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TRIBAL WASTE Journal

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TRIBAL COMPOSTING NOURISHES LAND AND TRADITION

BACKYARD COMPOSTING —THE BENEFITS START AND STAY AT HOME

TURNING FISH AND FOOD WASTE INTO RESOURCES

KIDS WORM UP TO VERMICOMPOSTING

Welcome to the *Tribal Waste Journal* (TWJ). Each issue features a different waste-related topic and presents related ideas, approaches, and activities successfully employed by tribes and villages. The Tribal Voice, an opinions forum, and an activity-packed Kids Page also appear in each issue. The TWJ is published annually.

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THE TRIBAL VOICE

Worms Reduce Waste and Nourish Bodies and Soils

Bordered by Canada to the North and Glacier National Park to the West, the Blackfeet Indian Reservation covers more than 1.5 million stunning acres of plains, rolling hills, and mountainous forests in northwestern Montana. Despite its vast size, the Blackfeet were able to rally their 10,000 reservation residents to help turn a small EPA grant into a big benefit in terms of reducing waste, giving back to the Earth, and nurturing the community.

Harnessing the creativity and energy of all of its community members, including school children, elders, an herbologist, and organizations like the Headstart Program, helped the tribe get their vermicomposting program off the ground. We spoke with Gerald Wagner, director of the Tribal Environmental Office and Mary Ellen Flamand, solid waste coordinator, about their approach to vermicomposting. The following are excerpts from our conversations:

TWJ: Why did you choose to promote vermicomposting versus other types of composting?

Mr. Wagner: Through a waste stream analysis, we found that a large portion of our waste stream was food wastes. Because of our harsh weather—long, cold winters beginning in October and lasting through late-April or early-May—vermicomposting is good because it can be done indoors under the kitchen sink or in a back pantry. The red wigglers are great! They consume more than their body

weight everyday. They just eat, eat, eat! Also, you don't have to turn the waste. The worms do all the work and the end result is nutrient rich compost and worm tea, which can be used in gardening.

TWJ: How does vermicomposting fit into your comprehensive solid waste management plan?

Mr. Wagner: Vermicomposting is a great way to get tribal members into a recycling mindset and into the habit of separating wastes. With vermicomposting, they are already separating out food scraps, so then separating aluminum, glass, plastics, and cardboard would be a logical next step. We are in the process of closing our current dump site and opening a new transfer station. As part of the transfer station, we are planning an outdoor composting operation. Composting is one part of our comprehensive solid waste management plan and will help us reduce the amount of waste passing through our transfer station, which will reduce our disposal costs.

Ms. Flamand: We're also encouraging tribal members to grow their own foods. Diabetes is a major health issue on the reservation. We hope that by growing healthful foods in family gardens, people will improve their eating habits and their health. We share this goal with Wilbur Fish, the Blackfeet Community College (BCC) Extension Agent and herbologist. Wilbur runs the greenhouse at BCC that now has two giant worm bins that use food scraps collected at the Head Start Program and a local restaurant. He uses the worm castings as a soil amendment. We have also been working with Wilbur and the college to promote the construction of community hot houses to help with family gardens.

Tribal members "feeding" the Blackfeet Community College worms.

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>
> —Gerald Wagner, director, Tribal Environmental Office, Blackfeet Indian Reservation

TWJ: How did you fund your vermicomposting initiative?

Mr. Wagner: We got our start when our EPA Tribal Coordinator for Montana, Stephanie Wallace, contacted us about available funding. She had been reviewing our comprehensive solid waste management plan and saw our plan for a vermicomposting program. From this, we received a $20,000 grant. The fact that we already had a solid waste coordinator on staff helped us to immediately start our program. We hope that the continued support of the tribe and college can help us keep the program going.

TWJ: How did you get the community involved? What was the community's reaction?

Ms. Flamand: When we started our vermicomposting project, we wanted to work with small children to teach them about composting and get them excited and involved. We coordinated with the Blackfeet Head Start program in Browning to collect their food scraps for the worms. At first, the staff was reluctant, but once we met with them and the project progressed they became really excited about it. We only collect about a pound of food scraps each week from the Head Start, so it is primarily an educational effort, but we feel it is worthwhile.

COMPOSTING TERMINOLOGY

Biosolids—Treated and processed sewage sludge. Biosolids are nutrient-rich organic materials that can be safely recycled and applied as fertilizer to sustainably improve and maintain productive soils and stimulate plant growth.

Vermiculture/vermicomposting—Using worms to break down organic matter into nutrient-rich compost called castings. Vermicomposting bins can function indoors or outdoors, but cannot process animal products or grease.

Worm tea—Nutrient-rich liquid generated during the vermicomposting process.

Windrow—Long, narrow piles of organic materials typically arranged in rows. Frequent turning of windrows aerates the piles and helps maintain the desired temperature and oxygen levels.

Garth and Radium Woolf with their composting science fair projects.

I also gave about 10 composting presentations in five of the seven communities on the reservation. The training focused on diverting food scraps from the waste stream, with vermicomposting as one method we discussed. I tried to make the presentations fun. I used humor, funny pictures, and stories whenever I could. For the kids, I do interactive skits that get them involved and excited.

One meeting of elders, attended by a mother and her son and daughter, inspired them to create science fair projects. Garth Woolf (14 years old) developed a project for the Middle School Science Fair. I gave him a five-gallon plastic container, the worms, and instructions on how to build a vermicomposting bin which he built by himself. His 12-year old sister, Radium, also entered a project in the science fair. Building on her brother's work, she used the worm castings and compost from Garth's vermi bin to fertilize a plant and compare its rate of growth to another plant that did not get any compost. Adrian Wagner, Gerald's son, took his vermicomposting project to the State Science Fair in Missoula.

TWJ: What other vermicomposting projects have you done?

Ms. Flamand: We wanted to help enhance the BCC greenhouse, so we used money from another grant we received to purchase design plans and build a "high-tech" worm bin box. The bin was 8 feet long by 4 feet high by 2 feet deep. We chose this particular design because it offered a controlled environment for the worms, but also because its height meant you didn't have to bend over a lot when taking care of the worms.

