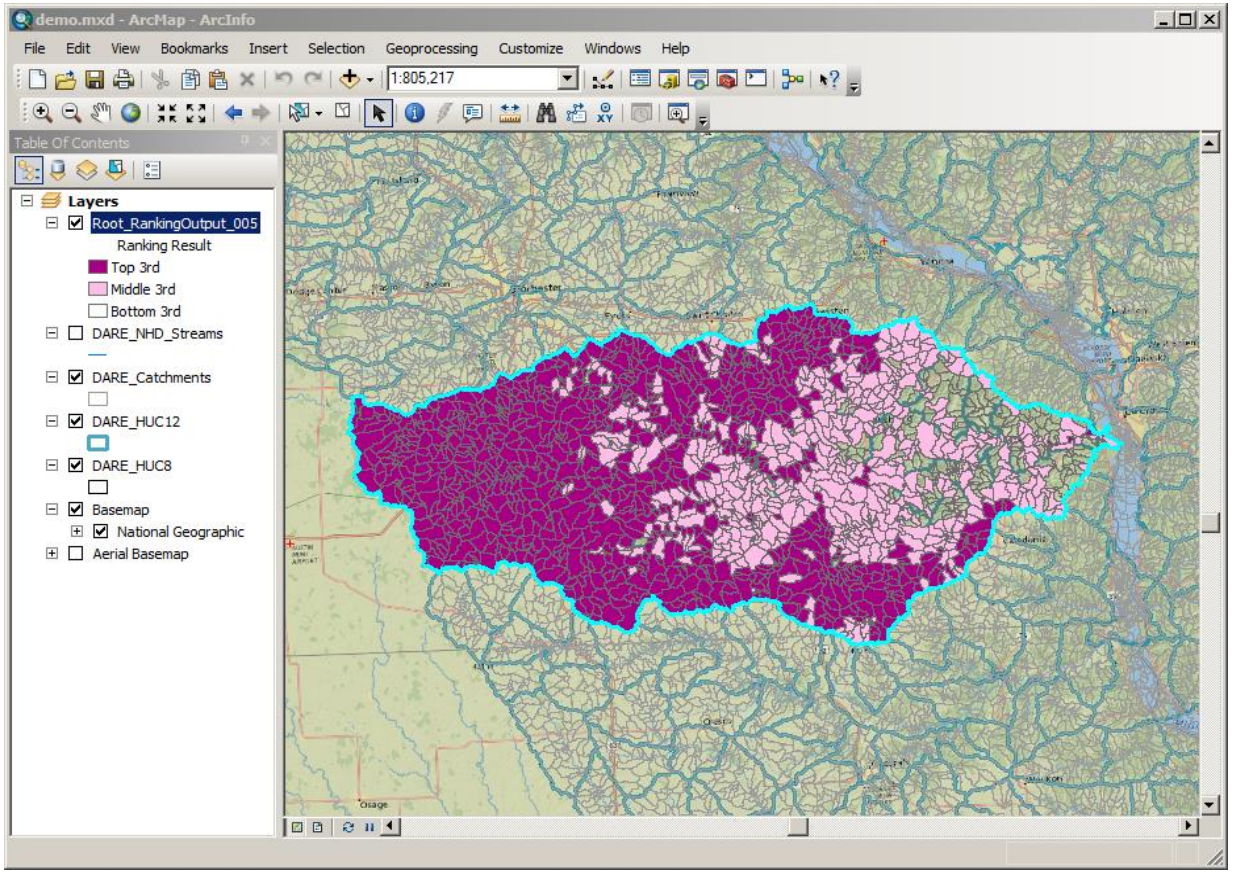
Decision Support Tools (v1)

