

Modeling Cottonwood Habitat and Forecasting Landscape Changes along the Missouri River

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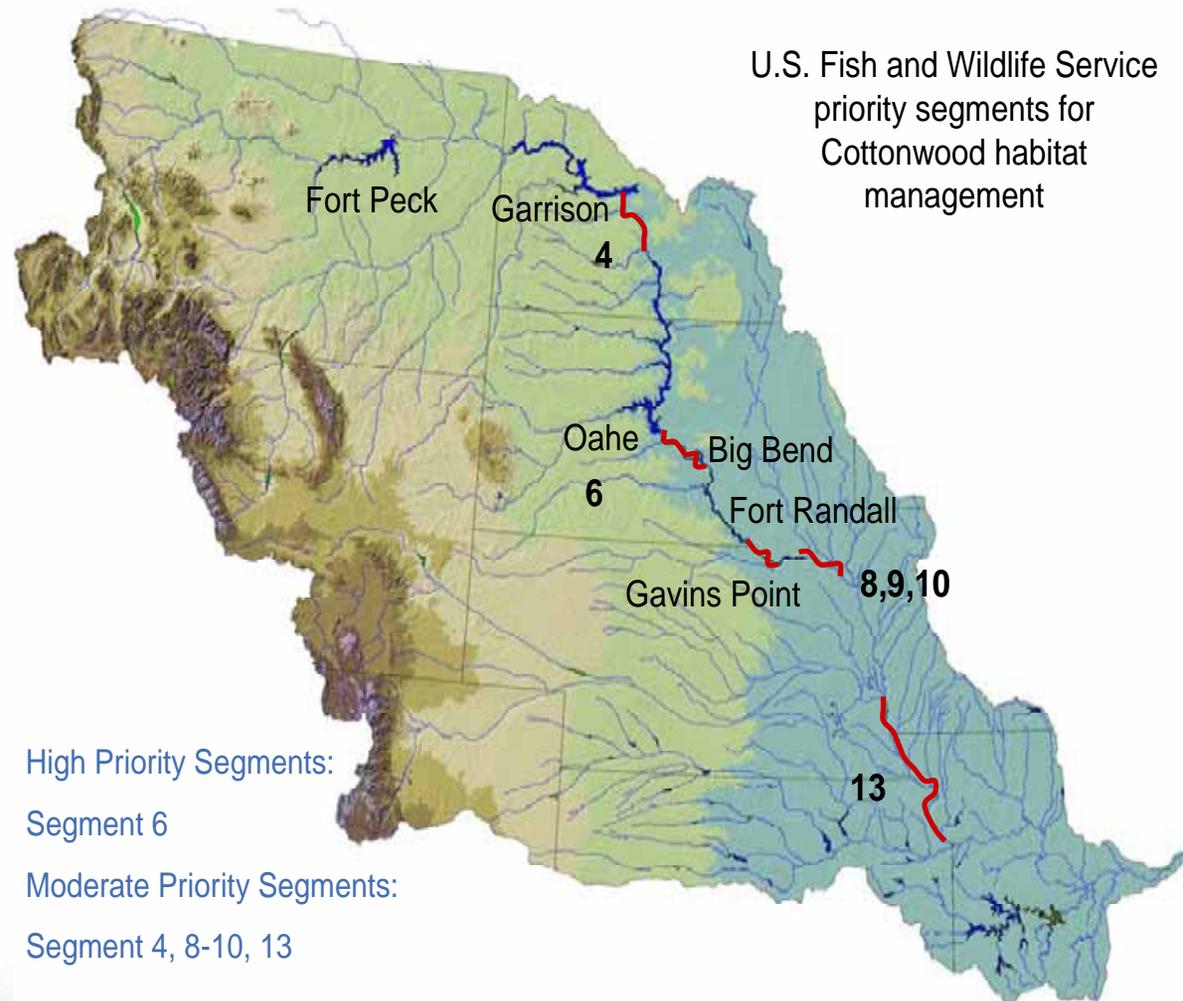
Presentation Objectives

- 1) Discuss the construction of a cottonwood community model for the Missouri River
 - How we took a conceptual model to a mathematical model we can use to compare potential restoration sites

- 2) Demonstrate how we forecasted future conditions of the cottonwood community
 - How we projected the no action alternative or “future without project condition”

Missouri River Cottonwood Management Plan Background

- The cottonwood management plan is a product that is being produced as a result of the Missouri River 2000 & 2003 Biological Opinion (BiOp).
- The BiOp had 3 Reasonable and Prudent measures to address for bald eagles over 6 priority segments.
 - Map & Evaluate Health
 - Create Management Plan
 - Ensure no more than 10% loss
- Team decided a true Man Plan would need to assess cottonwood community rather than just cottonwood species, so a model would need to be created.



Why model Cottonwood Habitat?

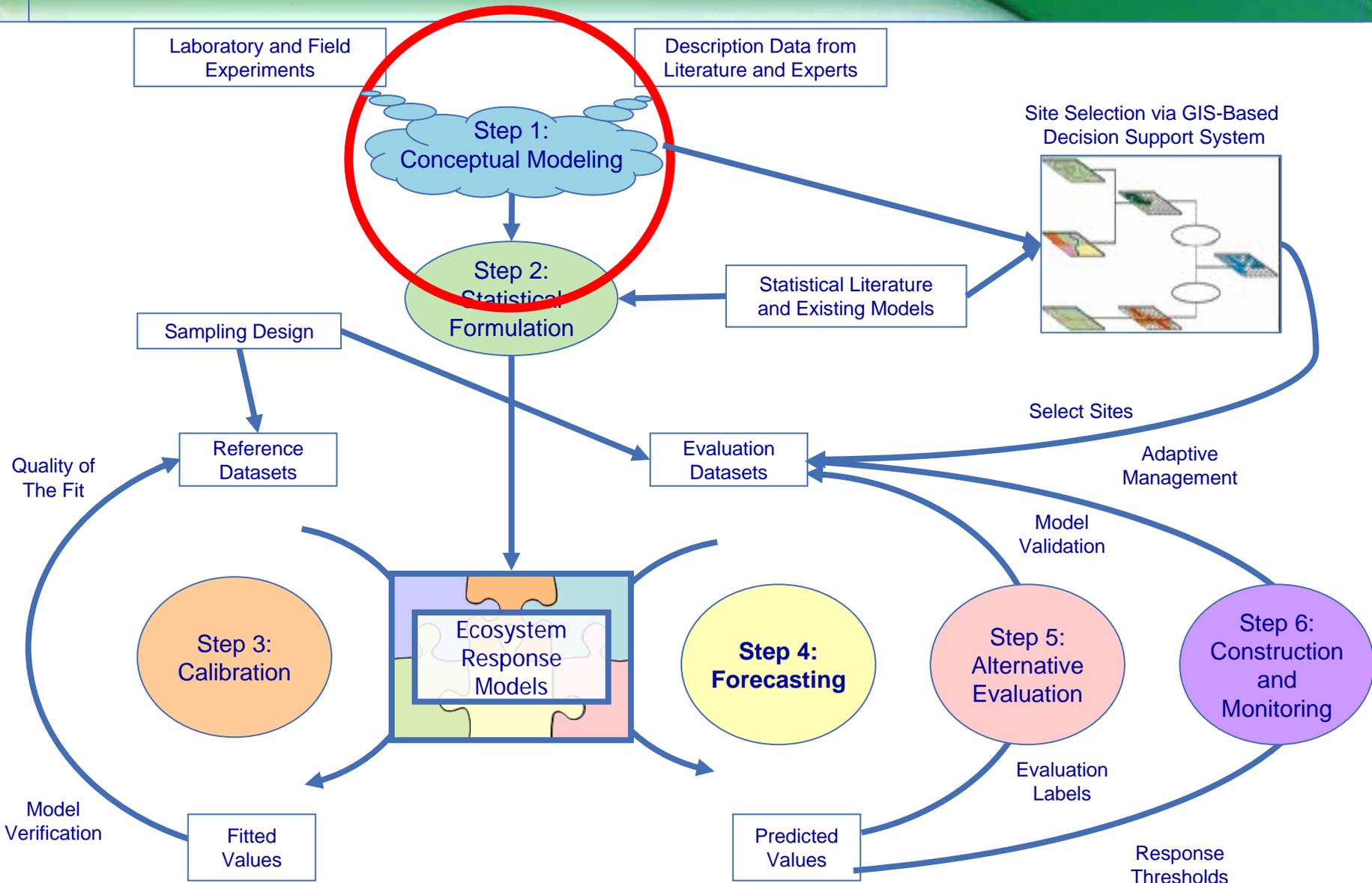
What's the point?

