

# RIPFLOW MODEL APPLICATION TO RIVER RESTORATION

## Kleblach Case Study



# OUTLINE

- Background
- Case study site & its restoration
- Modeling motivation & workflow
- River restoration modeling scenarios
- Open discussion & questions

# BACKGROUND

- Post restoration monitoring
- Long term assessment
- Shifting mosaic



# CASE STUDY SITE & RESTORATION

- Location
- Restoration objectives
- German Tamarisk (*Myricaria germanica* L.)
- Restoration applied measures
- Restoration consequences/implications



# CASE STUDY: AUSTRIA

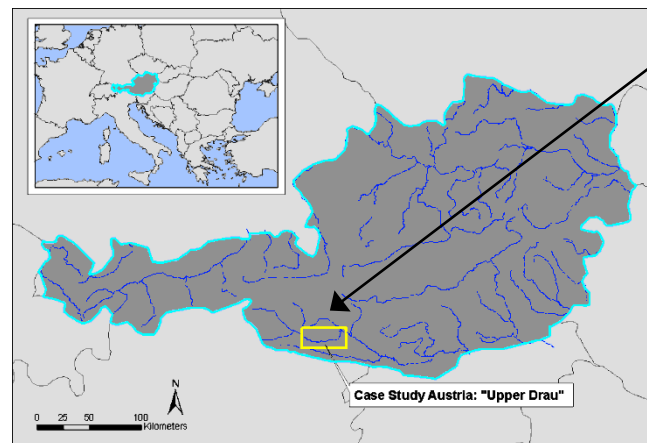
Upper Drau River:

Typical alpine river

Permanent flow regime

No flow regulation upstream

Channelized in the 1940s, restored in 2002



**RIPFLOW PROJECT**

## RESTORATION OBJECTIVES

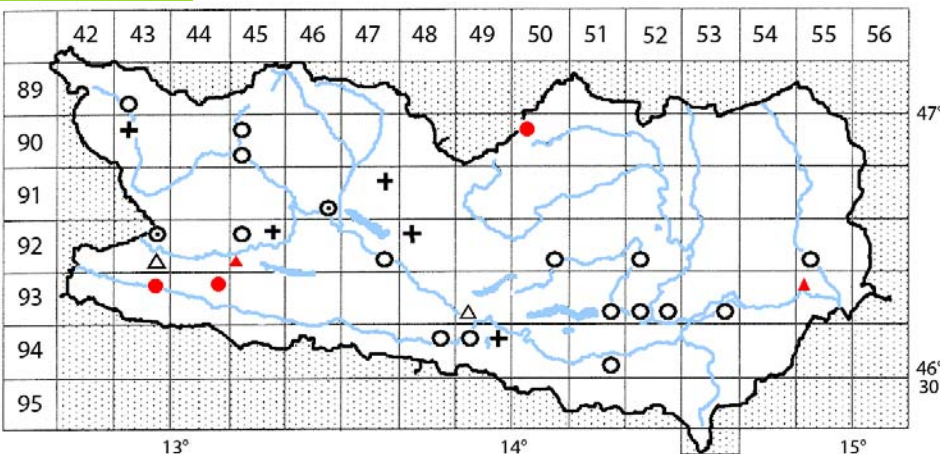
- Re-establish ecological functionality
- Suitable habitat for typical local riparian vegetation
  - German Tamarisk





# GERMAN TAMARISK (*MYRICARIA GERMANICA* L.)

- Alpine endemic riparian species
- Heavily endangered
- Loss of its typical habitat
- Indicator of ecological functionality



# G. TAMARISK LIFECYCLE HABITAT REQUIREMENTS

- Recruits on open & moist soil
- Sheltered from severe flooding in the 1<sup>st</sup> year
- Well adapted to river morphodynamics
- Suffers over-shading






















# RESTORATION MEASURES

- Dug side channel
- Former channel
- Open bank zone

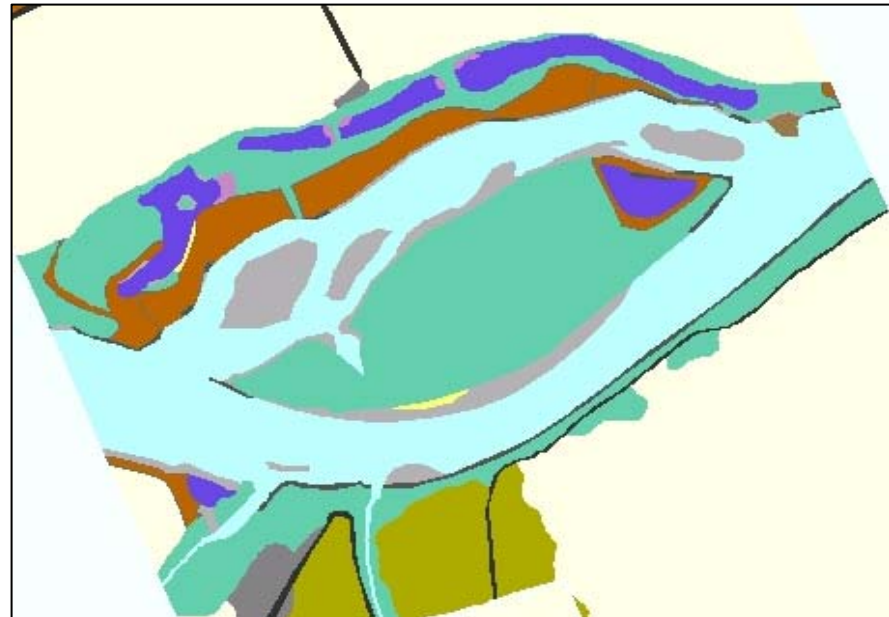
## Legend

AQUATIC ZONE	
	River
BANK ZONE	
	Woody Debris
	Initial Phase
	Pioneer Phase
	Herb Phase
	Pioneer Shrub Phase
	Shrub Phase
FLOODPLAIN ZONE	
	Deep Oxbow
	Shallow Oxbow
	Bog Forest
	Bare Soil
	Early successional woodland phase
	Established forest phase
HUMAN MANAGED AREAS	
	Rip-rap, Groins
	Spruce forest stand
	Agriculture land
	Urban areas
	Infrastructure

