U.S. DEPARTMENT OF EDUCATION

GreenRibbonSchools

# Highlights from the 2019 Honorees

U.S. Department of Education - 400 Maryland Ave, SW - Washington, DC 20202

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# Introduction

*Origins of the U.S. Department of Education Green Ribbon School Program*

In 2011, key advocates from the Campaign for Environmental Literacy, the Center for Green Schools at the U.S. Green Building Council, the National Wildlife Federation (NWF), and the Earth Day Network steered some 80 national and state-based nonprofit organizations to request that the U.S. Department of Education (ED) honor schools for their sustainable facilities, health practices, and effective environmental education. The award that evolved from this petition, U.S. Department of Education Green Ribbon Schools (ED-GRS), has had a significant effect on the green schools movement and allowed ED an unprecedented platform to address school facilities, health, and the environment.

These advocates and the federal family ultimately assisted ED in developing a consensus definition of a green school, featuring what came to be known as the three Pillars of the award:

**Pillar One:** reducing environmental impact, such as waste, water, energy, greenhouse gases, and transportation, encompassing the areas of school facilities, grounds, and operations;

**Pillar Two:** improving health and wellness by promoting a healthy physical environment (including aspects such as air quality, contaminant control, moisture control, acoustics, daylighting, pest management, and thermal comfort) and student and staff wellness practices (such as healthy school food and outdoors physical activity); and

**Pillar Three:** offering effective environmental and sustainability education, including civic learning, green careers, and STEM (science, technology, engineering, and math) connections.

*How the ED-Green Ribbon Schools Recognition Award Operates*

Going beyond the award requested by stakeholders, ED-GRS has become the federal communications and outreach tool around specific areas that ED had, until its advent, addressed infrequently. The award has allowed the agency to use its reach and audience to address matters of school facilities, health, and environment by highlighting innovative practices and sharing useful, free resources in these areas, despite limited authority to run grant programs in these realms.

Annually, state education officials voluntarily participate by nominating their top schools, districts, and postsecondary institutions based on their achievement in ED's

three Pillars. Although ED provides some suggestions as to how state education agencies might document nominees' work in the three Pillars, ultimately, states have flexibility in their selection and nomination, if they document progress for each nominee in all the three Pillars. ED then uses the award to communicate honorees' promising practices and the helpful resources they successfully employ to all of the nation's schools.

*Growth of the Initiative's Communications and Engagement Functions*

Over time, ED has added several components to the initial school award, including recognition of school districts and postsecondary institutions, as well as a state education agency official's award. The program's outreach also has grown, along with its engagement functions, with a resource website, www.greenstrides.org, and a Green Strides tour spotlighting clusters of honorees around an annual theme. Green Strides, the outreach and engagement arm of the award, uses its website, a newsletter, and social media to get the word out to schools about the three Pillars, providing information, to the extent that ED's limited federal resources allow, about free resources, programs, grants, and webinars.

*ED-Green Ribbon Schools by the Numbers*

With the 2019 cohort, the award has now honored some 420 schools, 76 districts, and 44 postsecondary institutions. In this case, larger numbers do not necessarily indicate broader influence. ED-GRS was never intended to certify thousands of schools. Each year, state education agencies are invited to nominate up to five early-learning through 12th-grade school or district candidates, and just one postsecondary institution. This is because ED requires only a few examples to highlight innovative practices. For the same reason, institutions — whether school, district, or postsecondary — are eligible only once for this award, and always must state their designation with the year in which they were honored. Once ED has highlighted an institution's practices, it is useful to move on to highlighting other, diverse examples. In fact, schools nominated from districts that already have won the award should demonstrate achievements above and beyond those previously honored in the district application.

*Table 1. Number of U.S. Department of Education Green Ribbon School honorees by year and type*

| Year | Schools | Districts* | Post-secondary* | Total |
|---|---|---|---|---|
| **2012** | 78 | N/A | N/A | 78 |
| **2013** | 64 | 14 | N/A | 78 |
| **2014** | 48 | 9 | N/A | 57 |
| **2015** | 58 | 9 | 14 | 81 |

| | | | | |
|---|---|---|---|---|
| **2016** | 47 | 15 | 11 | 73 |
| **2017** | 45 | 9 | 9 | 63 |
| **2018** | 45 | 6 | 6 | 57 |
| **2019** | 35 | 14 | 4 | 53 |
| **Total** | 420 | 76 | 44 | 540 |

*The District Sustainability Award was added in 2013, and the Postsecondary Award in 2015.

*Number of Participating States*

Despite the exciting efforts ED has highlighted with this recognition award, there is still work to be done to improve school facilities, health, and environmental engagement. Roughly 30 states voluntarily nominate candidates annually for this award. That means ED does not have a mechanism for highlighting the practices of green schools in the remaining 20 states, where state education agencies choose not to nominate.

*Table 2. Number of nominating authorities for the ED-Green Ribbon Schools Program by year*

| Year | Number of Participating Nominating Authorities |
|---|---|
| 2012 | 30 |
| 2013 | 32 |
| 2014 | 30 |
| 2015 | 30 |
| 2016 | 27 |
| 2017 | 29 |
| 2018 | 26 |
| 2019 | 28 |

- All states, territories, the District of Columbia, the Department of Defense Education Activity, and the Bureau of Indian Education are invited to nominate.

*Contributing to the Development of a More Coherent Definition of a Green School*

A key contribution of the award is believed to be that — to some degree and for at least a time — it brought various agencies and organizations together around a common definition of a green school. Rather than one organization using the term "green school" to denote an energy-efficient school, another using it to refer to institutions offering environmental and sustainability learning, and a third employing it to indicate environment health or wellness practices, there has been a convergence such that a green or sustainable school must encompass all three

Pillars. There continue to be initiatives that focus squarely on one segment of this work; however, it usually is with the stated understanding that they form part of a broader three-Pillar effort.

*A Bully Pulpit for School Facilities, Health, and Environment*

In 2011, the term "green school" was a relatively unknown concept at ED, as well as across much of the country. Today, there is a growing understanding of what this work entails, at least in small part because of ED's efforts annually to illustrate this work with the concrete practices of its honorees. ED's oversight of this award has offered the agency an opportunity to address and engage on school infrastructure and operational costs; environmental health and school wellness practices; nutritious, local, and student-grown school food; and hands-on, outdoors, project- and place-based, authentic, environmental, civic, and sustainability learning, among other related topics. The award also has allowed ED to highlight unique local, state, and national partnerships and where sustainability efforts intersect with equity.

*A Significant Effect with a Limited Budget and Innovative Collaboration*

Despite the limited availability of funds, the award has facilitated collaborations and connections that have saved resources. For example, both ED-GRS and Green Strides have enabled ED to share the many programs for schools offered by counterparts at the National Oceanic and Atmospheric Administration (NOAA); U.S. Environmental Protection Agency (EPA); U.S. departments of Agriculture, Interior, and Energy; and collaborators across the for-profit and nonprofit private sectors.

In the same way that ED works more effectively across a broader range of federal agencies as a result of the award, many state education agencies also are collaborating in exceptional ways with state health, environment, and energy agencies to select their nominees to ED. The private sector, both for-profit and nonprofit, also has gotten involved at federal, state, local, and school levels, working with schools and governments. Through this collaboration, ED's recognition award has become a tool to get various parties working better together for the benefit of students across the nation.

*Green Schools Are Successfully Serving Disadvantaged Populations*

Nearly 50 percent of ED-GRS honorees have served majority-disadvantaged student populations, as measured by free and reduced-price lunch. While this is in part due to award criteria design, which asks states to ensure that at least one of their nominees is disadvantaged, state nominations have exceeded this minimum requirement. With ED-GRS designated schools, districts, and postsecondary institutions providing better education to traditionally underserved students, green

schools practices may be another tool to advance equal access to a quality education for all students.

*A Green School Need Not Be Newly Constructed*

To ensure that the award highlights diverse examples of sustainability, the competition assesses candidates based on resources available to them, rather than in comparison to each other. In fact, the award has, over the years, highlighted many older school constructions engaged in low-cost, but highly effective, retrofits and behavioral change. All of these are steps that any school community can undertake, without a new construction that is designed specifically to be resource efficient and environmentally healthy. In this way, the award has helped to educate the public about the broad applicability of green school practices, in both old and new buildings.

*Creating Incentives for Multiple Pipelines for Sustainability Improvements by All Schools*

Another important consequence of the award has been the refinement of various national and state-specific green schools programs that the award has spurred. Many states have realigned preexisting state green schools programs, built new ones, and now recognize runners-up beyond those they nominate to ED, in order to create pathways to the national award, broaden recognition within individual states, and incentivize more change.

*The 2019 Cohort*

This year's selectees were confirmed from a pool of candidates voluntarily nominated and exhaustively reviewed by 28 state education authority implementation teams. While selection processes vary from state to state, members of several state agencies as well as outside experts often comprise selection committees. At the federal level, we have selected 35 schools, 14 districts, and four postsecondary institutions that demonstrate promising practices to cut costs, improve health, and ensure that students learn through the most hands-on, engaging means possible.

The diversity of U.S. Department of Education Green Ribbon Schools, District Sustainability Awardees, and Postsecondary Sustainability Awardees and the range of their work proves that any school, district, or postsecondary institution can take steps to improve the sustainability, health, and safety of school facilities; ensure nutrition and fitness practices for a lifetime of wellness and productivity; and engage students in real-world learning.

Schools use sustainability in context to teach important civic values and skills that encourage students to grow into responsible, compassionate, and contributing citizens. Furthermore, working with dynamic environmental, social, and economic systems from an early age nurtures precisely the type of thinking, collaboration, and problem-solving skills that careers of the future require. This is the case whether these students graduate from green career and technical programs, green college preparatory schools, community colleges, or liberal arts colleges.

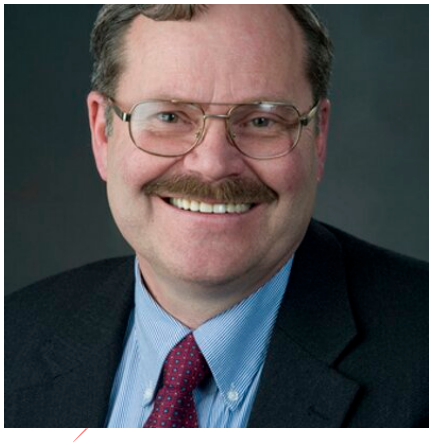
It is with tremendous pleasure that we present the 2019 U.S. Department of Education Green Ribbon Schools, District Sustainability Awardees, and Postsecondary Sustainability Awardees. These honorees are ensuring that their students learn to live, work, and play with sustainability and health in mind — not as an afterthought, but as an integral part of everything they undertake.

The 2019 Green Ribbons are here. Prepare to be amazed! When you recover, go to our http://www.greenstrides.org webpage and get started using some of the same tools these awardees employ.

*Table 3. Honorees by category of institution in 2019*

| | |
|---|---|
| Total honorees | 53 |
| Early learning through 12th grade schools | 35 |
| Non-public schools | 10 |
| Charter schools | 3 |
| Magnet schools | 2 |
| Public schools | 25 |
| Districts | 14 |
| Institutions of higher education | 4 |
| Disadvantaged-serving schools | 18 |

## Director's Award



The Director's Award celebrates an individual's exemplary efforts to administer ED-GRS in their state. Specifically, the ED-GRS Director's Award recognizes a state education agency official who does the most to advance green schools by running a robust competition process; connecting more schools to resources in all three ED-GRS Pillars; amplifying the stories of honorees; helping schools learn from one another; partnering with a variety of entities to bring more resources and expertise into schools; and exhibiting a dedication to exceptional school facilities, health, and environmental education through activities outside of the administration of ED-GRS.