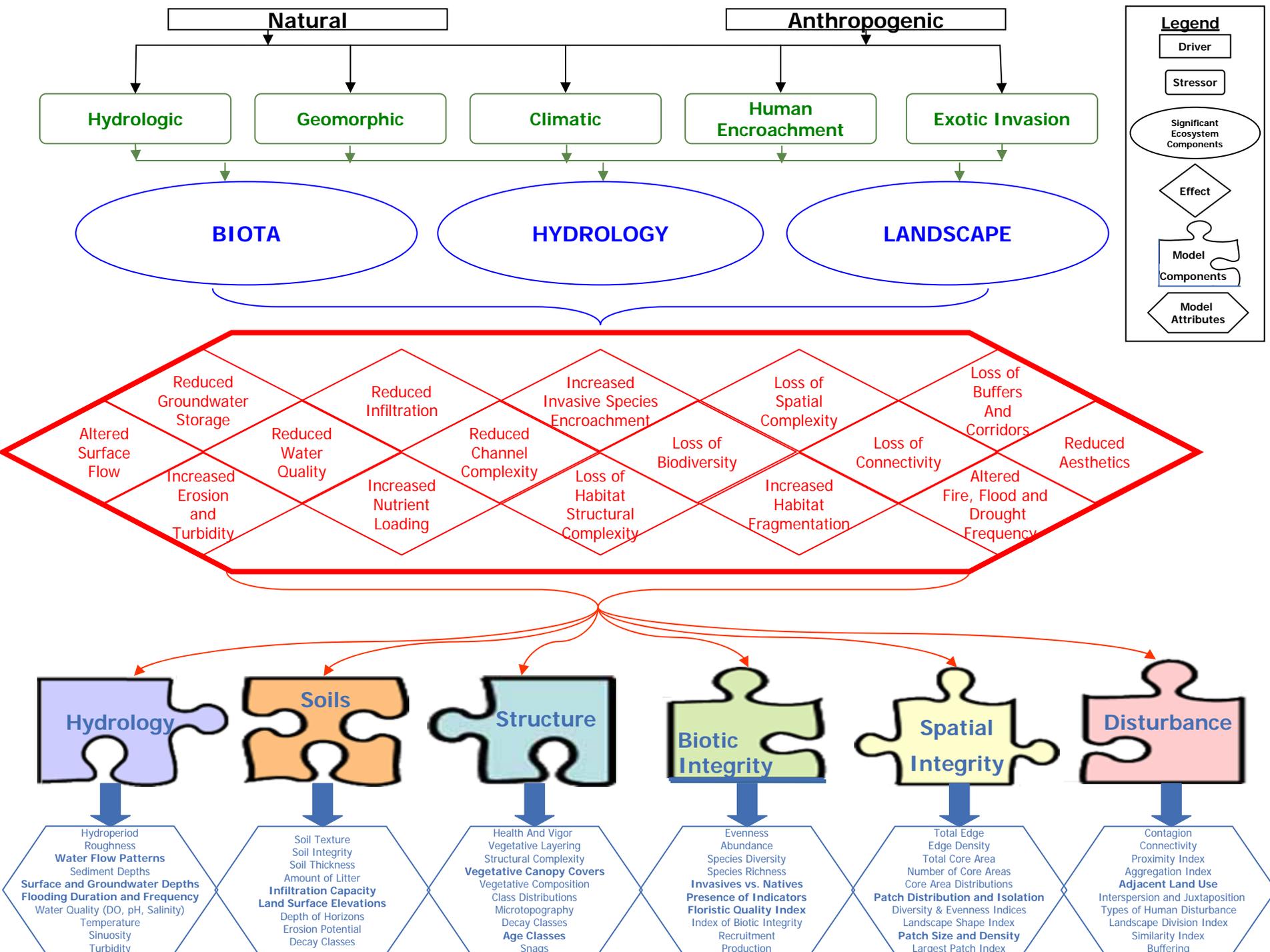
- A model that captures cottonwood community life requisites can be used to compare potential restoration sites to both the no action alternative as well as to one another to see which ones will give us **the most “lift” or habitat benefits.**

Example:

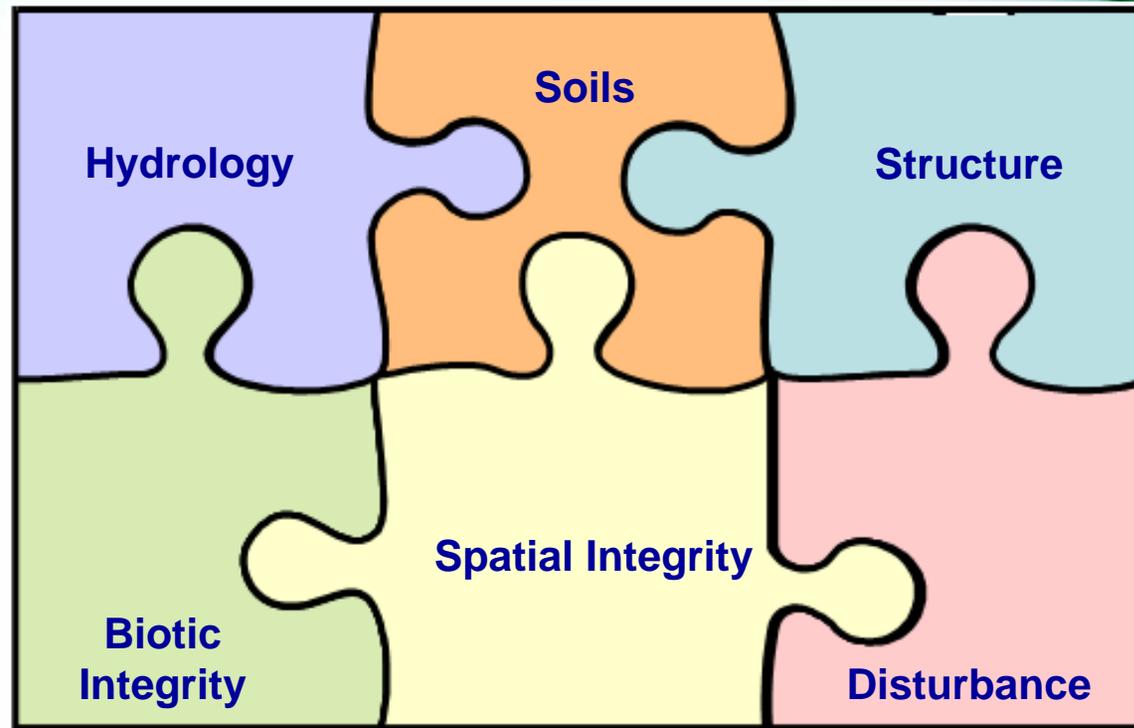
- Site A = 8 Habitat Units
- Site B = 12 Habitat Units
- Site C = 4 Habitat Units

Ecosystem Assessment Status



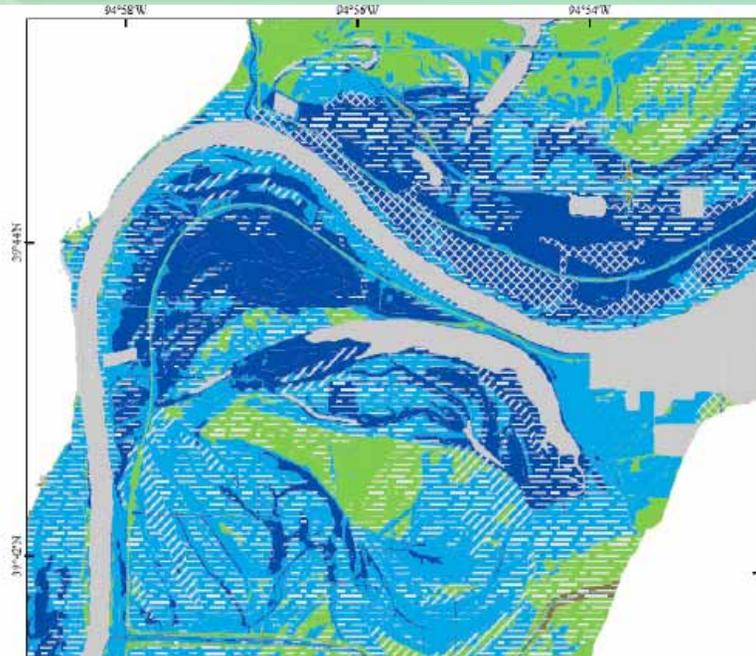


Model Components Combined to Form the Ecosystem Puzzle



Community based index models are constructed from combinations of components, that when combined capture the essence of the system's functionality.

HYRDOLOGY Component: Land Capacity Potential Index and Groundwater Depth



EXPLANATION
LCPI classes

		Wetness class			
		Frequently flooded	Moderately frequently flooded	Infrequently flooded	Rarely flooded
Retention Class	Strongly retentive	(FS)	(MS)	(IS)	(RS)
	Moderately retentive	(FM)	(MM)	(IM)	(RM)
	Poorly retentive	(FP)	(MP)	(IP)	(RP)
	Non-retentive	(FN)	(MN)	(IN)	(RN)

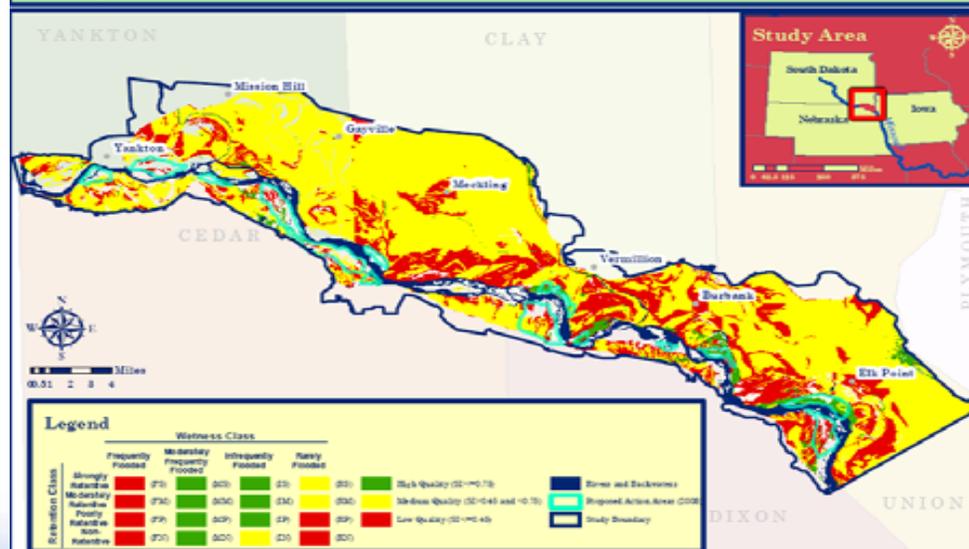
Cottonwood Dominate Forest (Old Growth, Mature, and Young) - CTWFOREST

