Endangered? The Scenic St. Croix River: A Case Study in Water Stewardship

by
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Photo by John Runk; Minnesota Historical Society. Used with permission.

Introduction

Approaching their home mailbox, Sara discovered two large publications protruding. One of them featured an aerial view of the scenic St. Croix River. Its headline boldly stated: **The Megabridge Is Not Wild and Scenic!** Remembering some mention in the news of the need for a new bridge on the St. Croix River, Sara was surprised by the controversial nature of the headline. A quote accompanied the photo:

> *It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved...*; as declared by the National Wild and Scenic Rivers Act, October, 1968.

The headline of the other publication proclaimed: **The Alien Invasion: Our Watershed is Under Attack.** Garlic mustard, spotted knapweed, the mute swan, purple loosetrife, rusty crawfish, and the zebra mussel, all exotic species, had invaded the St. Croix River Watershed. Of particular interest to Sara was a paragraph describing boats as the method of dispersal for the zebra mussel. Her family owned a marina on the St. Croix River. Reading further, she learned that there were other water quality impacts caused by habitat destruction from the growing population of the Twin Cities (St. Paul and Minneapolis) in Minnesota.

Sara's head was swimming. The articles all kept referring to water quality. Was her beloved St. Croix River in trouble? As a National Scenic Riverway, wasn't the river protected by the federal government? If a bridge were needed, wouldn't they have to build one? What did "exotic species" and "habitat destruction" mean? Were boats hurting the river? What else about the St. Croix didn't she know? This threat seemed real and she was nervous. What could she do? She didn't know anything about water quality.

As a junior in the College of Natural Resources at the local university, Sara had just begun classes in her water resources area of focus. Growing up with the St. Croix River as her backyard, she felt a sense of stewardship for the river. As a child, her moods seemed to be reflected in its changing dynamics. An active

child, her parents had channeled her energy outdoors. Long, hot summers she had collected bugs and stones along the river's edge. The brilliant fall colors of the aspen, sugar maple, and red and white oak trees framing the river had given her a last surge of energy before the dark serentiy of winter closed in. With snow melt the river gushed over its banks, cleansing away the debris from the long and cold Minnesota winters. If her river was in danger, she had to do something to protect it.

Sara hurried to her computer and started a search scanning web sites that discussed water quality. She learned that water quality monitoring tests the health of a water system, but she was uncertain what steps she should take to do that. Could she personally find out the health of her river?

The next day at school, she tracked down Dr. Muir, a Water Resources instructor, and asked her her opinion of the situation. Dr. Muir suggested she contact the Wisconsin and Minnesota Departments of Natural Resources, the local National Park Service governing the St. Croix, and the Minnesota Pollution Control Agency to explore ways of getting involved. Anticipating a large amount of work, Dr. Muir offered to give her credits as a special project, depending upon the amount of time Sara wished to contribute. With a few phone calls, Sara discovered there were numerous water quality citizen monitoring efforts in Minnesota, but none on the St. Croix River. Excited, she decided to organize a monitoring effort on the St. Croix.

Over the weekend, Sara read extensively about water quality issues. Frowning, she found startling information. Regulating boating traffic had been targeted as the primary prevention of the spread of zebra mussels. What would these rules mean for her parents' business? Reading on, she was somewhat relieved, yet even more perplexed, to find that nutrients coming from the tributaries were another threat according to the regulatory agencies. With the amount of issues involved, she knew she needed help. Distributing a flyer, she announced her intention of creating a Citizen Scientist Task Force to Save the St. Croix, which she called CSSC (Citizens Save the St. Croix). A date for the first meeting was scheduled. Motivated by the recent publications in the mail, a large group attended.

Section Scenarios

There are three sections associated with this case study, with an optional fourth section, all of which relate to water quality and the St. Croix River:

- **Section One** - History and regulatory authority of the St. Croix River
- **Section Two** - Water quality issues
- **Section Three** - Environmental decision making
- **Section Four** - Biomonitoring (optional)

As you work through these sections over the course of the semester you will learn about (and actually get to practice) water quality decision making. In **Section One**, you will gain knowledge about the resource (the St. Croix River) and the stakeholders (i.e., those involved in the decision making and those affected by the decision). **Section Two** will introduce you to four water quality issues of concern to the decision makers. In **Section Three**, a decision making model is presented that you will use to systematically arrive at an action plan. **Section Four** describes the importance of biomonitoring in water quality. Each section includes a group activity.

