Chapter 1

The Global Rivers Environmental Education Network and the Case of the Rouge River in Detroit, Michigan

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The roots of the Interactive Rouge River Water Quality Monitoring Project began on the Huron River and Huron High School in Ann Arbor, Michigan. In the Spring of 1984, William Stapp and Mark Mitchell approached a science teacher at Huron High School about a river project being developed at the University of Michigan, School of Natural Resources. Huron High School was an ideal site for implementing a pilot water quality monitoring program because it lies near Gallup Park on the Huron River, and because students windsurfed at Gallup Park and jumped from its bridges. There had been reports of windsurfers getting ear infections and diarrhea; at least one individual reported getting hepatitis "A". All of these illnesses could be linked to the water quality at Gallup Park.

Science classes learned how to safely and accurately run nine water quality tests that constitute the National Sanitation Foundation's

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Water Quality Index (NSF, WQI). These nine tests include: dissolved oxygen, fecal coliform, pH, biochemical oxygen demand, temperature, nitrates, total phosphates, turbidity, and total solids. Of these nine tests, fecal coliform was the most revealing in regard to public health concerns of students. Fecal coliform bacteria are found in the intestinal tract of warm-blooded animals, including humans. These bacteria are used as indicators for the probability of contracting waterborne pathogens that cause hepatitis "A", dysentery, and gastroenteritis. Based on Environmental Protection Agency (EPA) studies, the government has set a standard of 200 fecal coliform colonies/100 ml of water for total body contact, such as swimming (and for most people, windsurfing).

Through the water quality monitoring program, students measured levels of 1,500-4,500 fecal coliform colonies/100 ml of water—many times higher than acceptable levels for total body contact.

Students discovered that storm sewers upriver from Gallup Park were implicated as the primary source of fecal coliform bacteria. In response to information-gathering by students and their fecal coliform data, students began to compose letters of concern to the Ann Arbor News, to City Council, to the County Health Department, and to the Ann Arbor Parks and Recreation Department. The result of student efforts, citizen response, and a School of Public Health study was the erection of a sign at Gallup Park warning the public not to windsurf after rains.

In 1985, the project spread downriver to Belleville High School in Belleville, Michigan. Here students in Ecology class were eager to monitor Belleville Lake—a focus of recreation, especially water skiing and fishing. This impoundment of the Huron River had been closed twice to recreation in the previous ten years because of high fecal coliform levels. An important development in the design of the program occurred when a group of Belleville High School students and a group of Huron High School students met to look at water quality data, and try to determine why water quality changed over this 13 mile (21 km) stretch of river.

In 1986, the project grew to include Dexter High School and Middle School in Dexter, Michigan upriver from Huron High School. Students and teachers from these schools, from Huron High School, and from Belleville High School met to share information, to systematically collect benthic macroinvertebrates as indicators of water quality, and to plot their combined data using a computer graphing program.

The experiences and insights gained in three years of work with science classes along the Huron River set the stage for work along the Rouge River. Over the past five years, many of our educational colleagues

have been involved in an effort to improve education and the environment in the Detroit metropolitan region—and to transfer this model to other national and international regions.

This chapter is directed at the planning, development, implementation, and evaluation of a water quality monitoring model that is presently being used and adapted in over 200 rivers in North America, and in over 50 nations on all continents.

1.1 The Rouge Project and Education

The Rouge River (Figure 1.1) was labeled an Area of Concern in 1985 by the International Joint Commission because it exhibited serious degradation for aquatic life, and for recreational use. To those who lived near the Rouge, it was a river of abandoned automobiles, discarded shopping carts, eroded river banks, mammoth log jams, raw sewage, and toxic sediments. The environmental urgency of these problems, and the need to educate young people and communities about these environmental problems, provided compelling reasons to apply the Huron River program to the Rouge.