Rank criteria and results



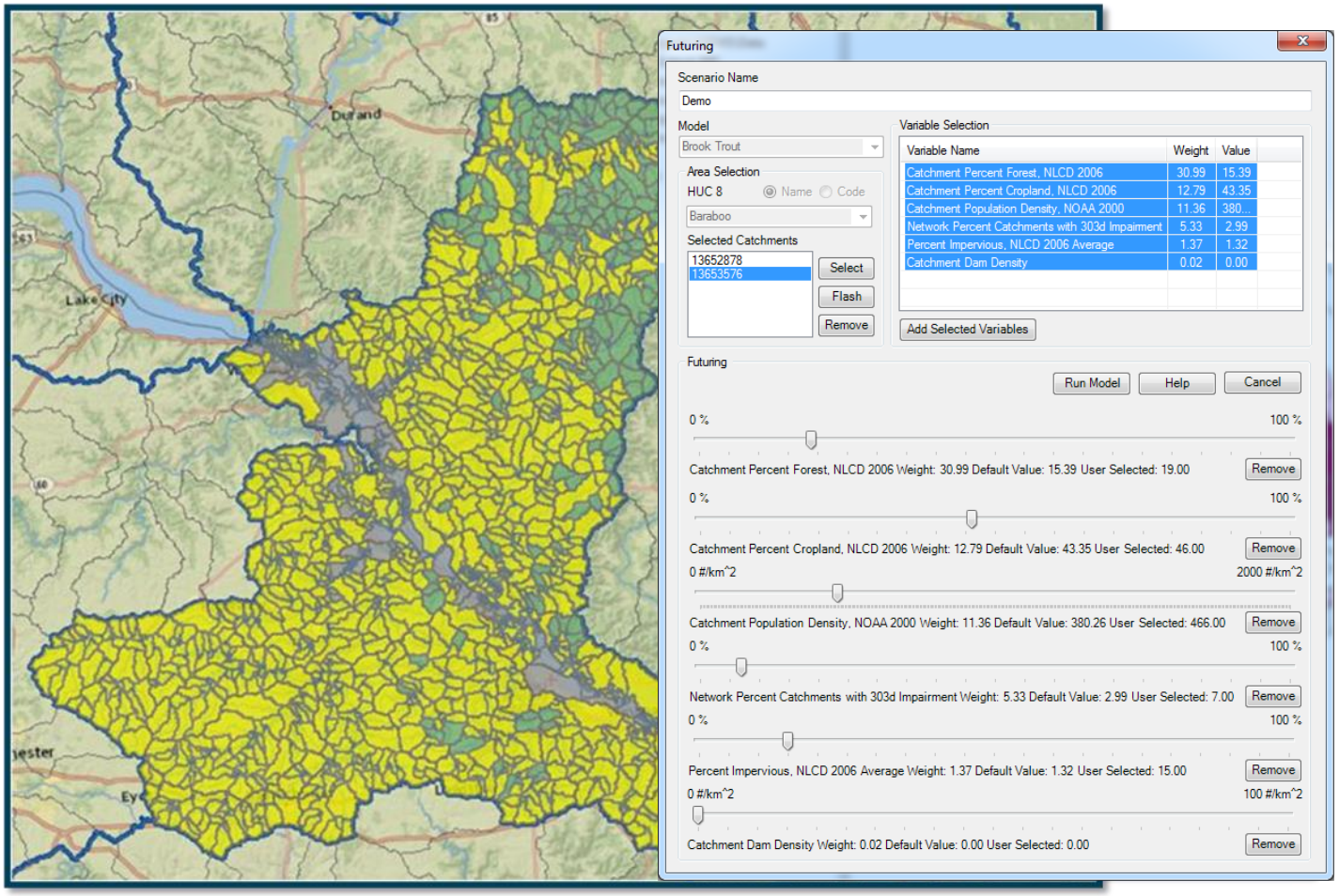


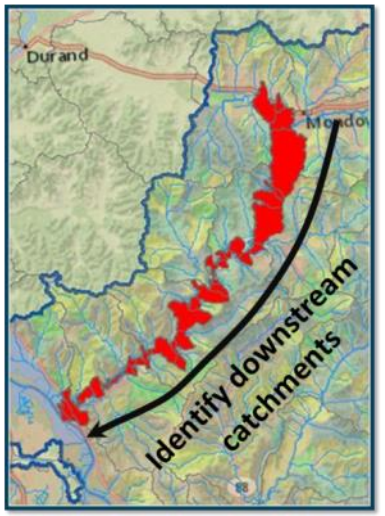


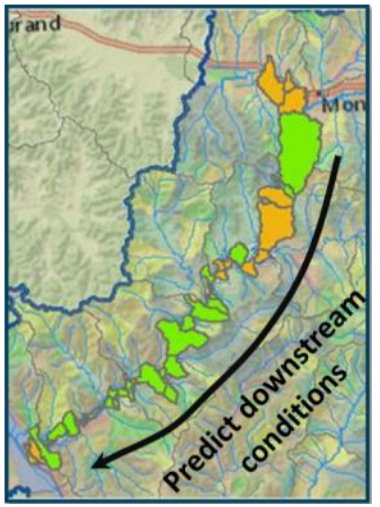


Decision Support Tools (v2)