1999



2003



# MODELING MOTIVATION & APPLICATION

- Motivation
- Case study calibration
- Case study scenarios

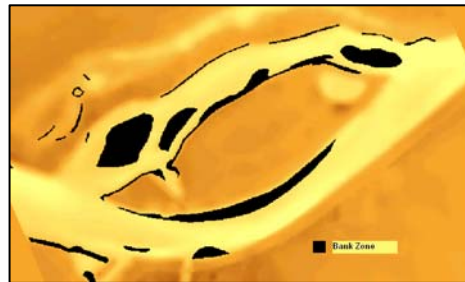


# MODEL CALIBRATION-BOUNDARY CONDITIONS

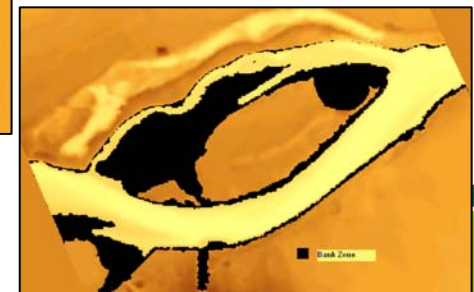
- Span year 2003 – 2010
- Fix groundwater ( $125 \text{ m}^3/\text{s}$ )
- Max Shear based on measured data
- Morphology change (DEM 2003, 2008)

Simulated Year	DEM	HQ Shear Max
2003	2003	HQ 3
2004	2003	HQ 3
2005	2003	HQ 3
2006	2008	HQ 0.5
2007	2008	HQ 0.5
2008	2008	HQ 0.5
2009	2008	HQ 2
2010	2008	HQ 1

D.E.M. 2003



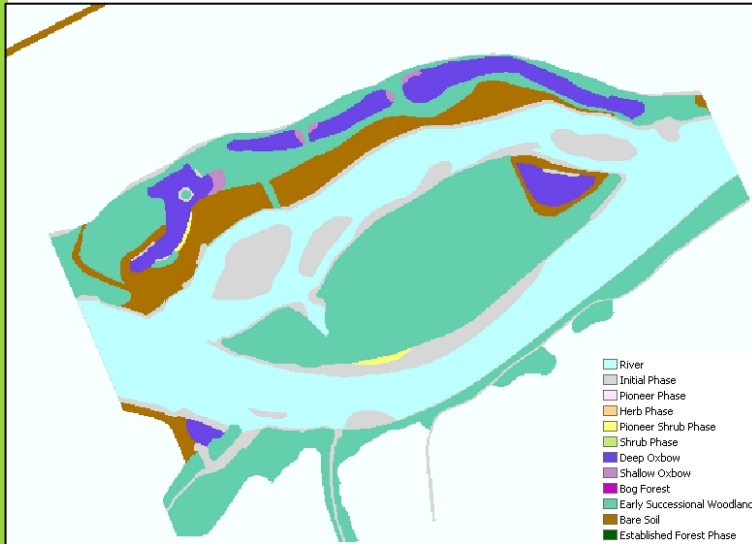
D.E.M. 2008



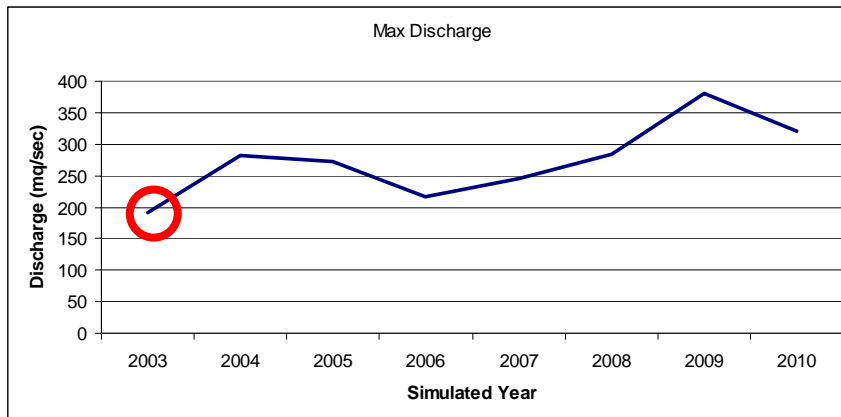
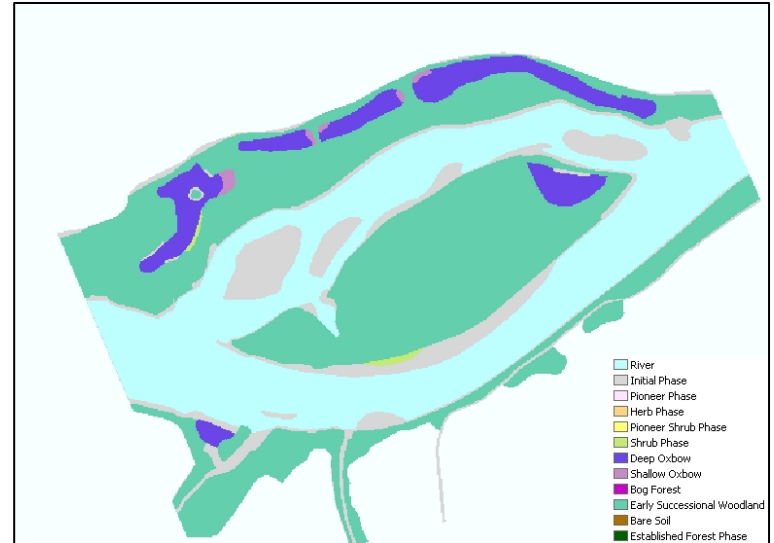