In 1987, Friends of the Rouge (a non-profit citizens group) expressed an interest in bringing the Huron River monitoring program to the Rouge River. The same year, a Rouge River Advisory Group was formed to help guide the development of a school-based river monitoring program in the Detroit metropolitan area. Represented on this Advisory Group were teachers, curriculum coordinators, Friends of the Rouge, water resource professionals, and educators from the University of Michigan, School of Natural Resources. The group was instrumental in identifying a diverse group of interested teachers, in establishing some goals for the program, and in bringing forth potential constraints to consider in working with the educational systems of multiple school systems. The Rouge Project began with 16 high schools the first year, 32 schools the second year—projecting up to 55 schools in 1992.

The goals for the Rouge Project included:

- linking diverse schools and communities together—rural, suburban, and city—through the common thread of the Rouge River;
- providing a watershed focus and watershed-wide monitoring;
- developing an informed citizenry on the problems and potential solutions to Rouge River water quality;

Figure 1.1
The Rouge River watershed - includes 48 communities and 3 counties

- increasing student problem solving skills;
- providing an interdisciplinary focus (social, political, economic, and ecological); and,
- promoting student empowerment and action-taking.

Educational programs like the Rouge involve the union of content and process. In the Rouge Project, process is manifested in training workshops for teachers and students, in training sessions for University of Michigan resource people who assisted in the classroom and field, in the Bus Tour for teachers in the lower Rouge River area, in the two week monitoring program, and in the Student Congress. The scope and sequence of activities were designed with the project goals in mind and revolved around two key content areas—water quality monitoring and computer networking.

The workings of the two week monitoring program and the Student Congress provide an important window for examining the role of the teacher in this program, the impact of computers upon the learner, and the constraints that emerge from institutional realities and structural inequalities.

1.2 Two Week Monitoring Program

The two week program occurred during the first two weeks in May because it allowed trained University of Michigan graduate and undergraduate students an opportunity to serve as mentors to high school people and as facilitators of the program with teachers. Water quality monitoring also seemed to integrate well with the Ecology unit that many science teachers taught in May.

1.2.1 Day 1: Orientation to the watershed

Many science classes and some social study classes utilized the following educational material: slide program of the Rouge; videotape of the citizen cleanup effort; maps of the Rouge River watershed; and a Social Studies Sourcebook that detailed the history of the area. Social studies classes also began a 5-day role-playing, simulation game called the Community River Action Plan Game; developed as a Master's Project. The purpose was to provide a watershed focus to the project, to reflect on personal and community connections to the river, and to provide some background information about the nature of the watershed.

1.2.2 Days 2, 3 & 4: Building information gathering skills and practicing safe and accurate water quality testing

During these days, teachers, students, and University resource people practiced the water quality tests in the classroom before venturing to their monitoring site along the river (Mitchell and Stapp, 1991). Student teams became expert in at least one of the tests. There were nine water quality tests to learn: dissolved oxygen, fecal coliform, pH, biochemical oxygen demand, temperature, nitrates, total phosphates, turbidity, and total solids. These days were also used to help students access the computer network that linked schools together and permitted ongoing discussions with more than one school.

1.2.3 Day 5: Water monitoring day—at the river

Each school traveled to their monitoring site along the Rouge River. For some schools, this meant a walk to the back of the school property, for other schools a 25-minute bus ride across Detroit. This day was used to collect real-world information in the form of water quality data. Stream surveys were used to make physical observation of the stream bank, life in the river, adjacent land uses, and presence of sewers. Student teams ran their tests, and some of the tests involved further work back at the school.

Students were busy recording data as well. Here is a message about their monitoring site that students at Osborne High School (a Detroit Public School) entered into the computer network: *...bridge at this site with a sewer pipe under it. The water we saw was a green color. There was a lot of trash and we also saw a shopping cart. The current of the water was moving fast. The water seemed to get deeper as we moved further down. We also saw ducks and all sorts of insects. There were a lot of trees around which made it quite shady. The sides of the water were very muddy.*

1.2.4 Day 6: Determining a water quality index

Through mathematics, students took the raw data from the nine water quality tests and converted it to a single number—a Water Quality Index (WQI)—representing water quality (Brown et al., 1970). The higher this number, the better the water quality. Suburban schools, like

Walled Lake High School near the headwaters of the Middle Branch, derived numbers near 80 (indicating good water quality); while city schools monitoring below Dearborn near the lower reaches of the Main Branch derived numbers in the 40's (indicating poor water quality).

