

# TRADITIONAL ECOLOGICAL KNOWLEDGE OF THE LAKE SUPERIOR REGION: EXPLORATIONS TO ENGAGE STUDENTS IN CULTURE, SCIENTIFIC INQUIRY, AND WELLNESS ACTIVITIES

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## ABSTRACT

Recognizing the accumulated knowledge and understanding of Ojibwa people about the natural history of the plants and animals in the Lake Superior region, this project engaged students in explorations that focused on the relationship of human beings to the natural world in both an ecological and spiritual sense. Students explored predator/prey relationships, habitat quality, and traditional ecological knowledge of Elders regarding animals in the Lake Superior region often revealed through stories, legends, and *gikinawaabi* – the Ojibwa word for learning by observation. Research scientists, wildlife biologists, Ojibwa community members, and mentors from the American Indian Science and Engineering Society (AISES) joined efforts to present this project at the Keweenaw Bay Summer Science Camp. Students also learned about traditional uses of and respect for moose and deer when hunted, including hide for clothing, bones for tools, and venison as a healthy alternative to modern processed foods. Additional goals of the project were to improve lifestyle choices including increased physical activity and healthier food and beverage choices leading to prevention of diabetes and its complications. This project was an interdisciplinary, standards-based, multicultural approach to engage students in using traditional ecological knowledge to discover the interrelatedness of all organisms in their ecosystem, to investigate how all animals need to make wise food and energy choices to stay healthy, and to explore cultural wisdom and career opportunities in science and health professions.

## INTRODUCTION

Traditional Ecological Knowledge and Wisdom (TEKW) is the accumulated human knowledge and understanding of place in relation to the world in both an ecological and spiritual sense. The rediscovery by scientists of ecosystem-like concepts among traditional peoples has been important for the appreciation of Indigenous knowledge in the science of ecology.

In traditional knowledge, the unit of nature is often defined in terms of a geographical boundary, such as a watershed, and all of the abiotic components, plants, animals, and humans within this unit are considered to be interlinked. Ecosystems are viewed as unpredictable, uncontrollable, and full of surprises, requiring wisdom for responding to ecosystem change. How-

ever the language of traditional ecology is different from the scientific. The language of traditional ecology usually includes metaphorical imagery and spiritual expression, differing from scientific language in context, motive, and conceptual framework (Berkes et al., 2000).

Conflict between “Ways of Knowing”

“Scientists and Indigenous Elders:

Both speak little English.

Both have difficulty communicating their knowledge to those who use it.

Both are isolated from much of the knowledge held by the other.

And until recently they have seen little use for each other’s knowledge.”

(Bielawski, 1992: 3)

For Indigenous people, a sense of place goes beyond the natural history to encompass the bio-cultural landscape rich in story and meaning. Long-resident cultures have, over time, developed knowledge and wisdom strategies which have enabled them to sustain environments, resources, and populations. Indigenous people are considered the “Wisdom Keepers” — stewards of much of the world’s biodiversity.

Ecologists recognize that working with Elders of communities by doing site visits or transect walks allows insight into rich vocabulary and perceptions of temporal and spatial dynamics of the land, such as memories of disturbance events and cycles marked by cultural references in which time was marked by seasons and moons; habitat descriptions of important cultural plants and their uses; and stories of the personal experiences and collective history of people, places, and relationships to other natural elements (Davidson-Hunt and Berkes, 2003).

For example, Indigenous people from Labrador to Alaska have monitored fat reserves of caribou to assess the nutritional status of the herd and predict trends. This has been an effective technique for dealing with complexity and uncertainty and is one of the key survival skills for sustenance. These techniques are relevant for scientists today, but the tradition originated in specific cultural, social, and ecological contexts in which the cooperation of families and communities created effective sustainability for the continuance of caribou harvesting as an essential part of their way of life (Parlee et al., 2005).

Resource management in the far north faces many unique issues including protecting the intact relationships between indigenous people and

the relatively pristine, vast ecosystems. A more holistic approach in the circumpolar north acknowledges that traditional relationships with nature are more than simply quantitative descriptions of relationships among people, animals, plants, landforms, and energy sources, but also wisdom acquired through understanding and maintaining balance in a complex system. This traditional ecological knowledge and wisdom recognizes humans as part of the natural world in which spirituality and the influential powers of all things are familiar to humans who have co-evolved with the environment (Watson et al., 2003).