# CALIBRATION RESULTS

Mapped



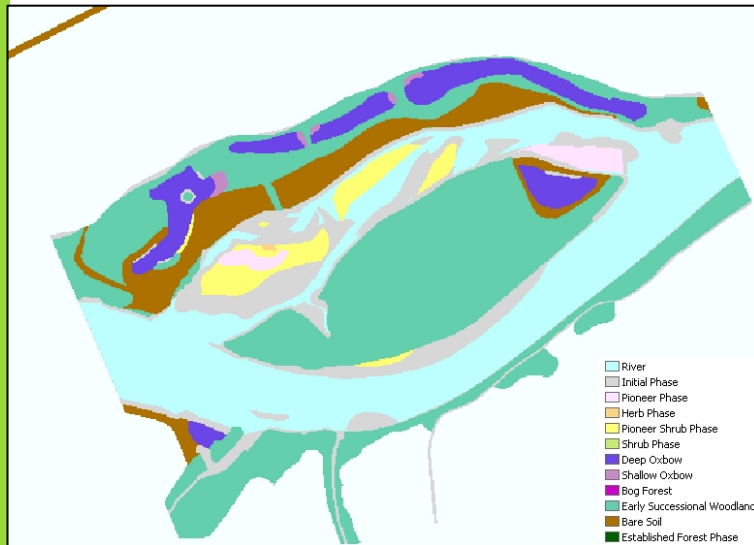
Simulated



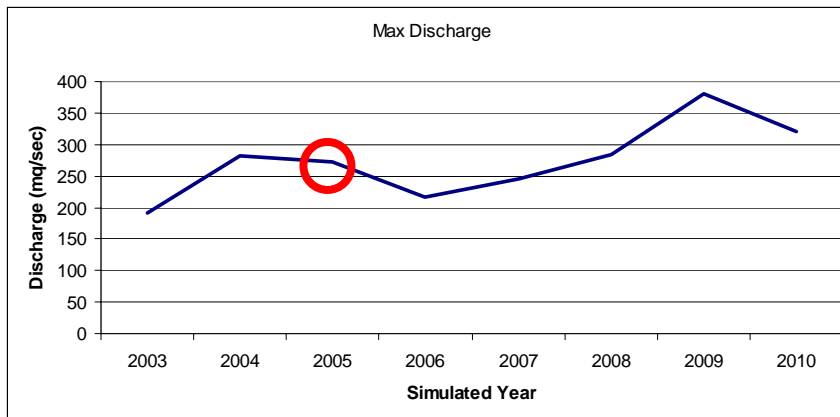
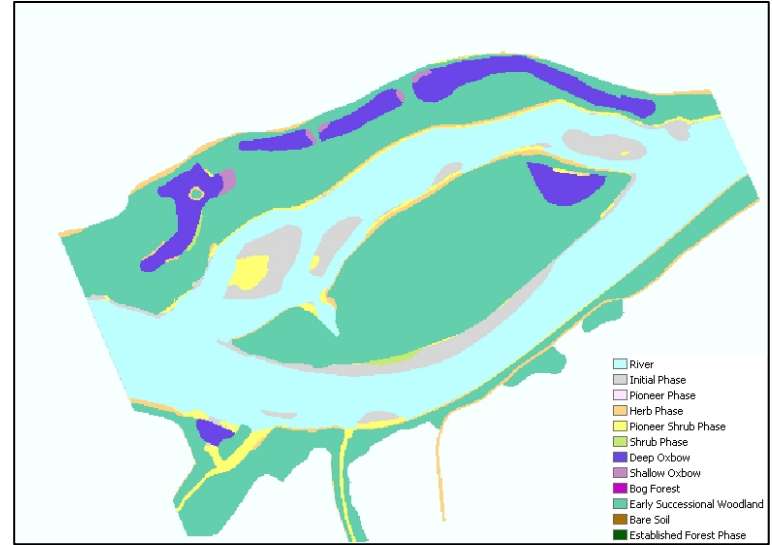
Year 2003

# CALIBRATION RESULTS

Mapped



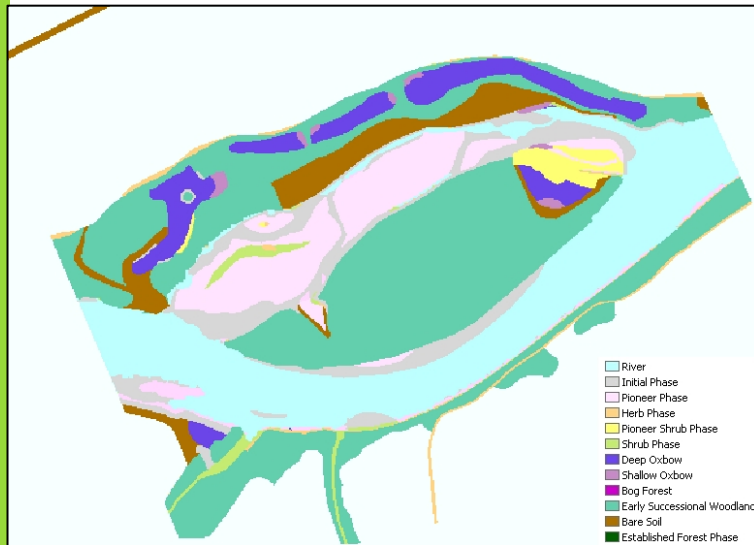
Simulated



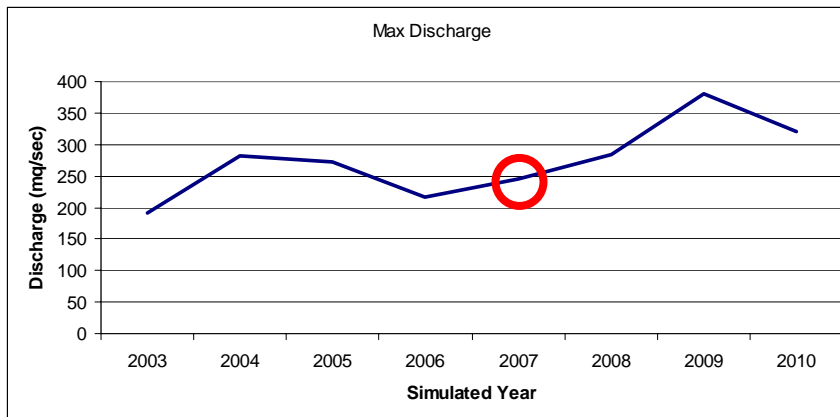
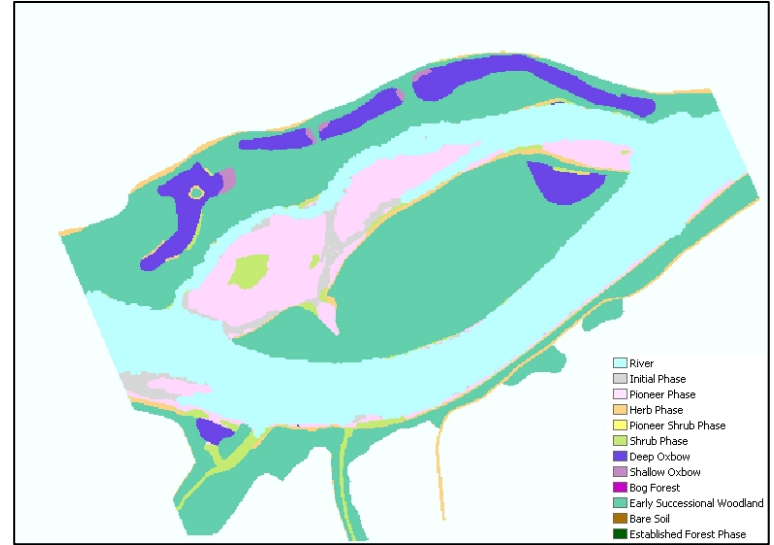
Year 2005