ED is delighted to have named John Olson, science content specialist from the Minnesota Department of Education, as the selectee for the 2019 Director's Award. For several years now, Olson's leadership and dedication have been integral to ED-GRS's success in Minnesota, as well as to the continued momentum of the green schools movement across the nation. Olson established a permanent home for ED-GRS in his office in 2012. He hosted a highly attended ED-GRS Green Strides Tour leg in 2014. Olson successfully engaged his postsecondary counterparts in 2015, becoming the only state to nominate a full six institutions in that — the first year — of the postsecondary competition. He developed a detailed plan to sustain his efforts during his Peace Corps leave of absence in early 2016.

Olson has engaged stakeholders from peer state agencies, nonprofit and for-profit private sectors, and the higher education community in order to share sustainable best practices, select ED-GRS nominees, and celebrated honored institutions at assemblies and presentations. Such collaboration to support local programs is not found in many other programs.

In sum, Olson has modeled excellence in ED-GRS implementation for other state education authorities to follow. ED commends Olson for his work to promote environmental stewardship, health, and sustainability and for inspiring more schools to aim high.

# 2019 U.S. Department of Education Green Ribbon Schools

## *Alabama*

### Troy University, Troy, Alabama

*Alabama's international university looks out for the planet*

Troy University is known for its beautiful, historic campus located in the charming southern city of Troy, Alabama. The 650-acre main campus is situated along rolling hills with oak, cedar, and pine trees present throughout the grounds. With over 1,000 international students on campus from over 80 countries, Troy University is known as Alabama's international university.

Troy has embraced continued growth in the academic space and the campus community. Even with this expansion, the university has increased efficiencies in energy and water usage and waste production. In all new construction and building renovations for the last six years, lighting control systems have been installed to complement light-emitting diode (LED) lighting and enhance energy conservation. This includes lighting in the new football end zone, the natatorium, and the new fitness center. Troy University's newly constructed parking lots feature LED lighting, and plans are in place to update the old parking lots' lighting as well.

All new construction and renovations for the last 20 years have included the installation of a building energy automation system, which allows for reduced utility usage when buildings are not occupied, thus reducing consumption of natural gas and electricity. In 2018, the university evaluated its cooling tower water supply lines, replacing all ill-functioning pressure regulator valves and gauges. These changes and other improvements to the irrigation systems on the university's Montgomery campus resulted in a savings of $80,000 annually.

The university maintains partnerships with and provides support for the Janice Hawkins Cultural Arts Park with the Choctawhatchee—Pea River Watershed Management Authority, the Alabama Department of Environmental Management, and the Daniel Foundation, among others, for environmental restoration of an on-campus urban forest, removal of invasive species, and addressing water runoff. Further conservation and environmental access efforts are offered through the university's on-campus 75-acre arboretum and its 180-acre Pocosin Nature Preserve. The arboretum preserves rare and uncommon species, emphasizing research on the communities and habitats of the Wiregrass region of the Southeast. Additionally, Troy University enjoys ongoing recognition by Tree Campus USA for responsible stewardship of forests and trees.

The university provides the Trojan Shuttle Service, encouraging students, faculty, and staff to take advantage of alternative transportation both on and off campus. An expanded array of alternative transportation options goes beyond the bus system and include an app-based bike and scooter program. This service provides 100 bicycles and approximately 20 scooters.

Troy removes invasive species such as Chinese privet and kudzu, and plants native trees and other drought-resistant plants on campus through their Tree Campus partnership.

To manage the occasional visits from beavers and other rodents to the bodies of water on campus, the university uses physical controls such as mulching, traps, caulking, and regular waste management to reduce pest populations and infiltration. Chemical controls are used only when needed and are applied selectively to ensure air, soil, and water quality. In a partnership with the Troy Animal Rescue Project, the school works to capture and rehome stray cats and other pets on campus. Campus water quality reports are prepared and shared with the university annually through the City of Troy.

In addition to robust recycling around the campus and residence halls, Troy University's waste management efforts extend to the kitchen. The university partners with Campus Kitchens Network, a national nonprofit organization that addresses hunger and food waste. Through this partnership, some 26,000 pounds of food has been reclaimed and apportioned into more than 15,000 meals. In 2015, Troy University became Food Recovery Verified, which is a program of Food Recovery Network that recognizes businesses and events for sending their surplus food to people, not landfills.

Each spring semester, all Greek organizations participate in the City of Troy's Keep Troy Beautiful Team Up to Clean Up event. Each organization is provided with a location, and the members pick up trash and debris in that area. After each football game, campus organizations clean the football stadium. The official Troy University Christmas tree is a live tree located in front of Claudia Crosby Theatre. The Student

Government Association decorates the tree with handmade ornaments that are recycled and redesigned every year by student organizations.

Troy University's commitment to the health of its students, faculty, and staff is demonstrated through the current construction of an 80,000 square foot fitness and wellness center. This facility was created based on the initiative and commitment of university students to their own health promotion, and it is scheduled to open in 2019. Existing expansive wellness offerings for students, faculty, and staff include health services and student peer education. Troy has a coordinator for outreach and peer educators who work with students and student groups on substance abuse education and intervention. Sport and recreation facilities, nature trails, conservation areas, and open outdoor spaces further enhance Troy's commitment to health. The School of Social Work collaborates with the National Association of Social Workers and the Montgomery Public Schools to encourage the cessation of tobacco usage.

The university not only demonstrates sustainable practices, but actively plans for sustaining a green future. In September 2018, Troy University received a $3.2 million grant from the National Institute of Standards and Technology that will establish the Center for Materials and Manufacturing Sciences. This research will focus on polymers and polymers recycling, and will prepare the next generation of the workforce for this growing industry.

Students are exposed to sustainability topics and green career pathways in their general studies science courses. The university expanded its general studies curriculum options in 2014 to include broader class options for students interested in environmental studies. Other interdisciplinary academic options include a First-Year Learning Community on Public Service and Sustainability for incoming freshmen. In this academic cohort, students take classes and engage in immersive activities designed to expose them to green career pathways and civic skills. The university hosts an Environmental Week every April in conjunction with Earth Day. Programs on recycling and waste reduction, conservation, biodiversity, and campus sustainability are offered to the student body.

Troy's College of Education hosts a "Power Up" STEM summer camp at the Pike County Boys and Girls Club. Under the direction of professors and teacher candidates, students focus on STEM and energy education for children in grades two through five. Fourth-graders from all over Pike County schools attend the annual Pike County Groundwater Festival, an event hosted by the Department of Biological and Environmental Sciences. Troy University is the newest hub in Alabama for the BEST Robotics competition, where students compete to design and market robots that often are tasked with solving environmental and sustainability problems.

## *California*

### Carrisa Plains Elementary School, Santa Margarita, California

*A net-positive solar powered rural school*

Carrisa Plains Elementary School is situated on a high desert plain bordered by the Los Padres National Forest and the San Juan River on the west, the Temblor Range and the San Andreas Fault on the east, and the Carrizo Plain National Monument on the south. The community is home to two of the world's largest solar plants, covering 13 square miles. BHE Renewables is located adjacent to and surrounding the school itself. The school serves one of California's most rural communities; students in prekindergarten through fifth grade are served in three-grade band learning environments. Eighty-two percent of students are socioeconomically disadvantaged.

The staff at Carrisa Plains is always looking for new and innovative ways to support the students; at the same time, they are providing opportunities for their students to help the world. Students and staff are learning about the world around them and working with and using their environment to promote a change in their education, their way of thought, and their way of living. Much of this change at Carrisa Plains is carried out with a clear conservation plan and a strong and supportive relationship with the Atascadero Unified School District (AUSD), headquartered more than 40 miles west of the school.

Energy use at Carrisa Plains is controlled by a programmable energy management system, based on an energy conservation plan that follows the practices of AUSD's resource management guide. In 2014, Carrisa Plains underwent modernization. Contractors and subcontractors were careful to minimize construction debris; to maximize construction recycling; implement appropriate stormwater handling measures; use efficient lighting; install heating, ventilation, and air conditioning (HVAC) equipment with a high seasonal energy efficiency ratio; increase the insulation of the entire building envelope; enhance daylighting; and provide increased natural ventilation. New carpet tiles allow for easy replacement of individual tiles. Areas that are not carpeted use a sustainable covering called Marmoleum. The school also added low-flow toilet valves and sink fixtures. An on-site 30 kilowatt photovoltaic system meets 100 percent of the school's electricity needs. Carrisa Plains is a net positive-energy campus, producing more energy than it uses in a year.

Carrisa Plains has a partnership with Cuesta College's sustainability resource center, through which the nearby community college provides Carrisa Plains' students with instruction in using hands-on kits from the National Energy Education

Development Project. Participation in Pacific Gas & Electric's Savings by Design and On-Bill Financing programs has also provided a variety of resources and incentives to the district and school site to make the school energy-efficient and inform students and staff about energy efficiency.

At the beginning of the 2015–16 school year, Carrisa Plains began to integrate a no-waste ideology that incorporates composting procedures into students' daily education programs. Each trimester, students perform a waste audit by gathering all waste material generated over two days. Students and staff then sort and weigh the collected waste and discuss the implications of the amount of waste created by the site. Student volunteers oversee sorting liquids, compost, recyclable, and landfill items into the appropriate collection bins. Carrisa Plains generates a fair amount of mulch because of the ample number of trees on the campus. The rounds from trees that must be felled are also used for seating in the outdoor classroom. Students have 1:1 Chromebooks beginning in kindergarten, and the use of paper at Carrisa Plains has decreased by 50 percent since implementation of the Chromebook program.


Instructional time recently was set aside for students to create and design habitats for native animals to use as hideouts. Once the design phase is complete, students will use recycled resources to build and install animal homes throughout the campus. Students in kindergarten through second grade have begun creating bird feeders to provide additional sustenance to the local birds.

Safe Routes to School provided Carrisa Plains with grant funds to resurface asphalt, allowing for a "bike garden" to be installed and all remaining areas to be reasphalted. Carpool signage and two new electric vehicle charging stations were installed. The rural school has offered alternatives to traditional walking or biking to school, such as Walk and Roll Wednesdays and Walk with Me, which have emphasized

alternative modes of transportation. The school purchased six bicycles that students use daily so that all students can ride a bicycle while at school during the week. Since 2016, Carrisa Plains has partnered with the County of San Luis Obispo Health Department to host Bike Rodeos, where students participate in bicycle safety training and assessment.

The staff uses various environmentally safe cleaning products. The school has good acoustics because of high ceilings, newly remodeled classrooms, wall surfacing material, quiet HVAC systems, and a high noise-reduction coefficient. Because the well water at Carrisa Plains is not safe for consumption, the site uses Crystal Springs Water Company for staff and student drinking water. Water is kept in Crystal Springs storage bottles until opened for use. Carrisa Plains reviews the EPA's IAQ (indoor air quality) Problem Solving Tool quarterly, and has used the EPA's IAQ reference guide to gain information about eliminating and preventing mold, radon, and asthma. Further, AUSD's Integrated Pest Management efforts prevent widespread illnesses from occurring.

Students work weekly with a nationally recognized social-emotional curriculum. An onsite health clerk is available to students throughout the school week, and counselors and a psychologist are on hand for them year-round. The California Healthy Kids Survey is administered annually to collect data on resilience, protective factors, risk behaviors, and school climate. Presenters and motivational speakers discuss self-esteem and character education. Carrisa Plains works with the Alliance for a Healthier Generation to support nutrition goals and expectations. Carrisa Plains also has promoted and supported programs such as Reimagine Recess, and resources such as 15 Minutes to Healthier Habits.

The Carrisa Plains campus has ample space to support gardens. The main garden is home to a chicken coop, raised food beds, a greenhouse, two compost bins, and an outdoor classroom. Five rain barrels that collect water are used to irrigate the garden's plants, fruits, and vegetables. The garden, though still in use, currently is under construction, with students helping to redesign the space and make it a more productive area for learning. The new construction includes the addition of more fruit-bearing trees and native plants, the expansion of the chicken coop, and the addition of covered areas for the outdoor classroom. Staff and students began construction of a sensory garden in 2018. This garden provides students with a calm place for learning and meditating. Recycled or recyclable materials created the foundation for the sensory garden.