		Wetness Class				Suitability Interpretation
		Frequently Flooded	Frequently Flooded	Infrequently Flooded	Rarely Flooded	
Retention Class	Strongly retentive	(FS)	(MS)	(IS)	(RS)	High Quality (SI >= 0.75)
	Moderately retentive	(FM)	(MM)	(IM)	(RM)	Moderate Quality (SI > 0.45 and < 0.75)
	Poorly retentive	(FP)	(MP)	(IP)	(RP)	Low Quality (SI <= 0.45)
	Non-retentive	(FN)	(MN)	(IN)	(RN)	

Cottonwood Dominate Shrubs (Poles and Saplings) - CTWSHRUB

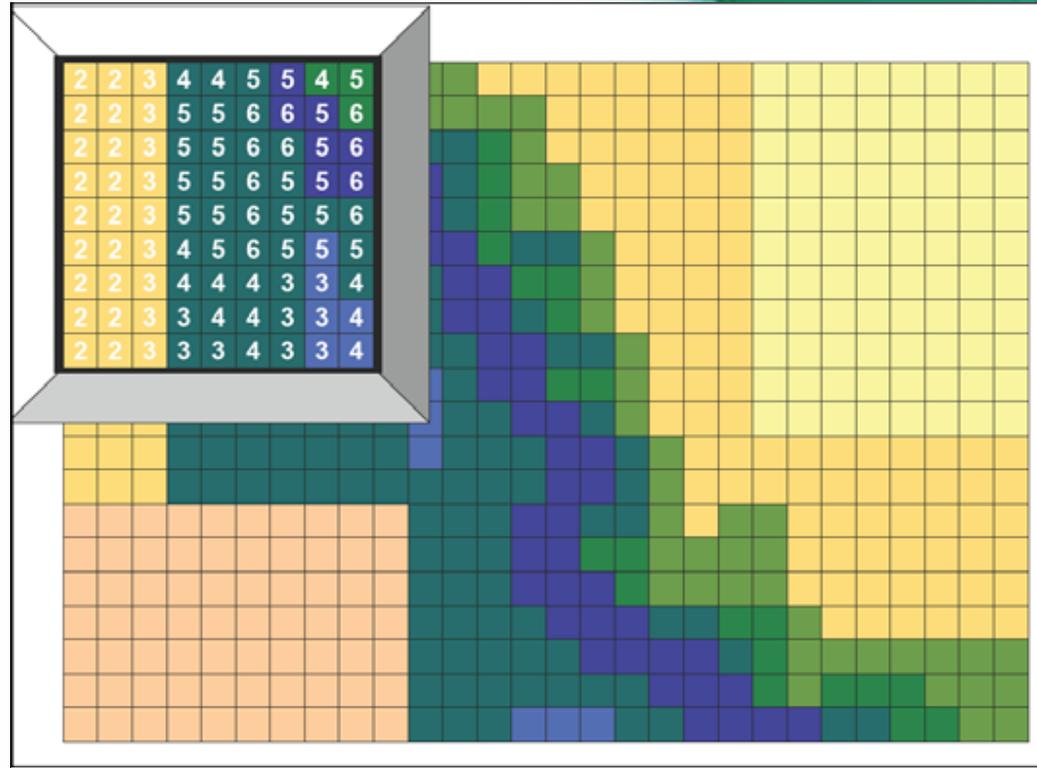
		Wetness Class				Suitability Interpretation
		Frequently Flooded	Frequently Flooded	Infrequently Flooded	Rarely Flooded	
Retention Class	Strongly retentive	(FS)	(MS)	(IS)	(RS)	High Quality (SI >= 0.75)
	Moderately retentive	(FM)	(MM)	(IM)	(RM)	Moderate Quality (SI > 0.45 and < 0.75)
	Poorly retentive	(FP)	(MP)	(IP)	(RP)	Low Quality (SI <= 0.45)
	Non-retentive	(FN)	(MN)	(IN)	(RN)	

Segment 10 - LCPI Correlation to Suitability of Cottonwood Forests

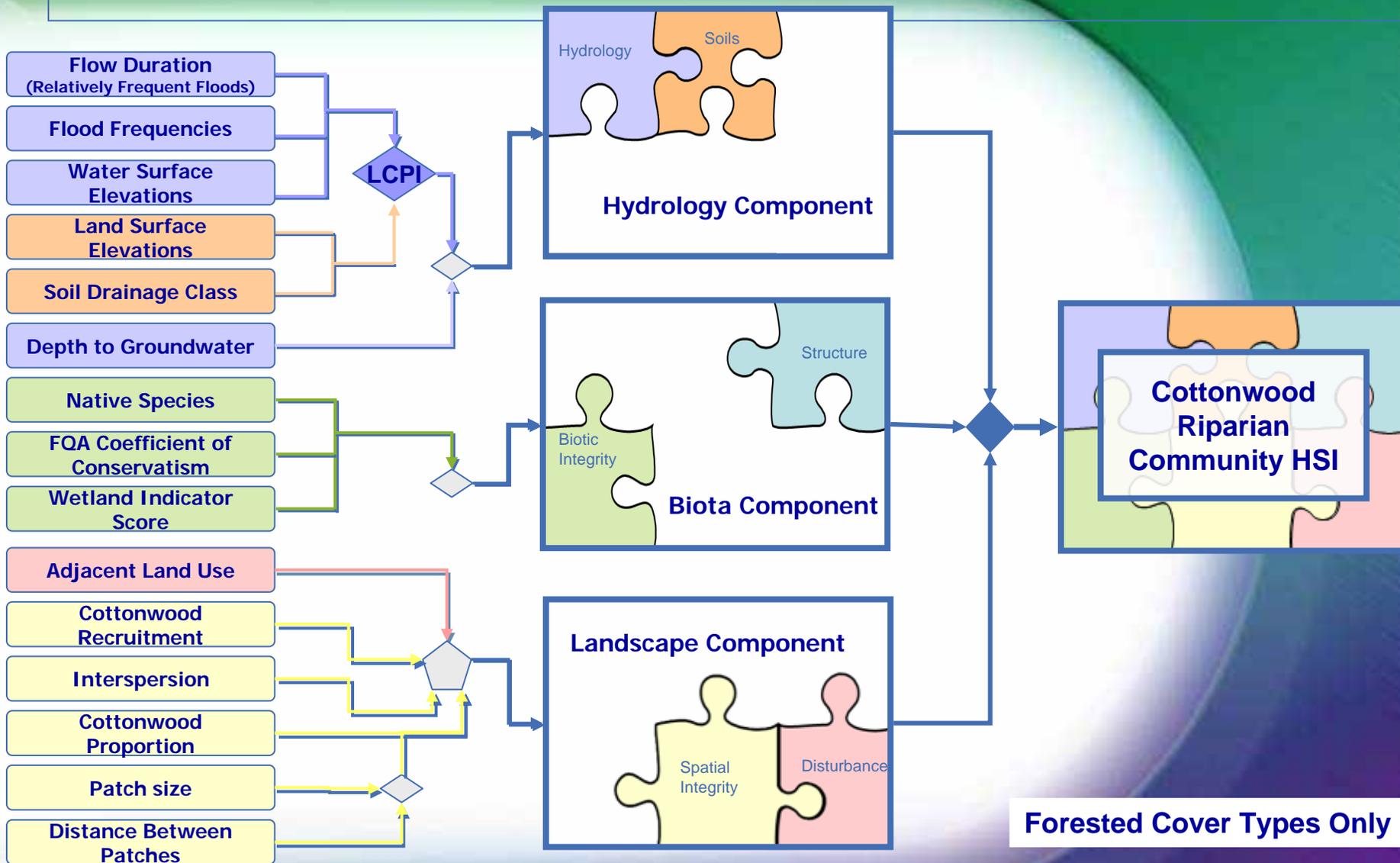


LANDSCAPE Component

- Interspersion
 - Using Spatial Analyst in ArcGIS 9.2, Neighborhood Statistics - Roving Window, Variety
 - Model Builder will automate the process for the District
 - Use Reference-Based Calibration - 1892 Cover Type Mapping
- Adjacent Land Use
- Patch Size
- Distance Between Patches
- Recruitment
- Proportion of Forest Dominated by Cottonwoods