# CALIBRATION RESULTS

Mapped



Simulated

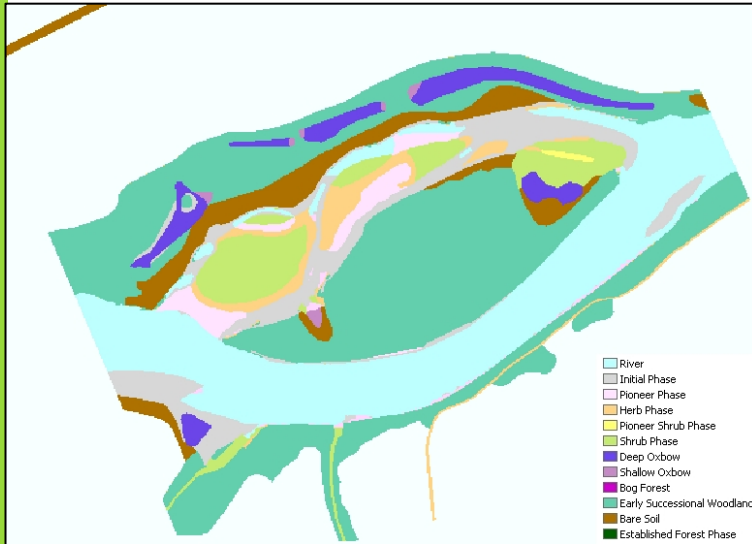


Year 2007

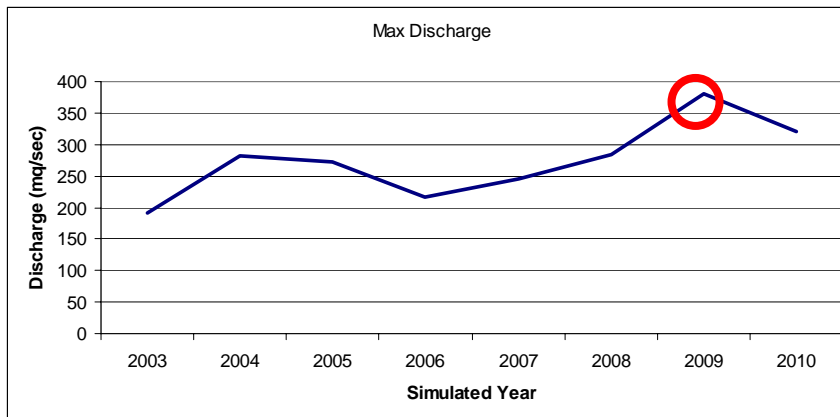
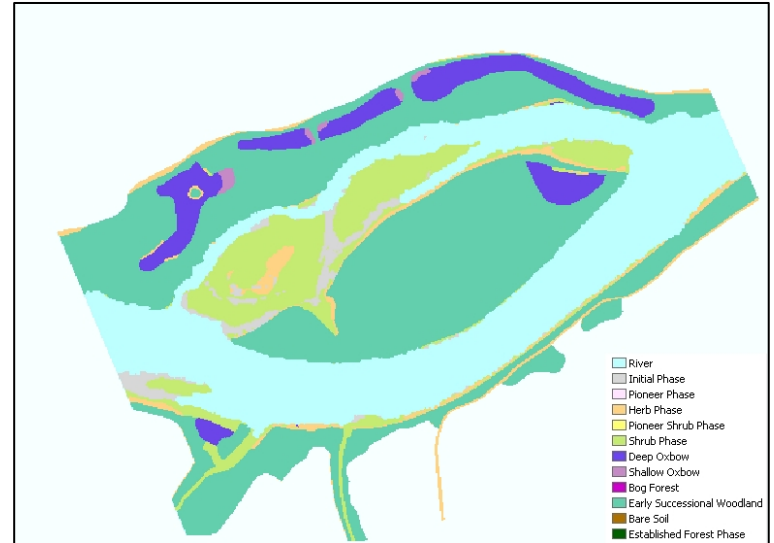


# CALIBRATION RESULTS

Mapped



Simulated



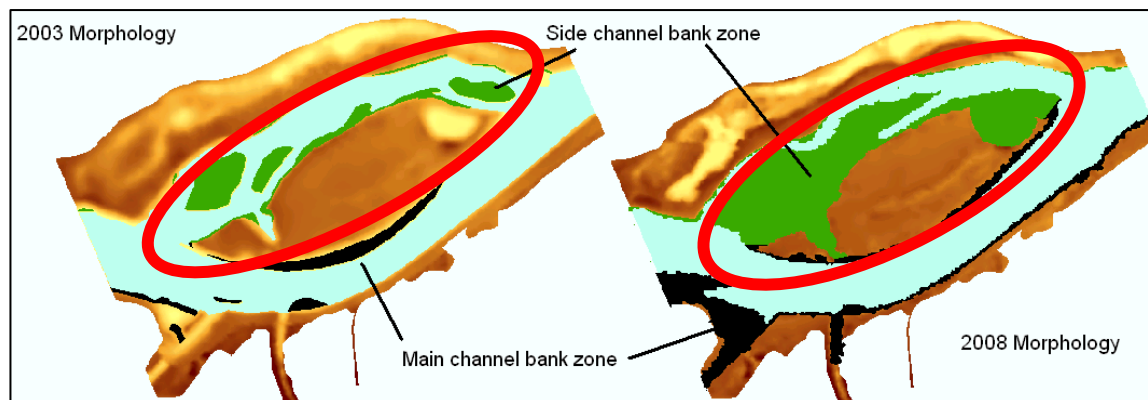
Year 2009

# RIVER RESTORATION SIMULATED SCENARIOS

- Scenarios boundary conditions
- Scenarios results
- Scenarios results conclusions