All Carrisa Plains students use the greenhouse, and manage waste with vermicomposting and recycling. They perform waste audits, conserve water, and use rain capture barrels while at school. They learn about soil, food webs, garden design, animals, ecosystems, recycling, oil spill cleanup, stormwater runoff, insects,

climate, seeds, and harvesting. Teachers and paraprofessional educators teach students the sequential process by which gardens help us survive, thrive, and grow.

The school recently established monthly garden work days, during which students volunteer their time to helping the school garden by raking, shoveling, and cleaning up. Carrisa Plains plans to implement a requirement for each student in third through fifth grade to complete a community service project geared toward supporting the Carrisa Plains and California Valley community as well as the environment. The school uses the EPA's Service-Learning: Education Beyond the Classroom resource for ideas on civic activities for students in all grades.

Carrisa Plains has an onsite commercial-grade kitchen that provides students with many opportunities to cook from scratch. Students learn the process of cooking and baking from start to finish while gaining an understanding of how and where their food grows. Students make entrees, salads, and snacks using fresh eggs, fruits, and veggies from the garden. In addition to creating meals on campus, a monthly student-led farmers' market provides a forum for students to sell eggs, vegetables, fruits, and a variety of other items from the garden.

## Eagle Rock Elementary School, Los Angeles, California

*An environmental manifesto: Mission to Mars*

Eagle Rock Elementary School (ERE) has embraced an innovative integrating framework known as the ERE Environmental Manifesto. Its goal is to link nearly all subjects and materials to a common theme: Mission to Mars. It is the kids in today's elementary schools who will be the brave explorers of the future and who need to be trained today for the adventures of a lifetime tomorrow.

The framework focuses on Earth first, with the belief that it is essential to provide an understanding about the interconnectedness of Earth's water, energy, and life support systems, as well as its technological systems. ERE's framework is built around teaching students how to treat their home planet as a sustainable "Earth-in-a-box," considering the planet's sensitivities, vulnerabilities, strengths, and weaknesses, while integrating biology, chemistry, ecology, physics, mathematics, and technology. The goal is to carry this knowledge of sustainability into space.

Eagle Rock has written environmental literacy requirements that address nine subject areas, including Earth's systems, the environment, and human influence. These areas expand students' knowledge about the earth, and they also engage students' problem solving and critical thinking skills in meeting these requirements.

The after-school green club extends many of the sustainability concepts learned in class to the school green grounds. Activities include monitoring and measuring plants and wildlife; sampling soil, water, and air; and maintaining various green projects around the school. The after-school garden club, which is sponsored by Sprouts Farmers Market, expands the interactions with the garden facilities once per week.

On field trips, students can participate in the Sepulveda Basin Environmental Education Program. They observe wildlife with binoculars, test a lake's water quality, and learn about native plants. Students also are given opportunities to go to the Catalina Island Marine Institute, where they can increase their science literacy, have hands-on experiential science using state of the art labs and equipment, and engage in field activities. Other field trips take students to a natural history museum, Underwood Family Farms, and the Los Angeles Zoo and Botanical Gardens. Several service-learning projects provide opportunities for students to learn sustainability principles, including neighborhood clean-ups, community e-waste roundups, and clothing and toy donations.

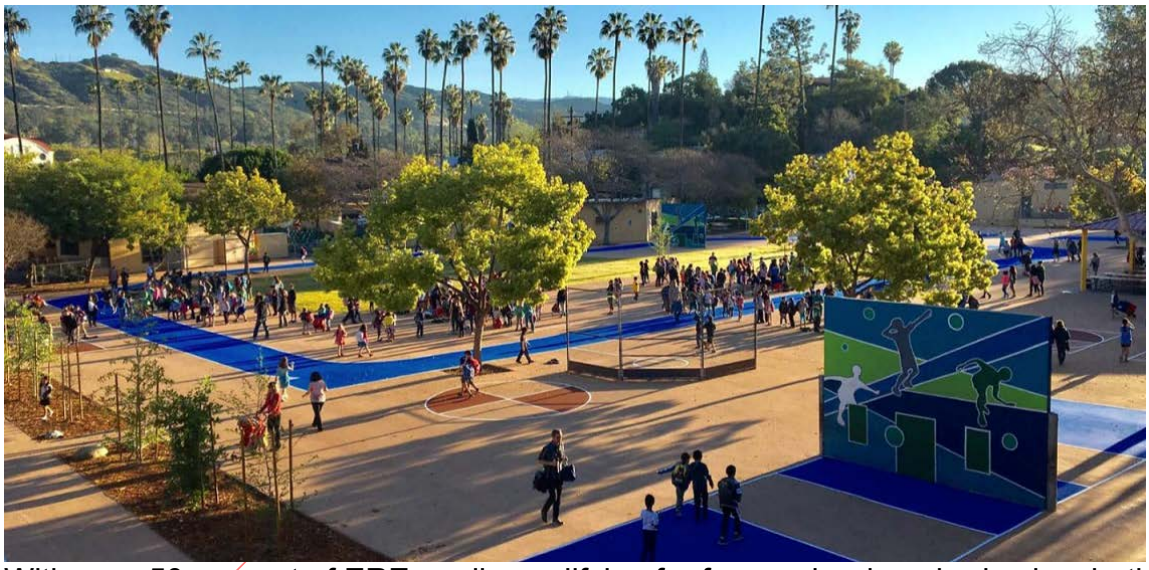
At the foundation of the Earth-in-a-box framework is a massive greening renovation that ERE has undertaken over the course of several years. ERE is, and historically has been, a *Title I* school. As such, funding for green projects has not fallen on the shoulders of the families. Funds instead have come from idea-inspired competitive grants. In addition, ERE has a green team made up of parent volunteers, teachers, and students, all of whom show a commitment to maintaining and expanding existing greening projects. The green team designs the green footprint of the schoolyard for the years to come. The design, development, and maintenance of the renovation was done in direct consultation with ecologists, environmental economists, and health professionals. This has ensured that the final product serves the best interests of the environment, the school, and — above all else — the health and well-being of students.

In 2016, ERE was honored as a flagship school in the Los Angeles Unified School District in recognition of the school's sustainable green renovations. The renovations removed 23,789 square feet of asphalt, which was replaced with a permeable surface made of decomposed granite; native/drought tolerant trees and plants; and buffalo grasses, a non-mowing, clumping grass that wears well under constant use. Innovative bioswales landscaped with trees and plantings now capture excess rainwater and recharge it into the groundwater aquifer. Green space was increased by more than 30,000 square feet. Where asphalt remained, ERE painted over dark surfaces with beige reflective paint. Partnering with a professor at

Occidental College, ERE took surface infrared temperature measurements before and after the renovation to quantify the reduction in heat island effect.

A garden program is integrated directly into the curriculum, serving more than 30 classrooms that attend six-week sessions of twice-weekly edible garden classes. ERE also is integrating the garden curriculum into its approach to the California Next Generation Science Standards.

As a result of learning about the garden, even the school's youngest students are familiar with complex scientific concepts like osmosis and the carbon and nitrogen cycles. They gain hands-on experience studying everything from the structures of plants to the life cycles of butterflies and the importance of bees. Students are taught the vital importance of agriculture throughout history in various civilizations. Working in the garden program and learning through trial and error gives them a real sense of the challenges other cultures have faced in providing food.



With over 50 percent of ERE pupils qualifying for free and reduced-price lunch, the garden provides an important introduction to health and nutrition, as well as access to fresh fruits and vegetables that otherwise may not be available to all ERE students. Moderate-to-vigorous physical activity levels during unstructured recess periods have significantly increased. Students play in the green spaces and develop gross motor skills balancing on the strategically placed wood structures, logs, and stumps throughout the campus yard. Notably, this increase in activity has correlated with a decrease in the frequency of antisocial behavior in the school.

The school community has made efforts to improve food nutrition by actions such as reducing the use of sugar, salt, preservatives, and other processed food items. After-school clubs include yoga and dance. Kindness campaigns are held each

year, which focus on elements of kindness and goodwill as positive messaging in lieu of anti-bullying messaging. ERE staff has been trained on Restorative Justice and has been implementing its principles. Multiple mental health programs are in place, which include Kids Hope USA®, a foster youth program, and the Asian Pacific Counseling and Treatment Centers, which provides much-appreciated peer counseling and mental health support. ERE students participate in a solar awareness and sunscreen program run by the University of Southern California.

An integrated pest management program has been established at ERE. The school also maintains and cleans its ventilation system once every month. All air filters are changed, coils are cleaned, and vents are washed every six months. ERE's parent drop-off zone is facilitated through a "safety valet" program, which allows parents to drop off kids safely with designated liaisons who lead students from cars to classrooms, eliminating vehicle idling.

Eagle Rock has made further efforts to reduce environmental impact, switching out bulbs to LED and toilets to low flow. ERE reduced gas use by 29 percent between 2010 and 2018, and reduced electricity use by 4 percent from 2012 to 2018. ERE is moving toward installing a solar energy system that will fully meet the school's needs. Currently, solar energy operates ERE's irrigation systems. ERE also plans to acquire solar panels for teaching as part of its Environmental Manifesto. More than one-third of the school's energy is obtained from purchased renewable energy across a portfolio of sources, including wind, solar, geothermal, biomass, and small hydroelectric power. With the support of the school district, ERE participates in the U.S. Department of Energy's Better Buildings Challenge. ERE's indoor and outdoor water use is metered together, and there has been a 13 percent reduction in ERE's water consumption from the baseline year of 2010 to 2017.

According to an ERE survey, 41 percent of students reported carpooling with two or more students in the car to and from school. Thirty-one percent reported walking. Seven percent of respondents used other public transportation, and 5 percent of respondents reported rolling to school. At ERE, carpool parking signs and electric vehicle charging stations have been installed, and a well-publicized no-idling policy has been implemented. The school celebrates an annual walk-to-school day, and has implemented a walking school bus program, in which adults accompany groups of students as they walk to school along a given route.

Eagle Rock reports a 38 percent recycling rate, with 60 percent of solid waste being diverted from landfill or incineration due to recycling. In ERE's compost system, 100 percent of landscape waste is recycled on-site. Tree wells are designed to retain dead plant material. Composting is done twice a week for educational purposes, with a bin provided through EnrichLA, a community wellness nonprofit organization that, among other things, builds edible gardens in local schools.

## Quail Lake Environmental Charter School, Clovis, California

*New methods "spork" learning and innovation*

Quail Lake Environmental Charter School (QLECS) operates under a schoolwide initiative that includes the sciences in an integrated curriculum, fostering a true understanding and connection to the sustainability of Earth's resources. QLECS seeks to teach core subject areas through integrated, hands-on curriculum and real-world experiences that make critical connections to sustainability.

In 2014, the Sanger Unified School District, of which QLECS is a part, supported the school's focus in environmental sciences by establishing an instructional support provider dedicated to science at the school. Since then, this faculty member has spearheaded the effort to integrate science into all content areas, with a focus on sustainability and the environment. QLECS' integrated units start with California Next Generation Science Standards (NGSS); they encompass higher-order questioning with response justification, grade-level progress monitoring, differentiation in the classroom, technology to enhance lessons, and integration of curriculum to create relevant learning.

In seventh grade, students study and develop new ways to conserve water. They research from citizen, legislator, and farmer points of view and create solutions to community problems. Third-grade students work with the California Department of Fish and Wildlife to learn about environmentalism and life cycles by raising salmon to be released into the San Joaquin River and caterpillars/butterflies to be released into the school's garden. QLECS environmental education field trips include visits to a pumpkin patch, zoo education center, nature center, an outdoor education center, Sequoia National Park, Sequoia Lake, a water treatment facility, and a three-day trip to Sierra Outdoor School.

All middle school students participate in an online system called Naviance. The program offers students an opportunity to learn about careers with which they may be unfamiliar. One of QLECS's goals through Naviance is to spend time discussing environmental career pathways. Middle school students at QLECS are also exposed to green career pathways through electives, such as agricultural business, the Project Lead the Way design and modeling course, and the Project Lead the Way Energy and the Environment class.