Case Study Questions

These questions are for students to discuss among themselves throughout the case as a means of directing their attention to the important components of the case. When we conclude the case, we will "revisit" these questions and discuss them together, as a class.

1. Why was the St. Croix River targeted in the articles in Sara's mailbox?
2. Is the water quality threat real or just publicity by the editors to promote their paper or cause?
3. How important are the water quality issues discussed? Do these issues cause problems that are immediate, temporary, or long term?
4. Do these water quality concerns affect the entire river or just a small area?
5. Is it important to have a model for decision making?
6. Who are the stakeholders? Why is it important for each stakeholder listed to be involved?
7. How can multiple uses of a water resource not degrade a river system?

Bibliography

Allen, T.F.H, Thomas W. Hoekstra. 1993. *Toward a Definition of Sustainability*. Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management. United States Department of Agriculture. Forest Service. Rocky Mountain Forest and Range Experiment Station. Fort Collings, Colorado. General Technical Report RM-247.

Gunderson, Lance H., C.S. Holling, and Stephen S. Light, ed. 1995. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. Columbia University Press, New York.

Karns, Bryon. (1998). 1998. *Zebra Mussel Response Plan. Final Report*. December 2, 1998. St. Croix National Scenic Riverway. National Park Services.

Kaszuba, Mike. (1998, April 14). Judge blocks new bridge over St. Croix. *St. Tribune*.

Minshall G.W. 1988. Stream ecosystem theory: a global perspective. *Journal of the North American Benthological Society* 7:263-288.

Perry, J., E. Vanderklein. 1996. *Water Quality of a Natural Resource*. Blackwell Science. Cambridge, MA.

Perry, J.A., S. Anderson, P. Davis and J. Bryson. 1997. A Team-Based Approach to Graduate Education. In Strachan, P and B. Clark (eds). *Managing Green Teams*. Greenleaf Publishing. Sheffield, United Kingdom. Chapter 3: 48-60.

Rittel, H.W.J. and M.M. Webber. 1973. Dilemmas in General Theory of Planning. *Policy Sciences* 4: 155-169.

St. Croix Interagency Basin Team. 1998. *Monitoring & Project Plan*. Metropolitan Council, Minnesota Pollution Control Agency, Minnesota-Wisconsin Boundary Area Commission, U.S. National Park Service, U.S. Geological Survey, Wisconsin Department of Natural Resources, Minnesota Department of Agriculture, Minnesota Department of Natural Resources, University of Minnesota. Agency publication in process.

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Endangered? The Scenic St. Croix River: A Case Study in Water Stewardship

Section One - The History of the St. Croix

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(Adapted from an interagency report drafted by Pam Davis and Rita O'Connell. St. Croix Interagency Basin Team. 1998. Monitoring & Project Plan. Metropolitan Council, Minnesota Pollution Control Agency, Minnesota-Wisconsin Boundary Area Commission, U.S. National Park Service, U.S. Geological Survey, Wisconsin Department of Natural Resources, Minnesota Department of Agriculture, Minnesota Department of Natural Resources, University of Minnesota. Agency publication in process.)

Map by Pamela Locke Davis; web version by Jim Stamos

The history of the St. Croix River mirrors the development of the states of Minnesota and Wisconsin. Native Americans utilized its ecosystem for food and medicine and the water for transportation. This scenic waterway, meandering through picturesque bluffs, hardwoods and floodplain communities and prairies, provided the vehicle for removing timber from the original great white pine stands. The river crosses three major ecoregions and provides protection for a rich riparian zone, originating in a region of northern spruce and pine and flowing southwesterly through hardwood forests and prairie, eventually joining the Mississippi River. The river supports numerous fish species, beaver, muskrat, and otters. Eagles, osprey, and ducks nest along the river. Insects, 41 species of fresh water mussels, and hundreds of other species of plants and animals make the St. Croix their home.