The raw water quality data and the calculated WQI was entered by students into the computer network to share with other schools.

1.2.5 Days 7 & 8: Gathering information from schools in the watershed, and computer graphing.

These days were spent pulling data off the computer network from other schools, and using graphing programs to graph each water quality test and/or the WQI's along each school's branch of the river. In this way students could begin to observe trends in water quality along the river, and to identify pollution problems.

1.2.6 Day 9: Building skills to identify and define problems and their sources

This day was devoted to brainstorming about possible water quality problems as reflected in the data and its sources. Students at Kettering High School in Detroit monitored just below the outfall of the largest combined sewer overflow—the Hubbell-Southfield drain. Their fecal coliform measurements ranged from 15,000 to 25,000 colonies/100 ml of water. These students identified this sewer as a public health concern based upon the Michigan fecal coliform standard of 200 colonies/100 ml of water for total body contact.

1.2.7 Days 10 & 11: Building skills to utilize information and developing action strategies

These days were spent clarifying the problem that students wanted to learn more about. Students asked these questions of each other: Who are the appropriate people to ask for more information? What agencies should know about this problem?

Some students used the Force Field Activity to help them problem solve by clarifying what they would like to do about the problem, what were the resources available to help them, what or who were some potential obstacles, and finally, what were some possible actions that

could be taken individually or as a group.

Students developed an action strategy, or recommendations for action as a group—this information was helpful to student representatives to the Student Congress. Novi High School (a suburban school) students placed this message on the computer network: *You can get a petition in your area and send it to your congressman. Some of us are going to take this to the Student Congress at Martin Luther King Jr. High School this weekend.*

Martin Luther King Jr. High School students placed this message on the computer network: *We are the host school of the Student Congress. We are looking forward to seeing all of you on Saturday, May 14, 1988. This will be an experience to remember! Will you be coming with water quality data? At our site there was a large culvert entering the river.*

1.3 Rouge River Student Congress

The Rouge River Student Congress is a culminating event for the Rouge Project. While some of the training workshops are held in suburban schools, the Rouge Student Congress is held at a city public school. On May 14, 1988 the Rouge Student Congress was held at Martin Luther King Jr. High School. Nearly 270 students, teachers, water resource professionals, and university resource people gathered at the school—a rare opportunity for European-American and African-American students and teachers to meet in search of solutions to a common problem, the loss of the Rouge River.

Students from 32 schools formed working groups to discuss water quality data at their sites, observations of land use, problem identification, and specific recommendations for solving shared problems along a particular river branch. Some of the student recommendations included:

- undertake Rouge River cleanup as a school project;
- raise awareness of younger students through education;
- organize their community to recycle/not pour oil down the storm drains; and,
- speak out at public hearings to protect natural river corridors.

Each student participated in skill-building workshops in the afternoon, ranging from street theater and writing editorials to community organizing and artwork as education. Students took control over the agenda of the day. As the day ended, students were charged with reporting back to their classes what had occurred at the Congress, and specific actions that other students could take.

1.4 Reflections on the Rouge Project

During the evolution of this project among Detroit area schools, it has been revealing to observe the points at which traditional pedagogy and institutional structures confront the alternative model of education presented by the Rouge Project. These points became most apparent through the changing role of the teacher in this program and the impact of computers upon the learning environment.

1.4.1 Role of the Teacher

The traditional role of teachers in most schools is one of a conveyor of accumulated past knowledge within the framework of a curriculum. In some ways, it is less threatening to “teach” from a textbook, and to follow a prescribed sequence of instruction than to facilitate a class of learners engaged in their own learning. This form of textbook-driven education has been called the banking/anti-dialogic form, because it treats student as receptacles into which the teacher makes deposits of information (Freire, 1970). This approach to education also regards students as largely passive and inactive.