Modeling the Ecosystem – Mature Forest

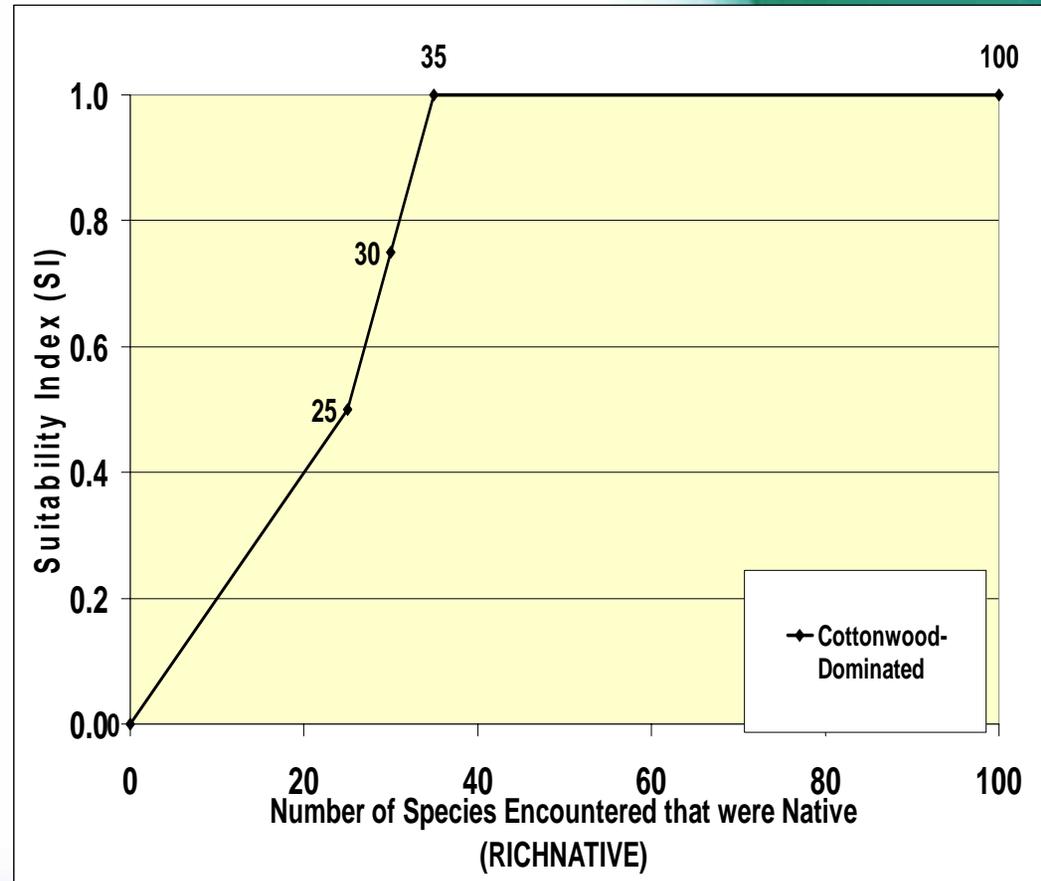


Missouri National Recreation River (MNRR) Cottonwood Riparian Community Model

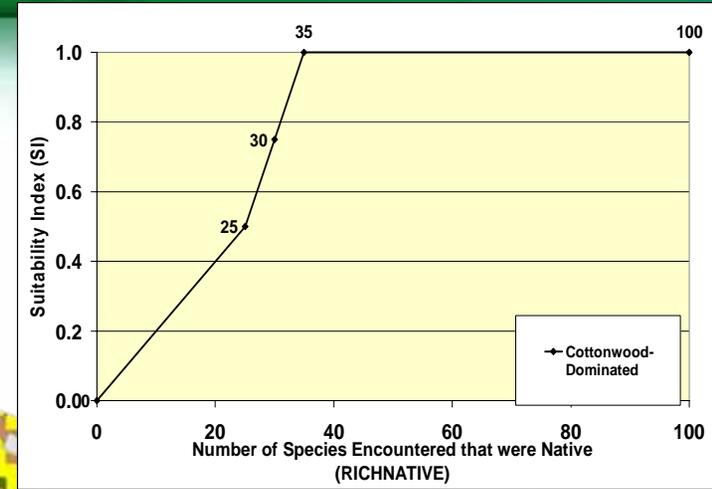
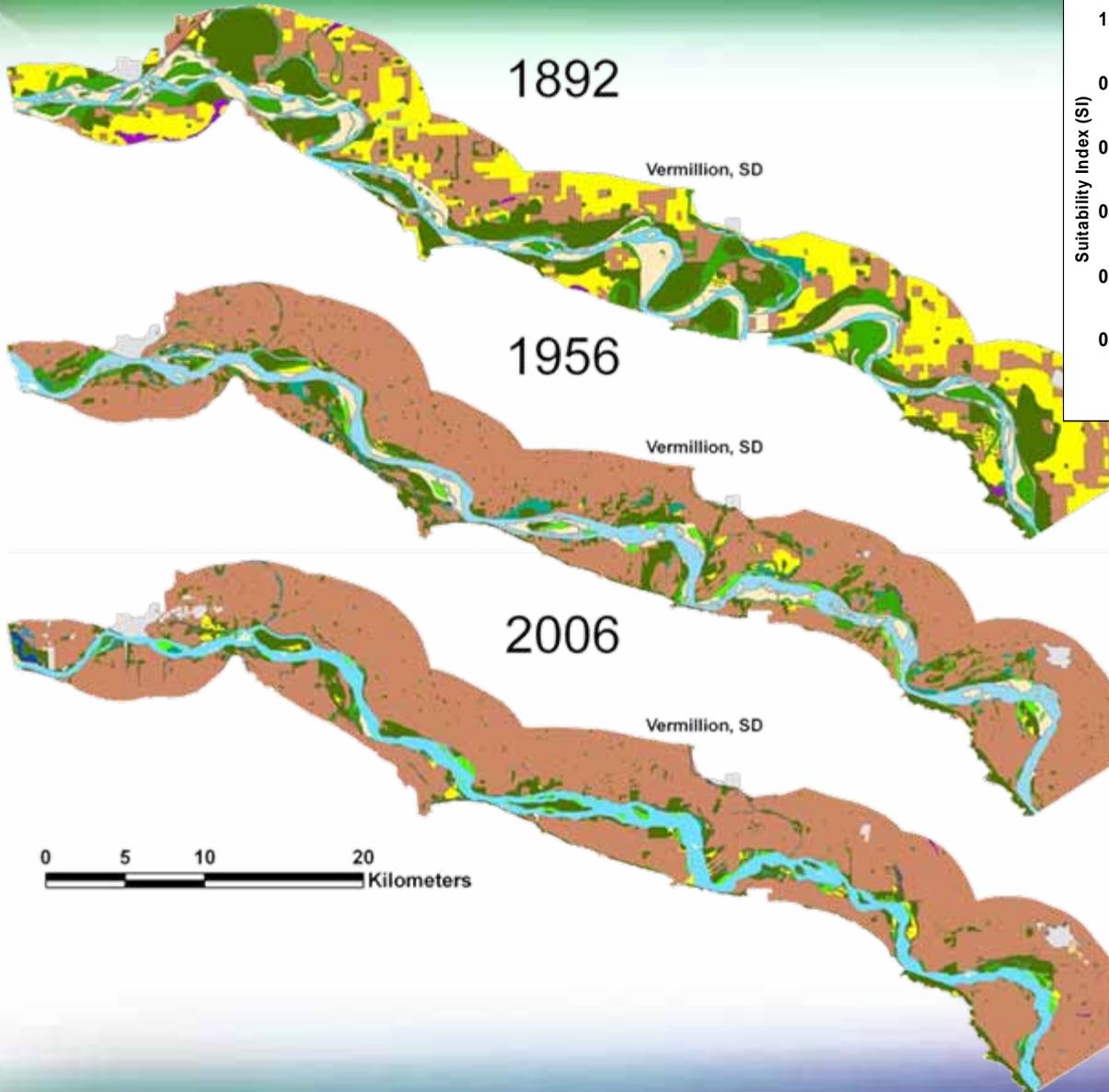
Component (Life Requisite) Code	Variable Code	Applicable Cover Type Code(s)	BIOTA Life Requisite Suitability Index (LRSI) Formula(s)
CBIOTA	RICHNATIVE	SHRUBS ONLY	$\frac{\left[\frac{(V_{RICHNATIVE} + V_{CVALUE} + V_{WIS})}{3} \right] + \left[\frac{(V_{CANHERB} + V_{CANSHRUB})}{2} \right]}{2}$
	CVALUE		
	WIS		
	CANHERB		
	CANSHRUB		
	RICHNATIVE		
CVALUE			
WIS			
Component (Life Requisite) Code	Variable Code	Applicable Cover Type Code(s)	WATER Life Requisite Suitability Index (LRSI) Formula(s)
CWATER	DEPTHGW	FOREST ONLY	$\frac{V_{DEPTHGW} + V_{LCPI}}{2}$
	LCPI		
	LCPI	SHRUBS ONLY	V_{LCPI}
Component (Life Requisite) Code	Variable Code	Applicable Cover Type Code(s)	LANDSCAPE Life Requisite Suitability Index (LRSI) Formula(s)
CLANDSCAPE	ADJLANDUSE	ALL FOREST AND SHRUB COMBINED	$\frac{\left\{ \left[\frac{(V_{PATCHSIZE} + V_{DISTPATCH})}{2} \right] \times V_{PROPCTW} \right\} + V_{ADJLANDUSE} + V_{RECRUIT} + V_{INTERSPERS}}{4}$
	PATCHSIZE		
	DISTPATCH		
	PROPCTW		
	RECRUIT		
	INTERSPERS		
OVERALL HSI			$\frac{V_{CBIOTA} + V_{CWATER} + V_{CLANDSCAPE}}{3}$