Many foundational concepts of ecology are made richer by traditional wisdom. Edges, transition areas, or boundaries often exhibit high levels of species richness or biodiversity in ecosystems. Similarly, in cultural transition areas where two or more cultures overlap and interact, there is often a rich or more diverse mix of ideas resulting in a broader range of traditional ecological knowledge about resources (Turner et al., 2003).

Recognizing this rich body of knowledge and wisdom, the Ecological Society of America recently created a section on TEKW, with the following mission statements:

- 1) to promote the understanding, dissemination and respectful use of traditional ecological knowledge in ecological research, application and education, 2) to encourage education in traditional ecological knowledge, 3) to stimulate research which incorporates the traditional knowledge and participation of indigenous people, and 4) to increase participation by indigenous people in the Ecological Society of America. (ESA, 2005)

## PROJECT DETAILS

Recognizing the accumulated ecological knowledge and wisdom of Ojibwa people about the natural history of the plants and animals in the Lake Superior region over time, the goal of this project was to use that knowledge and provide inquiry-based learning for students in Keweenaw Bay, Michigan. Students learned about the rich biodiversity of their “home,” including explorations of the organisms with whom they share their ecosystem, and the impact that humans have on the quality of the environment for all living things.

Additional goals of the project were to improve lifestyle choices including increased physical activity and healthier food and beverage choices leading to prevention of diabetes and its complications. Wellness activities involving food and exercise to stay healthy were woven into the program. Lesson components from the Diabetes-Based Science Education in Tribal Schools curriculum were incorporated into the sessions. This project was designed to engage students in traditional ecological knowledge to discover the interrelatedness of all organisms in their ecosystem and explore how all animals need to make wise food and energy choices to stay healthy using a multicultural standards-based approach.

The Lake Superior watershed is an area rich in natural beauty and abundant resources of native plants and animals, including the recent resurgence of moose and wolves. Moose have had a long history in Michigan. Stories of the Native people and records of the early explorers indicate that moose were abundant in Michigan's Upper Peninsula throughout the past. Many red ochre pictographs in the region depict the presence of moose and wolves. However, as the northern forests were logged, and settlers cleared the land, moose habitat was destroyed, and moose virtually disappeared from most areas of the state by the late 1800s. The young forests that grew up after the cutting of Michigan's virgin forests provided excellent habitat for white-tailed deer, and as deer increased moose numbers declined.

During the last century, natural forest growth, succession, and forest management practices have transformed the Lake Superior watershed into excellent moose habitat. Over the years, moose were occasionally seen in the Upper Peninsula, as a small population returned or persisted. In the winters of 1985 and 1987, 59 moose were trans-located from Ontario by the Michigan Department of Natural Resources (DNR) to an area in the central Upper Peninsula in a reintroduction effort called Moose Lifts I and II. Since 1985, biologists have been monitoring the moose population and habitat.

This interesting chain of events provided exciting learning opportunities, especially for students living in an area where North America's largest ungulate, moose (*mooz*, Ojibwa), roam freely. As part of the Keweenaw Bay Ojibwa Community College (KBOCC) Summer Science Program, students participated in two weeks of daily activities and field trips. Each day included a component of cultural experience, hands-on science, strenuous physical ac-

tivity, and nutritional snacks including natural local foods. The culminating experience was a community picnic in which parents, tribal members, and Elders were invited to share traditional food and games with the students and teachers.

On Ojibwa Culture

I believe that there is an energy — I prefer to call it a creative energy; other people call it something else — which exists beyond the human's physical awareness.... The energy exists within the land — the North American continent (Turtle Island). It exists within human culture — the Anishinabe's origins, history, present and destiny. It exists within the Anishinabe's spiritual teachings which sustain him/her on the earth.