> Some of us have lost touch with looking after the environment. We have become a throwaway society. We are trying to re-educate and teach tribal members that they are responsible for the waste they generate. The EPA grant we received has helped us get back to things we used to do—turning our waste into something good.
>
> —Mary Ellen Flamand,
> solid waste coordinator,
> Blackfeet Indian Reservation

Initially, we placed the bin inside the greenhouse, but it was too hot and the worms were drying out. Placing it outside lead to the worms and waste being over ventilated and dried out again because of the high winds on the reservation and the bin's design. Based upon the shortcomings and lessons learned from this first worm bin, Wilbur Fish and a colleague designed and built a new indoor/outdoor composting system. This system can handle a large amount of compostable materials and uses worms, hay, and food scraps to generate a nutrient-rich compost for use in the BCC greenhouse. The new design really fits our needs and environment and the castings and tea have produced spectacular results in the greenhouse.

TWJ: Does composting have any historical or traditional roots for your tribe?

Ms. Flamand: Some of us have lost touch with looking after the environment. We have become a throwaway society. We are trying to re-educate and teach tribal members that they are responsible for the waste they generate. The EPA grant we received has helped us get back to things we used to do—turning our waste into something good. Years ago, we used every part of the animal. I remember one elder telling me how she used to fashion a hardened bladder bag into a bowl to cook meat. She placed the meat, water, and hot rocks in the bladder bowl and boiled her meat. We have been trying to encourage people to think about these types of things again and even return to some of these practices.

TWJ: What advice do you have for other tribes considering composting?

Mr. Wagner: You can't do this on your own. You really need everyone involved. That is what we've done—involved everybody, including children, elders, and the community college. You also need the tribe to buy into the program. Any composting project needs to be pushed and funded as part of an ongoing recycling program. It is hard to sustain a program such as this without a steady source of financial support.

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Backyard Composting: Cultivating the Many Benefits

"You have noticed that everything an Indian does is in a circle, and that is because the Power of the World always works in circles, and everything tries to be round..."

Black Elk, Oglala Sioux Holy Man

Returning dead material to the Earth to provide fodder for new growth is central to the "circle of life" concept. Backyard composting—composting food scraps and plant clippings at home—provides an opportunity for people to play a role in continuing this cycle by returning valuable nutrients to the soil. At the same time, it saves money in disposal costs—a real benefit for tribes that subsidize waste disposal—and diverts unnecessary waste from the waste stream.

Backyard composting ties perfectly into home gardening—garden clippings can be composted, and the compost can be applied to the garden as a soil amendment, especially in areas with poor soil quality. By gardening in conjunction with composting, tribal members can grow healthy, low-cost produce and revive gardening skills often lost to the younger generation.

The Fond du Lac, Ho-Chunk, and Oneida Nations have had tremendous success with backyard composting programs without a huge financial investment. Here are their stories.

Backyard composting takes many shapes and forms, and tribes approach it in myriad ways. The Fond du Lac Tribe, located in northeastern Minnesota, provided 200 vermiculture bins and 200 backyard composting bins to community members free of charge to allow them to begin composting at home. Likewise, the Oneida Tribe, in neighboring Wisconsin, offered bins to tribal members at a discounted rate. Oneida's recycling coordinator, Diane Jourdan, is working toward a Master Composter certificate and teaches a home composting class to community members on Earth Day. The Ho-Chunk Nation, which has a non-reservation status and spans 15 counties in Wisconsin, conducted a home gardening and composting workshop for a small group of tribal families. Ho-Chunk's project focused on home gardening, with composting as an important element to introduce nutrients into the soil.

Fond du Lac Environmental Program

TIPS FOR STARTING A BACKYARD COMPOSTING PROGRAM

- Approach tribal council for funding
- Find a local expert
- Provide ongoing support/troubleshooting
- Publicize the program
- Connect to tribal tradition/other activities

Getting Off the Ground

To begin a community backyard composting program, most tribes undergo three main steps:

- Planning
- Securing funding
- Education

Planning involves determining the number of tribal members you want to involve in the early stages, whether you want to purchase bins, and how you will educate community members and publicize your project. Tribes often start by presenting the idea of backyard composting to the tribal council to solicit funding for start-up expenses. For the Fond du Lac Tribe's Environmental Program, backyard composting bins were an easy sell to the Reservation Business Committee (RBC) because of the money they would save. Waste sorts had demonstrated that food scraps comprised roughly 15 percent of the reservation's waste

stream; therefore, the tribe could lower its disposal costs by diverting food scraps to compost bins. The Environmental Program supplemented funding from the RBC with General Assistance Program (GAP) grant funding. The Oneida tribe received a grant for its vermicomposting project, but for backyard composting, the tribe simply purchased composting bins and sold them at a discount to tribal members.

An invaluable resource to most tribes when beginning a composting program is the wisdom of a local expert. The Oneida tribe was fortunate to have a composting guru in its recycling coordinator, Ms. Jourdan, who also relied upon the ongoing composting program of an adjacent county as a resource. The Fond du Lac tribe tapped the knowledge of local expert Ellen Sandbeck, author of a book about reducing the use of toxic substances in daily activities. Nathan Reinbold, Fond du Lac's environmental education outreach coordinator, says he educated himself through Cornell University's composting Web site, which contains comprehensive composting guides, curricula, and case studies.

For the Ho-Chunk tribe, getting started was a matter of getting connected. Ho-Chunk's project focused on home gardening, and the tribe brought in an expert to conduct a one-day home gardening workshop for Ho-Chunk families. EPA's Region 5 office connected the workshop coordinator, Lisa D'Angelo, with Mike Flynn of Milwaukee, an urban gardening instructor. The tribe was also fortunate that Ms. D'Angelo is an organic gardening expert. (One resource that Ms. D'Angelo recommends for those interested in home gardening is *Organic Gardening* magazine.)

Tribes that do not know of a local or tribal expert might consider the assistance of a university or state extension service. These institutions often have experts available for volunteer projects, and also offer information and technical assistance. Contacting regional EPA or state environmental agencies can also be helpful, as is networking with county employees and other tribes with composting programs.

