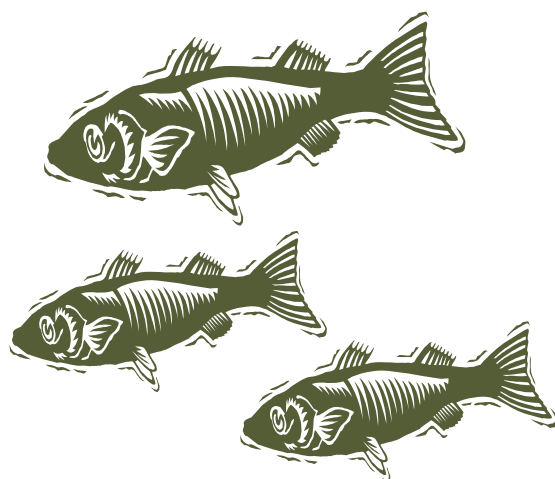


Scaling Obstacles: Turning Fish Waste into Resources



The Tlingit National Anthem is a testament to the determination and perseverance of the Tlingit people, who currently inhabit Southeast Alaska. According to the anthem, the Tlingits once lived far from the ocean in a region now known as Yukon Territory. After hearing that fish were abundant in the Pacific Ocean, they decided to journey from the interior of the continent to the coast. The journey was long, arduous, and riddled with obstacles, including a giant glacier. A group of daring women traveled under the glacier via a stream and urged the others to follow. Thus the Tlingit people prevailed and arrived at the ocean's edge, where food was plentiful.

The Tlingit people of Kake, a small village located on Kupreanof Island, 150 mile south of Juneau, possess the determined spirit of their ancestors. This tenacity enabled them to open a composting operation despite obstacles such as lack of technical expertise, inadequate equipment, and a harsh climate. The persistent villagers overcame many of these challenges to get "fish and chip" composting off the ground, relying on an abundant supply of raw materials and patience to beat the odds. Bob Mills, Kake's composting manager, believes that his team will soon raze the final barrier to success—breaking into the retail market—and the composting operation will become profitable.

In 2001, faced with the collapse of the island's timber operation, Sam Jackson, the CEO and president of Kake, decided to pursue composting as an economic development project. He recognized that the fish waste generated by the village's cold storage company could be combined with the slash and downed timber left behind by loggers to create nutrient-rich compost. In addition to having the right raw materials for compost, Kupreanof Island is speckled with former log clearing areas, open spaces that are far from the village and ideal for large, odorous windrow piles. Putting all the pieces together, Kake seemed to have the key ingredients for a successful composting operation.

A Learning Curve

When Mr. Jackson asked Bob Mills, who was a logging manager at the time, to run the nascent composting program, Mr. Mills' initial response was, "What's composting?" After

hearing the details, Mr. Mills accepted the challenge, although he had no prior experience with composting. Kake gave Mr. Mills a 902 Cat front loader and a dump truck to get started.

"Composting is like learning to swim. You can read about it or listen to someone explain the process, but you really learn by doing it."

Bob Mills, composting manager, Kake

Initially, Mr. Mills used the dump truck to haul salmon and crab carcasses, bones, and guts from the processing facility in Kake to the remote log clearing areas, where he combined the waste with sawdust from Silver Bay Logging Company in piles stretching 200 feet long. After

finding composting recipes on the Internet, Mr. Mills solicited advice from the Alaskan Wood Utilization Center and consultants. Despite conducting background research, Mr. Mills discovered that he was not prepared for the field. "Composting is like learning to swim," he said. "You can read about it or listen to someone explain the process, but you really learn by doing it." The first few piles did not produce a quality final product. Mr. Mills experimented with the moisture content of the compost piles and varied the ratio of fish waste to sawdust, tweaking the recipe, until he achieved success.

Training Trials

The initial recipe setback motivated Mr. Mills to attend a composting class to avoid future problems. He traveled to the state of Washington for a five-day Compost Facility Operator Training sponsored by the Washington Organic Recycling



(L) Making fish and chips: workers add fish waste to the prepared wood waste windrows. (R) Ships unload their catch at the Kake processing plant.

Council (WORC). “I thought the class would be a breeze,” said Mills. Instead he found himself surrounded by scientists, seasoned compost operators, and instructors who used words such as “thermal treatment” and “bulking agents.” Mr. Mills studied morning and night, and the instructor helped him master the material by defining new terms. On the fifth day, Mr. Mills passed the final exam with flying colors.