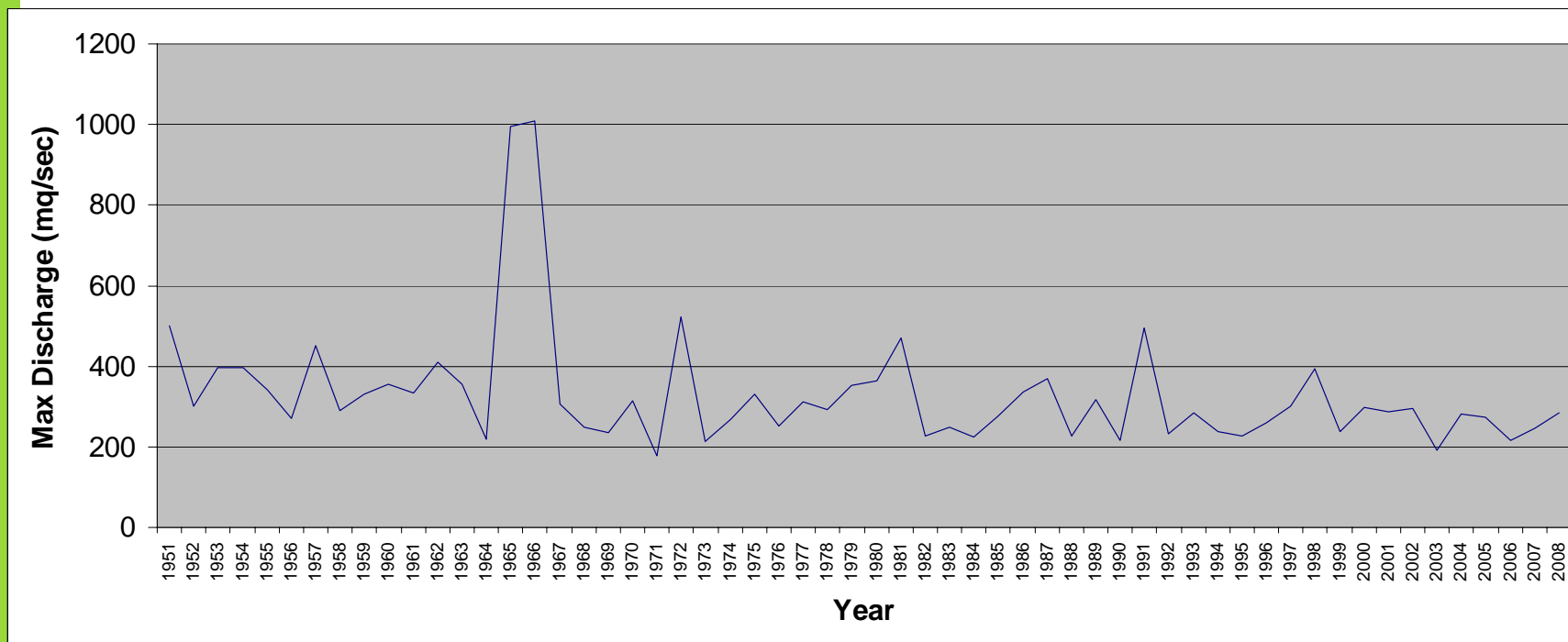
# SCENARIOS BOUNDARY CONDITIONS

- Scenario 1-Small in stream island (2003 DEM)
- Scenario 2-Large in stream island (2008 DEM)
- Simulated years: 60
- Initial phase in the bank zone
- Analysis focus on Bank Zone