The Rouge Project presented a problem posing/dialogic process to teachers and students participating in the Rouge Project. In this process, problems were posed about the environment—the Rouge River and its watershed—to teachers and students. Through this process of discovery, training, monitoring water quality, and sharing information, teachers and students moved towards becoming co-learners and co-investigators.

Furthermore, in the Rouge Project, students were encouraged to act upon water quality issues defined and refined by them. There were times when student and teacher action was discouraged by school administrators who were uncomfortable with controversy. A biology teacher of a wealthy suburban school was reprimanded by the school administration for speaking out and encouraging his students to speak out about a malfunctioning sewer pump station near the school.

1.4.2 Impact of Computers

When the Rouge Project began in 1987, it was considered to be the first educational endeavor in the nation involving computer conferencing for scientific, environment-related matters (Beebe, 1989).

Computers were used as tools or instruments in the Rouge Project. They could be used to store water quality data entered by students, to transform water quality data into more meaningful graphic forms, to share water quality data with decision-makers and with other students, and to serve as a network for sharing ideas, questions, and observations about the Rouge River.

During the first four years of the Rouge Project, the University of Michigan mainframe served as the host computer through a conferencing system called Confer II. Confer II also gave schools access to national and international networks.

The computer conference (or network) linked diverse students and teachers together. Through the computer network, divisions based upon class and race were blurred because students were interacting, through print on a screen, out of common concern and action for the Rouge River.

There has been research showing that computer conferencing softens traditional power structures. Traditional power structures are often dependent on nonverbal, subconscious aspects of communication, such as impressive offices, layers of screening by subordinates, or commanding body language (Beebe, 1989). The common ground of the network made it possible for students to ask questions of decision-makers from the Department of Public Works of Wayne County (where Detroit is located), or coordinators of the Rouge Remedial Action Plan with the Michigan Department of Natural Resources.

1.4.3 Institutional Constraints and Structural Inequalities

As presented earlier, the Rouge Project, because it did represent an alternative paradigm for education, often encountered constraints in its evolution which reflected the institutional nature of education. Of these constraints, the most visible and enduring was the pressure placed upon teachers to follow an established curriculum. This pressure is often manifested as a shortage of time to infuse alternative projects into the school calendar, and in a segmented view of education in which disciplines (each with their own curriculum) are taught separately. Some of the forces that drive curriculum are state learning objectives, standardized testing (like the Michigan Educational Assessment Program, MEAP), training orientation of teachers, and outside pressures for more testing and standardized curricula from those reacting to perceived crises in the country.

In most schools, even with the development of Social Studies material, opportunities for training, and encouragement from the organizers, the Rouge Project failed to remove disciplinary barriers,

Schools largely reflect the communities in which they are rooted. Fundamental inequalities exist in the way that local schools are funded—and not just in city schools, but also poorer suburban school districts. These inequalities were visible in the range of scientific equipment available to students, the availability of buses to take field trips, and even the size of classes.

Detroit, where the Rouge River Interactive Water Quality Monitoring Program is centered, is the largest city in the United States with an African-American majority. In 1970, 1.5 million people lived in Detroit, 44% of whom were African-American. Today the population is slightly over one million, and two-thirds are African-American. During the past twenty years, since the civil unrest of July 23, 1967, European-Americans have steadily moved to the suburbs, taking jobs, investments, and tax revenues with them. African-American income relative to European-American has declined and poverty has increased. Presently, 91% of the Detroit Public School students are of color. The 1987 census found 30% of African-American households in Detroit drawing public assistance and 35% living below the poverty line. The European-American exodus has been accompanied more recently by another movement out of the inner city, this one by members of the African-American middle class. In a recent assessment, Detroit Public School students scored below the national norm in seven of eight categories. Of all children entering the ninth grade in the Detroit Public Schools, 45% do not graduate from high school.

Jonathan Kozol's book, *Savage Inequalities*, states that public schools in most of the United States remain both segregated and unequal—and, in many cases are more segregated and less equal than in 1954.