Spreading the Knowledge, Spreading the Word

The keys to maintaining a strong backyard composting program in your community are:

- Conducting upfront education
- Providing ongoing support
- Maintaining publicity and awareness about the project

Teaching community members how to compost can be accomplished in a group format or on a one-on-one basis. For example, Diane Jourdan of Oneida teaches a class on home composting each year on Earth Day. Each student receives a free composting bin and learns how to use it during the class. Likewise, the Ho-Chunk workshop brought many people together to learn in a community setting. In contrast, Mr. Reinbold of the Fond du Lac Tribe spends 10 minutes with each community member when he or

A DAY OF GROWING

The Ho-Chunk tribe's one-day gardening and composting workshop consisted of hands-on instruction from expert Mike Flynn on how to plant a garden, integrate organic soil amendments, and compost food scraps to generate soil amendments and reduce waste. The class was held at the house of a tribal family that volunteered its garden for the demonstration.

Mr. Flynn taught the class at an introductory level, which was perfect for the families, most of whom had no gardening experience. In addition to his strong base of scientific knowledge, Mr. Flynn's humor and stories made composting exciting to many who had never considered the idea. After the class, the participating families shared a meal together.

In the future, Ho-Chunk hopes to offer the same class to more families, and to offer similar classes in seed saving, food preservation, and canning—specifically of traditional foods such as squash and Indian corn.

she picks up a free bin, explaining how the bin works and what materials can and cannot be added. He also gives participants a food scrap collection bucket that can be stored under the kitchen sink until the contents can be transferred to the bin.

After providing tribal members with an initial lesson, offering ongoing support and help pinpointing and correcting problems is critical. For Ms. Jourdan, this continuity was achieved by providing her phone number for people to call for questions or comments about their bins. When people described problems, Ms. Jourdan could often explain solutions. Participants in the Ho-Chunk gardening workshop reported on their progress when they saw Ms. D'Angelo at the clinic, and she visited the families to see the progress of their gardens.

Mr. Reinbold uses the Fond du Lac Environmental Program's monthly newsletter and the monthly tribal newspaper to discuss common composting bin problems and how to avoid them. He also uses these newspapers as a tool for publicizing the program, and informs residents that they can pick up free composting bins.

Students learn how to compost at the Oneida Tribe's Turtle Elementary School.

Publicity can occur both formally, through outreach efforts, and informally, through word-of-mouth. For the Ho-Chunk gardening project, word-of-mouth was the main conduit by which news and interest in the project spread. People told others about their gardens, and many more families expressed an interest in participating. Ms. D'Angelo keeps a list of families that saw their neighbors gardening and would also like to learn.

Other ways to publicize your backyard composting program and motivate people to participate include distributing information at fairs and community events or creating a composting Web page. You can also consider maintaining a demonstration organic garden, providing books to interested community members, providing gardening cushions, or creating creative T-shirts, such as Fond du Lac's—"Compost: because a rind is a terrible thing to waste." Another important idea for making the program a success is to incorporate a social element. For Ho-Chunk, the families who attended the workshop ate together afterward. Ms. D'Angelo commented that incorporating this social element was very important to the success of the project, as this is highly valued by the tribe.

BACKYARD COMPOSTING CAN BE APPROACHED IN SEVERAL WAYS:

- Use a basic 5-gallon bucket with a lid
- Purchase or build a compost bin outside of the home
- Trenching: Rake yard debris into a pile and add food scraps
- Backfilling: Dig a trench and fill it with compostable materials

Materials commonly added to backyard compost piles include fruit and vegetable scraps, peels, and rinds; coffee grinds and tea bags; bread products; and yard wastes such as leaves, grass clippings, and plant trimmings.

NEED FUNDING? GIVE BIA A CALL

Looking for funding for a solid waste project? Try calling your BIA Regional Environmental Scientist. That's what Nathan Reinbold, environmental education outreach coordinator of the Fond du Lac Reservation, did to get $40,000 to finance the creation of a large scale composting operation. After speaking with Herb Nelson, the BIA Midwest Region regional environmental scientist, he submitted a letter explaining the project and outlining the tribe's financial needs.

Mr. Nelson explains that the Environmental Management Program's operating budget covers the program's operating expenses and salaries of BIA's 12 regional environmental scientists and provides BIA's contribution to the Interagency Tribal Open Dump Cleanup Project. Any leftover funds are divided equally amongst the BIA regions to be awarded to tribes for environmental projects. Each region typically gets between $300,000 and $350,000 annually. Awards to individual tribes are generally less than $30,000, but there are very few restrictions on how the money can be used by a tribe.

Mr. Nelson recommends calling your BIA regional environmental scientist in the early fall to learn about the availability of funds and how to apply. The awards process follows the federal budget cycle, so applications typically need to be submitted to BIA by October 1 each year. Application requirements may vary by region, but in many cases a one-page letter outlining what the project would entail, how much is being requested, how the money will be spent, and a project time line is enough. "If you can spread your project out over 2-years, you increase your chances of getting funded," advises Mr. Nelson.

Connections

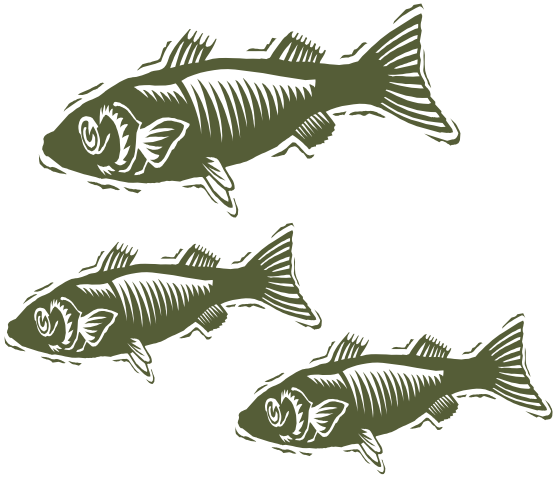
In addition to diverting organics from the waste stream, home composting and gardening often tie into tribal tradition. As Mr. Reinbold points out, composting fits with the Fond du Lac Environmental Program's motto: "It is our duty to protect the environment and those creatures that cannot protect themselves for future generations."