During the training, Mr. Mills realized that he had made some mistakes during his first few months as composting manager, and he learned how to correct them. He discovered, for example, that his compost piles were too moist, creating anaerobic conditions that stymied the decomposition process. He remedied the situation by increasing airflow through the piles and placing tarpaulins on them to minimize rain infiltration.

Investing in the Future

Mr. Mills approached the village and explained that he needed more equipment for the composting venture. Recognizing that the project possessed tremendous economic potential, Kake invested more than \$1 million in new equipment, purchasing a 2200 Cat backhoe, a 16-foot Scarab turner, and a bagging machine. Workers use the backhoe to dig a long ‘V’ down the center of each row of sawdust or wood chips

before adding fish waste. The Scarab turner is essential to the operation—imagine turning 200-foot-long piles by hand! The bagging machine enables workers to package the product for sale. Although Kake needed this equipment to succeed, heavy machinery is expensive, and the village was forced to close its cold storage operation, temporarily, to support the composting enterprise.

Although fish waste and wood debris must be chipped before Kake can use it in compost piles. During the first year, Mr. Mills purchased sawdust from a logging company located 100 miles south of the island because he could not chip the wood scattered about the island. He conducted an Internet search and located Bobby Wolfer, a businessman in the state of Washington who sells tubgrinders. Mr. Mills called Mr. Wolfer regularly for a year, cultivating a relationship with him. Eventually, Mr. Wolfer visited Kake to inspect the composting operation. The visit convinced Mr. Wolfer that Kake could succeed, and he worked with Mr. Mills to transport a tubgrinder, which cost approximately \$470,000, to Kupreanof Island.

Taking the Market’s Pulse

Mr. Mills used a value-added producer grant from the U.S. Department of Agriculture’s Rural

Development Service to hire Aadland Marketing. Kake used this firm for past projects, so Aadland Marketing employees were already familiar with the village’s culture and goals. In fact, Kake approached Aadland Marketing’s Greg Galik for help with the grant application. Mr. Galik worked closely with Mr. Mills and other representatives from Kake to draft an 80-page proposal for a marketing feasibility study that would allow the village to determine the price of its product, identify ideal product packaging, and create a promotion strategy. Kake requested \$77,000 and received \$47,327, which it matched.

Kupreanof Island is along a major shipping route between Juneau and Ketchikan. Ships traveling north from Seattle carry supplies to Anchorage and return with empty containers. Aadland Marketing contacted several shipping companies and discovered that Kake could move its compost to Washington state (where demand for quality compost is high) in these empty containers for only a small fee. Next, Mr. Galik organized focus groups in Washington and provided samples of Kake’s compost to gardeners and landscapers, who agreed that the product was loamy with a pleasant earthy smell. They liked the idea of compost generated from natural materials free of chemicals, so Aadland Marketing encouraged Kake to get its product certified as organic. The focus group participants also felt that “Totem Soils” was the perfect name for Kake’s compost and that it should be packaged in attractive 12-quart bags.

In addition to organizing focus groups, Aadland Marketing urged Kake to get its product tested for pathogens, metals, and general quality. Although Kake does not compost human waste, the village chose to follow EPA’s

biosolid composting regulations to ensure a vector and pathogen-free final product. Laboratory tests confirmed that Kake's compost is high-quality potting soil, although Mr. Galik pointed out, "Kake's windrows are young and compost is like a fine wine. It becomes more valuable as it gets older." Aadland Marketing suggested that Kake publicize these test results to demonstrate the quality of its product.

Aadland used the information obtained from the focus groups and product testing to create effective marketing brochures and a Web site for greenhouse operators and retailers. Mr. Galik and Mr. Mills are developing relationships with some of these individuals and hope to obtain several contracts before the next growing season. In 2003, Kake established 4,000 linear feet of windrows and composted 6 million pounds of fish waste, although Mr. Mills believes the operation could easily be expanded because fish waste is abundant in Southeast Alaska. Fish processors throughout the region are searching for alternatives to dumping this waste into local bodies of water, where it

disturbs ecosystems. Mr. Mills hopes to obtain a contract with a large retailer that demands large quantities of compost from its suppliers. If Kake secures a contract with this type of company, composting on Kupreanof Island could mitigate a regional environmental problem in addition to providing jobs for locals.