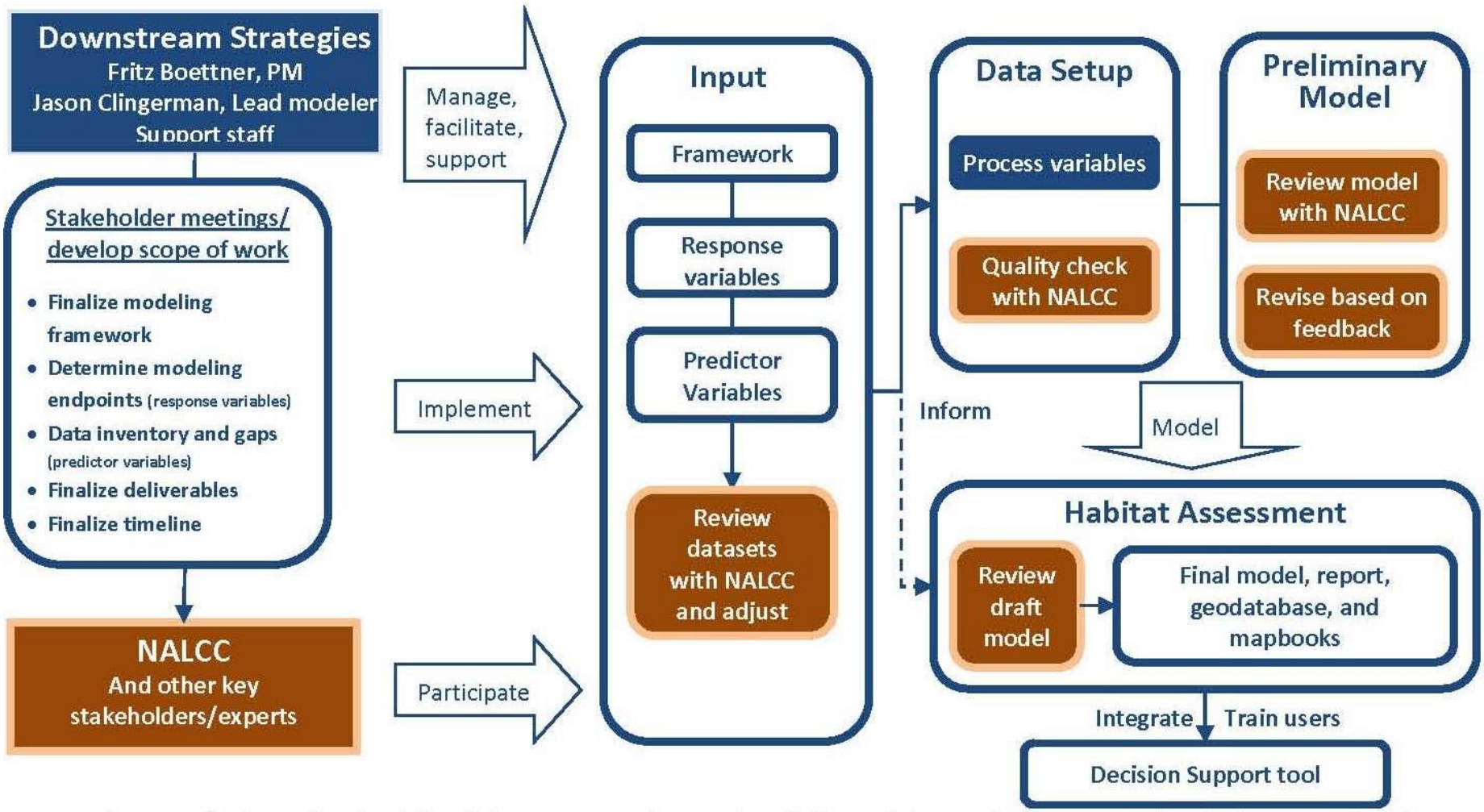
Futuring tool







Project Process



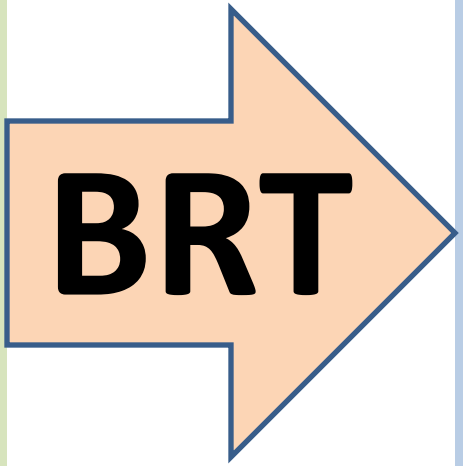
Modeling Approach:

Boosted Regression Trees

INPUT

Landscape Data
- Predictor variables
- Natural and Anthropogenic
- Local & Network
- Alternate Scenario Package

Stream or Lake Data
- Response variables
- Environmental Data
- Fish Data
  - Assemblage
  - Abundance
  - Presence Absence
  - Diversity/Health Indices



OUTPUT

Model Results
- Response variable predictions @ 1:100K catchment scale
- Predictor variable importance weightings
- Landscape / Stream response functions

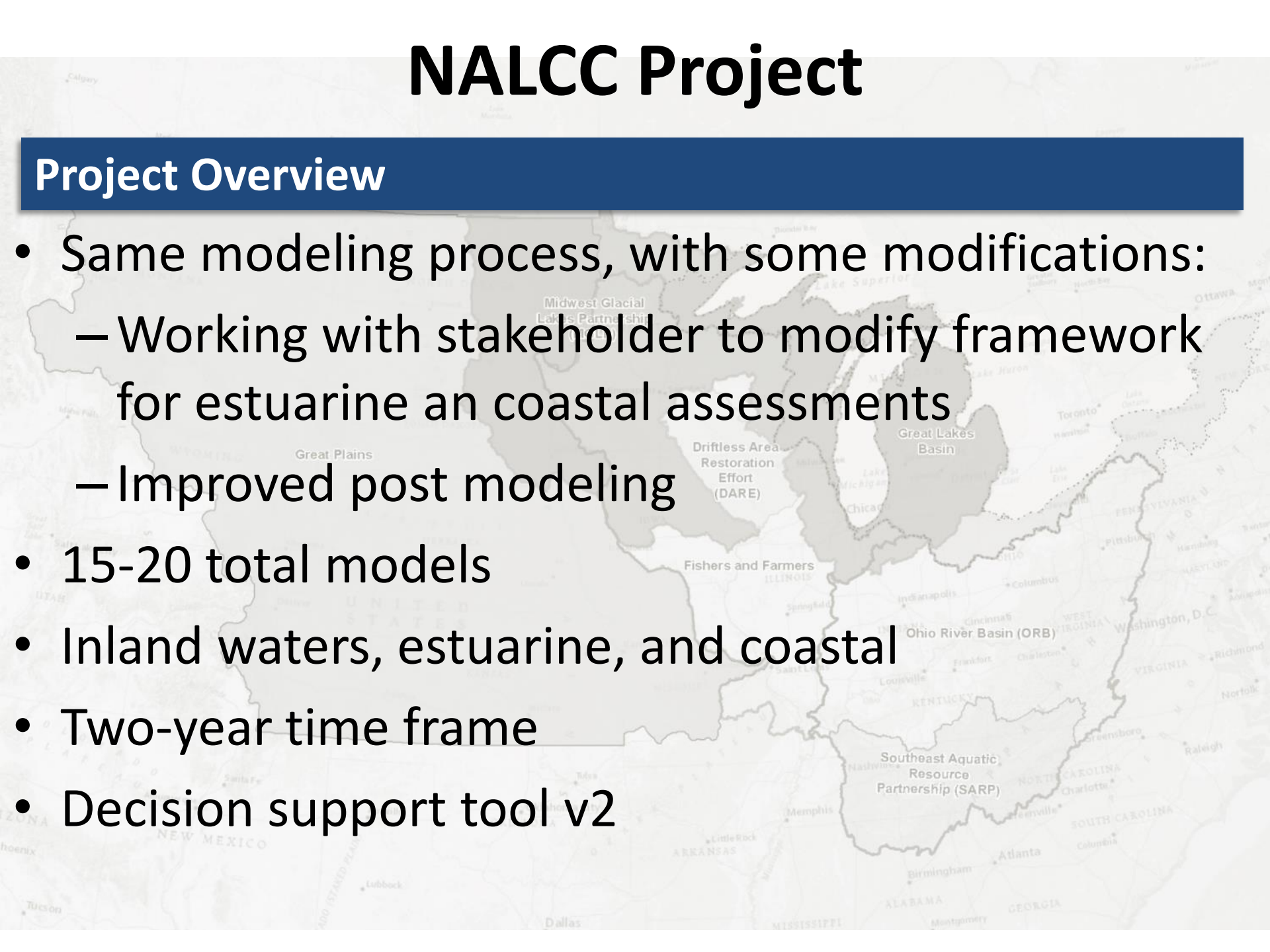
Post-Modeling Results
- Natural Habitat Quality Index (NHQI)
- Anthropogenic Stressor Index (ASI)
- NHQI and ASI can be from calculated up to HUC12, HUC8 from 1:100K catchments.