School grounds include 4,000 square feet of garden space featuring an outdoor classroom environment, a 2,000-square-foot butterfly garden, and planter beds in the front of the school that provide students with opportunities to study fruit production and plant management. The garden includes a 17 x 35-foot greenhouse to which all students have access and can use in various ways. Students in kindergarten through fifth grade visit the garden every two weeks for garden lessons led by their teacher and the school's science instructional support provider. Lessons not only focus on gardening skills, but also tie into the California NGSS and California Common Core State Standards that are being taught in the classroom.

After harvesting produce in the garden, students are encouraged to try it. Recipes and produce are sent home with students.

During the garden/agriculture elective, middle-school students research plants and learn design methods for the new raised beds in front of QLECS. They use iScape on their iPads to assist them in this process. Students then present their ideas — along with a cost analysis, scaled drawing, and explanation of choices — and export pictures from iScape to the class and administration to see whose plan is chosen. Finally, students plant the beds with the winning designs. This one project covers all subject areas and allows participating students to enhance the campus' outdoor space.

In the summer of 2016, QLECS installed a 137-kilowatt photovoltaic system to offset 62 percent of the site's annual energy usage, resulting in approximately $25,000 in annual savings. The school's remaining electrical needs are met by the local utility, Pacific Gas & Electric, which has a 27 percent renewable portfolio minimum. The school installed an energy management system in all permanent buildings, as well as energy-efficient lighting.

The school partnered with Tree Fresno in the San Joaquin Valley to enhance school grounds by planting 34 trees, which decreased water usage by replacing conventional irrigation with drip rings. Quail Lake has separate meters for indoor and outdoor water use. The school achieved a 33 percent reduction in indoor water

consumption and a 54 percent reduction in outdoor water use over approximately 10 years.

Over the last five years, QLECS has aimed to go paperless in as many areas as possible. School newsletters and flyers are sent out electronically. Students in first through eighth grades use 1:1 iPads. QLECS has taken steps to make hard copy items such as lunch menus and district flyers paperless, as well. In 2017, two water-bottle filling stations were added to the QLECS campus. All staffers were given custom refillable bottles with their names on them to use.

Quail Lake recycles 60 cubic yards per month and composts 10 cubic yards per month, achieving a waste-diversion rate of 78 percent. The school has composted all lunchtime food waste since 2016. A multiple-bin system in the cafeteria, overseen by the green team, allows students to sort their liquids, recycling, trash, and food waste. Last year, QLECS switched to using compostable trays and purchased a shredder in order to use the trays in on-site compost. In 2018, the QLECS cafeteria eliminated spork packets, replacing them with spork and napkin dispensers. The old spork packets consisted of a plastic spork, a straw, and a small napkin wrapped in a thin plastic bag. Most of this packet was going directly to the landfill or being pulled from the compost by the green team. Now, students take a spork or napkin from the dispensers, as needed. Straws are no longer used on campus.

The school decreased the amount of harmful chemicals on campus through integrated pest management practices and organic farming methods. QLECS ensures that 70 percent of the cleaning products used are third-party-certified as green products. QLECS switched to using microfiber cloths as an alternative to chemicals to clean surfaces in classrooms. Microfiber cloths are provided to each teacher to use as necessary, instead of turning to disinfecting wipes, and are picked up weekly for laundering.

Quail Lake seeks to implement practices that promote health and wellness throughout all campus features and programs. The physical education department offers Nutrition Wednesday, when students learn about healthy eating habits, calorie intake and expenditure, and physical exercise techniques. When planning classroom parties and staff celebrations, QLECS encourages healthy snacks and birthday potlucks. During the afternoon programs LEAP and Campus Club, students are given additional opportunities for physical play.

For the mental well-being of QLECS students, a Positive Behavioral Interventions and Supports system is in place that is deeply embedded in the school culture. The school also incorporates the Second Step curriculum in classrooms to help students how to understand and manage their emotions, control their reactions, be aware of

others' feelings, and have the skills to problem-solve and make responsible decisions. QLECS has an onsite school psychologist, counselor, speech therapist, and resource specialist program teacher to work with all students.

## St. James Academy, Solana Beach, California

*A holistic and spiritual approach to education and caring for community and nature*

St. James Academy strives to prepare students to live and work in the world as responsible citizens. In the words of Pope Francis, "We are faced not with two separate crises, one environmental and the other social, but rather with one complex crisis which is both social and environmental. Strategies for a solution demand an integrated approach to combating poverty, restoring dignity to the excluded, and at the same time protecting nature." At St. James, students are taught daily in the classroom, in church, and through hands-on indoor and outdoor activities that they have a spiritual and moral responsibility to care for their community and world.

St. James is fully committed to clean, efficient energy. In 2016, LED lights were installed throughout the campus, replacing all overhead fluorescent lighting. In 2017, rooftop solar was added. In their first year of use, the solar panels provided 98 percent of the school's on-site electricity. In addition, St. James has opted to purchase excess electricity from the Solana Energy Alliance under a 50 percent renewable and 75 percent greenhouse gas-free plan. Heating, air conditioning, and lighting are turned off during periods of non-use, and the school has a white, reflective roof. Based on St. James' clean energy commitment, Electrify America/Greenlots recently selected St. James for the installation of five dual 240-volt electric vehicle charging stations (one of which is accessible) at no cost (a $75,000 value).

Landscaped green spaces are drought-tolerant, and the grounds include a 1,500-square-foot edible organic garden, a 3,400-square-foot green schoolyard and outdoor classroom, and an 1,800-square-foot tree-shaded patio. The only grass maintained on campus is on the athletic field used for physical education and sports. Water-conservation practices include timed irrigation, mulching for landscaping, and a drip-irrigation system for the school garden. Two outdoor filtered water-bottle filling stations ensure that clean, cool drinking water is available to encourage hydration.

St. James students, staff, and parents follow a formal sustainable practices policy. The policy encourages the community to refuse, reduce, reuse, and recycle disposable plastics and Styrofoam. Reusable or biodegradable plates, cutlery, and cups are used in the teachers' lounge and at school events, including back-to-school night and open houses. The school eliminated all single-use plastic water

bottles in 2016; all students and teachers use reusable water bottles and are encouraged to use reusable lunch bags and containers. St. James students live throughout San Diego county. More than half of students carpool to school, and approximately 6 percent walk, bike, or skateboard.

The St. James campus is cleaned by an eco-friendly cleaning service, JAN-PRO, which uses microfiber cleaning cloths, bleach-free and chemical-free cleaning products, and HEPA-filtered vacuums. The campus has properly maintained ventilation and natural lighting throughout and is free of allergens and toxins such as lead, mercury, and radon. Every homeroom classroom opens to an outdoor environment with fresh ocean air and breezes.

Local family-owned Ki's restaurant supplies high-quality fresh and nutritious foods to the St. James student lunch program. Their menu offers gluten-free options, and all offerings are free of pesticides, fillers, preservatives, and trans-fatty acids. Additionally, St. James has a wellness policy indicating that campus celebrations must feature healthy foods instead of sugary treats or drinks. Students study health and nutrition as part of the physical education and sustainability curriculum.

All students, preschool through eighth grade, are required to participate in physical education, nearly 100 percent of which occurs outside. Sunscreen and hats are always advised. Every day, all students and teachers take two to three five-minute breaks that incorporate movement. They use GoNoodle and other tools within the classroom such as Indo Boards, which develop coordination, balance, core strength, and mobility. As a part of the school surf team, students learn the skills to surf and bodyboard while understanding the conditions of the ocean for their safety and the well-being of others. Surf team members also learn to respect, protect, and care for the ocean.

In 2016, St James received a grant from Feed the Future to rebuild and enhance its organic edible garden, now known as the peace garden. Together with school

volunteers, the garden was redesigned, planters and soil were replaced, drip irrigation was installed, and the garden was made accessible. Students plant seasonal vegetables and herbs, including broccoli, radishes, kale, lettuce, onions, tomatoes, basil, and rosemary, and they care for two citrus trees. Students make soups, salads, smoothies, and lemonade with their organic harvest. St. James students are becoming healthy in every aspect of their lives — physically, mentally, emotionally, spiritually, and relationally.

A part of the core ideals at St. James is that every person on the planet has a role and has an influence. St. James' inclusion program recognizes all forms of learning and fosters growth for every student. Children with special needs are welcome to enroll at St. James, and their learning skills are integrated into their grade. The school's peer mentoring program gives junior high students an opportunity to support the education of younger students in a warm and supportive environment. The school's culture of inclusivity was fostered by the eighth-grade class of 2016, which gifted the school with a Buddy Bench where a child can sit if they need playmates, leading to the formation of many new friendships.

St. James' holistic and spiritual approach to environmental and sustainability education cuts across all STEAM disciplines, as well as social studies, religion, and community service. Students study Pope Francis' 2015 encyclical on climate and justice, *Laudato si': On Care for Our Common Home*, in which the pope urged all people of faith to care for the Earth and the poor.

Outdoor education at St. James is supported by a dedicated sustainability teacher and University of California master gardener. Junior high students have planted a Native American garden featuring plants used by the local indigenous Kumeyaay nation. Native American garden activities are integrated into third- and fourth-grade social studies. Students learn about the native uses and conservation of endangered Torrey pine trees located on the adjacent church campus. Nonnative ornamental plants are being removed and replaced with native, drought-tolerant pollinator plants to attract local bees and birds.

Second-grade students take an outdoor day trip to the San Diego Zoo annually to study animal life cycles. Fifth-graders attend an overnight trip on the Star of India, the world's oldest active sailing ship, to study ocean ecology, the night sky, mariner navigation, and all aspects of crewing a large ship. Sixth-graders spend three days at AstroCamp, an outdoor science school focused on exploring the universe through hands-on experimental science, astronomy labs, physical science labs, and field science. Students in grades seven and eight attend a three-day retreat that includes sunrise hikes and outdoor games, and where spirituality and healthy relationships are explored.

In the 2017–18 school year, junior high and alumni students engineered and built a butterfly house to protect and conserve threatened monarch caterpillars so that they may grow into butterflies. Ample milkweed, the only food source for monarch caterpillars, is maintained in the pollinator garden. The fifth grade annually works with San Diego Coastkeepers to clean debris from local beaches, and they keep statistics on what they find.

In 2017, the entire school participated in an outdoor performing arts production of the environmental fable *The Lorax* by Dr. Seuss, and they adopted a line from the play as the school sustainability theme: "Unless someone like you cares a whole awful lot, nothing is going to get better." All costumes were made from recycled or borrowed materials. Following this production, St. James students have continued to perform excerpts from *The Lorax* outside of school, including at a community holiday parade, for the San Diego Roman Catholic Diocese and bishop, at other churches, and at the 2018 Rise for Climate March. St. James' outreach efforts continue to inspire their community and others toward a more sustainable future.

## Rialto Unified School District, Rialto, California

*Environmental issues inspire students to think globally and act locally*

Rialto Unified School District (RUSD) is a diverse district in Southern California's Inland Empire, serving more than 25,000 students in 29 schools. Environmental education and use of green technologies are the foundations upon which RUSD educates students, makes decisions regarding student and staff health, and develops innovative partnerships and practices that support environmental and sustainability literacy.

In order to teach students to be responsible citizens of a global society, RUSD provides educational experiences that develop environmental literacy for all students in prekindergarten through 12th grade, which include outdoor learning, the California Environmental Principles and Concepts, innovative environmentally-focused course offerings, and community-based environmental stewardship projects.

Rialto's science education is the catalyst for environmental education, using local and community projects to tap into students' curiosity and thirst for knowledge, as well as project-based learning about local environmental issues. To fill the gap between the adoption of the California Next Generation Science Standards and the aligned instructional materials, RUSD middle and high school teachers worked hard and developed their own open-source free textbooks from vetted online resources.

Provisions were made at each school for students who did not have access through a device at home.

The district's STEM CARES (Science, Technology, Engineering and Mathematics Cultivating Active Responsible Environmental Stewards) program uses locally relevant environmental issues to inspire students to think globally and act locally to improve their community and their world. RUSD was one of the first districts in California to develop and earn University of California science laboratory course approval for robust integrated science sequences of courses based on environmental sciences that promote students making green college and career choices.