Local Challenges

While Mr. Mills waits to hear from retailers, he must continue to maintain the compost piles and meet local challenges. Bears, fluctuating rainfall, and odors are ongoing challenges facing the operation, and Mr. Mills must address them to keep the windrows intact and village residents content. For example, bears harass workers as they turn the compost piles. Mr. Mills does not have the funding to erect fences around the windrows, so he must chase away the bears on foot.

Climate also presents an obstacle. Southeast Alaska experiences a rainy season in the fall and winter and a dry season in the spring and summer, which makes maintaining proper moisture levels in compost piles difficult. During the summer, Mr. Mills must add water to the windrows, and during the winter, he must cover them with tarpaulins to keep them dry. Eventually, he would like to obtain funding for a warehouse to keep the curing piles out of the elements and away from bears.

Trucks loaded with fish waste used to pass through Kake, traveling from the fish processing plant to the compost site, until residents complained of the associated stench. Mills asked the truck drivers to circumvent the village, adding several miles to the trip, but appeasing community members.

U.S. DEPARTMENT OF AGRICULTURE'S VALUE-ADDED PRODUCER GRANTS

When Bob Mills needed funding to hire a marketing firm, he turned to the U.S. Department of Agriculture's (USDA's) Rural Development Service for assistance. USDA offers value-added producer grants, which tribes and villages can use to develop and implement marketing plans for value-added agricultural products such as compost. As Mr. Mills discovered, the grant application is complex and time-consuming, but can yield great rewards. The average grant award is \$170,000, although applicants can request up to \$500,000, and grant recipients must match 100 percent of the funds.

USDA publishes the value-added producer grant application deadlines and funding levels in the Federal Register and announces this information on its Web site at www.rurdev.usda.gov/rbs/coops/vadg.htm. For a list of state office contacts, visit www.rurdev.usda.gov/rbs/coops/vadgstateoffice.html.

Despite such obstacles, Mr. Mills remains confident that Kake's composting operation will be successful. He believes that gardeners will request the premium Totem Soil when they learn about it. He also hopes to begin accepting fish waste from other processing plants in Southeast Alaska. While Mr. Mills waits for Totem Soil to gain popularity, he provides advice to others interested in composting. In 2004, for example, he attended a wood utilization convention in Anchorage and delivered a presentation on Kake's project with a message of hope. "It's been a struggle," said Mr. Mills. "But I'm glad we're doing it."



Cherokee Commitment to Quality Creates Premier Food Waste Compost

Just as quality compost requires the proper mixture of raw materials, individuals working for the Eastern Band of Cherokee Indians' composting operations must possess the perfect blend of technical expertise, business acumen, and cultural knowledge. The Cherokee run two successful large-scale composting operations—one for food scraps and one for biosolids—at the Qualla Boundary in North Carolina. The tribe credits well-trained composting operators with saving them thousands of dollars in tipping fees annually. By selling compost to tribal members at bargain prices, these employees have also encouraged community members to return to the tribe's agricultural roots through gardening.



To reduce waste disposal costs, the Cherokee began composting biosolids from its wastewater treatment plant in 1995 and expanded its operations to collect food residuals in 1997. Today, the tribe composts approximately 72 tons of food waste and 96 dry tons of biosolids per month. The food waste, collected from seven local restaurants, including three within Harrah's Cherokee Casino, sells for \$35 per ton, while the biosolids compost garners \$15 per ton.

Considered a landmark program, the tribe's composting operation has been lauded by EPA and other organizations. The tribe, however, needs to look no further than its customers to recognize its success. "Our repeat customers say our compost is the best in the world," says Ritchie Bottchenbaugh, a composting supervisor for the tribe.

The End Product Begins with Training

As with all types of composting, developing an expertise in large-scale composting is a hands-on, trial-and-error process. However, as John D. Long, former composting manager, emphasizes, "There are so many technical things you need to know to compost properly and produce a quality product—carbon/nitrogen ratios, moisture levels, temperature—you need training to get and keep all of this straight." The tribe's commitment to producing a high-quality compost product begins with its staff. Compost managers look for highly motivated employees and require

professional training to ensure they have the know-how to create a superior product.

"It took a little while to get people to use and want our products. Now we can't keep the stuff."

—John D. Long, former composting manager, Eastern Band of Cherokee Indians

The Cherokee's composting and recycling managers, including Mr. T. Trejo, Mr. Bottchenbaugh, and Mr.

