

Relating water quality to river resources – developing indicators

Mississippi Makeover
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What indicators would be meaningful to you in noticing improvements in the health of the Mississippi River?

Why establish indicators?



Turbidity

A measurement of
water clarity



Turbidity and sediment are directly related



**Low turbidity =
clear water**



**High turbidity =
muddy water**



Low turbidity (clear water)



Sunlight penetrates to bottom promoting diverse and abundant aquatic vegetation

Abundant vegetation and low sedimentation rates provide healthy invertebrate populations

Abundant vegetation and invertebrates provide food for waterfowl, furbearers, and other wildlife

Abundant vegetation and invertebrates provide food and nursery habitat for fish

High turbidity (muddy water)



Little vegetation due to low light penetration and high suspended sediment

Fewer and only pollution tolerant invertebrates due to poor dissolved oxygen and excessive sediment

Fewer waterfowl due to lack of vegetation seeds and insects for food

Fewer species of fish due to lack of insects and poor spawning habitat

Once aquatic vegetation is lost it is difficult to get back without restoration

A healthy Mississippi River has:

- Clear water
- Diverse and abundant aquatic vegetation where bottom conditions and flow are suitable
- Diverse and abundant invertebrates
- Diversity of fish and wildlife species
- Resilience to disturbance

Recreational values provided by a healthy Mississippi River



- **Swimming**
- **Fishing**
- **Boating**
- **Wildlife watching**
- **Hunting**
- **Hiking**
- **Trapping**
- **Camping**

Economic values provided by a healthy Mississippi River

- Tourism
- Product sales
- Bait and commercial fishing
- Reduced costs for water treatment
- Reduced flood damages



Social and intrinsic values provided by a healthy Mississippi River



- Clean drinking water
- Invasive species control
- Aesthetics
- Public access and use



Other restoration efforts have developed indicators that are:

- **Valued**
- **Visible**
- **Verifiable**

So everyone can benefit from them; see them personally; and understand progress towards them.

Selecting indicators based on river science – two examples

High turbidity, poor vegetation



Increase vegetation using summer water level drawdowns to expose sediment and germinate plants



Sediments dry & oxidize, dormant seeds germinate, plants emerge



Vegetation collects sediments and improves water clarity ...



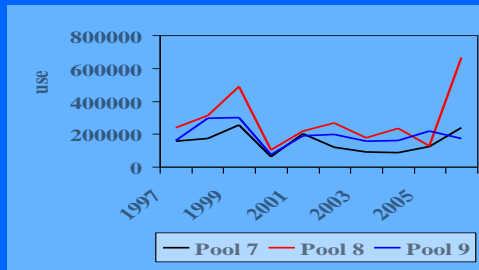
Swans eat vegetation ...



Clear water helps vegetation persist ...



Swans numbers increase



Bird watchers vacation near swans



Tourism \$\$ increase

High sediment deposition – will fill Lake Pepin in 300 years



Reduce sediment by repairing gullies along Minnesota River tributaries



Reduced sediment loading to the Mississippi River



Providing recreation for 1,000 years



Lake Pepin's life expectancy increases



Scientists currently monitor:

- Water quality
- Vegetation
- Fish
- Mussels
- Invertebrates
- Birds
- Mammals
- Amphibians
- Rate of filling (sedimentation)
- Algae blooms

Some indicators we can influence directly, others have outside influences

Indicators tracked by Long Term Resource Monitoring Program

- Water quality
 - clarity, dissolved oxygen, temperature, nutrients
- Vegetation
 - number of species, percent coverage, density
- Fish
 - number of species, catch per unit of effort, size distribution

Once broad indicators are selected:

- Determine current status of important measurements (number of species, percent coverage, etc)
- Decide on desired future conditions (objectives) for each measurement
- Develop a monitoring program to measure and report progress
- Adjust actions/indicators as needed

EXAMPLE - Current status of Indicators

Indicator	Lake Pepin's life span (yrs)	Secchi (ft)	# of species	Veg quality index	use days	#/angler hour
Sedimentation	300					
Water clarity		1				
Aquatic vegetation			5	11		
Migratory birds - Tundra Swans					1800	
Fish - Lake Sturgeon						0.1

Desired future status of Indicators – example objectives

Indicator	Lake Pepin's life span (yrs)	Secchi (ft)	# of species	Veg quality index	use days	#/angler hour
Sedimentation	1,500					
Water clarity		6				
Aquatic vegetation			15	17		
Migratory birds - Tundra Swans					60,000	
Fish - Lake Sturgeon						0.5

What indicators would be meaningful to you in noticing improvements in the health of the Mississippi River?