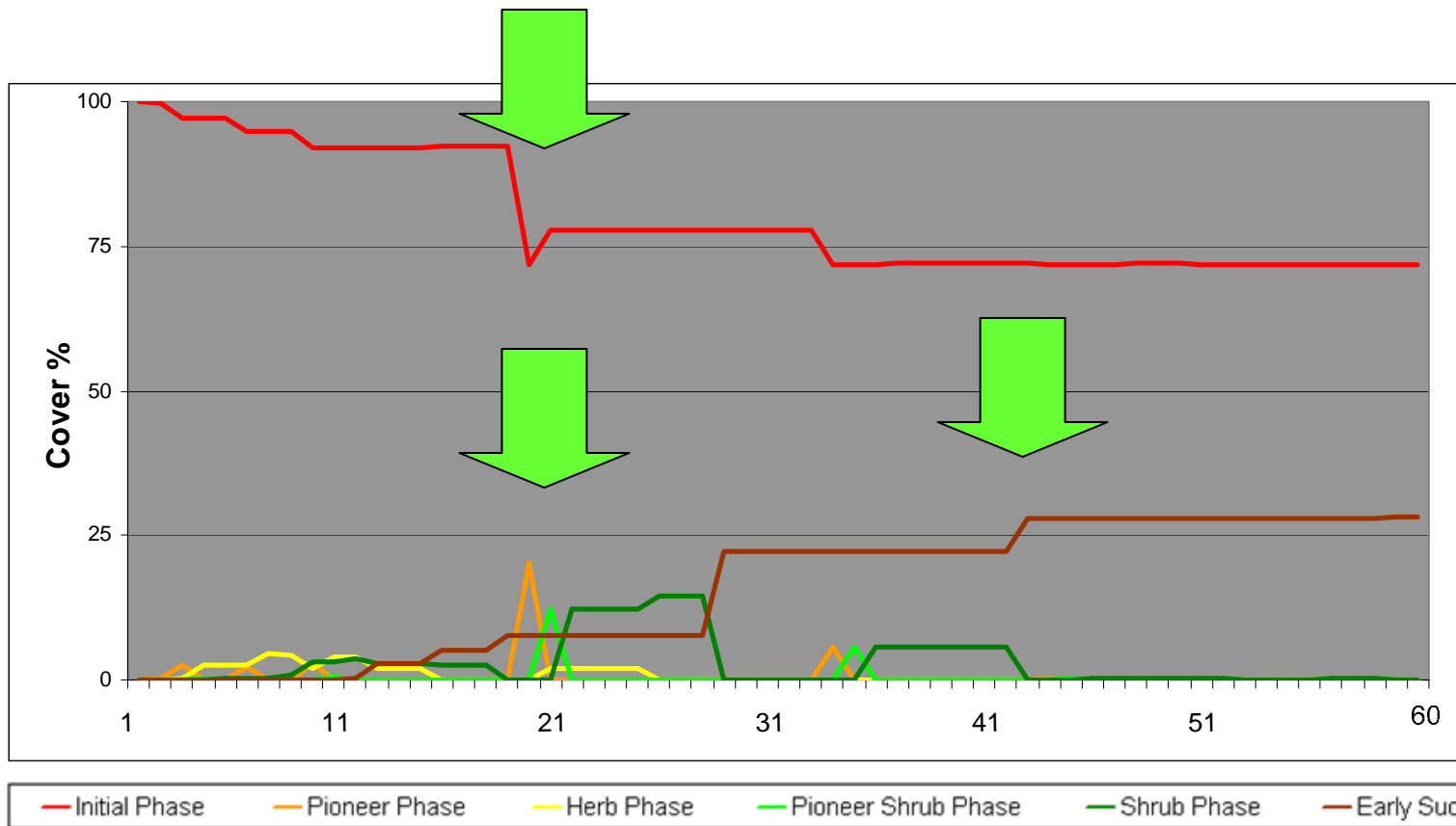




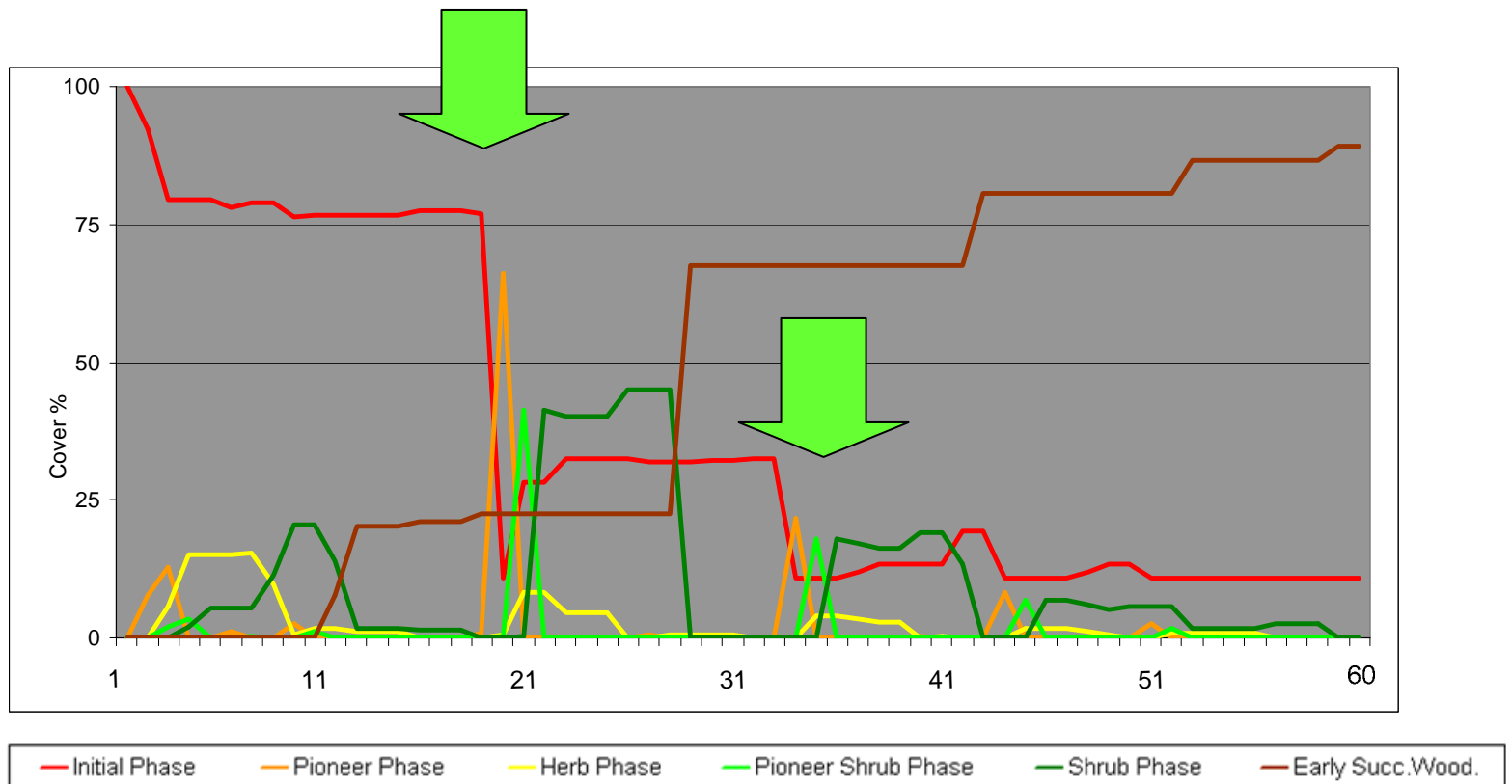
# DISCHARGE BASE DATA



# SCENARIO 1-SMALL IN STREAM ISLAND

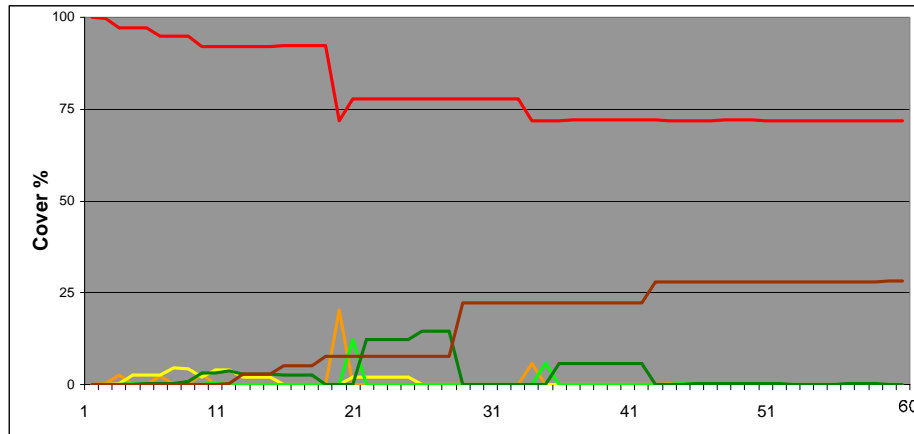


# SCENARIO 2-LARGE IN STREAM ISLAND

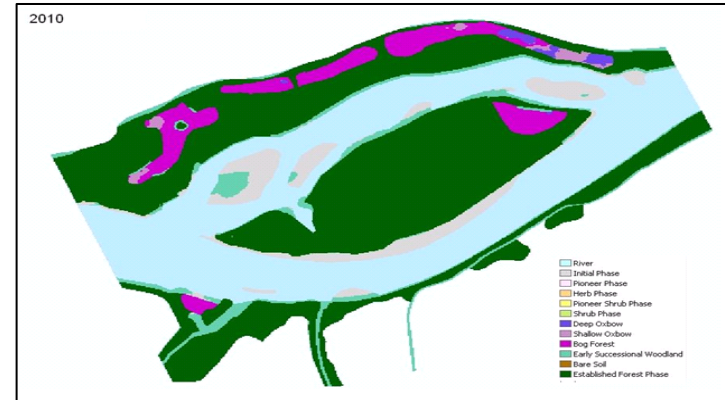




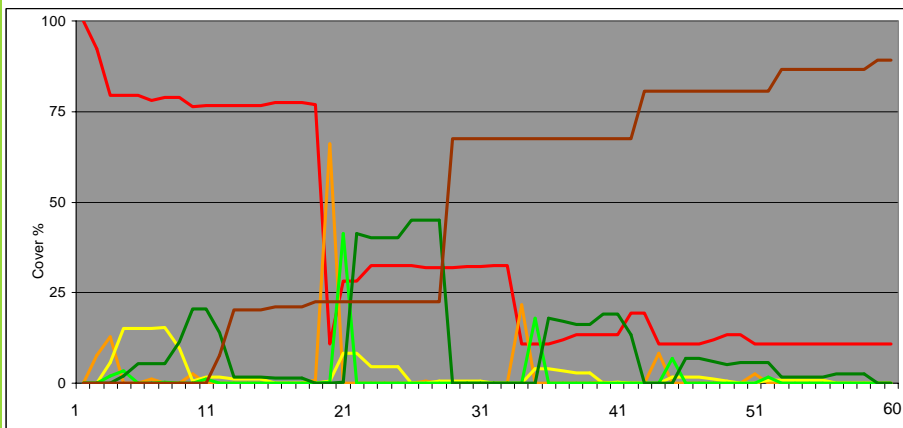
## SCENARIO 1-SMALL IN STREAM ISLAND



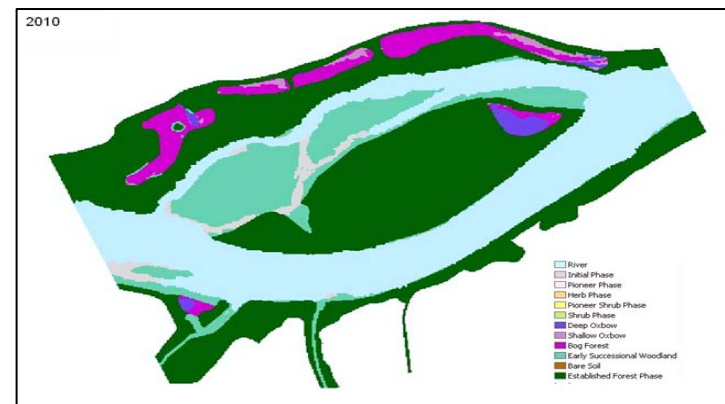