Long, obtained certifications through the Carolina Composting Council and the Solid Waste Association of North America (SWANA), both of which they highly recommend. They keep their certifications current by attending annual workshops. Mr. Long also attended the Better Composting School at the University of Maryland, of which he speaks highly. The tribal composting managers emphasize that many beneficial training opportunities exist—the challenge is to secure the necessary resources to attend them. Inquiring about scholarships is one strategy to reduce the financial barriers.

The Cherokee now share with others the expertise they have gained

through training and experience. In August 2004, the tribe hosted a Carolina Composting Council certification course funded by EPA Region 4. In addition, Mr. Trejo developed a comprehensive guide replete with photographs, *Composting Made Simple*, which EPA distributes to other tribes to help them develop similar large-scale composting programs. Representatives from several tribes in the region, including the Seminole Tribe of Florida and the Mississippi Band of Choctaw Indians, have also visited the composting facilities.

The Composting Nitty Gritty

The Cherokee emphasize the importance of training because there is much to know. Turning food residuals into a nutrient-rich soil amendment involves many steps, numerous measurements, and more than a month's time from start to finish.

The tribe's food residuals composting program begins at the restaurants, where restaurant employees manually separate kitchen wastes and remove contaminants such as plastic and glass materials. Tribal utilities employees collect the food wastes as many as two or three times per day to maintain a positive relationship with the restaurants. After collection, employees transport the containers of food waste to the tribe's waste transfer station and weigh them to maintain accurate records for documentation and reporting requirements. They then mix the food residuals with wood chips and sawdust—derived from chipping community members' yard trimmings in a Duratech tub grinder—as well as shredded waste paper from tribal office buildings. The wood chips and paper serve as a source of carbon, and the wood chips also create spaces for aeration.

The tribe uses a front-end loader to mix the materials, then places the

mixture in windrows—long piles that measure 100 feet long, four feet high, and six feet wide. The piles are turned once on the first day, then three to four times per day for the remainder of the windrow process. The piles must remain at a constant temperature above 135°F for 15 days, a standard that the Eastern Band of Cherokee generally exceeds. After approximately four weeks in the windrows, the new compost is transferred to a covered storage area for curing and screening.

The tribe uses a different composting method to compost biosolids—composting approximately 96 dry tons per month—with additional modifications to destroy pathogens, reduce moisture, and address the specific nature of the waste. Unlike food residuals composting, biosolids composting is guided by federal regulations under the Clean Water Act (40CFR Part 503).

Biosolid waste is first dewatered and chemically treated at the tribe's wastewater treatment plant, then composted on a bed of wood chips using a fan-forced aerated static pile method in a roofed, partially walled building. A perforated plastic pipe runs through the center of each bed of chips, and air is forced into and out of the pile through the pipe to help ensure that conditions do not become anaerobic, which would release odor and attract vermin.

The tribe exceeds EPA's time and temperature requirements for biosolid composting to ensure that all pathogens are destroyed. The piles require 13 to 15 days to reach 146°F, and the temperature is maintained for 15 days. Then, the compost is placed in a curing pile until the moisture level drops to 30 percent or less. After the compost moves through the curing pile, it is screened

to a quarter inch size. To ensure the quality of its compost, the tribe sends samples for nutrient and metals testing to an EPA accredited facility.

The Tribe's Business Acumen

While composting provides numerous benefits, the primary reason the Cherokee decided to begin a large-scale composting program was to save money. As Mr. Long says, "We got started composting out of necessity." When the federal municipal solid waste landfill regulations became effective in 1991, the tribe was one of many communities across the United States required to close their landfill. In response, they constructed a waste transfer station and set the goal of recycling as much as possible to reduce waste transportation and disposal fees. Thus, composting was a smart business proposition for the tribe.



The Cherokee use their own compost to improve the landscape around tribal office buildings.

When the Cherokee decided to begin the food residuals composting program in 1997, they applied for and received a three-year project grant for \$133,500 from EPA. The grant required that the tribe match 5 percent of the funding, but the tribe matched 122 percent, using the funding to purchase equipment, prepare the site, hire an extra staff member, and develop the composting guide, *Composting Made Simple*. The operational expenses are now approximately \$180,000 per year, and the program comes close to breaking even by selling the final product.