During the 1950s and '60s, a burgeoning population from the Twin Cities continued to push for development and increased recreational usage of the St. Croix River. Worried that continued urban stressors would put the natural resources of the watershed at risk, concerned citizens and politicians pushed for the St.

Croix to be included in the original National Wild and Scenic Rivers Act. The St. Croix National Scenic Riverway (SCNSR), which includes the Namekagon River and the upper portion of the St. Croix, was established as part of that original Act in 1968. The Lower St. Croix National Scenic Riverway was added in 1972.

This park is one of the most biologically diverse national parks of the Midwest. Together the Upper and Lower St. Croix flow 154 miles from its origin at St. Croix Lake near Solon Springs, Wisconsin, until it joins the Mississippi River at Prescott, Wisconsin. Approximately 80% (129 miles) of the St. Croix River forms part of the boundary between Wisconsin and Minnesota. The upper 20% of the river is entirely within Wisconsin. Due to the river's location and federal designation, multiple agencies manage the St. Croix. From its source in Wisconsin to the northern boundary of Stillwater, Minnesota, the National Park Service has regulatory authority along the mainstem of the St. Croix. From Stillwater to the mouth, near Prescott, the Wisconsin Department of Natural Resources and the Minnesota Department of Resources share joint powers along the mainstem. In addition, there are many counties, cities, and townships along the mainstem and within the watershed which, along with other Wisconsin and Minnesota state agencies, have varying levels of management and regulatory authority.

Regulated designated values to the river:

Riverine Designation	**Authority**	**Area of the river covered**
National Wild and Scenic River	National Park Service	From its source in Wisconsin to northern Stillwater
	Wisconsin Department of Natural Resources	From Stillwater to its mouth at Prescott, Wisconsin side
	Minnesota Department of Natural Resources	From Stillwater to its mouth at Prescott, Minnesota side
Outstanding resource value	State of Minnesota	Entire St. Croix River and the tributary Kettle River
	State of Wisconsin	A. From the source to the northern border of the city of St. Croix Falls B. From Osceola to Hudson C. The tributary Namekagon River
Exceptional resource value	State of Wisconsin	From St. Croix Falls to Osceola

Under Minnesota Law, "Outstanding Resource Value Water" designation means that no new or expanded discharge of any sewage, industrial waste, or other waste is allowed unless there is not a prudent and feasible alternative to the discharge, and if allowed, the discharge shall be restricted to the extent necessary to preserve the existing high quality, or to preserve the wilderness, scientific, recreational, or other special characteristics that make the water an outstanding resource value water. In addition, new or expanded discharges to waters that flow into outstanding resource value waters are to be controlled so as to assure no deterioration in the quality of the downstream outstanding resource value water. Under Wisconsin Law, any new or increased discharge to an "Outstanding Resource Value Water" would have to match the background quality (i.e., river water to which effluent is being discharged) of the river. Any new or increased discharge to an "Exceptional Resource Value Water" would have to match the background quality of the river, unless there are compelling environmental, public health, social, or economic reasons to meet lower standards for sustaining fish and aquatic life.

Section One Group Activity

This activity focuses on the complexity of the decision making process with multi-regulatory authorities and the opportunities and challenges that arise as a consequence. Rivers commonly are borders between states and between countries. An understanding of this regulatory overlap lays a foundation for the importance of including all stakeholders in the decision making process and the challenges of regulating water resources.

Goals

- To gain an understanding of the complexity and sometimes conflicting interests of stakeholders.
- To construct a role for water stewards (i.e., concerned citizens) in water resource protection.

Activity (40 minutes)

5 minutes to read Section One, above
10 minutes to write the necessary information on the map
15 minutes to discuss and answer the following questions
10-25 minutes to report findings to the larger group (depending on the number of small groups)

Questions

1. The St. Croix is a multi-regulated river. On the map provided of the St. Croix indicate:

    a. Which areas are regulated by the federal government
    b. Which areas are regulated by the two state governments
    c. Indicate the area covered by each regulation

        Example: To what geographic area does Minnesota's Outstanding Resource Value apply?