A new career and technical education (CTE) green construction pathway is under development. The integrated water science courses are linked to a career pathway in water distribution or treatment, and serve as a context for learning about green technologies, environmental issues, and sustainability; they are approved as both a CTE pathway and as stand-alone science courses. The citizen-science course sequence consists of environmental science and exploring marine environments. It is linked to the engineering pathway, and will be linked to the green technology pathway that currently is under development.

Nine elementary schools participated in the Orange County outdoor education program; the program included an overnight field trip to examine marine environments, fossils, stars, and planets, as well as various edible plants. All elementary school and secondary school science teachers receive between three and five environmentally focused professional learning sessions each year. Teachers participating in Elementary Einstein Fellows workshops are developing environmental science-themed integrated curricula using project-based learning.

Rialto has a fundamental belief in maximizing the efficient use of resources, including human ones. The district has been especially successful in leveraging the expertise of classified staff to work directly with students and teachers; this has increased engagement in the classroom and in outdoor learning environments on school grounds. RUSD's grounds supervisor works directly with the district science lead to develop lessons for the recently installed outdoor gardens, which were funded by a California Proposition 84 grant. The nutrition services division has partnered with the science lead and local farmers to bring locally grown fruits and vegetables to an elementary and a middle school in a pilot program. The farmers have talked to classes about the environment that supports these crops, as well as the nutritional value of these foods. The district energy manager has worked with science and CTE classes on energy audits.

From February 2014 to October 2018, RUSD realized a 23 percent reduction in electrical energy usage and a 12.5 percent reduction for water and sewer usage. RUSD contracts with Cenergistic, and it funds a full-time energy manager. The district tracks energy usage using Energy Cap software. In its latest EPA ENERGY STAR report (March 2016), 96 percent of RUSD schools documented an ENERGY STAR score of 70 and above, with a mean score of 91 and a median score of 94. In 2015, the board approved the installation of solar panels at all school sites by SunEdison (now Onyx Solar). The completed project has a total capacity of 7,800 kilowatts, which meets 80 percent of district needs. For the 20 percent of energy purchased, renewable energy comprises 25 to 28 percent of the companies' portfolios. Other recent projects have replaced inefficient transformers, installed motion sensors and low-flow fixtures, and added cool roofs, LED lighting, and skylights.

The landscaping at most elementary, middle, and high schools, as well as at the district office and the district professional development center, has been replaced with drought-tolerant plants and xeriscaping (a style of landscaping used in arid regions that requires little or no irrigation or other maintenance) to reduce water consumption. School sites have installed water-restrictive faucets and replaced toilets with low-flow models. Water expenses have been reduced by 24 percent. Veolia, one of the district's water companies, is a partner that provides many water-focused, classroom-based student learning opportunities. There are gardens at 19 elementary, five middle, and two high schools, and 16 elementary schools have citrus groves. Both the gardens and groves are used as outdoor learning spaces.

The common labs at each grade in elementary and middle school provide outdoor science instruction. Students spend approximately three hours per week on average in the school gardens learning about topics including life cycles, growing food, and ecosystems. While a few elementary schools have chosen to brand themselves as "STEM with a focus on environmental education" campuses, all schools are, in fact, involved in using their gardens as outdoor learning laboratories. The district's

culinary program is highly successful, with state-of-the-art facilities; the culinary teacher has developed a kitchen garden as a learning space.

At the elementary level, students learn how to support the environment and how the environment supports them. Most of their projects involve gardens, but they also focus on the human effect on the environment. At the middle school level, students explore alternative energy, conduct food waste audits, and lead recycling efforts. At the high school level, students examine environmental issues related to production and consumption of goods and ways to reduce the effects of humans on the environment. Students also have designed California native gardens, solar boats, and desalination units. Parent Garden Champions is a new program in which parents receive training from the district science lead and the grounds and maintenance supervisor to support the maintenance of their local school gardens. Every school was provided with the basic materials and tools to maintain its garden.

Waste disposal and recycling is tracked with the assistance of staff, billing companies, and students. Each classroom at each school has at least one recycling bin; schools participating in composting programs have special food bins. Elementary, middle, and high schools compete against each other quarterly to determine which campus can recycle the most. Once every quarter, maintenance personnel at each school collect the recyclables from the school and weigh them. The nutrition services department reward the elementary, middle, and high school with the highest recycling rate with a barbeque picnic. Waste disposal and recycling also is tracked through monthly billing from Burrtec Waste Industries, Inc. The bills break down costs into the amounts of waste disposal and recycling by site. Additionally, high school science students from environmental science and Advanced Placement (AP) biology classes collect data during waste audits to determine how RUSD is reducing its carbon footprint by using data from the schools that are composting. Burrtec works with RUSD to teach students about waste reduction.

Rialto's integrated pest management practices, designed to eliminate or reduce the use of pesticides and chemicals, focus on preventive measures, mechanical devices, and glue boards. When pesticides are used, as a last resort, about 75 percent are safer products. RUSD purchases and uses green cleaning products and high-efficiency cleaning equipment to reduce chemicals and asthma irritants. All classrooms are air-conditioned, and humidity control is monitored by the HVAC system. Except for a few classrooms, all indoor learning environments in the district have views of trees and nature.

The district and the City of Rialto have implemented a citywide Safe Routes to School program. The program includes pedestrian and bicycle education such as those offered in Safe Moves student bike/pedestrian workshop/assemblies, and Bike

Rodeos, an interactive program to teach children the skills and precautions to ride a bicycle safely, which is conducted at school playgrounds. The district has conducted a safe route analysis at every school site made adjustments to improve ingress and egress. The city and the district work jointly on the walking school bus program. Twenty-nine percent of students report walking and 10 percent report rolling to school, with another 35 percent carpooling and 15 percent taking the school bus.

The district supports the mental health and positive behavior of students through the Positive Behavioral Interventions and Supports (PBIS) program, for which there is a full-time, district-level coordinator. There is also a counselor on special assignment on staff who provides restorative practices coaching, PBIS training, and training on the effective use of restorative circles. Each of the three comprehensive high schools is home to a wellness center; two include meditation gardens.

Each year the city organizes an Earth to Table event and a community conservation fair. During these events, many of the district's schools participate in a walking tour; help put together food boxes for those in need; learn about pedestrian safety, water conservation, pollution prevention; and learn how to make healthy choices about food and exercise. RUSD partners with CEMEX to organize an annual community five-kilometer run at the local surface quarry, the proceeds from which are donated to the district's STEM program.

## *Connecticut*

### Weston High School, Weston, Connecticut

*Sustainable action from innovative thinkers, creative problem solvers, and inspired learners*

Weston High School (WHS) is a suburban high school serving 840 students in the town of Weston, in grades nine through 12. Sixty-three percent of WHS students participate in AP coursework, with a 94 percent passing rate on their testing. WHS' mission is to provide a safe and intellectually challenging environment that empowers students to become innovative thinkers, creative problem solvers, and inspired learners prepared to contribute to the global society. WHS has embraced programs, policies, and initiatives that create a safe and healthy environment for their students while also creating a curriculum and culture that trains students to improve both their local and global community. In doing so, Weston High has become a model for local school systems in terms of sustainable action.

Weston's commitment to sustainability is visible in every hallway and every classroom. Weston has made the United Nations 17 Sustainable Development Goals part of the curriculum objectives, and they are displayed on posters in each

classroom and throughout the hallways. This serves as a daily reminder to students that they are part of a larger global community, and that the purpose of their education is in part to contribute to the achievement of these goals. As a further illustration of this commitment to sustainability, the hallways of several school wings are decorated with murals that promote sustainable initiatives.

While sustainability goals are incorporated into all disciplines, they are a focus of the science and social studies curriculum. In science, standard and AP environmental science courses are offered, with approximately 50 percent of all students in the school taking one or the other before graduation. Further, courses in advanced science research and Project Lead the Way (an engineering and STEM- focused course) are offered to teach students the necessary skills to tackle real-world, 21st-century problems.

Other classes that include environmental concepts are AP U.S. History, which includes reading and assignments on environmental preservation in the progressive era, and Introduction to Economics, which emphasizes sustainable practices and economic effects. The AP Microeconomics and AP Macroeconomics courses also emphasize sustainability and green practices by serving as positive externalities in a market.

All these courses encourage students to step beyond the classroom in order to experience these sustainability challenges firsthand in both the local and global community. For example, students in the environmental courses are given numerous opportunities to work directly with local organizations and government officials. Students have done everything from physical volunteer work to attending presentations and town meetings. Groups with which they have worked include: the Weston Sustainability Committee, the Weston First Selectman, the Lachat Town Farm, the Nature Conservancy and Devil's Den Nature Preserve, Earthplace Nature Center, Wakeman Town Farm, and Trout Unlimited.

Weston has embraced a relationship with a local service organization, Builders Beyond Borders, in which students do local community service and travel to Latin America during school vacation to do construction projects in underprivileged communities.

In addition to its commitment to educating students about sustainability, Weston High also is committed to teaching them about the environment. This is evident in the high priority placed on the health and well-being of students, as well as in the creation, structure, and operations of Weston High. When the school added a new science wing in the past decade, officials built to LEED Silver certification standards.

Weston High has retrofitted lighting with LEDs, and added motion sensors for classroom and hallway lighting.

The school actively recycles plastic, purchases green cleaning products, uses the EPA's IAQ Tools for Schools Action Kit, and has made efficiencies in its bus transportation system to reduce carbon dioxide emissions. Teachers' paper copies are tracked and enumerated through Papercut software, encouraging them to reduce usage. Weston High is fortunate to be in an area surrounded by rich forest and wetland ecosystems. Classes are conducted outdoors regularly to take advantage of these areas. The building features numerous outdoor courtyards, which bring natural light to classrooms and a connection to nature.

Water-bottle filling stations are located throughout the school to reduce plastic bottle consumption. Weston has a packaged sewage treatment system, which can perform as well as Mother Nature in transforming sewage waste into clean, harmless substances, mostly water and nitrogen gas. This treatment system creates an environment that facilitates the growth of bacteria that break down sewage into nonpolluting end products. This water, once treated, is discharged directly back into the ground. The district is on a well water system, and maintenance is controlled by the town administrator. Water is tested annually.

Weston prides itself in offering all types of meals, including vegetarian and vegan options. Students always have access to the salad and fruit bar, among other vegan and vegetarian snacks and drinks. The cafeteria also highlights multicultural meals from around the globe, with Asian, Latin, and Mediterranean cuisines often featured.

WHS has its own vegetable garden. Various classes and clubs maintain this garden. The environmental science courses (AP and standard), biology courses (AP, honors, and standard), and the special education department often do research and studies, and they work in the garden. Clubs have an equal, if not greater, importance in maintaining the garden. Various clubs plant, harvest, and cook with the vegetables in the garden. The garden further is used to supply the cafeteria. WHS purchases local foods, as well.

The school surpasses expectations in physical education by having implemented Project Adventure, a program based on team building that establishes challenging yet achievable goals. The program requires applying critical thinking, learning, and teamwork to improve peer relationships and self-esteem. The Weston Student Government also holds events throughout the year that provide students with the opportunity to get outside. For example, "Food, Friends, and Funk" is an event that takes advantage of the benefits of being outdoors.

With the recent formation of the Weston High School green team, which is a collaboration of all sustainability-minded clubs, classes, and groups in WHS, the school is enacting a host of new initiatives in and around the school. These include collection and recycling of textiles, e-waste, and ink cartridges and batteries. The green team has started implementing composting in the cafeteria, installing electric vehicle chargers on campus, creating nature trails in the surrounding forests, and incorporating bee hives and pollinator gardens around campus. WHS also is working to build stronger collaborative relationships with the surrounding community so that sustainable efforts extend beyond the campus.