Leland Bell, *The Island of the Anishnaabeg*

### ANIMALS IN OUR HOME — PREDATOR AND PREY/WOLF AND MOOSE

Students explored predator/prey relationship, habitat quality, and traditional ecological knowledge of Elders regarding animals in the Lake Superior region including Isle Royale. Research scientists, wildlife biologists, Ojibwa community members, and mentors from the American Indian Science and Engineering Society (AISES) joined efforts to present this project for students in the Keweenaw Bay Indian Community (KBIC).

Field trips to the local moose habitat locations provided opportunities for searching for clues, using Global Positioning System (GPS) locators, map and compass work, triangulation with radio telemetry locations, and meticulous observational and recording skills. Students also made observations on the human impact in natural areas.

Students learned about animal tracks and sign and how to become outdoor detectives using nature field notes to record their observations in a scientific and artistic way, enhancing different ways of knowing. They made plaster casts of tracks in the classroom to prepare them to do casts of any tracks found on field trips in summer or winter. On one field trip, although no moose were sighted, tracks and droppings of moose were evidence of their recent presence. Students explored the tracks, followed them around a muddy area, measured them, and made casts to take home.

One unique feature of this project was the multicultural mix of students in this rural community with large representation of Native American fami-

lies and families of Finnish descent. Native American students attend local public schools with ethnically mixed enrollment, rather than tribal schools. This experience was culturally adapted for Native American students by emphasizing visual and active learning, especially *gikinawaabi*, learning by observation (Ojibwa), which is also the heart of empiricism.

Considering that Native Americans and rural Upper Peninsula residents are under-represented in the science and health careers, this project provided an opportunity for students to enjoy the fun and challenge of “doing science” and learning about science and health careers and healthy life-style choices. Students also had opportunities for learning about each other’s cultures. College students from AISES assisted as role models and mentors.

Furthermore, Michigan DNR biologists and wildlife technicians who worked on the moose trans-locations and on-going population monitoring were available as resource professionals. A research ecologist from the Isle Royale Moose/Wolf Ecological Study presented information and stories about animal behaviour, habitat requirements, and scientific observational techniques.

## IMPORTANT NATIVE PLANTS IN OUR HOME

Tribal members, spiritual leaders, and Elders participated in teaching sessions with the students and shared their knowledge. One of the presenters was Jim St. Arnold, Great Lakes Indian Fish and Wildlife Commission (GLIFWC) specialist and coordinator of a project to interview and archive what Native American Elders know about using plants. They interviewed over 200 tribal Elders from 11 tribes in Wisconsin, Michigan, and Minnesota. Jim and his wife, Judy, shared their wisdom with the young students.

The St. Arnolds told the students that traditional knowledge used to be disregarded by science as merely anecdotal. But in recent years, scientists have been paying more attention to TEK as valuable information in scientific studies. The GLIFWC project focused on food and other uses of plants — what plants were used for foods, how different saps were used, how wild bergamont was used as a hair conditioner, or how cattails and bull rushes were used to make mats. The Elders said a lot of the plants they used to harvest are hard to find now, like hazelnuts, wild plums, and gooseberries. One Elder remembered picking cattail roots, drying them out, and beating them into a flour to

make bread. He said it was important to let people know what's disappearing, so maybe something can be done about it.

Wild rice, *manoomin*, is a plant from the Great Lakes region that has particular ecological and cultural significance to the people. It is important for those who have wisdom about harvesting *manoomin* to pass knowledge of the ricing down to the younger generation because many of the Elders are passing on and are taking that knowledge with them. The GLIFWC project was funded by a grant from the Administration for Native Americans. From the interviews, they gathered information on over 200 plants and plant parts used for food and other uses (Meeker et al., 1993).

Traditional use of natural resources for the Anishinabeg and other native peoples always reflected the philosophy called *The Seventh Generation*. "The concept is simple, and culturally ingrained," explained Jim St. Arnold.