OUT OF SIGHT, OUT OF MIND

Odors are a common problem for large-scale composting operations, “especially early on when you are learning and perfecting your process,” states Mr. Long. The Cherokee initially experienced odor problems because the compost piles were not receiving enough oxygen. When they switched from a front-end loader to a windrow turner to turn the piles, the odor problem was virtually eliminated. However, neighboring community members continued to complain. To solve the problem, compost operators planted bamboo between the station and neighboring property, and the complaints died off. Explained Mr. Long, “If people see your process and it looks like it should smell, then people will complain about it smelling. If they can’t see it, then they don’t know or think that there is anything to complain about.” He emphasizes that locating the facility away from homes when possible allows you to address odor concerns before community members complain.



Tribal council members have been very supportive of the composting program because they recognize the cost savings and benefits. As Mr. Long explains, “We had to go before the tribal council and show the actual numbers from our pilot project to demonstrate the cost savings. It is like going to a bank for a loan—you need to show them something concrete. Once we showed the council our numbers, it was a no-brainer.”

Another factor the tribe considers critical to their success is the strong rapport they maintain with the local restaurants that generate the food waste. Mr. Bottchenbaugh keeps an open line of communication with the restaurant managers, speaking to them nearly every day. He stresses the importance of being flexible with the restaurants and responding to their needs. Tribal utilities employees generally pick up the food scraps two or three times per day, but if the restaurants request more than three pickups, the composting employees gladly oblige.

The tribe sells most of its compost to residents, tribal roads divisions,

and other tribal programs that pick up the product at the transfer station. While the Eastern Band of Cherokee has not bagged its compost, it has begun marketing it to organizations off the reservation. Mr. Bottchenbaugh is talking to Harrah’s about purchasing compost from the tribe, and he is also working with the North Carolina Department of Transportation, which is interested in using composting berms to replace silt fences.

Word-of-mouth has carried the testament of the high quality of the Cherokee compost throughout the community. Local organic farmers rave about the high nutritional value of the compost, and the tribe has collected letters from enthusiastic customers. The owner of Cherokee Daylily Gardens attests, “In all our years of growing daylilies, we have never experienced this rate of reproduction.” As Mr. Long summarizes, “It took a little while to get people to use and want our products. Now that people have seen the results they get with our compost and realized the nutrient value of the food waste compost, we can’t keep the stuff.”

A Return to Tradition

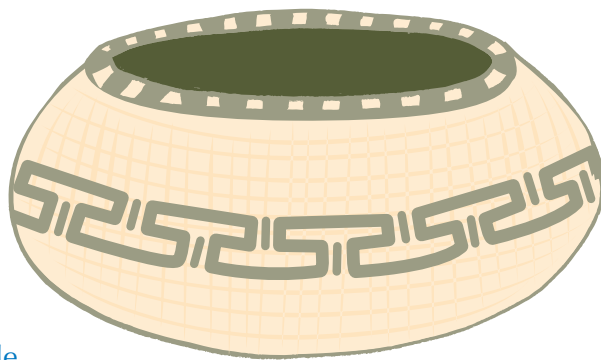
Above and beyond the practical benefits of composting, its practice has a history within Cherokee tradition. As Mr. Bottchenbaugh describes, “My grandpa says that he can remember his grandma throwing food waste in a pile of leaves and rolling it around.” Mr. Long adds, “As a farmer, I have composted all of my life, I just didn’t know it at the time. When we cleaned out the animals’ stalls, we piled the straw and manure and let it decompose. Then we spread it on our fields. We were composting, we just didn’t call it that.” Thus, composting offers the added value of bringing the tribe back in touch with its roots. In addition to composting, tribal members were traditionally farmers—growing vegetables such as corn, potatoes, beans, and squash. Tribal employees believe that gardening is good for the community because it reacquaints people with this agricultural tradition.

To encourage tribal members to garden, the tribe has given away free or discounted compost. The tribe’s extension office recently worked with the Chief to provide community members with coupons for compost to promote gardening. All 150 coupons issued by the office were redeemed. People came to pick up the compost at the transfer station, and at the same time the tribe gave away gardening kits.

As the program moves forward, Mr. Bottchenbaugh is pleased with this additional benefit for the tribal community. “The composting coupons benefit more than just the transfer station’s bottom line,” Mr. Bottchenbaugh said. “The Cherokee people have a rich history of farming, and the composting coupons encourage them to get back to gardening.”

Unique Gardens Dig Deep Into Cultural Roots

In addition to reducing waste and generating a valuable soil amendment, composting contributes to the revival of traditions and the preservation of cultural knowledge. Ho-Chunk Nation's project demonstrates that tribes can use composting to reconnect with their agricultural roots. The Eastern Band of Cherokee Indians, which once relied on agriculture for survival, distributed coupons for free compost to tribal members to encourage the rediscovery of home gardening. But some tribes are taking the cultural component of composting and gardening projects to the next level. For example, the Mashantucket Pequots and the Pomo Indians of Redwood Valley Rancheria are cultivating endemic species to restore lost arts and historical knowledge.