For the Ho-Chunk tribe, whose program focuses on home gardening and composting, the project creates a specific demonstration of the circle of life. The compost is an important component of the gardening project, because the soil in the area has a high sand content—people will say that the soil is so poor that you cannot have a garden. Therefore, it is necessary to teach gardeners how to incorporate organic wastes such as peat moss, grass clippings, and compost to enrich the soil. Teaching home gardening revives skills from the grandparents' generation that younger people say they would like to develop.

Through a ripple effect, news of Ho-Chunk's home gardening and composting project has made its way to the tribe's historical society. Says Lisa D'Angelo, "The project connects to the work of the historical society—which strives to revitalize all aspects of Ho-Chunk culture, including diet, language, and traditions—because it connects to the tribe's history as an agricultural, as opposed to a hunter-gatherer, tribe." Home gardening gives people access to inexpensive, organic vegetables—a benefit emphasized by Ms. D'Angelo, who works for Ho-Chunk's Black River Falls Health and Wellness Center. Gardening also encourages people to be more active and helps families work as units.

Students from the Fond du Lac Ojibwe School show off their compost and one of its contributors.

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 abound on Kupreanof Island, logging 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."

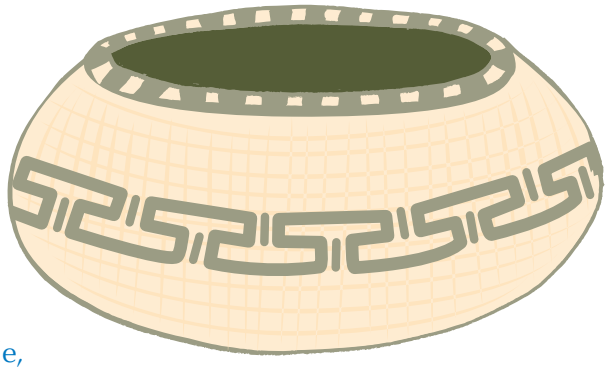
A Return to Tradition

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 Mashanantucket 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.

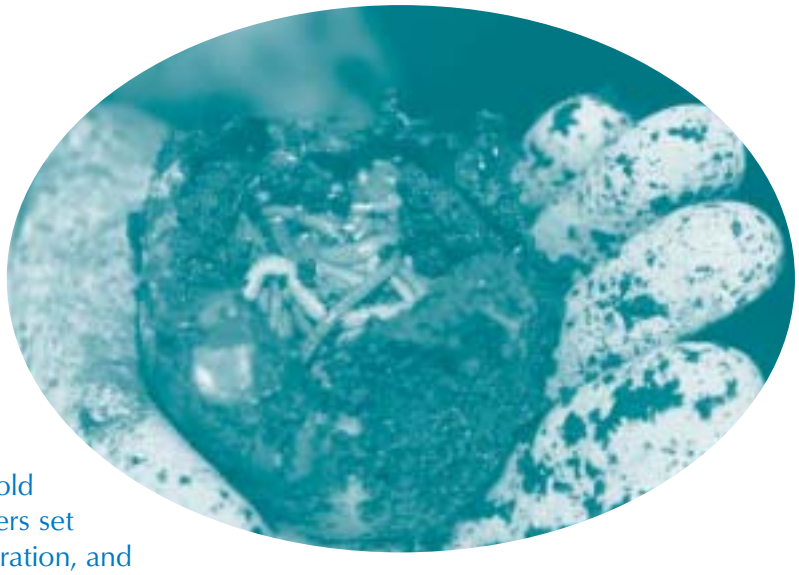
The children of Redwood Valley Rancheria enjoy the fruits of their labor by harvesting the pumpkins grown using the tribe's compost.

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.

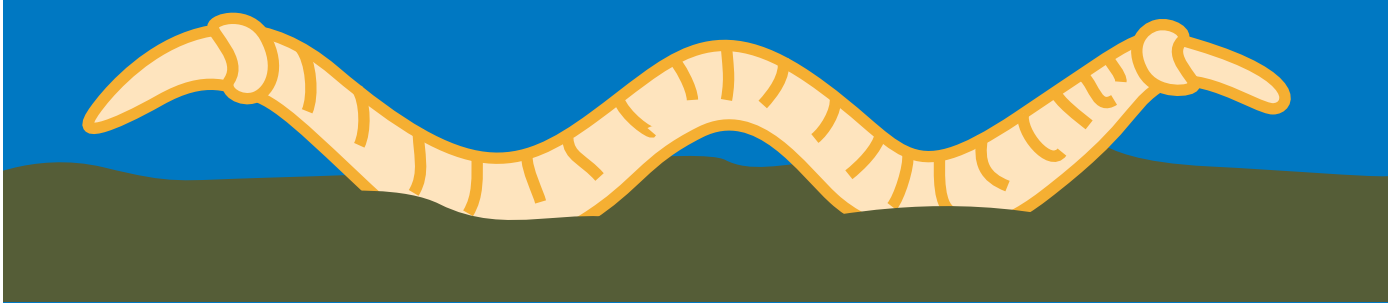
SELECTING AND SETTING UP A WORM BIN

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 wrigglers 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.

Salt River Landfill's Green Waste Composting Beats the Heat

Don't think you can compost in arid climates? Think again. The Salt River Pima-Maricopa Indian Community composts nearly 3,000 tons of yard trimmings and commercial landscaping waste each month!

Located just east of Phoenix, Arizona, the Salt River Reservation is home to approximately 6,000 enrolled members of the Salt River Pima-Maricopa Indian Community. With an average annual precipitation of less than 10 inches per year and an average high temperature of above 100°F during the summer, the Salt River Reservation might seem to be a less than ideal location for a large scale composting operation. Yet despite the hot, dry Arizona climate, the Salt River Landfill still manages to produce a high-quality product that makes its way onto the shelves of local nurseries, hardware stores, and home improvement centers.

The Salt River Pima-Maricopa Indian Community's green waste composting program is located at its permitted Subtitle D landfill. Owned and operated by the community, the Salt River Landfill is run as an autonomous enterprise. The community built the landfill for two purposes—to manage the reservation's municipal solid waste and to generate revenue. In fact, the majority of the waste received at the landfill comes from neighboring Mesa, Gilbert, and Scottsdale. As part of its contract with these communities, the landfill also accepts green waste, which consists of yard trimmings and landscaping wastes (e.g., grass clippings, tree trimmings, shrub trimmings) from both residences and commercial businesses, including landscaping companies.