When you do things, you don't just do things for today, you do things for the future. Resources should be protected not for your children or their children, but for children seven generations down. With that goes some other simple beliefs. People have their place within the natural systems and there is a give and take within that circle. When you take something, you always give something back.  
*Jim St. Arnold*

## CULTURE AND LANGUAGE — LEARNING FROM ELDERS AND SPIRITUAL LEADERS

Everything the Power of the World does is done in a circle. The sky is round and I have heard that the earth is round like a ball and so are all the stars. The wind, in its greatest power, whirls. The sun comes forth and goes down again in a circle. The moon does the same and both are round. Even the seasons form a great circle in their changing and always come back again to where they were. The life of a man is a circle from childhood to childhood. Everything tries to be round.  
*Black Elk*

Learning experiences for students also featured narrative storytelling, visits by Elders, and family and community activities. Using the accumulated knowledge and understanding of Ojibwa people about the natural history of the plants and animals in this area over time, experiences focused on the relationship of human beings to the natural world in both an ecological and spiritual sense, often revealed through stories and legends. Ojibwa words for animal names, numbers, and foods were used whenever possible and cultural



information about animal clan names was included in sessions as part of Anishnaabe language revitalization in the community.

Traditional stories concerning the four sacred foods and water were used in the sessions. Mornings opened with spiritual offering of tobacco and prayers of thanks for the gifts of the four sacred foods and the stories that are told about them. Spiritual leaders discussed how tobacco is important as a sacred offering and should not be abused by cigarette smoking.

Four sacred foods (from KBIC Ojibwa Culture):

- Wild meat and fish: Moose (*Mooz*), Deer (*Wawashkeshi*), Fish (*Gigo*), Beaver (*Amik*), Bear (*Mukwa*), Partridge (*Bine-wag*), Muskrat (*Wazhashk-wag*)
- Berries: Strawberry (*Odeimin*), Blueberry (*Miinan*), Blackberry (*Odata-gagomin*), Raspberry (*Miskomin*)
- Grains: Wild Rice (*Manoomin*)
- Vegetables: Corn (*Mandaamin*), Squash (*Okanakosimaan*), Pumpkin (*Okosimaan*)

Spiritual leaders conveyed that an important part of every meal is to take a moment before eating to give thanks for the food and water — showing appreciation for the good food itself, for the labour of those who produced and prepared it, for the animals and plants that gave their lives to nourish us, and for the earth that gave us the gifts that made it all possible (water, soil, air, rain, nutrients). The pleasure of good eating is about much more than the taste of the food — it is about a deep appreciation for, and connection with, everything in life. It promotes good environmental stewardship in thinking about the whole food chain and protecting our resources so that we can enjoy wonderful, colourful, healthful, nutritious foods whose flavours delight our mouths.

In addition to nutritious foods and physical activity, an important component of health that was included was self-esteem and the feelings of safety and security that come from family and community. In Ojibwa, this is expressed as the “Seven Gifts.”

<i>zaag'iwewin</i>	—	love/caring
<i>debemowin</i>	—	honesty/truth
<i>dabasenimowin</i>	—	humility/modesty

<i>zoongenimowin</i>	—	courage/bravery
<i>ganaadenimowin</i>	—	respect/honour
<i>bagidinidizowin</i>	—	trust/loyalty
<i>gikendamaawin</i>	—	wisdom/knowledge

Students learned about traditional uses of and respect for moose and deer when hunted, including hide for clothing, bones for tools, and venison as a healthy alternative to modern processed foods. One activity for the students was a spirited discussion of traditional ways of acquiring food — hunting, fishing, harvesting and the amount of work involved in that effort, contrasted with common present-day ways of getting food from the grocery store or fast food restaurants. Students compared and contrasted the calories and nutrients in a traditional Anishinaabeg meal with a modern fast food meal, and it was an eye-opening experience for most students.

#### TRADITIONAL ANISHINAABEG MEAL

- Venison roast (4 oz.), 200 calories, 5% fat, iron and B vitamins
- Wild Rice (1 cup), 180 calories, 0% fat, fiber, B vitamins
- Fiddle heads (1 cup), 35 calories, 0% fat, fiber, vitamin C
- Bannock (4 oz.), 150 calories, 7% fat, fiber, B vitamins
- Raspberries (½ cup), 35 calories, 0% fat, Vitamin C

Total traditional meal: 600 calories, low in fat and high in nutrients.