A garden roof atop the Mashantucket Pequot Museum and Research Center offers environmental, aesthetic, and cultural benefits. Many garden roofs contain "green" features, such as compost piles, but the Pequot's roof serves a greater purpose. The museum borders a swamp filled with rhododendrons that provided refuge to the Pequots during King Philip's War. To preserve this historical site and create an idyllic setting for special events, the tribe decided to install the garden roof, which reduces runoff into the swamp and contains decks and paths for meetings and receptions.

Initially, the Mashantucket Pequot tribal council envisioned gardens with plants native to the Northeast and hired experts to develop a collection. The tribe, however, had trouble with these contractors and replaced them with tribal maintenance employees who lacked knowledge of native plants. As a result, the garden morphed from a collection of indigenous species to a haven for non-native ones.

The green roof continues to evolve as the Pequots find ways to meet new challenges and increase the potential for cultural education.

Tribal members hope to replace many of the exotic species with native ones and plan to populate garden beds with plants that their ancestors used for food, medicine, and other purposes. The gardens will include species such as Indian hemp, which is used to make rope, and blood root, which is used to treat blood ailments. Despite some obstacles, such as minor leaks in the roof, the museum staff remain committed to maintaining the roof and improving public access to ethnobotanical information.



(L) Sedge beds being prepared for transplanting the white root sedge plants. (R) Rows of white root sedges growing.



The children of Redwood Valley Rancheria enjoy the fruits of their labor by harvesting the pumpkins grown using the tribe's compost.



Like the Mashantucket Pequots, the Pomo Indians of Redwood Valley Rancheria discovered a way to connect gardening with cultural restoration. The tribe received a social economic development grant from the Administration for Native Americans (part of the U.S. Department of Health and Human Services) to develop a white root sedge garden. Historically, Pomo Indians wove baskets from the roots of white root sedge plants. Although white root sedge grows naturally along streams and rivers near Redwood Valley Rancheria, tribal members cannot access the plants because the tribe does not

own riverfront property. In the grant application, the tribe framed the garden as a heritage preservation and economic development project—tribal members would use the white root sedge to create traditional baskets and sell baskets, roots, and entire sedge plants to generate revenue.

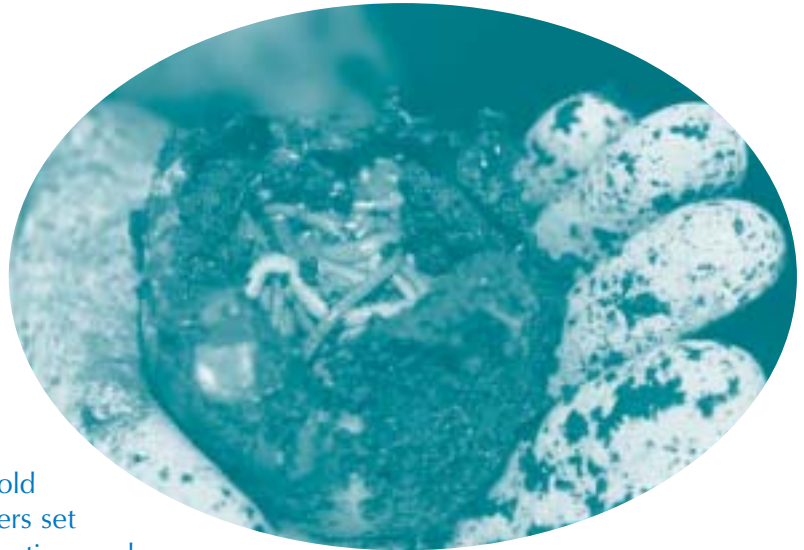
To prepare the garden for the sedge plants, tribal members dug trenches, and applied a small amount of compost, then added 6 to 8 inches of clean sand to imitate the natural terraces where white sedge usually grows. Ironically, it is important that the compost is below the sand so that only the deep nutritional

roots of the sedge plant reach it. The shallow roots, which are harvested for the baskets, turn dark when they are in nutrient rich soil such as compost. Basket makers prefer the roots to be light, as they decorate the baskets with dark materials and the decorations stand out better against a light foundation.