Development of Normalized Variables

- Flow Duration
(Relatively Frequent Floods)
- Flood Frequencies
- Water Surface Elevations
- Land Surface Elevations
- Soil Drainage Class
- Depth to Groundwater
- Native Species
- FOA Coefficient of Conservatism
- Wetland Indicator Score
- Adjacent Land Use
- Cottonwood Recruitment
- Interspersion
- Cottonwood Proportion
- Patch size
- Distance Between Patches



Reference Based Calibration

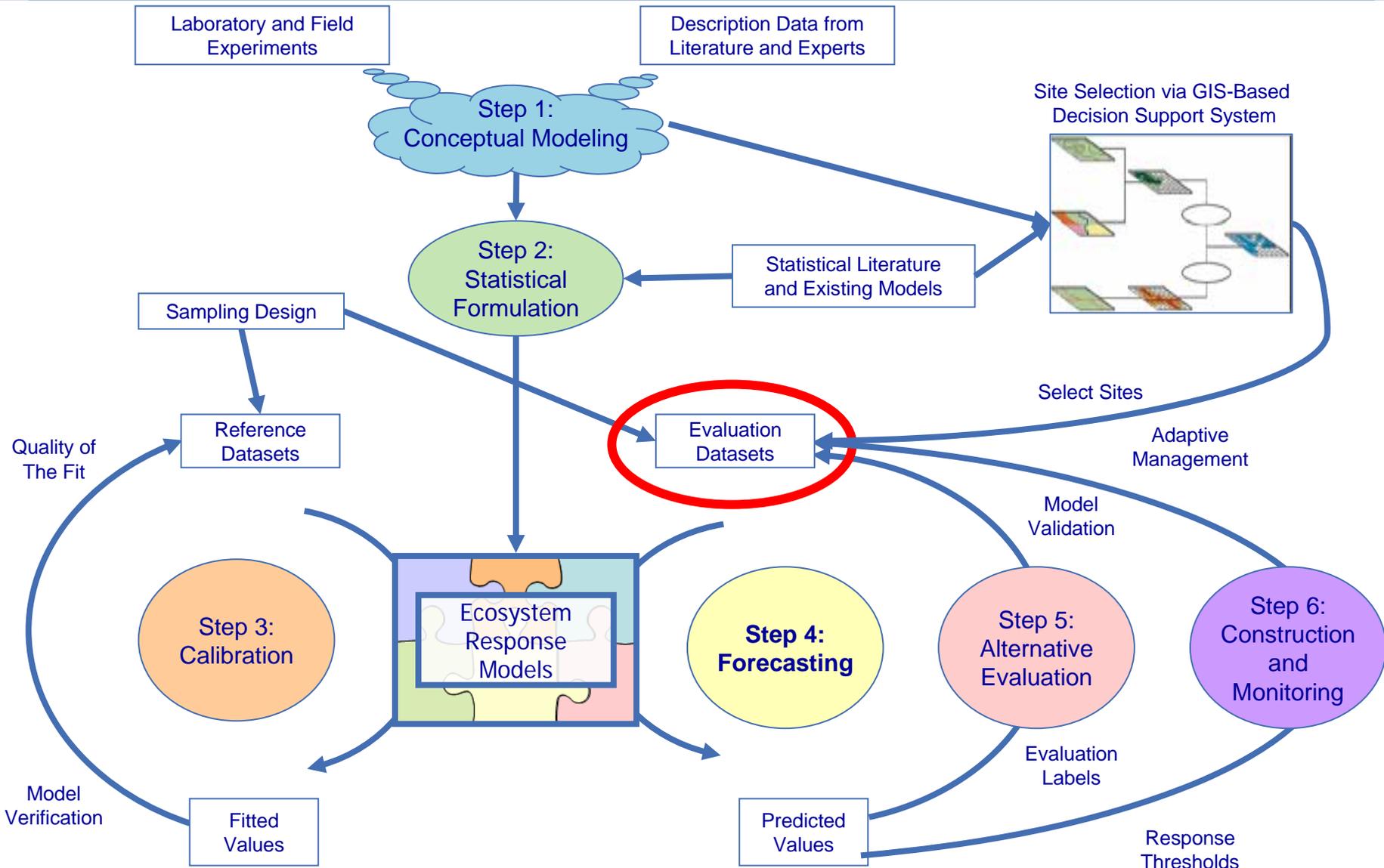


Missouri River Floodplain

Land Cover Class

- Water
- Backwater
- Sandbar
- Forest
- Woodland
- Shrubland
- Grassland
- Riparian Low Vegetation
- Wetland
- Agriculture
- Urban

Ecosystem Assessment Status



Ecosystem Assessment

- HEAT: Habitat Evaluation and Assessment Tools

- EXHEP
- EXHGM
- Almost CERTIFIED!!

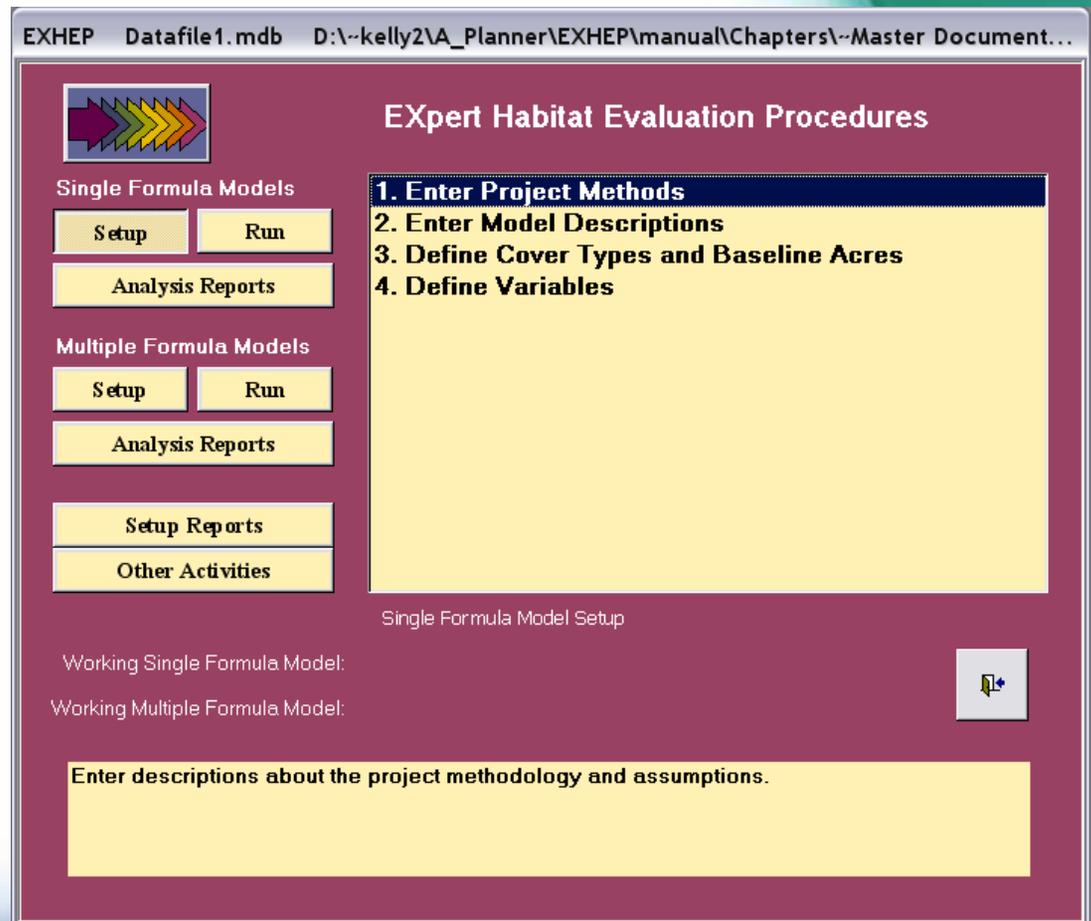
- MS Access db

- (Office 2003)