— Initial Phase — Pioneer Phase — Herb Phase — Pioneer Shrub Phase — Shrub Phase — Early Succ. Wood.



## SCENARIO 2-LARGE IN STREAM ISLAND

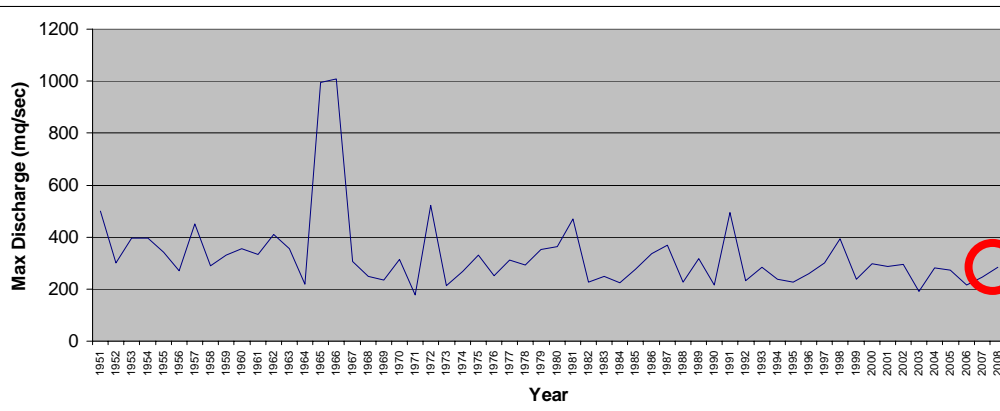
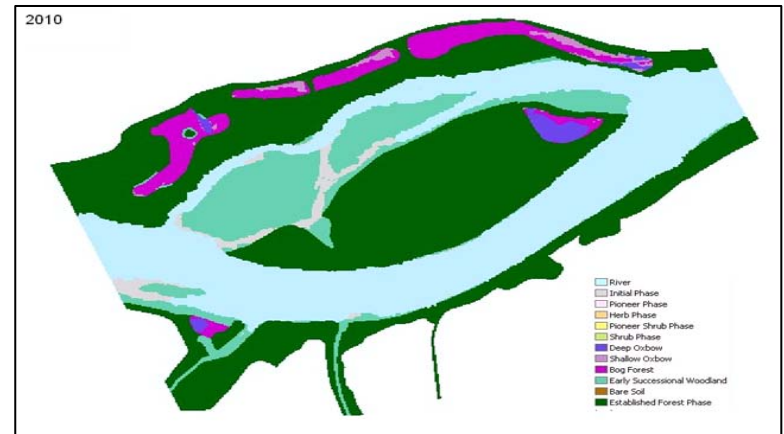
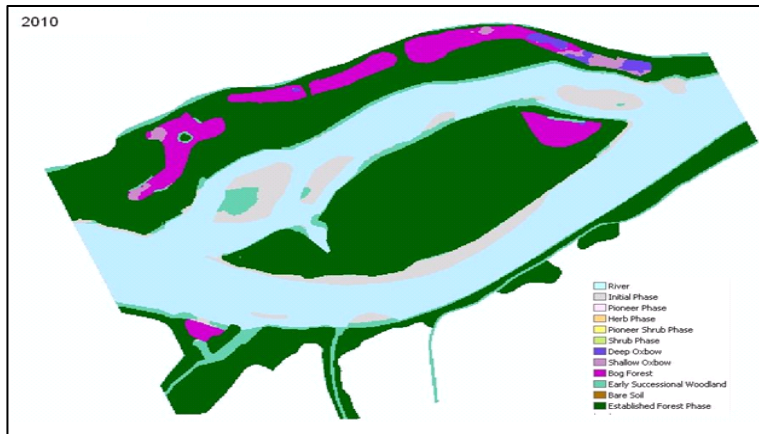


— Initial Phase — Pioneer Phase — Herb Phase — Pioneer Shrub Phase — Shrub Phase — Early Succ. Wood.