## *Delaware*

### The Jefferson School, Georgetown, Delaware

*Tiny by design, mighty by nature*

The Jefferson School (Jefferson) started in 1992 as a nonprofit, private, independent day school, providing integrated, hands-on learning experiences for children ages 3 through 14. Tiny by design (the current enrollment is 102 students, and the maximum possible is 120), Jefferson's philosophy is that children are naturally curious, learn best by doing, and seek to understand interconnections.

Jefferson provides enough information to kindle children's curiosity and then the tools to help them forge their own paths of discovery and learning. Jefferson aims to integrate subjects just as they are in the real world and have children outside every day. The school features active, engaged learning via multi-sensory, hands-on experiences in a curriculum interwoven with its 43-acre campus.

Adjoining the Redden State Forest, Jefferson boasts two ponds, trails with fitness stations, an outdoor classroom, a Nature Explore classroom, pollinator gardens, vegetable gardens, a greenhouse, goats, chickens, and beehives. In addition, there are numerous native trees, bush, and wildflower plantings, as well as purple martin nest houses.

Jefferson recycles every material the state of Delaware accepts. There also are compost containers in each classroom. Each week, third- and fourth-graders weigh each classroom's recycling and composting amounts. The school uses no lawn pesticides, herbicides, fungicides, or fertilizers.

Since 2010, Jefferson has cultivated alliances with regional partners to build a nature-centered, active curriculum. Partners include the Delaware Nature Society, the University of Delaware College of Marine Studies, the Lewes Historical Society, Delaware Tech, Delaware Department of Natural Resources and Environmental Control solar car and bridge challenges, the Delaware Bee Keepers Association, Delaware Wetlands, Nanticoke Watershed Alliance, Stash Your Trash, Delaware Inland Bays, Oceana, Delaware Native Plants, Parkside High School Horticulture Department, Echo Hill Outdoor School, iNaturalist, and the National Phenology Network.

Jefferson hired an environmental science coordinator in the spring of 2017, and a summer outdoor program coordinator in the fall of 2018, to work together to enhance both year-round programs and outdoor maintenance.

The environmental science coordinator meets with all grades weekly; student and teacher participation in environmental topics is built into the schedule. In addition, the environmental science coordinator has regular contact with the school head, maintenance staff, and parents.

Jefferson has addressed four Eco-Schools pathways (energy, wildlife habitat, biodiversity and healthy living), involving students each step of the way. The school conducted the Eco-Schools energy audit and subsequent energy-saving campaign; measured the square footage of impermeable surfaces; planted trees and pollinator gardens to reduce lawn area; estimated biodiversity around campus; evaluated tree size and forest quality; and started weighing recycling and composting. Students have investigated virtual water use, ecological footprints, and the life cycle of their personal possessions. The school switched overhead fluorescents to LED lighting; installed water-bottle filling stations; and recently mounted a solar voltaic field. These changes complement the school's geothermal heating system to reduce its environmental impact.

The school has an active physical education and health program, daily recess (with nature trail walks for interested students), and frequent classes outside at all levels of instruction. Most environmental science classes go outside once or twice a week. All levels take numerous outdoor-oriented field trips. Fifth- through eighth-grade students also attend the Echo Hill Outdoor School in the fall.

Health classes focus on nutrition and healthy eating habits. Once a month, parents bring in healthy snacks for "Eating the Rainbow" events featuring fruits and vegetables in many colors. Environmental science and health classes collaborate to have students investigate the environmental impact of different diets and the distance food travels to arrive at our tables. Middle school students frequently provide healthy, handmade (and often solar-cooked) snacks for the school. For the healthy living pathway, Jefferson evaluated weekly time spent outdoors at each grade level.

In addition to in-school activities, Jefferson sponsors fall and spring on-campus family camping nights, a star night with local astronomers, and a spring five-kilometer walk/run for the community. The school has a "Road Kill Café" area (featuring decomposing deer, fox, raccoons and other finds) that students visit frequently. Game camera photos of scavengers are regularly featured in morning meetings.

Students participate in a yearly "Stash Your Trash" sculpture contest, a gardening contest at Salisbury's Parkside High School, and Delaware Department of Natural Resources and Environmental Control's solar car and bridge contests. Jefferson offers fall and spring campouts, a pre-holiday campfire, a winter hike, and a five-kilometer run. Students have planted more than 100 trees and bushes and over 350 wildflowers in the last school year. Students care for school chickens and goats. Middle schoolers build rowboats. Jefferson has hosted speakers on topics including wild edibles, litter reduction, and watershed health. Jefferson participates in iNaturalist and the Delaware Schoolyard Biodiversity Project, and posts phenology

observations on Nature's Notebook for the National Phenology Network (including cloned lilac observations and the Journey North tulip gardens project).

## Caesar Rodney School District, Wyoming, Delaware

*Cultivating stewards of the Chesapeake*

Several years ago, Caesar Rodney High School (CRHS) formed Caesar Rodney School District (CRSD)'s first student-led environmental organization, Earth Club. In 2017, Earth Club was rebranded as the EcoTeam. Today, a districtwide green team includes building administrators and department heads, and each of the district's 12 schools has its own student-led EcoTeam.

In 2016, CRSD completed an energy audit of 10 school buildings, the district office, and the maintenance building. This data is being used as a baseline to create a comprehensive energy management plan for the district, as well as individualized action plans developed by students at each school. Two new schools are expected to receive LEED Silver certification and be recognized as 21st-Century Education Schools, a design framework that pays special attention to physical, social-emotional, and academic environments. Both elementary and middle school "neighborhoods" are watershed themed. As students travel through the building, they are immersed in their local estuary, starting with a vestibule housing a giant floor map of the St. Jones River and Chesapeake Bay watershed, and including glass partitions etched with topographic mapping, such as natural shapes, textures, and color palette.

Alternative energy sources within the district include geothermal energy, which is currently used to run four CRSD schools; a solar array, which is installed in the high school outdoor classroom; and a wind turbine at the two schools located on Dover Air Force Base. All 12 schools organize sustainability data using Eco-Schools' dashboard and the ENERGY STAR Portfolio Manager.

Four CRSD schools have installed substantial rain gardens, which process runoff before entering storm drains. With the continued partnership of the U.S Fish and Wildlife Service, CRSD has removed mowed turf and replaced it with native and drought-resistant vegetation and permeable substrates for pathways and weed suppression. The early childhood center faculty planned and installed a native arboretum, in conjunction with the U.S. Forest Service and Project Learning Tree.

Schools in the district are adding share tables and composting garden and cafeteria scraps. Grants support the installation of water-bottle filling stations (which are

popular at CRHS), the successful reusable bags project at Frear Elementary, and the "No Straws Please" campaign at Nellie H. Stokes Elementary School, all of which reduce single-use plastics and promote proper hydration. The district's network of EcoTeams, in partnership with the Delaware Department of Natural Resources and Environmental Control, the Delaware Solid Waste Authority, and Revolution Recovery, has begun a campaign to communicate how to "recycle right." CRSD piloted its own student recycling training kit in its gifted education and enrichment program. Building custodians and students with special needs from the Charlton School are essential team members at each school as they help transport recyclables. These endeavors provide Charlton School students with practical vocational and critical life skills, while also providing inclusive time with the student population.

The district partners with community organizations like the Delaware Solid Waste Authority and Delaware Department of Natural Resources and Environmental Control (DNREC), which provide educational experiences and resources to help the district better understand and manage the solid waste stream. The U.S. Fish and Wildlife Service has partnered with the district for many years, providing valuable resources and expertise to help transform portions of mowed turf and drainage swales into native habitat with increased biodiversity. The NWF and Green Building United support CRSD schools along twelve pathways of the NWF's Eco-Schools USA program, which provides unique learning experiences through effective sustainable management of school grounds, facilities, and curriculum. Local businesses like Wyoming Millwork Co. and local branches of Lowe's and M&T Bank recognize CRSD's commitment to green schools, providing regular mini grants to fund various projects. CRSD participated in a statewide program funded with a B-Wet (Bay Watershed Education and Training) grant from NOAA. The grant provided funds for three district schools to partner with the Delaware Department of Natural Resources and Environmental Control to facilitate and pilot Meaningful Watershed Education Experiences (MWEE), install or amend outdoor classrooms, and survey schoolyard biodiversity. Community partnerships also support a commitment to the

implementation of NGSS, as CRSD's instruction department begins to explore ways to bring more STEM lessons outdoors.

F. Niel Postlethwait Middle School, along with Allen Frear Elementary School and the John S. Charlton School for special needs students, comprise a facility now known as the EcoCampus at CRSD. The EcoCampus is growing into a district hub for green schools initiatives, student field experiences, and teacher professional development. As a follow-up to a past summer's green schools professional development courses held at the EcoCampus, district teachers who attended the courses were provided with resources to facilitate installation or renovation of outdoor classrooms, community gardens, and compost centers on their campuses.

In 2017, CRSD hired its first environmental education specialist, whose responsibility is to advise the district on school facilities, health, and environmental learning. The person in this role also works with outside districts as they consider making sustainable changes. Across the curriculum at each grade level, CRSD includes at least one curricular unit that provides the opportunity to assess student environmental literacy. The high school offers a general environmental studies course, as well as an AP version. The instruction department also has assembled a math, science, and environmental education division, known as MSE2, to inform principals of the latest trends and pertinent information available to their faculty. In the social studies curriculum, teachers work with students to design green cities and make connections between economics and ecology. Annual career fairs at each CRSD school features partners from Delaware State Parks, DNREC, the EPA, and local nature centers.

The instruction department developed a series of summer professional development courses, with three courses focused on the district's growing outdoor learning infrastructure. Each course had full enrollment of approximately 25 staff members from throughout the district. In the course called Compost Center, participants were led along a story line, "An Apple's Two Tales," written and illustrated by middle school students. After receiving a fresh apple snack from partners at local Fifer Orchards, participants explored how natural resources cycle through the environment, and how there are choices for waste disposal (using their apple cores as examples). All participating schools received a free compost tumbler to begin its own compost center.

The course called The Community Gardens showcased CRSD's expanding network of raised bed gardens. Participants learned basic gardening skills, and they concluded a day of training with a harvest and an opportunity to make fresh smoothies and infused oils. Participating schools received a free raised garden bed. Finally, the Outdoor Classrooms course explored what possibilities exist for developing interactive outdoor learning facilities where students and staff can work

with nonformal education partners and authentic environmental education experiences. Attendees of this session were provided a prototype "go-bag" filled with simple field equipment, including an iPod touch with the iNaturalist app as a tool to encourage staff to get outdoors and explore.

The district has supported the installation of gardens at each campus. Backyard-style gardens, in conjunction with regularly provided cafeteria meals and interpretive signage, offer students and families more access to knowledge of where food comes from and increases the chances that, when given the opportunity, students will try new foods like radishes and asparagus. Each year, the Delaware Farm Bureau Foundation's mobile classroom rolls onto elementary campuses to teach children about farming, healthy eating and agriculture. This helps build excitement and support for our CRHS agricultural science program. All this work is also made possible by support from partners at Kent Community Garden Collaborative and Clark Seeds, Inc., which provides free expertise, along with seeds, plants, soil, and tools at discounted prices. The Delaware Master Gardeners are working to support EcoTeams throughout the district by providing mentors to each community garden. Additionally, the district operates a food bus that brings free meals to children throughout the summer.

## *Florida*

### MAST Academy, Miami, Florida

*Keepers of the coast*

Established in 1991, Marine and Science Technology Academy (MAST) converted the local Planet Ocean museum, which closed that same year, into a unique magnet program among the 400 schools in the Miami Dade County Public School system. The school's mission is to provide a marine setting and nurturing environment for studies leading to academic success, career preparation, an appreciation of the sea, and environmental awareness.

In 2015, MAST added a sixth- through eighth-grade program and a Cambridge Advanced Program of Studies track, tripled the student body size, and doubled the school's square footage with a large construction project. Notwithstanding the increased capacity, efficiency improvements resulted in a reduction in electricity consumption by almost two-thirds. In July 2017, MAST requested and obtained an energy-efficiency audit from Florida Power & Light. That report served as a baseline for MAST's energy-efficiency goals.