In addition to helping the tribe revive the lost art of basket making, the white root sedge garden generates environmental benefits. White root sedge plants can filter pollutants from runoff and stabilize soil along highways and near parking lots, protecting streams and rivers. The tribe already moved dozens of plants from the garden to the edge of the parking lot of the tribe's new education building. In addition, the California Department of Transportation purchased some of Redwood Valley Rancheria's sedge plants for a bioremediation project along a highway. These pilot projects enabled tribal members to determine the conditions white root sedge requires to thrive. The tribe plans to apply this information to future projects, market the sedge plants to new customers, and prove that economic development and cultural revival can complement one another.

Students and Teachers Worm Up to Vermicomposting

You've heard of guinea pigs and hamsters as school pets, but have you ever met teachers who welcomed worms into their classrooms? Staff and students at Oneida Nation's Turtle Elementary School proudly care for thousands of worms that process food scraps and old newspapers into valuable compost. Cafeteria workers set aside food scraps for the worms during food preparation, and science teachers help students feed and care for the worms.



The Oneida Nation of Wisconsin is not the only tribe to recognize the power of red wigglers (*Lumbricus rubellus*), which can eat half of their body weight in 24 hours. Deanna Himango and Nathan Reinbold, of the Fond du Lac Band of Lake Superior Chippewa's Natural Resources Division, implemented a vermicomposting program on the reservation. This program started at the local Ojibwe School and expanded to 200 households. Mr. Reinbold estimates that approximately one in three families living on the reservation composts, using either an indoor worm bin or a traditional outdoor bin. As a result, the tribe saves thousands of dollars on waste management each year.

TIPS FOR VERMI- COMPOSTING FROM TRIBES

- Obtain support from participants prior to purchasing worms
- Establish a reliable method for collecting food scraps
- Keep food scraps free of contaminants
- Routinely feed worms
- Monitor bin progress
- Use the harvesting process and the final product to cultivate interest in composting throughout the community

Locating funding for a vermicomposting program, educating appropriate staff, setting up worm bins, and establishing a consistent feeding routine takes time, but now the programs at both Turtle Elementary School and Ojibwe School are self-sufficient. The schools no longer receive grants or outside sources of funding for vermicomposting, but their worms continue to multiply, and each year, the schools compost more organic waste. Between 2000 and 2002 alone, Ojibwe School composted approximately 5,200 pounds of food, saving the tribe \$3,300 in hauling fees.

Garnering Support

Obtaining support for a vermicomposting program from participants prior to setting up bins is critical. Ms. Himango held worm committee meetings at the Ojibwe School to convince cafeteria staff,

administrators, and science teachers that worms make good indoor companions, despite their reputation as slimy outdoor critters. At the meetings, Ms. Himango explained that a properly maintained worm bin has a pleasant earthy odor. She also pointed out that vermicomposting would save the tribe money and conserve landfill space. Although the meetings allayed many fears, it took the enthusiasm of children to fully convince adults that vermicomposting was a worthy venture. "Initially the yuck factor made some faculty members reluctant to participate," said Laura Manthe, the vermicomposting program coordinator. "But they came around quickly when they saw how excited the kids were about the project."

The projects at Turtle Elementary School and Ojibwe School demonstrate that vermicomposting is not



An Oneida Turtle Elementary School student works with one of the 30 containers used in their vermicomposting project.

for everyone. Initially, children and a few progressive adults were the only community members excited about worm bins. Their enthusiasm was contagious on Fond du Lac Reservation, where a number of children convinced their parents to compost.

Keeping Food Scraps Contaminant Free

When Ms. Manthe proposed a vermicomposting program at Turtle Elementary School, some faculty members argued that the students would not be able to remember which food scraps to collect for the worms. It took only three days, however, for the children to master their new roles in the cafeteria. Kindergartners through eighth graders collect food scraps in 5-gallon red bins each day during lunch. The older students weigh the scraps, load the red containers onto a wagon, and feed the worms, burying extra scraps in an outdoor compost pile. These children monitor the

collection bins to ensure that meat, bones, and dairy products do not contaminate the worm food.

Fond du Lac's Ojibwe School operates a similar food scrap collection system. Each day, third graders termed "worm wrigglers" obtain a copy of the lunch menu, highlight the items worms can eat, place the menu near a red bin for food scraps, and oversee the collection process.