- Not Spatially
Explicit

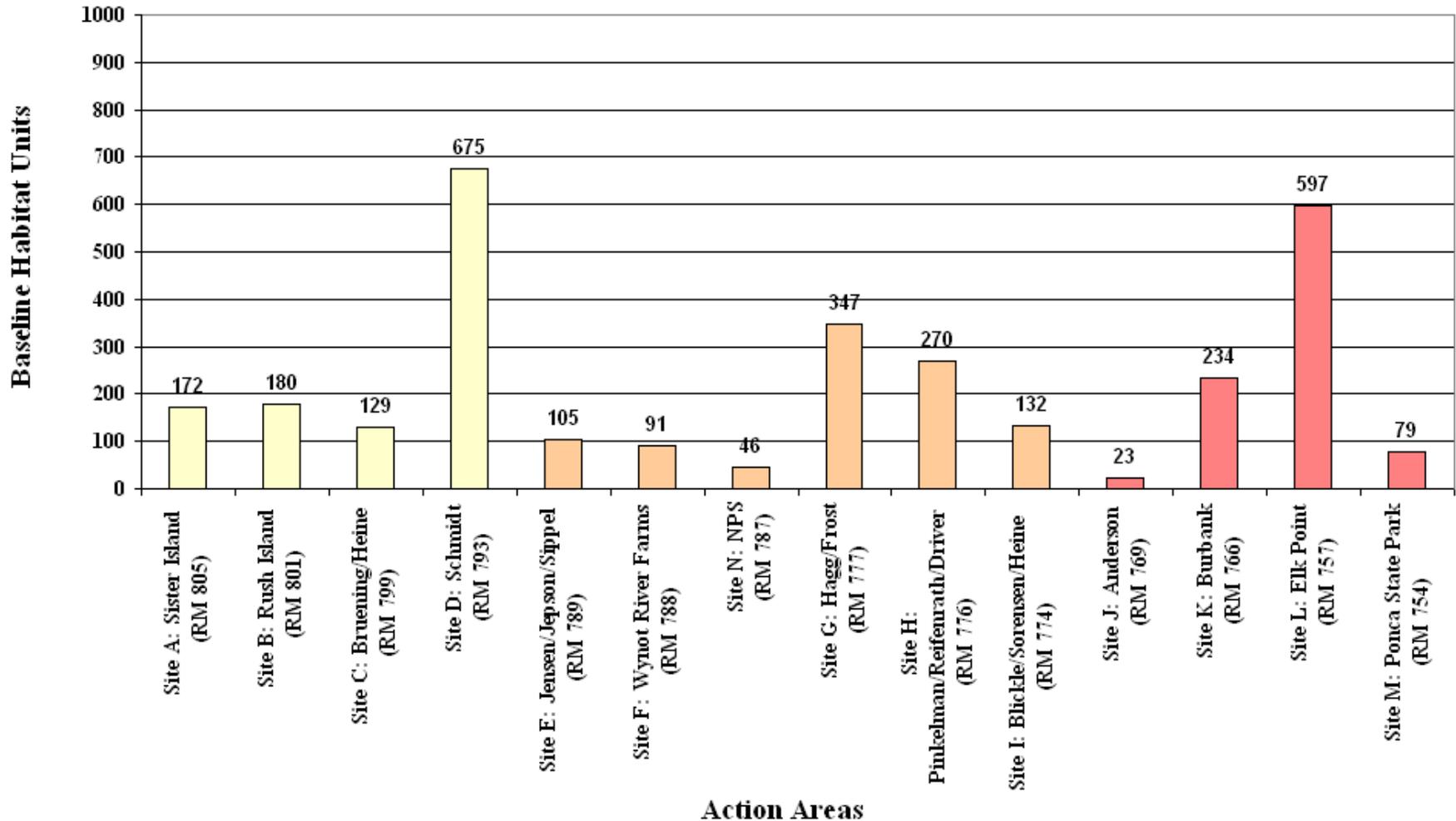
- Just Software

- not a model

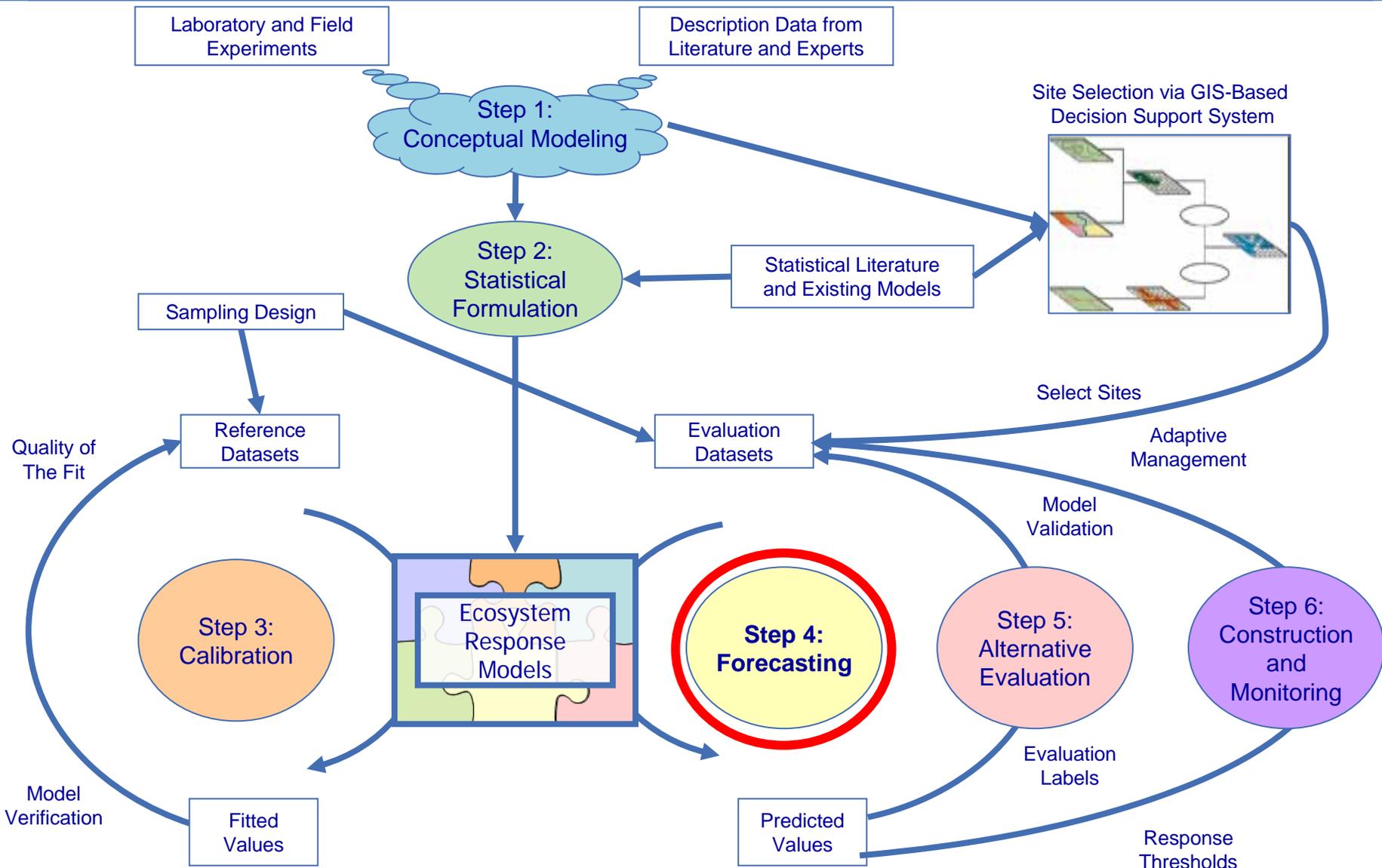


Baseline Results

Baseline HSI's for all Action Areas in Segment 10 of the Missouri River Cottonwood Management Plan

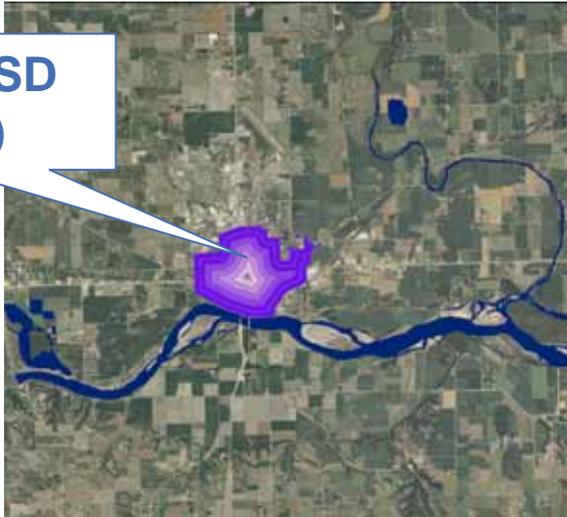


Ecosystem Assessment Status

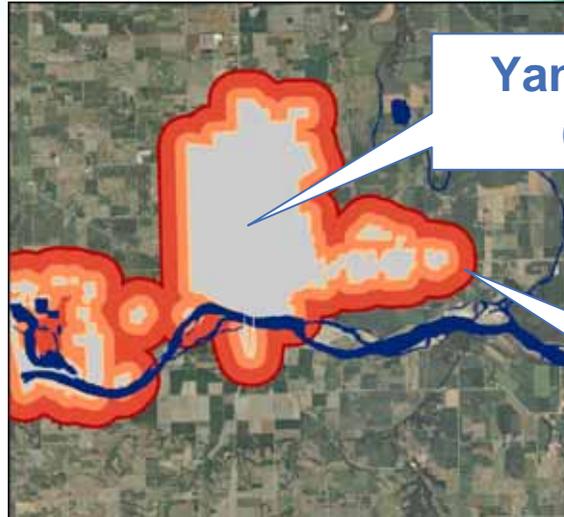


Without Project Forecast – Urban Growth

Yankton, SD
(1890's)

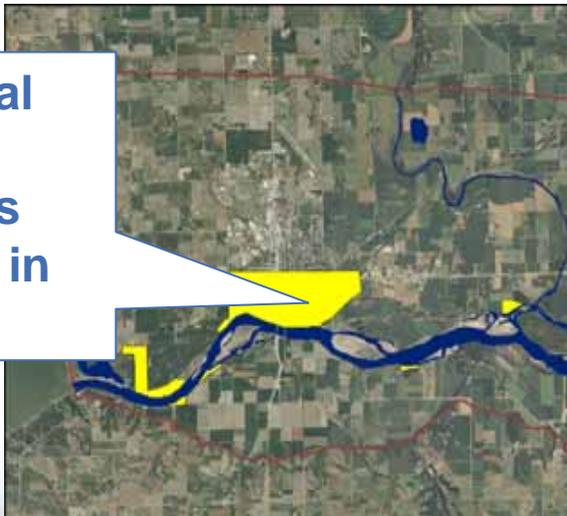


Yankton, SD
(2006)