#### FAST FOOD MEAL

- Cheeseburger (1/4 lb.), 530 calories, 51% fat, iron, B vitamins
- French Fries (2 cups), 610 calories, 29% fat, minimal nutrients
- Soda Pop (16 oz.), 200 calories, 0% fat, 54 gm. sugar, 0 nutrients
- Ice Cream (1 cup), 320 calories, 45% fat, trace of calcium

Total fast food: 1660 calories, large amount of fat and sugar, minimal fiber and nutrients.

We fear the cold and the things we do not understand. But most of all we fear the doings of the heedless ones among ourselves. *An Inuit Shaman*

## EVALUATION

Summer Science Camp was offered for younger and older students in two separate two-week sessions with a total of 70 children enrolled. We monitored the sessions to assure that the content was culturally relevant and developmentally appropriate for the participants. Comments and suggestions of students and parents were used to change, improve, expand, and implement future programs.

Evaluation of the project was done through process and outcome evaluations throughout the sessions. Authentic assessment of learning was based on participation and responses of students in activities. A final evaluation questionnaire and informal interviews were used with students and their parents to elicit comments and impressions of the experience.

The enthusiasm of the children and parents regarding the impact of the health and science content was evident in follow-up questionnaires and verbal comments in interviews. Students themselves listed numerous things they remembered from Summer Science Camp that they will use in their lives including: facts about plants and animals, Ojibwa culture, respecting others and nature, how to work as a team, learning science projects and cultural art crafts, eating healthy foods and snacks, drinking water, not eating junk food, not smoking and drinking, and exercising everyday.

Parents indicated that students reflected what they learned by their words and behaviour when they came home from camp such as, telling facts about plants and animals, sharing cultural information and storytelling, making healthy snacks, meeting new friends, learning science and art, and passing on information to the rest of the family about diabetes and the dangers of smoking.

Many of the eighth grade students indicated that they enjoyed this program so much they wish they could attend again next year. These students will form a cohort of new high school students who will be primed to attend the high school summer institute. Similarly, the older students who helped as teacher assistants may become participants in the community college. Speakers who presented sessions for the program became a valuable community resource and have served as career and cultural role models for the students.

## COMMENTS FROM PARENTS ON WHAT THEIR CHILDREN LEARNED AT SUMMER SCIENCE

Excitement about all activities and moose! They talked about the animals and field trips; tracking moose; healthy snacks; doing science projects; running laps; met new friends; learned lots; wants to come back next year; want to do cooking and planting at home.

Talked about how papa should quit smoking — it's not good for you!

My daughter came home and wanted to make snacks she learned at camp.

Wonderful — hope it is around many years.

Megwetch!! Thank you — this was a great year!

Summer Science Camp is too short! The kids loved to come everyday.

Great opportunity. Thank you — it was well liked by all.

## COMMENTS FROM YOUTH ON WHAT THEY LIKED ABOUT SUMMER SCIENCE

Met new friends; learned about being a team; the moose and beaver dam when we went to look for moose; fishing at Canyon Falls; art projects; information on smoking; field trips and activities.

Learned how to get along with others, how to work together as a team, be nice, be polite, not to smoke and drink, be healthy, don't eat too much junk food, learned about different fruits, drinking water, all the stuff about animals, new facts about animals, respect others and nature, running laps, exercise everyday, how to be active and still have fun, more Ojibwa words, how to make footprints and wing prints, how to make fossils, learned how to make healthy snacks, learned to sew crafts, how to have a good body.

I will eat a healthy diet.

This was the best 3 years in my life!! See you next year!!!!

I had so much fun this year — if I could come back next year, I would. (eighth grader)

Thank you very much!!

I am faced with the fact of diabetes in my life one day because I have issues with high sugar and my mother has diabetes. I have learned that the three things I need to do to stay healthy are to have less stress, more exercise, and healthier eating habits.

I find that if I come up to the fitness center every night, I have a good time, stay out of trouble, and get lots of exercise, and I made the PRIDE Board (Personal Responsibility in Daily Efforts).