2. Discuss and record several benefits and challenges that arise from this division of power with regard to water quality.

- Within your group, decide on one benefit and one challenge that might be of particular concern to the larger group.

3. Where can a citizen group fit into this regulatory structure? Discuss and record several benefits and challenges of a citizen effort.

    - Decide on one benefit and one challenge of a citizen-led effort to present to the larger group.

At the end of the 30 minutes, the recorder for your group will write the answers to questions 2 and 3 on the board (or overhead). Then, as part of a larger class discussion, each reporter will explain to the class the reasons for his or her group's answers.

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Section Two - Water Quality Issues



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Endangered? The Scenic St. Croix River: A Case Study in Water Stewardship

Section Two - Water Quality Issues

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Perhaps one of the most crucial issues facing the world as it enters the third millennium is increasing water scarcity and degradation of water quality. What has changed over time is the absolute availability per capita. All regions of the world have seen availability decrease with increasing population. No body of water can support all the different uses without suffering some degree of degradation. Four water quality concerns for the St. Croix River have been targeted for our involvement. Each issue is identified below, followed by a brief description.

1. Building a new bridge
2. Exotic species: focusing on the zebra mussel
3. Nutrient loading from the tributaries
4. Large woody debris buildup

1. Building a New Bridge

In the spring of 1998, a federal judge ruled that the proposed plan of a $100 million freeway-style bridge across the St. Croix River would have a detrimental effect "...on the recreational value of the river..." (Kaszuba, 1998). Until recently, bridges weren't viewed by the federal government as a water resource project. The proposed bridge would replace a deteriorating historic bridge in downtown Stillwater, a Minnesota landmark since 1931. The population growth has caused traffic jams as cars enter and exit the outdated bridge. A fierce battle over the construction of a replacement bridge has been going on for 15 years. Some of the arguments against bridge construction include concerns of increased urban sprawl and the damage bridge construction would have on the river's ecology and aesthetic and recreational value. Another freeway bridge (Interstate Highway 94), located approximately eight miles south of Stillwater, was completed in 1995, replacing two other antiquated and overburdened structures.

2. Spread of the Zebra Mussel

Non-native organisms can become biological pollutants when they establish themselves and gain a competitive advantage over the native species. Frequently introduced species simply die out. On occasion, the new species finds conditions conducive to growth and outcompetes the native species. Often non-native species are introduced through boat transport. Zebra mussels (*Dreissena polymorpha*) present a particular problem due to their rapid reproductive rate. A female reaches sexual maturity within a year and produces up to one million eggs per season. In the larval stage (veligers), they float about finding something upon which to attach. Boats are a frequent target, transporting the mussels to new locations. Zebra mussels can

attach to native mussels. Covering the native shell with several layers of zebra mussels makes it difficult for the native to survive. Having extended its habitat throughout the length of the Mississippi River, which is at the mouth of the St. Croix River, the zebra mussel represents a threat to the St. Croix River. In 1995 the federal park service created a check point at the Arcola Sand Bar restricting boat passage north based on inspection stickers and special permits. During the summer of 1998, the park service found 64 adult zebra mussels attached to boat hulls on the lower St. Croix River (Karns, 1998).

3. Nutrient Loading from the Tributaries

(adapted from an interagency report drafted by Davis and O'Connell, 1998)

Water in the Upper St. Croix has maintained a relatively high quality since National Scenic Riverway designation. Activities in the tributaries and their watersheds of the SCNSR are affecting the water quality. Development and recreational uses from the expanding Minneapolis-Saint Paul Metropolitan Area are putting pressure on the Lower St. Croix. The sometimes conflicting uses are threatening the value of the St. Croix's National Scenic Riverway designation and its outstanding resource value. According to the Water Resources Management Plan for the St. Croix National Scenic Riverway, which was created by the managing agencies and other stakeholders, the impact of tributary nutrient loads on the river poses a top threat to water quality.