At the request of veteran teachers, the MAST parent, teacher, and school association (PTSA) created the MAST PTSA sustainability committee to introduce green infrastructure and reinvigorate hands-on sustainability activities such as organic gardens, schoolwide recycling, Bayshore beach cleanups, and coastal restoration projects.

In 2018, the PTSA partnered with the Phillip and Patricia Frost Museum of Science to create a Green Champions program that recognizes MAST students at an end-of-year ceremony for dedicating community service hours toward sustainability efforts. Students who attend monthly Green Champion meetings, MAST workdays, and Frost Science coastal restoration days on Virginia Key, as well as dedicate community service hours to environmental or health and wellness programs at MAST, receive bronze, silver, or gold recognition for their achievements.

To increase school security, the PTSA funded an off-grid, solar-powered guard shack, repurposing materials decommissioned during construction of a new school building. The engineering teacher worked with students to calculate the required materials, including the purchase of the specially designed air conditioning unit with a built-in inverter and deep-cycle batteries to allow the system to run wholly off the grid.

The academy installed the first electric car-charging unit at a school in the district, doubling the electric car presence on campus. MAST retrofitted pool lights and the engineering classroom with dimmers, motion sensors, and LED lighting. It has participated in the Green Apple Day of Service. MAST installed energy monitoring hardware through the ReNew Our Schools competition.

The first school in its district to eliminate straws from its cafeteria, MAST also replaced Styrofoam cafeteria trays with compostable trays and installed six water-

bottle filling stations across campus to encourage healthy hydration and reduce waste. The school has funded the only operational recycling program in the school district, securing common area and classroom recycling bins. MAST has enforced its no-idling policy and secured a bike rack and two free BikeSafe clinics through the University of Miami's Pediatric Neurology department.

An outdoor heated swimming pool and a mile-long shaded walking trail allow students to exercise along Biscayne Bay. MAST has a mandatory freshman swimming program, as well as a triathlon event that includes a one-mile run on a shaded trail behind the school, a 200-meter swim, and a one-half mile kayaking component. Sun safety is incorporated into the physical education curriculum across all grade levels. MAST students grow vegetables on-site in two outdoor raised garden beds as well as indoors for the culinary and experimental science class. This produce is then consumed by students. The culinary class also coordinates local organic vegetable delivery for MAST families.

Mental health and wellness are supported at MAST with three on-site professional counselors and a peer counseling program known as the Health Information Program (HIP). HIP trains upperclassmen to talk with ninth-grade physical education students about challenging health topics such as sex education, sexual orientation, drug use, bullying, and physical abuse.

The academy was founded to provide effective environmental and sustainability education. MAST includes rigorous classroom courses and offers internship opportunities with environmental scientists and nationally prominent science institutions. Students can pursue one of two highly acclaimed academic programs: (1) the maritime program, or (2) the Cambridge program. AP courses available include environmental science, biology, chemistry, physics, computer science, calculus on both the AB and BC levels, mechanics, electricity, and magnetism. The Cambridge courses are offered on marine science, environmental management, and global perspectives.

Students can take electives in topics such as solar, experimental science, and engineering. MAST has one of only two JROTC Coast Guard programs in the country. In addition to the course offerings, students pursue internships with institutions located just minutes from the school, including with NOAA, the United States Coast Guard, and the University of Miami Rosenstiel School of Marine and Atmospheric Science. Students have hands-on opportunities to apply their environmental and sustainability knowledge through monthly beach cleanups, native plant gardening, coastal restoration, shark tagging, coral reef restoration, and eco art campaigns.

With the academy's Family, Career, & Community Leaders of America club, the culinary class participates in several competitions that focus on recycling and redesigning, food innovations, budget and finance, and environmental ambassadorship. The culinary class takes field trips to a local farm where students learn about the crops, and they plant, harvest, and share a picnic with the farmer; and they take a charter boat excursion to fish and learn about sustainable fishing.

The academy was selected this year to become the first Miami-Dade public school to provide an Outward Bound experience for students and teachers. Seven teachers and seven students explored the Blue Ridge Mountains for five days. They endured challenging physical conditions, and they rapidly developed trusting bonds with other participants to problem-solve and collaborate on expeditions, which included rock rappelling and creating a zipline system.

## FAU Lab School District, Boca Raton, Florida

*Environmental stewards caring for the community through sustainability and service*

The Florida Atlantic University Lab School District (FAULSD) is a small lab school district run by the Florida Atlantic University College of Education. It comprises Florida Atlantic University High School (FAUHS), A.D. Henderson University School, Karen Slattery Educational Research Center for Child Development, Pine Jog Environmental Education Center, and Palm Pointe Educational Research School. In the journey to the top of the green schools mountain, students and staff have gained the power to observe what is around them, learn what changes can do, change what they can, and inspire those they meet along the way.

A districtwide program created and led by students entitled "Save Energy, Save the Future" encourages staff to make sure any unnecessary electronics are turned off when not in use and when not in their rooms, such as computers, overhead projectors, and other electronic classroom tools. Other energy-saving highlights include the installation of occupancy sensors and a solar-powered walkway with a solar-powered backup. FAUHS has built a solar/electric powered car from the frame up and using recycled materials. The newest construction in the middle and high schools are an autonomous solar powered go-kart, along with solar powered race cars.

Families are encouraged to operate through an online rideshare organizing mechanism. The district observes National Walk to School day and offers preferential parking for low-emission vehicles.

Hydroponic gardens as well as a butterfly reading garden have been added to various school grounds to encourage use of the lush outdoor areas and beautiful

Florida weather. Additionally, the district expanded two outside classroom gardens, including variable systems such as aquaponics, vertical hydroponics, horizontal hydroponics, raised bed gardens, barrel gardens, and a new research-based aquaponics lateral system. These gardens were built in the center of the high school for all students to observe, learn, and participate in care and maintenance. Cistern and rain barrel systems reuse greywater to irrigate plants.

In their community service efforts, FAULSD students and staff collect donated blankets to create care packages for cancer patients, focusing on no waste, repurposing, no physical flyers, and digital notification. For a districtwide Color Run, the focus is again on having no waste, an environmentally safe color product, reusable water bottles, and all-digital notification. A Lego wall of innovation allows messages and artwork to be recreated every week by a different grade to allow for a change of décor and of message every week in a front lobby walk in area. This area is made of recycled Legos donated to FAULSD.

The district installed additional water-bottle filling stations, and all students were provided refillable water bottles both to encourage consumption of water in lieu of sugary caffeinated beverages and to decrease refuse. Recycling programs are headed by the student-facilitated Planet Patrol, marking on the charts of every classroom the number of recyclables collected and whether it was sorted properly. Awards are then given to the best classrooms based on data collected by the Planet Patrol. FAUHS encourages work to be submitted electronically with few exceptions, and electronic work is accepted whenever possible in the lower grades.

All FAULSD schools have adopted a STEAM culture for all education and curriculum, and within that curriculum, have integrated environmental consciousness and studies. Administration has built outdoor education time into the curriculum across all grades. All grades have a minimum of one field-based or outdoor investigation, and most have numerous outdoor learning events during the year to

encourage students to expand their knowledge beyond the classroom. Environmental stewardship is integrated with culturally authentic resources, Spanish-language curriculum, and citizen science process skills like data collection, analysis, habitat restoration, and water stewardship.

The district has updated its five-year plan with an expansion, including hands-on environmental research, which can be implemented into the curriculum. It has grown the green team and set up sub-teams within the district to allow for additional resources and completion of tasks. The requirements of being a green school are formally addressed at parent and student government organizational meetings. FAULSD works to cultivate new staff interest in sustaining and growing school sustainability efforts.

Students have designed and implemented an automated instrument to measure tumor-infiltrating lymphocytes in cancer tumors, and, in another project, a system for early identification of airborne chemicals. They are involved in multiple ecological projects including Seaperch, an underwater robotics program where students build underwater submarine robots using recycled materials.

District schools participate in the Million Orchid growing project with FAU Pine Jog Environmental Education Center and Fairchild Tropical Botanic Gardens. This program to restore Florida native orchids has been tremendously successful. Additionally, students are conducting field research on a variety of subjects, including studies on Bachman's sparrows, mangrove restoration, ocean currents, geological effects of beach nourishment, carbon sequestration, and invasive exotic species.

Students run a YouTube channel associated with their on-campus WeatherSTEM station. Hands-on aquaponics includes a 400-gallon circulating freshwater tank with fish, gravity-feed filtration, and hydroton lava rock, allowing students aquaponics situational exposure.

The district has grown, expanded, and stretched its sustainability programming, continuing to strive for excellence, not as a reward, but as a culture. Already, students have created animatronic owls to preserve the natural habits of the native species, solar powered cars and go karts, and robots that will be able to harness energy from the ocean. Where will they go in the next five years? The sky's the limit…or maybe not.

## *Georgia*

### Robert W. Gadsden Elementary School, Savannah, Georgia

*Teaching conscientious environmental preservation with energy-saving strategies*

Robert W. Gadsden Elementary School (GES) exemplifies the concepts and ideas of conscientious environmental preservation and sustainability. GES was opened in 1955 and rebuilt in 2012. It serves 558 students from kindergarten through the fifth grade. Most students live in the surrounding urban neighborhood, and nearly half walk to school. GES is a *Title I* school, with 98 percent of its students eligible for free or reduced-price lunch. Business partners have played an active role in engaging students to be better citizens and supporting the sustainability efforts.

The campus is 7.25 acres, landlocked in an urban community. Less than 30 percent of the land is dedicated to buildings. When the facility was rebuilt in 2012, a second floor was included in the design to reclaim more than an acre of green space. This resulted in a new athletic field and space for a 6,400-square-foot, 30-kilowatt photovoltaic system. The photovoltaic system is expected to lower energy costs by 5 percent and avoid production of more than two tons of carbon dioxide every month.

The school has one of the lowest utility costs per square foot in the district at 76 cents. GES also achieved a 38 percent reduction in greenhouse gas emissions. A variety of energy-saving strategies have included the incorporation of energy-management performance guidelines and automated temperature-control systems; the integration of occupancy sensors; the scheduled replacement of conventional lighting with LED; the development of efficient student transportation; and the introduction of recycling. The school was ENERGY STAR-certified in 2014 with a Portfolio Manager score of 91.

Four transport buses adhere to strict bus-idling guidelines. Over two tons of waste were recycled in one school year by the recycling club, run by third-, fourth-, and fifth-graders. The cafeteria transitioned from Styrofoam trays and bowls to paper trays. The trays are made of 20 percent recycled pulp and 80 percent paperboard, manufactured from wood pulp grown in the U.S. from certified forests. GES reduced water use by 13 percent in the past year, and three water-bottle filling stations were installed. The stations are expected to eliminate over 3,000 plastic bottles.

School leadership partnered with Southern Soccer Academy Savannah United to increase the diversity of students' participating in soccer programs and provide additional education in health and fitness. Golf clinics are offered on the weekends through Camp Explore where students gain experience in the sport and are educated on increasing the quality of their health. Through Gadsden's 21st Century after-school program, students participate in daily fitness classes. A running club was established for students to exert energy before the school day. Curtis V. Cooper Primary Health Care, Inc. is a nonprofit community health center that provides services (including primary care, dentistry, behavioral health, and patient assistance) to Gadsden students through an on-site clinic. This helps reduces the amount of valuable instructional time that would be required for appointments off-site.

Students engage in five-minute brain breaks throughout the day to move their bodies and subsequently increase focus. Safer, Smarter Kids is an annual training session for students in kindergarten through fifth grade, teaching students how to better protect themselves from physical and mental abuse. A Character Counts program has been implemented, with six pillars of character development to help students exemplify appropriate behaviors and to provide a positive school climate. Coordinated Early Intervening Services and Dare to Be King programs focus on mental health, helping students learn how to deal with trauma and daily stressors. Gadsden's faculty and staff also participate in an annual "The Biggest Loser" wellness project to promote healthy eating and living. In addition, Village Community Garden of Sylvester, Georgia, and the local YMCA partnered with GES to grow garden produce.