We take landscape and aquatic data.
Using BRT – we 1- predict conditions; 2- identify dominant stressors; and 3- quantify stressors and natural quality catchment by catchment.

NALCC Project

Project Overview

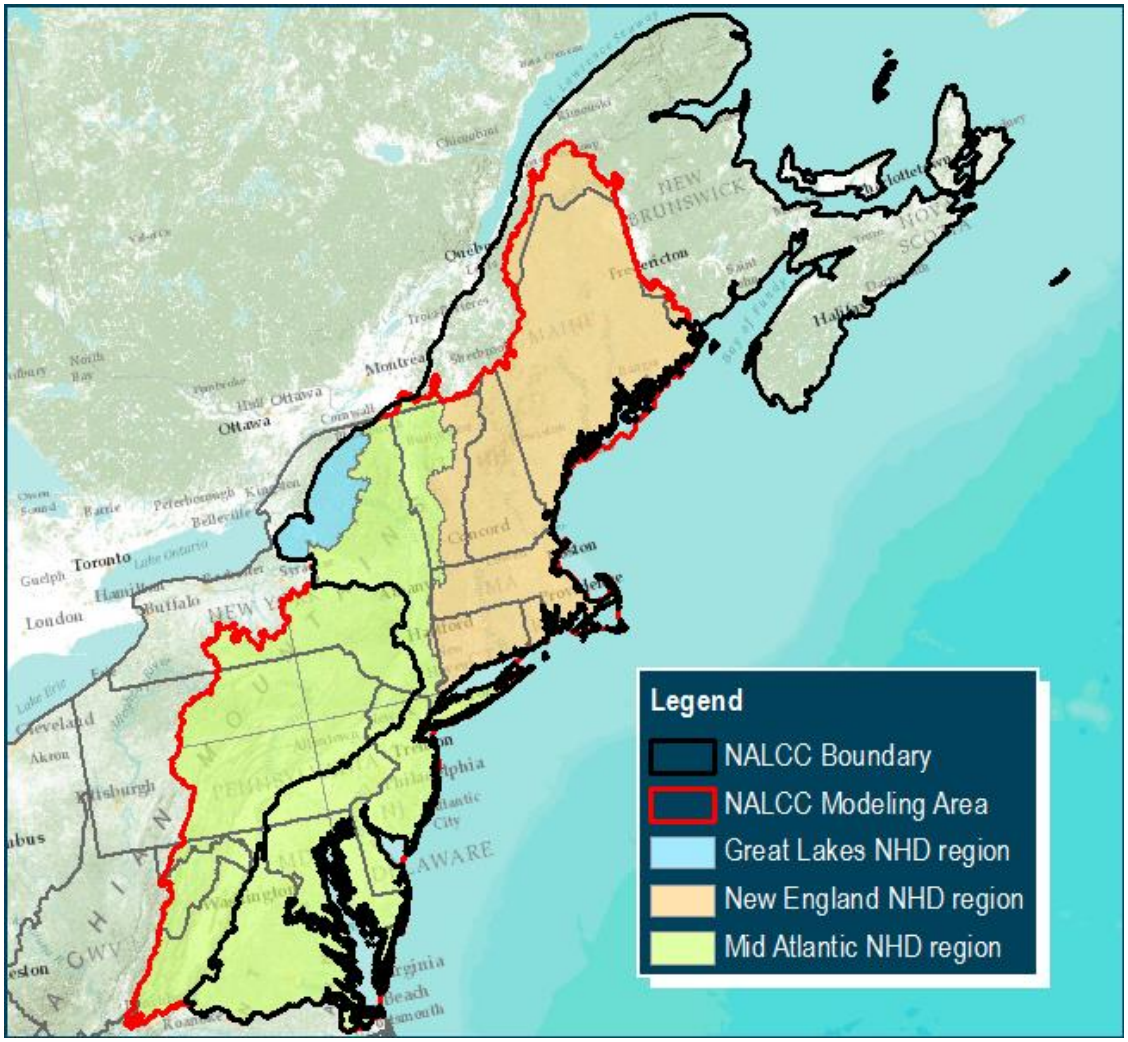
- Same modeling process, with some modifications:
  - Working with stakeholder to modify framework for estuarine an coastal assessments
  - Improved post modeling
- 15-20 total models
- Inland waters, estuarine, and coastal
- Two-year time frame
- Decision support tool v2