Increased levels of nitrogen and phosphorus above the levels needed for natural growth can cause problems for plants and animals, and can be toxic to humans. Nitrogen and phosphorus enter streams from various sources:

- through runoff of fertilizers, livestock wastes, and soil erosion
- municipal and industrial wastewater treatment facilities and livestock feedlots
- precipitation and ground-water inflow

Early theory believed nutrients within rivers were not usually a problem, because residence time is so short that nutrients flow through the system too quickly for algae blooms and other local impacts to occur, except perhaps in backwater channels (Minshall, 1988). Research is beginning to show, however, that this is not always the case. In the St. Croix River, the riverine nature is further complicated by the human-built and natural impoundments on the lower end of the river. Both the dam-impounded reservoir at St. Croix Falls and the in-large-part natural impoundment of Lake St. Croix (impacted by the downstream Mississippi River dam at Red Wing) are quite lake-like in nature and, as such, are vulnerable to build-ups of nutrients in the water column and sediments. In a basin such as the St. Croix, it may very well be the case that increased nutrients do not cause a problem in a subwatershed, but do cause a problem when those nutrients reach Lake St. Croix. An extreme example of such a scenario is the "dead zone" in the Gulf of Mexico, credited in part to the impact of high levels of nitrogen being discharged from the Mississippi River, of which the St. Croix is a tributary. The dead zone refers to an area so polluted by nitrates and devoid of oxygen it no longer sustains aquatic life for most of the year. In the Gulf of Mexico the dead zone extends 7,700 square miles.

The extent of the perception of a nutrient problem is broadening. Recent public concern arose over the lack of phosphorus limits on expanded discharges proposed for the Minnesota cities of Rush City and Hinckley wastewater treatment facilities. The St. Croix Interagency Water Resources Management team has already recognized this concern and recommended that an interim goal of "no net increase" in nutrients be instituted in the basin until monitoring efforts provide data to allow more specific goal-setting.

Although nutrients are not the only contaminant of potential concern in the St. Croix watershed, their

presence is often associated with excess sediment loads. Increases or decreases in sediment loads can change physical aspects of the river, thus causing alterations in the biological community and perceptions of water quality.

4. Large Woody Debris Buildup

Large woody debris (LWD) piles consist of logs, branches, and sticks that fall into the water and remain at a location. LWD piles create a substrate for aquatic invertebrates and a cover for fish, provide energy flow and nutrient cycling, and influence soil and sediment transport. In many large rivers, such as the St. Croix, debris piles may provide the only stable substrate for invertebrates and algae to colonize. Channel morphology is influenced by the creation of pools below LWD. Historically, LWD piles were eliminated to suit the needs of the timber industry to transport logs downstream. Recreational users cleared obstructive pieces of wood, often referred to as "snags." Piles of wood in the streams and rivers were regarded as a nuisance and their elimination was the general management policy. Currently within the St. Croix River, piles of wood are left in place unless safety becomes an issue.

After the spring of 1999 snow melt and accompanying high water levels, boaters using a popular boat ramp had complained of woody debris impeding ramp access. Water resource managers were reluctant to remove the woody debris, since along that stretch of river the wood piles were the primary substrate for invertebrates. Yet this particular boating club had been the most supportive and helpful in the implementation of the boat permitting policy with the zebra mussel. Members of the club had even volunteered weekend hours to educate the public at the educational center.

Section Two Group Activity

Humans have different values for a resource. From these values stem uses. For example, a community may value a natural resource for its aesthetic value and tourist trade. To protect these values, management of the river could be directed to protect boating, fishing, swimming, and river hiking. Use of a river causes some impact; multiple uses cause further degradation.

To understand the impact of different uses on a river, the natural processes at risk need to be examined. Natural processes operate over a wide range of space and time (ie., temporal and spatial scales). A manager's scale of interest determines what information is needed and which questions are asked in regards to long-term sustainability of the resource. Spatial scales can range from microhabitat to global. For example, if one was concerned about the feeding habits of a single organism, its microhabitat would be studied. If one was concerned about changes in the ozone layer, one would need to study it on a global scale.