The Salt River Landfill operators began the green waste program in 1996 in an effort to reduce the volume of materials landfilled. As green waste takes up a significant amount of landfill air space, separating and managing it separately extends the operational life of the landfill by several years. Both the community and landfill operators felt that composting the green waste made sense economically, operationally, and environmentally. "It was just the right thing to do," explained Frank Velazquez, assistant general manager of the landfill.

Initially, a front-end loader broke apart incoming loads of green waste which were then hand-sorted by a four- man crew to remove contaminants. The sorted green waste was then ground in a tub grinder and placed in open-air piles to compost. Landfill staff monitored the temperature of the piles using hand probes and turned them regularly with the landfill's front-end loader to ensure proper aeration. The finished product was then shipped to a local mulch manufacturer that mixed in amendments, and bagged and sold the final product.

Not completely satisfied with the quality of its finished products, the landfill operators decided to switch from using simple piles to composting in windrows. While this decision resulted in a more uniform final product, it also required additional equipment and increased operational costs.

Challenges: Climate and Contamination

As might be expected, the greatest challenge facing Salt River Pima-Maricopa Indian Community's green waste program was the area's climate. The hot, arid climate quickly dries the chipped material, short-circuiting the composting process and making compost piles and windrows a potential fire hazard. To address both these issues, the landfill staff installed a fire hydrant system at the dedicated 5-acre composting area. The hydrant system allows workers to spray the compost piles as needed to maintain the proper moisture levels to sustain the decomposition process. The system also doubles as a fire suppression system in case of a fire.

Another major problem was the contamination of incoming green waste with inappropriate materials such as painted or chemically treated wood. "If the community is not making a whole-hearted effort, one single bag of nongreen material can ruin entire batches of product," laments Mr. Velazquez. "Even nontoxic contaminants, such as plastics, glass, and other trash, can degrade the quality of the compost, creating an unaesthetic, even dangerous, final product."

To minimize contamination, the program managers work with the communities of Mesa, Gilbert, and Scottsdale to educate their residents about the types of waste acceptable for composting. Mr. Velazquez noted, "Mesa has an excellent program; it purchased special 90-gallon containers for its residents specifically for green waste. That has helped cut down on some of the contamination."

Changing Hands

After six years of successful composting, the landfill managers assessed the entire landfill and composting operation and decided that they were diverting a disproportionate amount of time and resources to the green waste program. At the same time, the green waste program was reducing the volume of waste disposed in the landfill and generating an environmentally beneficial and useful product. Not wanting to end the program the landfill managers and tribe concluded that it made more sense economically and operationally to let the experts handle the composting operation.

To this end, the community hired a recycling company from Houston, Texas, to assume control and daily operation of the green waste program. "They are a very professional group," said Mr. Velazquez. "They brought in their own equipment and personnel and completely took over operation of the green waste composting program. They streamlined operations and now produce a very high quality compost material."

Currently, the green waste program is a break-even endeavor. The minimal tipping fee for incoming green waste charged by the landfill offsets the expense of paying the contractors to run the green waste program. Though not generating revenue, the program's real value is in saving space at the landfill—which translates into longer landfill life and continued revenue—and meeting the community's goal of trying to recycle as much as possible.

Compost's Future in the Arid West

"It seems that everyone in the Midwest and East have great green waste programs, and that mulch and compost are used heavily in these areas," observes Mr. Velazquez. "In comparison, mulch and compost are not used as much in the West." He attributes this to the arid climate, the relatively few number of trees, and the abundance of rock and gravel in the area, which makes rock mulch the more common choice for landscaping. Although using compost as a ground cover has not caught yet in the region, Mr. Velazquez, his subcontractor, and a few others in the field have high hopes for the increased use of this product in the West in the near future. They believe that as the cost of landfill space continues to increase, separating and composting, mulching, or grinding organic materials will become more common. "My overall message is that there is hope," opines Mr. Velazquez.

For other tribes considering green waste composting programs in any region—arid, humid, or even arctic—Mr. Velazquez offers this advice, "Educate yourself. Learn and understand the decomposition process by taking courses, such as SWANA's composting course; reading composting periodicals; and consulting with experts, especially local professionals with experience composting plants common to your region under local climatic conditions."

The drop-off location and windrows at the Salt River Landfill

TIPS FOR COMPOSTING IN ARID CLIMATES

- Educate yourself on all aspects of the composting process
- Consult with local composting experts
- Ensure access to water to maintain proper moisture levels in piles and prevent fires
- Work with your community to prevent contamination of source materials
- Consider all the benefits of a green waste program, not just profitability

Composting Garbage and Sludge—An Alaskan Solution

Climate, geography, and geology often combine to create seemingly insurmountable challenges for waste management in Alaska. The village of Haines, located in southeast Alaska, like many communities, faced a limited number of waste management options—all prohibitively expensive. Fortunately, Haines Sanitation, Inc. (HSI) devised a creative and innovative approach to solve the village's solid waste management problems: in-vessel municipal waste composting.

HSI, under the leadership of company president, Lynda Walker, and vice president, Tom Hall, is composting the village of Haines' municipal solid waste and sewage sludge through a large-scale, aerated in-vessel operation. This municipal waste composting treats unseparated garbage and sewage sludge from the village's wastewater treatment plant to create an inert material suitable for use as landfill cover.

Ms. Walker and Mr. Hall strongly believe in this process and hope to work with other villages in the near future to develop a customized system to meet their needs. "Spreading mixed compost or using it as a cover material for an existing open dump is a much better option than throwing untreated garbage and honey bucket waste on the tundra or into surface water. The health and environmental benefits will justify the costs to the villages." Ed Emswiler from Alaska Department of Environmental Conservation (ADEC) agrees, "It is a much better option than open dumping and much of the burning currently taking place in Alaska. HSI has demonstrated the technology works—now we just need to get out there and test it."