In the Detroit metropolitan area, stark inequalities are seen in educational funding between more affluent suburban school districts and city schools. According to a Detroit Free Press survey in 1988, Detroit spent about \$3,600/year on each child's education; this is in contrast to spending of \$5,700/year/child in Grosse Pointe and \$6,400/year/child in Birmingham—both wealthy, suburban school districts (Kozol 1991).

The de facto segregation between city and suburban schools in the Detroit area has only grown more pronounced since the Supreme Court in the case *Milliken v. Bradley* (1974), overruled a U.S. District Court decision ordering a metropolitan desegregation plan (Kozol 1991).

Dr. Martin Luther King, Jr. would surely decry the separate and unequal state of education found in the Detroit area today. His message was of integration, not separation, of *the creation of a beloved community of blacks and whites working together for the good of all* (Cone 1991).

1.5 The Significance of this Project and Approach to Creative Ways of Educating Youth

The philosophy and practice of the Rouge Project can be identified by its following elements:

1. building bridges of understanding across race and class through shared problem solving about a common resource—the Rouge River;
2. focus upon forming an interdisciplinary understanding of the Rouge River and its problems;
3. students actively engaged in learning about community environmental problems;
4. teachers and students as co-learners and co-investigators;
5. development of problem-solving skills;
6. local and international focus;
7. union of theory and practice/thought and action; and
8. empowerment of young people.

Although the Rouge Project focuses upon the Rouge River as a community problem, the educational model followed in the Rouge could be adapted to other issues of importance to students.

Science for all Americans, written by the American Association for the Advancement of Science with the National Council on Science and Technology Education in 1990, tried to respond to *what should be the substance and character of education?* The report goes on to say that too many students are not being educated adequately, and education is failing the nation. There is no more urgent priority facing our nation than the reform of education.

The report makes a number of recommendations in an effort to try to improve American education. Some of the key recommendations to consider are:

- reduce the amount of material covered in schools, and focus on key ideas and concepts;
- weaken or eliminate boundaries between subject areas and become more interdisciplinary in our approach;

- direct more attention to the natural connections of material and to provide more relevance in education;
- teach by methodologies based on learning principles derived from current and well-researched literature, and emphasise curiosity and creativity;
- recognize that nations and cultures are becoming increasingly dependent on one another and that we must help students to see the relationship between local and international connections; and,
- place more attention on the learning needs of all children; and promote collaboration between administrators, teachers, parents, and students, as well as university faculty, business, labor, and political leaders.

In Michigan, some school districts undergoing educational reform have formed school-community committees to identify learning goals that students should acquire by the time they graduate. These learning goals transcend individual subject areas, emphasize the relationship between curriculum areas, and are designed to help students to:

- comprehend the nature of persistent social problems in the United States;
- demonstrate a respect for the dignity and inherent worth of the individual;
- understand and use effective techniques for dealing with interpersonal relationships;
- demonstrate attentive listening behavior and effective listening skills;
- engage critically and constructively in the oral exchange of ideas;
- gain an awareness that thinking skills form the core of the learning process;
- understand the principles and values which sustain democracy and develop the attitudes and skills for democratic participation in society;
- use rational, ethical, and humane processes for problem solving and decision making;
- identify community resources available to deal with issues and problems;
- develop sensitivity to possible social, political, economic, and ecological implications of current and projected

developments;

- recognize the dynamics of conflict and cooperation between and among groups;
- understand the concept of due process, and know the procedures and resources which are available to resolve conflicts;
- identify major trends, developments, and social changes which may have a significant impact on the future;
- be able to define a problem, collect information, record data, process information critically, draw appropriate conclusions and work toward the resolution of practical problems; and,
- draw reasonable conclusions by evaluating information found in various sources and defend conclusions.

There are many people—inside and outside of the schools—calling for educational reform. The nature of current reform movements reflect past calls for increased math and science education during the post-Sputnik era.

Most of the reforms offered, however, are clothed in neo-conservative philosophies of education that ignore and work against equity issues. Such elements as tuition tax credits, schools of choice, and increased standardization in testing and curriculum are potentially damaging to poorer public schools and students (Barnett, 1989). These proposals are also raised in the political context of decreased federal spending for schools, and the rollback of money for early educational programs designed to help “at-risk” young people catch up.