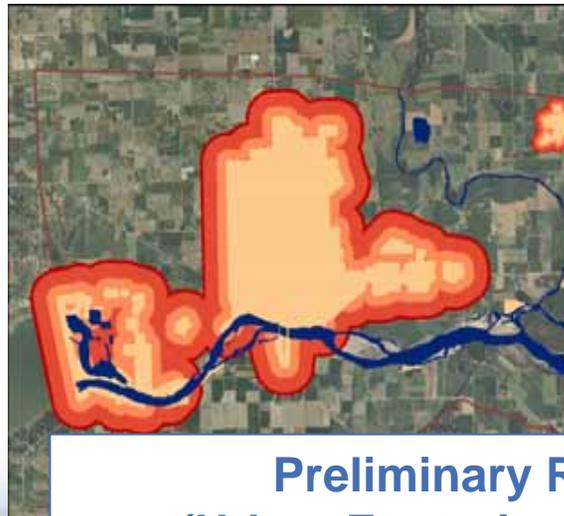


Yankton, SD
(2110)

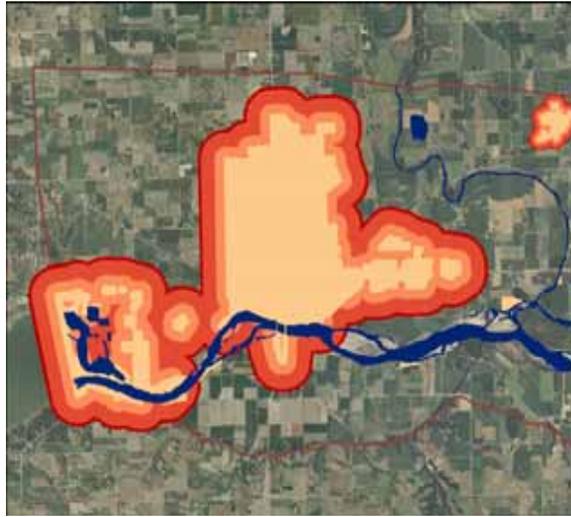
Additional
Urban
Hotspots
identified in
2009



Preliminary Results
(Urban Footprint 2006-2110)

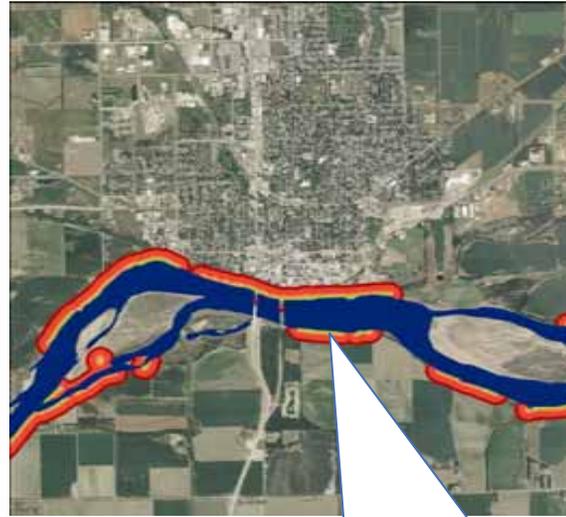


Bank Stabilization



**Preliminary Results
(Urban Footprint
2006-2110)**

+



**Bank Stabilization
Promotes More Growth
(2006-2110)**

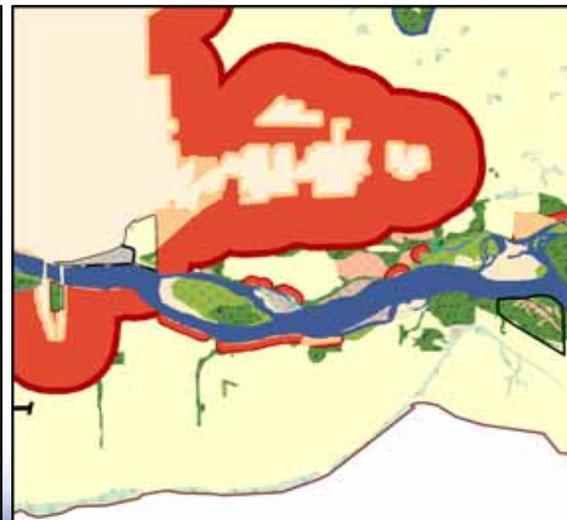
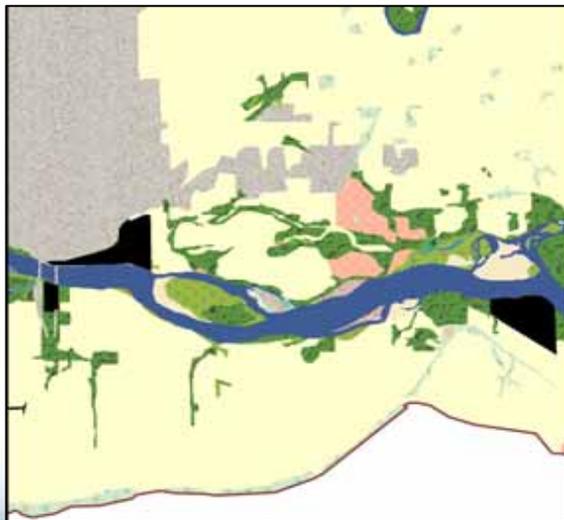
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**Stage 2 Preliminary
Results
(Urban Footprint 2006-
2110)**

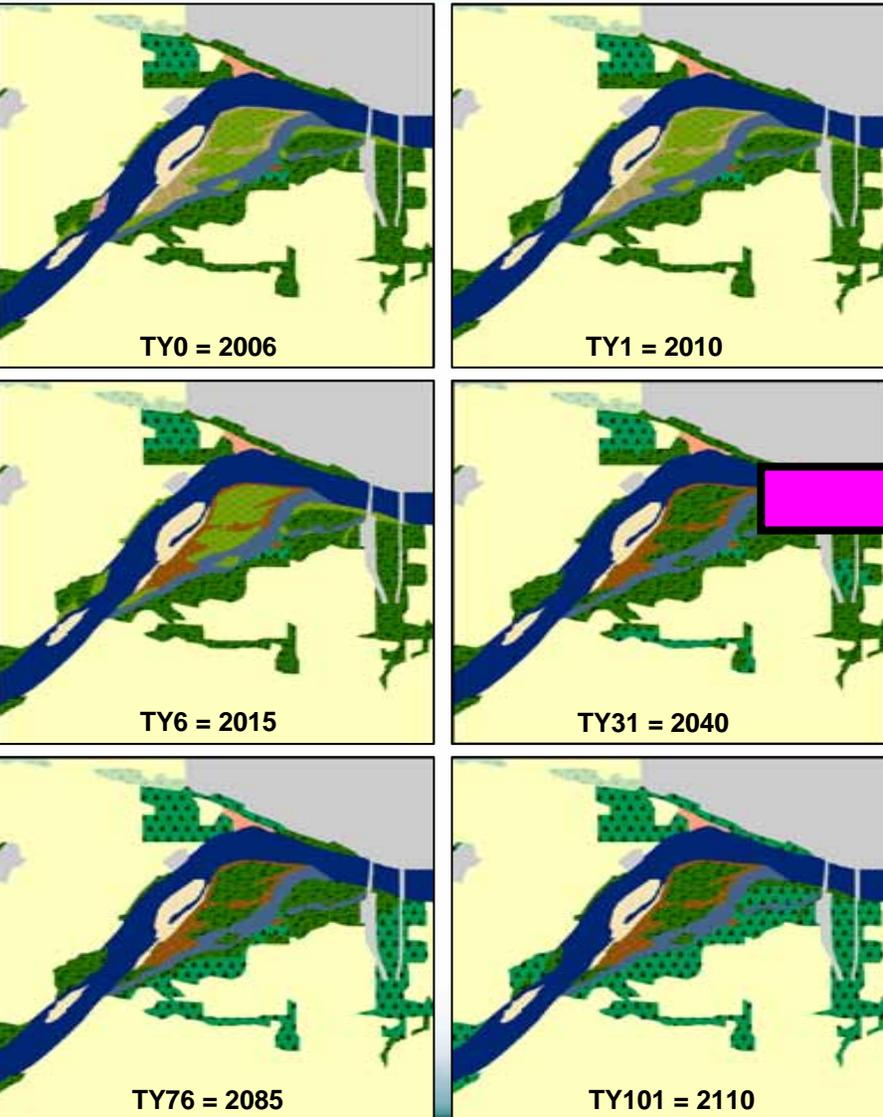
Erosion & Protected Areas

And then consider
Model effects of high
Erosion Areas and
exclude Public Lands
from conversion
activities (protected
through purchase or
easement)