HSI turned to municipal waste composting as an affordable method for managing the village's waste after exploring several other options. HSI's first option was to bring its landfill into full compliance with the Subtitle D landfill requirements. This approach was immediately rejected as being too expensive. HSI then tried shipping waste to Seattle for disposal. After paying more than $200,000 in one year and charging community members more than $40 per month for a one can per week garbage pickup, this was also abandoned as too costly.

> "Municipal solid waste composting is an option that needs to get on the table in Alaska. Its major advantages are its ability to stabilize garbage, control disease and vectors, and manage and decontaminate sewage sludge."
>
> —Ed Emswiler, Alaska Department of Environmental Conservation

It was at this point that HSI decided to pursue composting. Over the next two years, HSI spent approximately $500,000 designing, purchasing components, building, and perfecting its municipal waste composting system. The entire system, with the exception of the computer monitoring and control system, was built using off-the-shelf components and electronics. A significant portion of this sum was spent perfecting designs and addressing engineering and operational problems as the system was built. With this experience, Mr. Hall believes he could now

HSI's final compost product curing in windrows. Not even mid-winter freezing temperatures slow the process down.

reduce the cost of developing a new system for a village to between $300,000 and $350,000, including all freight costs.

While this price is still high, HSI believes the potential improvements to village health and the environment justify the expense. Mr. Hall also points out that the process could potentially use fish waste or honey bucket waste (i.e., raw sewage) in addition to, or in place of, biosolids. "We just need to try it and work out the engineering," explains Mr. Hall.

Advantages of Composting

While cost savings is the major motivator in HSI's composting, volume reduction, waste stabilization, and the generation of a usable product are other major benefits of municipal solid waste and sewage sludge composting. By reducing the volume of the 1,100 tons of waste it treats each year by about one-third, HSI's process will nearly double the life of the current Class III landfill (permitted for inert wastes only), according to Mr. Hall.

The composting process also effectively neutralizes organic materials in waste and sludge that attract birds, rats, foxes, dogs, bears, insects, and other disease vectors. The process destroys organic compounds that can leach from untreated waste and contaminate drinking water supplies or valuable fishing waters. "Our compost will not leach or attract animals. We have not had any problems with bears, and the ravens are really not happy with us," reports Mr. Hall. The decomposition process also decontaminates sewage sludge, making it safe for disposal—an important health consideration for many Alaskan villages.

HSI's finished compost also can be used as landfill cover material. Adequate volumes of suitable cover material are extremely hard to find and expensive to procure in many parts of Alaska, particularly in remote tundra settings. HSI believes that the large amounts of decontaminated, inert compost that its process generates presents a low-risk alternative to expensive imported cover materials. At this time, HSI is awaiting ADEC approval to use the final compost as cover material at its Class III landfill. Mr. Hall is confident they will receive approval. "It makes an excellent cover material as it compacts well and can support plant growth," he explains.

The Process

HSI's mixed waste composting combines most of the municipal solid waste generated by the Haines community and sewage sludge from the community's wastewater treatment plant. Some materials such as construction and demolition (C&D) debris and other large items are separated and taken directly to the landfill. The materials collected through the community voluntary recycling program are, likewise, managed separately and not composted.

The first step in the process is shredding the garbage and mixing it with the biosolids from the wastewater treatment plant. The shredding and mixing takes place in a mixing trommel, a 12-foot diameter by 30-foot long, knife-lined rotating drum. After spending two hours in the mixing trommel, the waste/sludge mixture is ready to be placed in the digester.

Using the proper carbon-to-nitrogen ratio (i.e., waste to biosolids) is

EPA 503 REQUIREMENTS

The Subpart D (pathogen and vector attraction reduction) requirements of 40 CFR Part 503 regulations were developed for the land application or disposal of biosolids (sewage sludge). For biosolids to be applied to lawns and gardens as a soil amendment, they must meet the Class A Pathogen and Vector Attraction Reduction Guidelines. These guidelines require that temperatures be sustained during the biosolid composting process at 55° Celsius (131° Fahrenheit) or greater for at least three days if in-vessel or static aerated piles are used, or 55° Celsius or greater for at least 14 days if aerated windrows are used. There are no federal *composting* requirements, but many composters use the 503 regulations as guidelines for their composting operations.

A MILLION DOLLAR ALASKAN OPPORTUNITY—DENALI COMMISSION SOLID WASTE PROGRAMS

In 2004, the Denali Commission received a $1 million appropriation from the U.S. Department of Agriculture's Rural Development office (USDA RD) to address deficiencies in solid waste disposal sites which threaten to contaminate rural drinking water supplies (under the FY 2004 Omnibus Appropriation Bill (H.R. 2673 Sec. 764)). This funding provides the Denali Commission and its partner organizations an opportunity to identify innovative solutions to technical and logistical challenges of traditional handling of municipal solid waste (MSW). The appropriation authorizes the Denali Commission to fund pilot projects incorporating emerging technologies to improve local management options. To date, Denali Commission has allocated $842,870 of the $1 million FY04 funds to 13 separate projects, including several composting projects.

For FY05, USDA RD appropriated another $1.5 million for the Denali Commission Solid Waste Program to distribute. While the initial FY04 was considered a single-year funding opportunity, the 2005 funding signals the possibility of continuing investment by USDA RD.

To learn more about the Denali Commission's Solid Waste Program and funding opportunities please contact: Cindy Roberts at 907 271-3018 or email to croberts@denali.gov. A list of the current award recipients and application information is available on the Web at <www.denali.gov/Program_Documents.cfm?Section=Solid%20Waste>

crucial to achieving maximum compost efficiency and ensuring the process is self-sustaining within the digester. HSI uses an aerobic composting process, so proper water and air concentrations also are critical. When all of these ingredients are in the proper proportions, the composting/digestion process generates temperatures sufficient to sustain decomposition and meet EPA 503 Pathogen Reduction and Vector Attraction Requirements. During the first two years, HSI experimented with different waste, sludge, air, and water ratios. Mr. Hall believes they have finally found the proper proportions and can consistently produce compost of the desired quality.

HSI staff monitor and control air and moisture levels within the digester with a computer control system. To maintain desired moisture levels, water is periodically added, mostly derived from previous batches of compost. Because it is a closed-loop system, no water is discharged from the system to pollute the environment.