The following activity analyzes the scale of the water quality issues mentioned to understand the extent of the water quality impact from various uses.

Goals

- To explore water quality impacts from various uses.
- To evaluate the scale of concern from various uses.

Activity (35 minutes)

5 minutes to read Section Two, above
20 minutes to discuss and answer the following questions
10 minutes to report findings to the larger group

Questions

1. Water quality issues

    a. List the water quality concerns for each issue.
    b. How does each concern effect water quality?

2. Scale

    a. What temporal and spatial scale does each issue address?
    b. Based on the scale of each issue, where can we be most effective as citizens?

3. Assistance

    a. Do we need wider support?
    b. From whom can we get support?

4. Decide which issue you would like the CSSC to address and why.

At the end of the 25 minutes, the recorder for your group will write the answer to question 4 on the board or overhead. Then, as part of a larger class discussion, each reporter will explain to the class the reasons for his or her group's answer. This will be followed by each group voting on which issue to address.

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Section Three - Environmental Decision Making



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Endangered? The Scenic St. Croix River: A Case Study in Water Stewardship

Section Three - Environmental Decision Making

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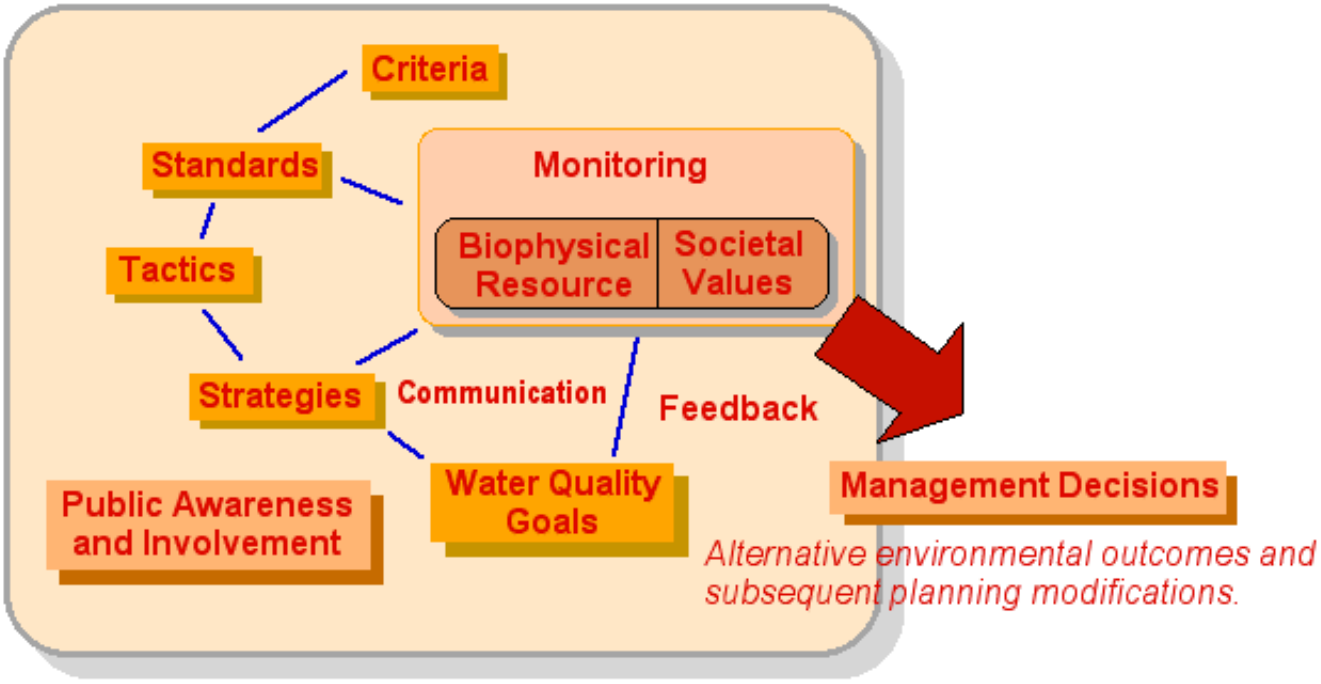
Environmental issues, such as water quality protection, don't lend themselves to easy, single discipline based answers; they are messy, complex and emotionally laden. Effective watershed management involves multiple agencies sustainably managing multiple uses. To include all of these variables, a decision-making process needs to be followed that clearly defines the values of the decision makers and the goals of society. Feedback mechanisms are necessary at every level to adjust/modify the goals and policies, and interpret/monitor the impact of management's actions on the resource. To be sustainable, watershed management has to include effective communication pathways with all stakeholders and the public.