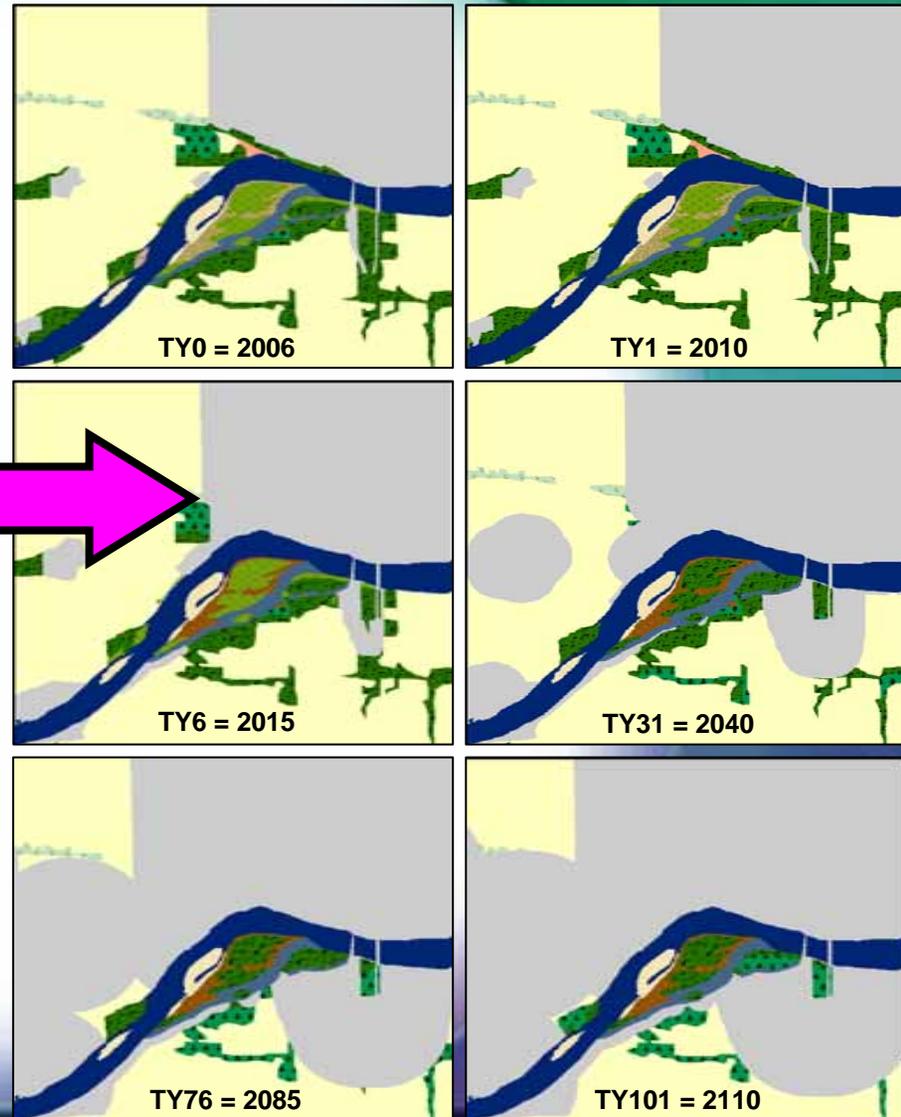


Vegetative Succession

Natural Succession Model

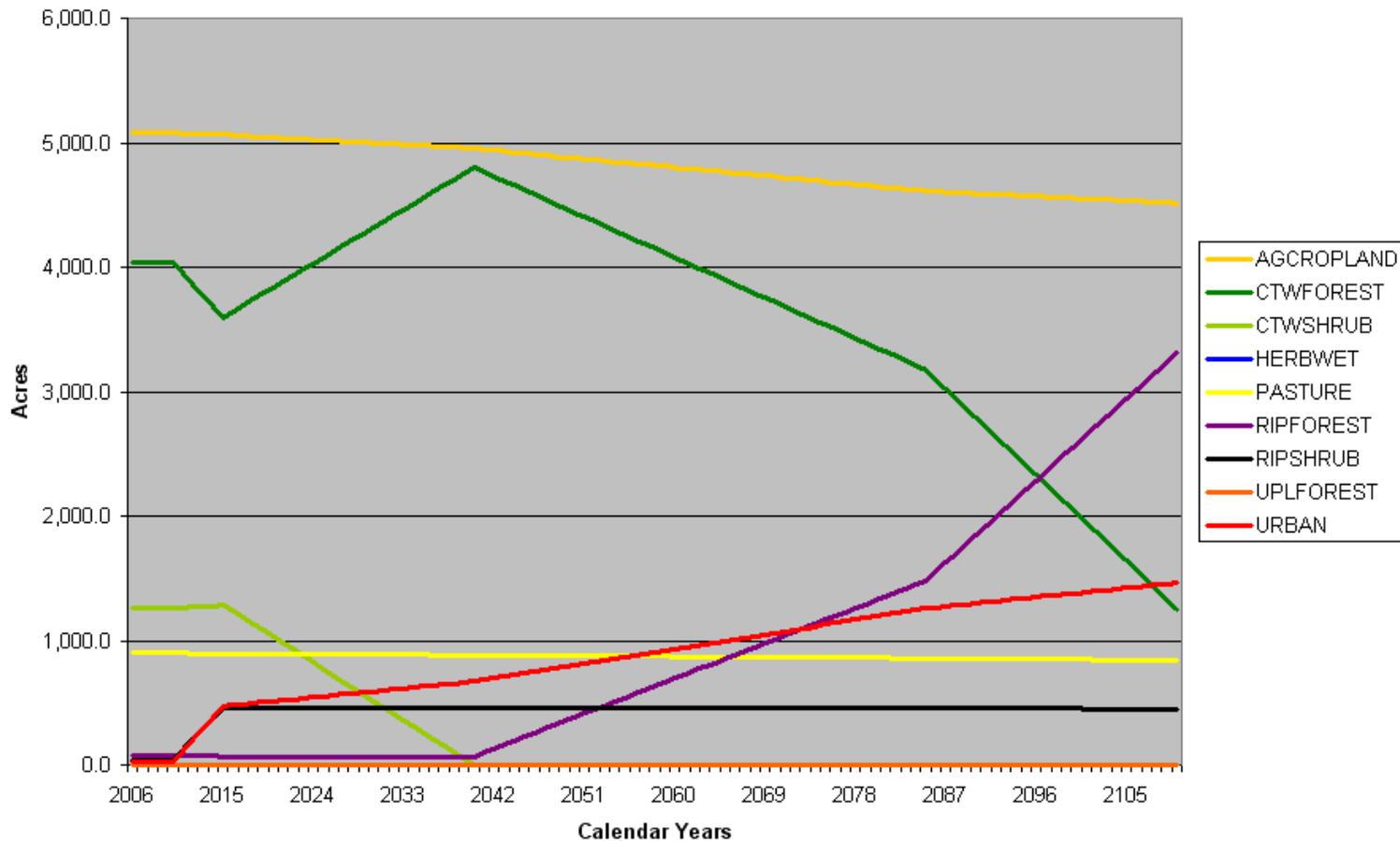


Succession + Urban Land Conversion



Without Project Forecast

Onsite Without Project Acreage Forecasts (2006-2110)



Take Away Points

- Conceptual models help teams develop numerical models that will assist in demonstrating which sites provide the most habitat benefits.
- Forecasting parameters that are likely to change in time is critical to capture the “future without project” condition.
- Our program is using both of the above methods to better understand the potential future fate of the cottonwood community and how we can best make management decisions to restore the health of the community.

Cottonwood Management Plan: Future Actions

- Draft CMP and Programmatic EA
- Public review of plan and EA
- Complete cottonwood model
- Final plan and EA
- Implement preservation and restoration activities from plan

Summer 2009

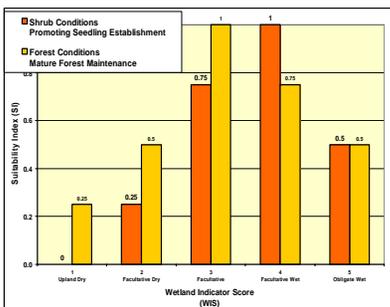
Fall 2009

Fall 2009

Fall 2009



2010+



Fall 2008

Summer 2009

Fall 2009

2010 +

Interagency and Interdisciplinary Team

- **Corps of Engineers - Omaha and Kansas City Districts, Engineer Research and Development Center**
- **National Park Service**
- **Natural Resource Conservation Service**
- **U.S. Environmental Protection Agency**
- **U.S. Fish and Wildlife Service**
- **U.S. Geological Survey**

- **Iowa Department of Natural Resources**
- **Kansas Department of Wildlife and Parks**
- **Lewis & Clark Natural Resource District**
- **Missouri Department of Conservation**
- **Nebraska Forest Service**
- **Nebraska Game and Parks Commission**
- **South Dakota Department of Game, Fish, and Parks**
- **South Dakota Department of Agriculture**

- **Cheyenne River Sioux Tribe**
- **Lower Brule Sioux Tribe**
- **Omaha Tribe**
- **Pine Ridge Agency (Oglala Sioux Tribe)**
- **Rosebud Sioux Tribe**
- **Winnebago Tribe of Nebraska**

- **Benedictine College**
- **South Dakota State University**
- **University of Nebraska**
- **University of South Dakota**
- **USD - Missouri River Institute**

- **Izaak Walton League of America**
- **The Nature Conservancy**
- **Missouri River Futures**