To keep temperatures within the digester from getting too high (i.e., high enough to kill the beneficial microorganisms responsible for the decomposition process), the computer regulates the flow of air into and out of the vessel. If temperatures become too high, more air is pushed through the vessel in order to cool the compost. Conversely, air supply is reduced when temperatures are too low. The computer system also records in-vessel temperatures over time to demonstrate that each batch meets the EPA 503 temperature requirements. Odors from the decomposition of the waste are controlled by passing air exhaust through a wood chip and sawdust biofilter.

After the 14-day digestion period, the compost is removed from the vessel and passed through a rotating two-inch screen. This screening separates the larger particles (mostly glass, plastic, and cans) from the compost. The large-sized waste is taken to the landfill and buried as inert municipal waste. The screened compost is then placed in curing bins for 14 days. After curing, the final product is ready for use. In 2003, HSI produced approximately 400 tons of usable compost and landfilled 300 to 400 tons of screened, inert material.

Due to its unsegregated nature, the compost contains small shards of glass, plastic, metal, and other items that can pose a safety hazard. Occasionally, needles end up in the compost when community members throw them in the trash instead of taking them to the community health facility for proper disposal. Because the compost frequently contains these dangerous items, HSI workers wear protective safety gear (e.g., gloves, boots, and aprons) when handling it.

RESOURCES

PUBLICATIONS

Appelhof, Mary. *Worms Eat My Garbage: How to Setup and Maintain a Vermicomposting System*. Kalamazoo, Michigan: Flower Press, 1982. <www.wormwoman.com>

U.S. EPA. *Biosolids Technology Fact Sheet: In-Vessel Composting of Biosolids* (EPA832-F-00-061) <www.epa.gov/owm/mtb/invessel.pdf>

U.S. EPA. *Biosolids Technology Fact Sheet: Use of Composting for Biosolids Management* (EPA832-F-02-024) <www.epa.gov/owm/mtb/combioman.pdf>

U.S. EPA. *Composting Yard Trimmings and Municipal Solid Waste* (EPA530-R-94-003) <www.epa.gov/epaoswer/non-hw/compost/cytmsw.pdf>

U.S. EPA. *Fact Sheet: Cover up with Compost* (EPA530-F-02-002) <www.epa.gov/epaoswer/non-hw/muncpl/ghg/f02022.pdf>

U.S. EPA. *GreenScapes Brochure* (for large land-use applications) (EPA530-K-03-003) <www.epa.gov/epaoswer/non-hw/green/pubs/brochure.pdf>

U.S. EPA. *GreenScaping Your Lawn and Garden* (brochure for homeowners) (EPA530-K-03- 002) <www.epa.gov/epaoswer/non-hw/green/pubs/home-gs.pdf>

U.S. EPA. *Waste Prevention, Recycling, and Composting Options: Lessons from 30 Communities* (EPA530-C-01-002) <www.epa.gov/epaoswer/osw/cdoswpub.htm>

WEB SITES

Better Composting School, sponsored by the University of Maryland/Maryland Cooperative Extension <www.agnr.umd.edu/users/Bioreng/recyclegreen.htm>

Cooperative State Research, Education, and Extension Service (CSREES), U.S. Department of Agriculture. <www.csrees.usda.gov/Extension/index.html>

Cornell University/Cornell Waste Management Institute Composting Web site <cwmi.css.cornell.edu/Composting.html>

greenroofs.com <www.greenroofs.com>

Green Roofs for Healthy Cities <www.greenroofs.org>

Green Roof Plants <www.greenroofplants.com>

U.S. Composting Council <www.compostingcouncil.org/index.cfm>

U.S. EPA Composting Web site <www.epa.gov/compost>

U.S. EPA GreenScapes Web site <www.epa.gov/greenscapes>

U.S. EPA Jobs Through Recycling: Organics Web page <www.epa.gov/epaoswer/non-hw/recycle/jtr/comm/organics.htm>

U.S. EPA Waste Management in Indian Country <www.epa/gov/tribalmsw>

Solid Waste Alaskan Network (S.W.A.N.)—Composting <www.ccthita-swan.org/Tutorials/composting_final.cfm#9>

Solid Waste Association of North America composting certification. <www.swana.org>

Washington Organic Recycling Council (WORC) composting training <www.compostwashington.org>

FUNDING

U.S. Department of Agriculture Value-Added Producer Grants <www.rurdev.usda.gov/rbs/coops/vadg.htm>

Bureau of Indian Affairs Environmental Management Program grants—contact your BIA regional environmental scientist

Denali Commission Solid Waste Program <www.denali.gov/Program_Documents.cfm?Section=Solid%20Waste>

RELATED RESOURCES

Annual Native American Permaculture Design Course Permaculture—permanent (Agri) culture—is the harmonious integration of landscape and people, providing food, energy, shelter, and other needs in a sustainable way for all species. It is a holistic approach based on traditional practices. For more information contact:

Traditional Native American Farmers Association
Phone: (505) 983-2172 or (505) 412-0336
E-mail: tnafanm@yahoo.com or teszu@aol.com

The National Gardening Association, a nonprofit organization established to help gardeners, has a series of articles on the many uses of native plants.

Native Plants as Food <www.nationalgardening.com/special/tmi/article3.asp>

Native Plants as Medicine <www.nationalgardening.com/special/tmi/article4.asp>

Native Plants for Fiber, Dyes, and Other Uses <www.nationalgardening.com/special/tmi/article5.asp>

PERIODICALS

BioCycle Journal of Composting & Recycling. JG Press Inc. <www.jgpress.com/biocycle.htm>

Composting News. <www.recycle.cc>

Worm Digest. <www.wormdigest.org>

CONTACTS

The Tribal Waste Journal would like to thank everyone who shared their stories and experiences for this issue. Interviewee contact information is provided below for those who are interested in learning more about specific tribes' programs.

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To be placed on our mailing list or submit ideas or success stories, send an e-mail to Janice Johnson, creative director of the *Tribal Waste Journal*, at <johnson.janice@epa.gov>.