Figure 1: Interactive Decision Making Model
(modified by the author from Perry and Vanderklein,*Water Quality: Management of a Natural Resource*, 1996
Redrawn for the web by Jim Stamos, Biological Sciences Department, University at Buffalo)



The model in figure 1 is useful as a guide to environmental decision-making, where often getting one's way is deemed more important than the resource needing protection (Gunderson, 1995). Value systems of the managers and stakeholders influence interpretation of data and definitions of the goals. For example, acid rain can increase the clarity of a lake, making it aesthetically pleasing, but in the process killing certain organisms. Most environmental problems can be articulated in numerous ways; different stakeholders have varied agendas and conflicting expectations, and often the choice of evaluation determines the solution. Messy problems often are too generalized or too narrowly defined, with unclear objectives.

Definition of Terms of the Interactive Decision Making Model

- *Goals*: Broadly defined: used to introduce laws and policies
- *Policies:* More specific: define how a goal will be accomplished.
- *Objectives*: More quantitative, short term, and specific; components necessary to achieve policy.
- *Strategies*: Planning approaches to achieve objectives.
- *Tactics*: Specific action to achieve a strategy.

Application of the Interactive Decision Making Model

Example: Development is threatening the trout population of Running Creek. The state government wants to designate this stream a trout stream to ensure a sustaining trout population, which would require controls on development. Government officials knew this was a volatile issue in this growing community and wanted to get as much input as possible from all stakeholders and keep the public aware of what was going on.

Societal values: A public information notice was sent to private homes and businesses in the area announcing three meetings to start discussion of the task at hand. During these meetings, the initial discussion centered on the value this creek held to everyone. Some of those items mentioned were the natural aesthetics of the area, fishing, property values, and business growth. Agreement was made to focus on the aesthetic value by way of protecting the fish habitat since it was the natural beauty of the area that had initially drawn development interest.

Biophysical resource: A study was made of the creek to determine if the creek could support a trout population, and what biological and physical conditions would have to be maintained. If the creek (i.e., the water resource) couldn't support a sustainable trout population, then the goals would have to be changed.

Communication and feedback: Throughout the decision making process, the newspapers continually carried the story of what was happening. Stakeholders were encouraged to appear at local events and talk on the radio about the situation and the progress being made. Public meetings were held monthly to give those involved an opportunity to express their interest and concerns.

Water quality goal: The decision was made to protect the condition of the creek necessary to maintain a sustainable trout population.

Policies, objectives, and strategies: A policy was established that a riparian buffer of 100 feet would be maintained around the creek to maintain the shading necessary for cooler water temperatures (a trout requirement) and filter nutrients from the land use activities. Next, objectives were established such that would ensure compliance of the riparian zone buffer. One of the objectives stated "establish a location where a permit could be secured for development based on a review of the building plans and follow up through visits at the construction site." A strategy to meet the objective was to ensure staffing for the permitting process.

Another policy was determined to develop a monitoring program for the creek, followed with objectives and strategies.

Tactics: Tactics are specific actions to achieve the strategies. For example, a tactic was to hire and train staff as well as citizen volunteers for the monitoring program.

Standards and criteria: A standard for the water temperature was established at a range between 17-22 degrees C. Criteria for the standard were based on temperatures suitable for the Brown Trout.

Monitoring: A monitoring program was established with agency personnel and citizen volunteers to test the water conditions and trout habitat. A monitoring program had been in effect prior to the decision-making process and now citizens were organized to assist. The stakeholders were constantly updated as to the results of the monitoring to ensure that the goals were being met.