The question should be raised: Are schools about the work of quality education for **all** children? Many people in middle-class America still hold to the myth that there is equal access to educational opportunity for all. The late Ron Edmonds, founder of the Effective Schools movement, once stated that “we know more than enough to educate the children of the poor, and if we choose not to, it may be because we do not intend to.”

One of the current theories as to why African-American students are not thriving in schools is contained in the work of Janice Hale-Benson. In her book, *Black Children: Their Roots, Culture, and Learning Styles* (1986), she posits that an explanation for the difficulties African-American children experience in school may be their participation in a culture very different from the European-American, dominant culture that designed the school. This is similar in thought to W.E.B. DuBois' description of the black child as having *two warring souls*, one rooted in an African

identity, and the other in survival in white society. For curricula to deal with issues of equity, African-American students need to understand their history and struggle in European-America, and their rootedness and identity in Africa.

Dr. Martin Luther King, Jr. said of education:

The function of education, therefore, is to teach one to think intensively and to think critically. But education which stops with efficiency may prove the greatest menace to society. The most dangerous criminal may be the man gifted with reason but with no morals.

We must remember that intelligence is not enough. Intelligence plus character—that is the goal of true education. The complete education gives one not only power of concentration but worthy objectives upon which to concentrate. The broad education will, therefore, transmit to one not only the accumulated knowledge of the race but also the accumulated experience of social living.

1.6 The Global Rivers Environmental Education Network (GREEN)

The Rouge Project, and its educational model, quickly moved to other watersheds around the Great Lakes and in bordering Canada. As the program has expanded internationally, other components have been added: testing for heavy metals, shifting to a more comprehensive interactive computer program—EcoNet; developing international cross-cultural partner programs; and extending the program to other curricular areas. Our global dependence upon clean water, and the need to educate people about their rivers, led to the development of GREEN.

Today, 85% of the people in the world live along rivers and waterways. We are dependent on clean water for meeting agricultural, domestic, municipal and industrial needs. These waters are decreasing in water quality and becoming more costly to clean up, in order to meet human needs. In the third world, one out of four hospital beds are occupied by people who have waterborne diseases, and 70% of the people do not have access to clean drinking water.

The concept of GREEN originated in 1984 as a water quality monitoring project with high school students in the Great Lakes Region. The program has evolved to include watershed-based programs involving tens of thousands of students, teachers, professionals, and interested citizens each year in all regions of the United States. Collected data is sent

to the Rouge River Watershed Council and to all State, county and local regulatory agencies.

The scope of the project expanded into a global project and communication forum in the winter of 1989. Twenty-two workshops were hosted by educational and environmental professionals on five continents to stimulate interest in an international network on water quality for students. The response from the workshops was very enthusiastic. Currently, educational professionals in Africa, Asia, Europe, Latin America, Middle East, North America, and Oceania (representing 130 nations), are a part of GREEN and developing programs and strategies for participating in the GREEN network.

By inviting schools to incorporate water studies into their curricula, GREEN encourages students to research and pursue solutions to problems of natural resource management. Involvement in GREEN gives students the opportunity to learn about the common dimensions and shared concerns of local water uses and to communicate with each other in addressing their local issues. School curricula are enhanced as students monitor the water parameters. Projects take on an interdisciplinary approach as history, social studies, humanities, and geography are incorporated to enrich students' understanding of river issues.

Through linking schools around the globe with instructional materials, newsletters, an international computer network, partner watersheds, and other forums, GREEN seeks to improve the quality of watersheds and rivers, and thereby the lives of people. GREEN uses watersheds as a unifying theme to link people within and between watersheds to build an international network of people and institutions that encourage global sharing and cooperation. Programs are developed to foster cross-cultural sensitivity, respect different ways of thinking, and to build a more caring and peaceful world.

The GREEN headquarters and address is: 721 E. Huron St., Ann Arbor, Michigan, USA. 48104 Tel: (313-761-8142).

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