The Key to Happy Worms

Though worms are not picky eaters, they require a blend of nitrogen-rich food scraps and carbon-rich bedding material to remain happy. The worms at Ojibwe School and Turtle Elementary School thrive because teachers and students ensure that they eat a balanced diet. At both schools, worms receive food year-round.

At Ojibwe School teachers have discovered a way to reduce the amount of time spent caring for the worms—food scraps are stored in a refrigerator and added to the

vermicomposting bins periodically rather than every day. Teachers often take care of feeding the worms, involving the students when time allows. Alternatively, students at Turtle Elementary School feed their worms every day, as the process takes less than 15 minutes.

Connecting with the Community

In addition to reducing waste hauling fees, a vermicomposting program can strengthen bonds in the community and generate interest in composting by fostering communication between children and adults. At Turtle Elementary School, students use a screening table to separate the worms from their castings. Then they mix the worm castings with soil and spread them over raised garden beds, where they grow fruits and vegetables such as raspberries, squash, potatoes, and broccoli. The students enjoy weeding the garden and caring for the plants, as the teachers turn these activities into social events. Each fall, the



Students from the Fond du Lac Band's Ojibwe School pour composting "tea" for sale to community members.

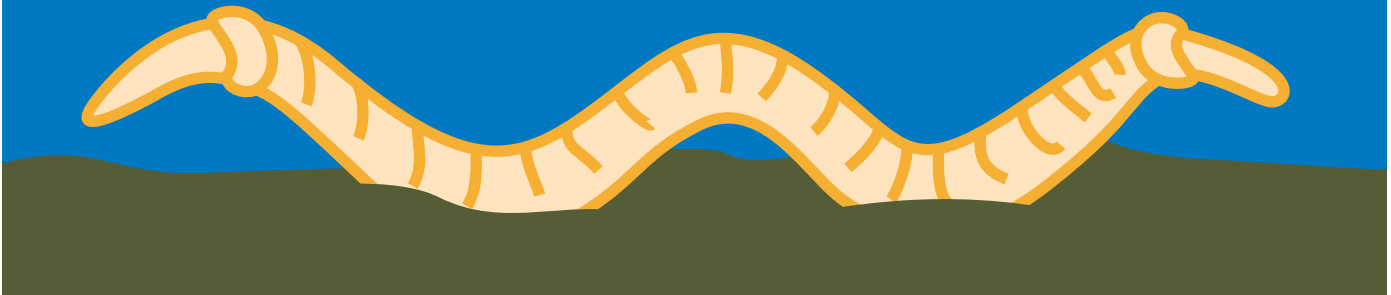
SELECTING AND SETTING UP A WORM BIN

Indoor composting bins range from the homemade variety to special three-tiered systems. Although the Fond du Lac Environmental Department distributes recycled-content plastic bins to community members, it uses four large metal troughs for vermicomposting at Ojibwe School. The Oneida Tribe uses 30 25-gallon plastic containers for the Turtle Elementary School Project.

Any vermicomposting bin must include a cover, as worms like dark, moist environments. Also, worms like to feed near the surface, so a bin should not be too deep. Holes near the bottom of a vermicomposting bin allow nutrient-rich liquids from the decomposing waste to drain.

After selecting a bin of the appropriate size, the next step is to shred bedding material such as newspaper, computer paper, or leaves into small pieces, soak them in water, and spread them around the bin. Worms ingest grit and store it in a digestive organ called a gizzard, where it is used to grind up food; therefore, it is important to sprinkle a gritty substance such as crushed oyster shells, sand, or soil throughout the bedding material.

The final step in setting up a worm bin is adding the worms. Most experts suggest using red wigglers (*Lumbricus rubellus*) or brandling worms (*Eisenia foetida*), which can be purchased from worm farms or garden supply catalogs. After giving the worms a chance to adjust for a few days, food scraps can be added.



children harvest the organically grown produce and prepare dishes for a community feast. Adults bring venison, buffalo, and other treats.

At Ojibwe School, worm wigglers bring messages about composting home to their parents. In addition, students at the school sell their worm castings and “tea”—the nutrient-rich liquid generated during the

composting process—to community members at Earth Day fairs and other events. The children package the castings in take-out containers affixed with labels that explain how to use the compost. They assume ownership of the program and gain experience running a “business” while educating the community about the benefits of composting.

Mr. Reinbold and Ms. Manthe credit vermicomposting with reducing waste management costs, increasing childrens’ self-esteem, and encouraging interaction between the generations. With such an impressive track record, worms could become permanent fixtures in classrooms across the country.