Section Three Group Activity

Sara explained to the people who had come to the meeting that the CSSC was her first experience in group decision-making and in leading a group. She was worried that the decisions they were making and the decisions of the St. Croix managers were not motivated by what was best for the water quality of the river. Sara wondered how her values, and the values of the other citizens and stakeholders, might affect their decisions.

Goals

- To follow a model for more effective decision making.
- To understand the effect of personal values when making decisions.
- To engage in a decision-making process that emphasizes the importance of feedback and communication.

Activity (45 minutes)

Based on the water quality issue agreed upon in Section Two, follow the interactive decision making model shown above in figure1 to plan a course of action. Remember that feedback and communication is important at every step.

Questions

1. In small groups, using the issue agreed upon from Section Two, develop an interactive decision making model identifying:
    - The components of the resource that are of concern
    - What values society has for this resource
    - Goal
    - Policies
    - Objectives
    - Strategies
    - Tactics
    - Feedback mechanisms at each step
    - Communication program to inform interested/involved individuals
    - Public awareness and involvement campaign
    - Monitoring program:
        1. What will be monitored?
        2. Why is it being monitored?

3. Where are the monitoring sites?
4. Why were these sites chosen?
5. What will be done with the results?

2. How do you value the St. Croix River?

3. What values might other stakeholders have towards the river?

    - Discuss and indicate where conflicts may arise.

4. How might these conflicts be resolved?

Create your model and write out your answers to the questions above on the paper that will be collected at the end of class.

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Section Four - Biomonitoring



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Section Four - Biomonitoring

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Monitoring a water resource identifies its biological, physical, and chemical conditions. Comparing these measurements to established water quality criteria can assist in determining the health of the river. Monitoring before, during, and after an event(s) affecting water quality can determine the effect of the event on water quality.

In addition to gathering samples for biological, physical, and chemical analysis of a river, citizens add another important element. If citizens perceive the water as degraded, this perception will impact how they feel about the water quality and its suitability for various uses. Often a visual assessment of the river is included in monitoring, such as the items "physical condition" and "recreational suitability" listed below, to relate perception with actual data analysis.

Section Four Group Activity

Sara decided that they needed to collect data on the current state of the water quality of the St. Croix River. The day before the meeting, Sara completed a visual assessment and took a water sample of the river from behind her house. A nearby research lab had volunteered to analyze the sample. At the end of the meeting, Sara distributed the following data and asked the group to research its significance in terms of water quality. For example, does 0.07 mg/l of phosphorus mean there is too much phosphorus, and what significance does phosphorus have in water quality? At the next meeting, they would discuss the results and determine their agenda.

Variable	Data
Secchi transparency depth (meters)	1.37
Total phosphorus (mg/l)	0.07
Physical condition	1 = crystal clear
Recreational suitability	2 = very minor aesthetic problems
Wind	Calm
Water surface	Ripple
Cloud cover	100%
Water level	Above normal

Air temperature (C)	22 degrees
Water temperature (C)	18 degrees
Dissolved oxygen (percent saturation)	70%
Velocity (m/sec)	0.0
Invertebrates	% of invertebrates collected: Diptera = 85% Ephemeroptera = 3% Trichoptera = 6% Arachnida = 1% Coleoptera = 3% Crustaceans = 1% Mollusca = 1%

Keywords: water quality, exotic species, zebra mussel, scale, decision making, environment

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Endangered? The Scenic St. Croix River: A Case Study in Water Stewardship

Conclusion

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The entire class will discuss the process in which they have been involved during the course of this case study. Comments will be are recorded on an overhead to be copied and made available for distribution.

Group Discussion Questions:

1. Why did Sara initially organize a CSSC meeting? What were her interests?
2. Why does the water quality of the St. Croix River seem to be in jeopardy?
3. Can a multi-regulated river with multiple uses be protected from further degradation? How?
4. What water quality issues need to be addressed first and why?
5. What is the purpose of using a model in environmental decision making? Is the interactive decision making model effective? Why or why not?
6. What will happen to the St. Croix River? Do you know other rivers that are at risk for water quality degradation?



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