Kid's Page

OF THE EPA TRIBAL WASTE JOURNAL

Calendar Contests

Want a way to deliver your waste management or environmental message 12 months of the year? Create a calendar and fill it with recycling, composting, and other waste reduction tips. Consider sponsoring a poster or photography contest for students as artwork for the calendar to get kids excited and involved. The Red Lake Band of Chippewa Indians held a poster contest for middle school students. More than 40 students submitted posters with a pollution prevention and protecting the environment theme. Red Lake Department of Natural Resources staff selected the 12 winning posters for use in the calendar and distributed more than 500 calendars to tribal members.

The White Earth Band of Chippewa Biology Department also produced a calendar to increase environmental awareness within the community. The calendar featured photographs of scenic areas on the reservation, such as a local landing at sunset and native wildlife, and contained environmental quotations in Ojibwa from famous chiefs. The tribe packed the back page of the calendar with information on its solid waste ordinance and ways for members to report illegal dumping incidents.

COMPOST CROPS

After your kids have put in all the hard work and effort composting yard trimmings or food scraps in their backyard and vermicomposting bins, here is a great exercise to demonstrate the usefulness of compost. Using two similar garden plots—one with a bucket of compost mixed into the soil and one without—kids can compare compost's influence on the plants' rate of growth. Over a 4 or 5 week period of watering, weeding, and measuring the plant growth for each of the plots, kids can compare the size and appearance of the plants in both plots. They can also dig up one plant from each plot and compare the root structures of both plants, and dig around in the soil and examine and compare differences between the soil texture, moisture content, and presence of worms or other insects. When the vegetables are ripe, harvest and have a feast!

For additional information about this activity, visit <http://www.epa.gov/epaoswer/osw/kids/quest/pdf/37crops.pdf>, or order a free copy of The Quest for Less: Activities and Resources for Teaching K-6 (EPA530-R-00-008) from EPA's National Service Center for Environmental Publications (NSCEP) at 1-800-490-9198.

"Worms are more powerful than the African Elephant and more important to the economy than the cow."

—Charles Darwin

COMPOSTING AND OTHER WASTE REDUCTION WEB SITES FOR KIDS

FirstGov For Kids <www.kids.gov> is the U.S. government interagency Kids' Portal developed and maintained by the Federal Citizen Information Center. It provides links, grouped by subject, to federal kids' sites along with some of the best kids' sites from other organizations. Included are links to numerous composting, vermicomposting, and recycling sites.

healthfinder®, <www.healthfinder.gov> developed by the U.S. Department of Health and Human Services, is an excellent resource for finding government and nonprofit health and human services information on the Internet. Among the links to more than 1,500 health-related organizations' Web sites, are links to numerous environmental health sites, including several composting and recycling sites.

COMPOSTING

EPA's Planet Protectors Club for Kids <www.epa.gov/epaoswer/osw/kids/index.htm>

Kids Recycle! Composting <www.kidsrecycle.org/composting.php>

Recycling: Make a Compost Heap for Your Garden (World Wildlife Fund) <www.panda.org/news_facts/education/middle_school/homework_help/projectidea.cfm?pjid=1>

Reduce Waste—If Not you, Who? (Minnesota Office of Environmental Assistance) <www.reduce.org>

VERMICOMPOSTING

Ask the Answer Worm! <www.nrcs.usda.gov/feature/education/squirm/skworm.html>

As the Worm Turns: Worm Composting at Portland Public Schools <www.pps.k12.or.us/district/depts/fam/enviro/wormturns.shtml>

Kids Recycle! Vermi-composting <www.kidsrecycle.org/worms.php>

National Institute of Environmental Health Sciences (NIEHS) Kids' Pages: Vermicomposting (Making Good Use of Garbage!) <www.niehs.nih.gov/kids/worms.htm>

The Adventures of Herman: The Autobiography of Squirmin' Herman the Worm <www.urbanext.uiuc.edu/worms/index.html>

Worm Away Your Cafeteria Food Scraps (North Carolina Cooperative Extension Service) <www.bae.ncsu.edu/people/faculty/sherman/worms.html>

GARDENING

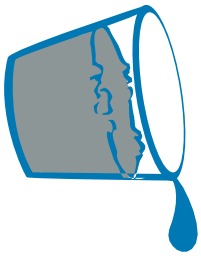
Junior Master Gardener <www.k2demo.com/jmg/index.k2?did=2016&sectionID=2016>

University of Illinois Extension: My First Garden: A Guide to the World of Clever and Fun Gardening <www.urbanext.uiuc.edu/firstgarden/index.html>

Handmade Recycled Paper Planters

Here is an activity that lets kids close the loop on used paper by creating recycled paper planters out of used newspaper. Begin by soaking small pieces of shredded newspaper and pulping the paper fibers with a hand egg beater until it looks like mush. Then mold the pulp to the inside of a plastic cup-shaped container or soda bottle with the top cut off, squeezing out as much water as possible. Let the pulp dry completely for the next three days. Carefully remove the handmade recycled paper planter from its mold, and it is ready for use! The planter can be transplanted in the ground where it will decompose and provide nutrients to the plant as it takes root and grows. You can further close the loop by using compost from classroom vermicomposting or backyard bins and planting the seedlings in school or home gardens.

For additional information about this activity, visit <http://www.epa.gov/epaoswer/osw/kids/quest/pdf/29plant.pdf>, or order a free copy of The Quest for Less: Activities and Resources for Teaching K-6 (EPA530-R-00-008) from EPA's National Service Center for Environmental Publications (NSCEP) at 1-800-490-9198.



COMPOSE YOUR OWN COMPOSTING SONG

Have your kids write lyrics about composting, recycling, or any other environmental issue. They can rewrite the lyrics to one of their favorite songs or compose their own music and lyrics. The Compost Song is a great example:

THE COMPOST SONG: "TAKE ME OUT TO THE COMPOST"

(Sung to the tune of "Take Me Out to the Ball Game")

Take me out to the compost
Take me out to the pile.
Add some soil and a few good worms
I don't care if I'm turned and I'm churned
'Cause it's root root root for the microbes;
If they don't live it's a shame.
For in two, four, six weeks, I'm out in the old garden.

—Pam Ahearn, Waits River School, East Corinth, Vermont