## SCENARIO 1-SMALL IN STREAM ISLAND

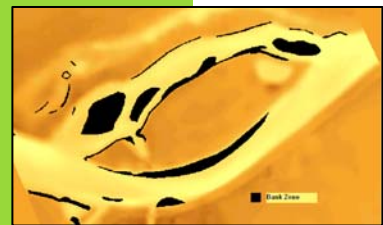
## SCENARIO 2-LARGE IN STREAM ISLAND



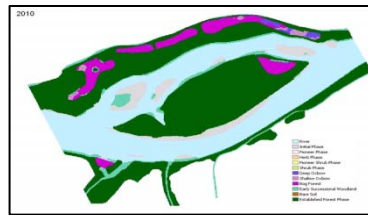
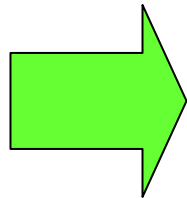
Year 2010 (simulated)

# RESUME I-MODEL RESULTS

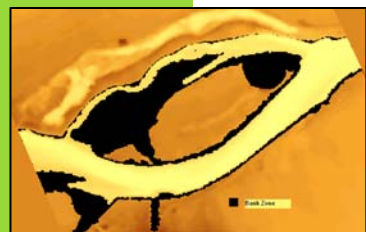
- Two scenarios
- Different (opposite) morphologies
- Scenario results:



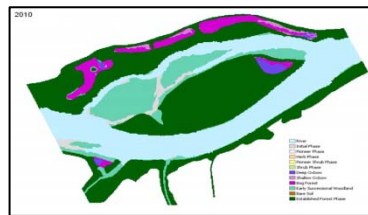
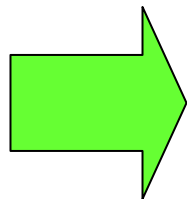
Too narrow



Regression prevails



Too wide



Succession prevails

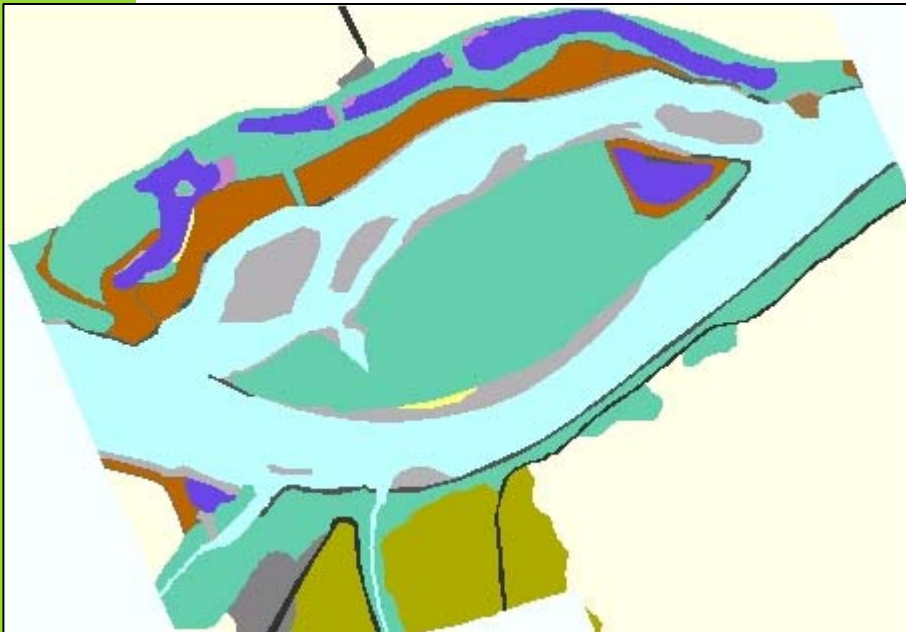
# CONCLUSION I

- Both unsuitable for longstanding Tamarisk
- Scenario 1: excess of disturbance
- Scenario 2: excess of concurrence
- Tamarisk hardly can survive
- Ecological functionality is limited

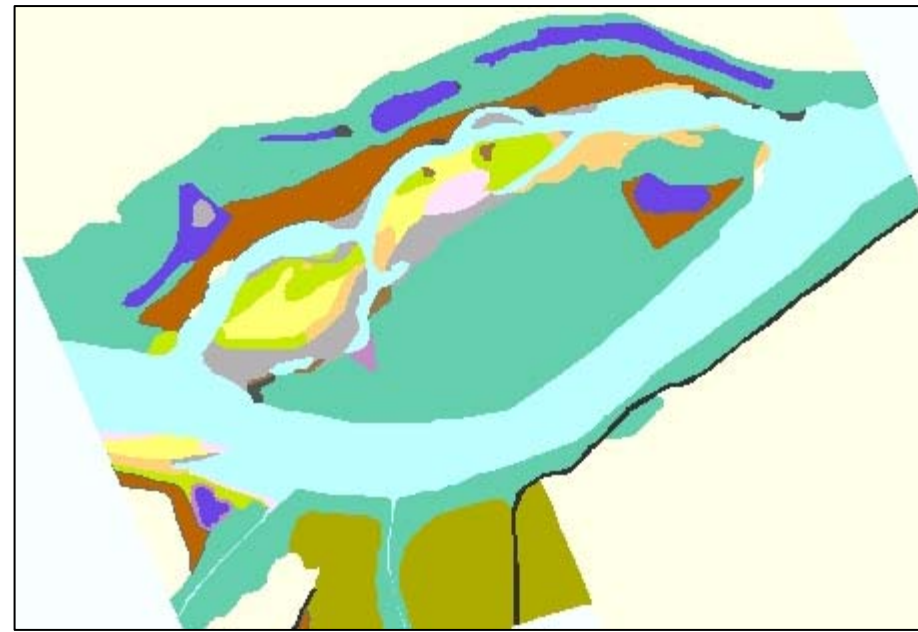


# CONCLUSIONS II

- Model results confirm observed trend
- Uncertainties: sediment transport & bank erosion effects

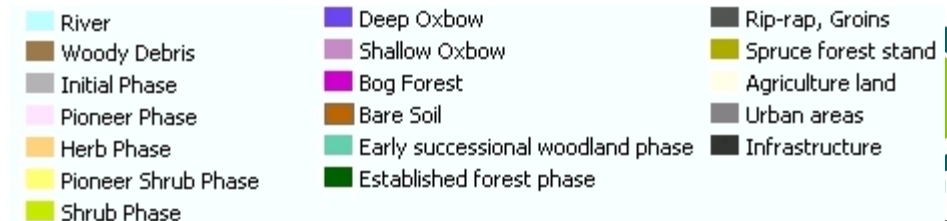


Mapped vegetation 2003



Mapped Vegetation 2010

Legend:



# ADAPTIVE MANAGEMENT: CONCLUSIONS FOR WATER MANAGERS