Many students who struggled in conventional classroom situations, thrived in the hands-on experiential learning used in this program. Inquiry-based methods were used extensively. Using the 5E model (Engage, Explore, Explain, Elaborate, Evaluate), an interdisciplinary, multicultural, standards-based project included the following activities:

- Students participated in a brainstorming session about organisms they share their home (ecosystem) with and the life needs of all organisms. Students constructed simple food chains and more complex food webs as they discovered and collaborated.
- On detailed maps of the area (topographical maps), students mapped locations of their own personal land use, including where they live, play, eat, shop, and learn, and made calculations on their home-range size and configuration.
- Using information from the Michigan DNR and the Isle Royale Moose/Wolf Ecological Studies, students compiled information addressing their own curiosity about the home-range, habitat needs, and energy requirements of common animals.
- Students compared and contrasted traditional ways of acquiring food through hunting, fishing, planting, harvesting and the amount of work and energy expended versus common modern ways of obtaining food from grocery stores or fast food restaurants, making the connection with the rise in obesity and diabetes.
- Students, with the help of older students and adults, identified native plants that they observed as they walked through the northern forests on field trips and discovered the connections between all living things in ecosystems.

The learning opportunities provided an authentic inquiry-based science experience for middle school students during the Keweenaw Bay Indian Community Summer Science Camp. Mentors from the American Indian Science and Engineering Society Student Chapter at KBOCC assisted middle-school students in their investigations on a field trip to nearby moose habitat sites and a practice session beforehand. Research ecologists provided background information on moose/wolf interactions from the Isle Royale Ecological Study and a biologist from the Michigan DNR participated in the field trips.

This project was an interdisciplinary, standards-based, multicultural approach to engage students in discovering the interrelatedness of all organisms in their ecosystem, in investigating how all organisms make wise food and energy choices, and in exploring career opportunities in science and health.

Just before dawn on the fourth day, the eagle flew out of the crack between darkness and light, that edge between night and day. He flew so high that he flew completely out of sight. He said, I have seen that there are humble people who are still trying to live in harmony with the universe. The Creator entrusted the Eagle with the duty of reporting to him each day the condition of the Earth's people. So the miracle of sunrise happens again for the Anishinaabe. This is why the Eagle is so respected by nature and natural people everywhere.  
*A legend by Jay Loonsfoot, KBIC.*

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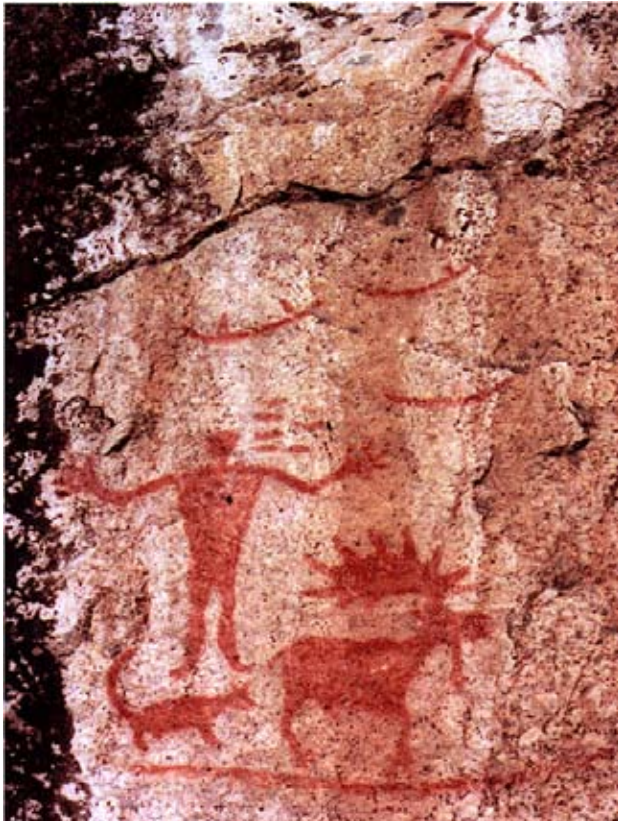
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*Figure 1. The Hegman Lake pictograph site which shows a human with upraised arms with large hands, a moose followed by a wolf, and canoes above, is probably the best known of the red ochre sites in the Great Lakes Region.*

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*Fig. 2. Students from Keweenaw Bay Indian Community Summer Science Program.*



*Figure 3. Students exploring and gikinawaabi, learning by observation (Ojibwa).*





*Figure 4. Cultural teacher describing the use of natural materials for clothing and foods.*