NALCC Project

Modeling area

- Geographic scope includes NALCC region (excluding areas outside the NHD extent, Canada) plus the Hudson, Delaware, Susquehanna, Potomac-Shenandoah, and James River Drainages



Model Inputs

Datasets

Landscape Data
- Predictor variables
- Natural and Anthropogenic
- Local & Network
- Alternate Scenario Package

Stream or Lake Data
- Response variables***
- Environmental Data
- Fish Data
  - Assemblage
  - Abundance
  - Presence Absence
  - Diversity/Health Indices

Data Sharing and Gathering
- Hosting data online as developed, for example ArcGIS online
- Data request process

Predictor Datasets

Comid	Huc8	Areasqkm	Eco_code	Cumdrain	Minelevra	Slope	Precip	Temp	Imp06avg	Imp06avg	grassp
1873207	7040001	2.072	9.2.3	2.0718	348.54	0.00627	797.4292	62.7444	0.7146	0.715	1.6
1873209	7040001	1.211	9.2.3	1.2114	359.52	0.00687	797.7139	62.12095	0.70282	0.703	0.2
1873211	7040001	3.088	9.2.3	3.0879	359.75	0.00737	797.7005	62.1972	1.116	1.116	1.2
1873213	7040001	0.317	9.2.3	4.6161	357.84	0.00443	797.7	62.2	0	0.931	2.8
1873215	7040001	5.3	9.2.3	12.6297	347.89	0.00405	797.5027	62.91815	0.80574	0.838	1.2
1873217	7040001	3.631	9.2.3	18.3321	343.83	0.00163	796.9678	63.50615	1.49603	0.954	0.3
1873653	7040001	0.16	9.2.3	7.3296	355.21	0.00244	797.5544	62.81798	0.75843	0.861	2.2
1873655	7040001	0.33	9.2.3	4.9464	355.69	0.00434	797.7	62.20272	1.20436	0.949	1.3
1873659	7040001	2.223	9.2.3	2.223	355.68	0.01042	797.6443	62.43037	0.67207	0.672	3.1
1873661	7040001	4.567	9.2.3	22.8996	341.23	0.00107	797.43	63.2	1.60433	1.084	1.3
1873663	7040001	1.412	9.2.3	1.4121	341.02	0.0127	797.3007	63.45252	4.36138	4.361	
1873665	7040001	4.793	9.2.3	4.7934	346.18	0.00805	797.0475	63.47557	0.91063	0.911	1.2

Each column is a landscape attribute thought to contribute to aquatic conditions downstream – local and network (cumulative) measures.

Each row is a segment level watershed and the final column is the fish response variable of interest.

Response Datasets

COMID	SAFO_PA
271853	1
271857	1
272565	0
272609	0
1754906	1
1754952	1
1755022	0
1755054	0
1755080	0
1755100	1
1755130	0
1755176	0

NALCC Project

Collaboration

- Model development input from experts
- Data from other projects (stream classification, flow classification, stream temperature, stream connectivity assessment) used as predictor variables
- Modeling datasets
  - Predictor Variables (at the catchment level)
  - Response variables (Fish or endpoint data, at the catchment level and raw formats)
- Modeling outputs used for other research efforts

NALCC Project

Technical Challenges and Needs

- Complete and quality data
- Input from regional experts
- Coastal and estuarine modeling challenges
  - Scale and framework
  - Available data
  - Input from experts, define objectives

Target Audience Engagement

- Based on the objectives of the NALCC
- Similar efforts are aimed towards biologists, field staff, managers, policy-makers, conservation agencies, and the general public.