Students explore various career pathways related to agriculture and farming not normally presented to students from urban communities. Through an established partnership with Savannah State University, Gadsden has implemented a curriculum

that exposes students to marine science, urban farming, horticulture, and other agricultural sciences and careers. This curriculum has contributed to improved test scores on fifth-grade state assessments. The partnership is essential to groundbreaking research focused on reducing and eliminating food deserts in low-income communities surrounding the school that have limited access to affordable and nutritious food. In addition, an integrated greenhouse and aquaponics lab has been built through this unique relationship.

Prekindergarten students visit Oatland Island Wildlife Center each year to explore wildlife, conservation, and habitats. Kindergarten through fifth-grade students learn about the environment and coastal wildlife through a Tybee Island Marine Science Center partnership. The energy efficiency education coordinator from Georgia Power designed a curriculum for the school to educate and empower students to play an active role in reducing global warming.

An outdoor learning experience, "When are We Wasting Water?," from the Green Education Foundation, teaches students the effect that washing hands has on water sustainability. Students conduct outdoor scientific investigations to learn about water conservation when washing hands, how to prevent the spread of diseases, and how water can be better managed. This experience builds an understanding of measurement, scientific inquiry, health management, and global environmental issues. The #GadsdenGives initiative allows students to apply all they have learned through their environmental and sustainability curriculum to give back to their community to maintain its vitality and beauty and ensure it remains sustainable.

## Sharon Elementary School, Suwanee, Georgia

*This school D.I.G.S. hands-on environmental education!*

The greatest asset to the environment surrounding Sharon Elementary School (SES) — to safeguarding student and staff health and to providing effective environmental education — is D.I.G.S. (Discover, Discover, Inspire, Grow, Succeed). This is an outdoor classroom, a habitat, and an area to explore all things related to science. This once-barren space evolves each year as SES students acquire more knowledge of the earth, climate, and their responsibilities as citizens. The area is a Certified Wildlife Habitat® through the NWF, and it is an Atlanta Audubon Society Wildlife Sanctuary.

The outdoor classroom includes a pergola with *American Disabilities Act*-compliant tables; a concrete path stamped with native Georgia animals and plants; a Georgia limestone amphitheater for outdoor lessons; a native rock garden containing

marble, sandstone, limestone, and granite; a butterfly garden with organic milkweed for monarch butterflies; the beginnings of a loofah garden; a three-sided barn made of reclaimed wood; signage for self-directed learning; a tool shed; and a WeatherBug Station atop the school.

The compost bins provide nutrients for the garden. An erosion table is used to teach third- and fifth-graders the importance of protecting the land. The school created a landfill exhibit of student trash in May 2017 and began allowing students to observe the changes in decomposition of materials over following year. The outdoor classroom features a mobile whiteboard to use in different locations. SES recently installed an in-ground sundial ellipse to teach shadows based on Earth's position in relation to the sun. The school has constructed a sensory path made of various materials for students to walk on barefoot. Other D.I.G.S. projects include a water-wicking bog with sundew, a Venus flytrap and pitcher plants, and a dinosaur/archaeological dig site.

This outdoor hands-on environmental science learning space facilitates a curriculum covering erosion, types of soil and proper drainage, composting, clean water, water collection, beneficial insects, crops, lifecycles, and weather. Students in all grades look forward to lessons in D.I.G.S. as well as annual D.I.G.S. Days, with stations covering a variety of topics, including pollinators, eating local, plastic bag use, and limiting pesticide use.

Indoors, fifth-grade recycling ambassadors manage collection bins and recycling education efforts; oversee TerraCycle product collection; and share news with the entire school population. The green team raises awareness of walk-to-school days, adopt-a-road days, community-sponsored events like cleaning up a local river or recycling electronics, and the new student-driven undertaking of Crayola ColorCycle. Cross-curricular instruction occurs to combine what students learn about waste reduction, reuse, and recycling with their observations over time of the nearby landfill. Cross grade-level teaching allows older students to share their knowledge with younger students about decomposition and the importance of recycling. Students walk to the recycling center across the street to see firsthand and better understand recycling processes and rationales

Another well-visited location is C.A.S.T.L.E. — Collaborative and Social Technology Learning Environment — which serves as the school's media center and library. Besides being the leader of the school's Makerspace, the librarian tweets out information about new texts offered for checkout, and she highlights the increase over the past few years of nonfiction texts covering habitats, climate change, recycling, landfills, garbage, composting, scientists, geology, Earth, and environment. Last year, the SES team placed third in the First LEGO League Robotics State Competition by removing microplastics from drinking water. In 2019,

the team is recycling plastics using a 3-D recycler by grinding up plastic waste and turning it into 3-D filament to become a 3-D product.

The science lab uses an outdoor nature walking trail along a creek to teach habitats, food chains, food webs, and benefits of decomposers. The lab hatches a new bird species each spring, so far including Indian Runner ducks, Ayam Cemani and Top Hat chickens, quail, and emu. SES also hatches and raises a variety of praying mantises, butterflies, moths, worms, and Madagascar hissing cockroaches. The second-graders hatches chickens annually. Primary classes hatch a variety of insects. Students provide daily care for a bearded dragon, two eyelash-crested geckos, and two White's Dumpy tree frogs.

Sharon has received several awards for its farm-to-school participation, including one for its recipe contest using ingredients from the school garden. An indoor tower garden adds salad to daily lunches, and D.I.G.S. vegetables grown in the facility's 10 raised beds and in two 20 x 20-foot plots are used in school lunches. The school's chicken coop has seven hens, whose eggs are used in the cafeteria and offered to staff and families.

The cafeteria provides nutrition education through a "Harvest of the Month" program. SES offers after-school yoga and weight loss competitions for staff. The school provides Blessings in a Backpack for needy students and celebrates no homework Wednesdays to decrease stress and anxiety. Families receive physical activity calendars, and the school celebrates students' participation in physical activity outside of school with a display of photos. The parent-teacher organization sponsors a dance-a-thon. Nursing students work with the school's registered nurse to provide additional care and education to students.

Sharon has switched to green cleaning products, implemented the EPA's IAQ Tools for Schools and partnered with Georgia Commute schools to promote anti-idling. SES collects water in a 200-gallon cistern buried underneath its outdoor classroom area, which is used to irrigate the crops. The school has seen a reduction in energy use of 12 percent and in greenhouse gas emissions of 6 percent over the last two years and received ENERGY STAR certification in 2015.

**Georgia College & State University, Milledgeville, Georgia.**

*Smart money leads to sustainability-smart students*

Georgia College & State University (GC) is committed to the stewardship of natural resources and exploring ways to enhance the sustainability of the campus and its

community. GC has implemented initiatives, projects, and procedures that promote its sustainability goals. Accordingly, it has achieved the Association for the Advancement of Sustainability in Higher Education Sustainability Tracking, Assessment, and Rating System (STARS) Bronze Level.

The Office of Sustainability (OOS) is responsible for campus sustainability initiatives; promoting education and outreach; and offering opportunities for internships, volunteering, service learning, and community service. The OOS has provided some 30 internships with over 10,000 hours of service, including opportunities for experiential learning, leadership, and professional development, all while having a positive and tangible influence within the campus community. Partners include the Sustainability Council, the Sustainability Fee Program, the Campus Kitchen at Georgia College (CKGCSU), the gardening club, and the environmental science club.

Through the Georgia Power Energy Efficiency Incentive Rebate Program, 42 projects have resulted in over $200,000 in rebate awards and 3 million kilowatts per hour saved. Projects include LED conversions, reflective roof installations, heating and air optimization, as well as occupancy sensor installations. LED conversions alone have contributed to a savings of over 2 million kilowatt-hours, with a continued effort to have 100 percent of the entire campus in LEDs by the year 2020.

Through the SFP, competitive grants are available to current GC undergraduate and graduate students to implement projects that advance sustainability through education, research, service, and campus operations. Successful projects have addressed waste reduction, responsible use of resources, sustainability education for the campus community, and behavior change, as well as provided research data. The program has provided some $600,000 to fund 106 student-led projects, such as retrofitting electric golf carts for solar power, and creating a rooftop solar array, installed in 2016, which generates four kilowatt-hours to the existing building.

The college received the 2015 bronze level Bicycle Friendly University award from the League of American Bicyclists. GC provides bike stations and shuttles with bike racks. Shuttle services and TapRide (similar to Uber) accommodate residents and commuters with rides to on-campus facilities and off-campus conveniences.

The recycling initiative, which began in 2013 with a recycling rate of 3 percent (three tons), has seen a slow increase to 23 percent (47 tons). These efforts help to divert plastics, paper, paperboard, cardboard, and metal cans from the landfill. In 2011, refill retrofit kits were added to water fountains with 14 Brita filters and 11 hydration stations to allow refilling of reusable bottles and glass containers. Some 2,500 reusable bottles were distributed across campus, and their use is encouraged.

The campus community garden, established in 2016, provides a place where students, faculty, staff, and community can interact, learn about gardening, harvest produce, and simply relax. For 20-plus years, lawn material collected has been used for compost and returned to the campus grounds and landscape. In 2016, the compost program began processing post-consumer food waste from the dining hall to make compost for the campus garden and grounds and landscaping. Within the last year, compost interns converted 20,000 pounds of food waste, reducing landfill costs. CKGCSU, launched in 2018, recovers food designated for disposal and contributes it as a supplement to meals provided to those in need. Combining the efforts of the compost program with CKGCSU, GC expects to reduce food waste to the landfill by 50 percent.

The Office of Environmental Health & Safety and Fire Safety (EHS&FS) is the point of contact for all environmental health and safety compliance issues. The use of chemical pesticides is kept to a minimum through an integrated pest management plan. A local pest control partner treats each building as needed instead of multiple times a year. As a conditionally exempt small-quantity generator, GC manages universal waste through proper disposal of pesticides and recycling of used oil, mercury-containing lamps and equipment, batteries, and non-polychlorinated biphenyls-containing ballasts eliminating this waste from the landfill.

The wellness and recreation center, a LEED Silver-certified building, is home to resources for students to improve their fitness with a walking track, basketball courts, exercise equipment, climbing wall, and an indoor pool. GC's Continuing Education Office also offers programs encouraging exercise, from a variety of dance classes to yoga. The Puppy Time Program is available to students during finals week, allowing students to reduce their stress levels by interacting with puppies brought onto campus. Since 2009, GC has become a leader in Live Healthy Baldwin, a communitywide initiative with a goal of reversing the childhood obesity epidemic. The purpose of the program is to increase opportunities for healthy eating and physical activity by providing access to healthy and affordable foods and

bicycles for children. Off-campus health and wellness programs have been developed with community partners to encourage engagement of students, faculty, and staff within the community. Partners include local farms, the Harrisburg Community Garden, the Life Enrichment Center, the Boys & Girls Club, and Milledgeville Cares.

A sustainability certificate, implemented in fall 2017, provides students with the ability to describe the global manifestations of sustainability across culturally diverse regions; examine specific applications of social, environmental, and economic policies and their influence on human societies; model the world, including ecosystems, economic systems, and sociopolitical systems; evaluate the effect of individual and collective lifestyles and identify political and ethical variations; characterize energy and material systematics from physical, ethical, and economic viewpoints; assess campus and community sustainability strategies and actions; describe issues of sustainability within the geographies of contested spaces; explore the campus and community through service learning and community outreach; and demonstrate and advocate environmental responsibility in a human context.

The EHS&FS has partnered with GC's Department of Biological and Environmental Sciences and the Department of Chemistry and Physics to develop an internship program. This program is a tool that works with students interested in a career in the field of environmental health and safety. The program focuses on using the knowledge gained within the environmental science degree program and converting it into a real-world application concerning regulatory compliance with the rules and standards that govern environmental health and safety. In addition to the internship program, the EHS&FS provides training and a state license to senior-level students in the field of erosion and sediment control, qualifying them to identify environmental concerns on construction sites that could contribute to water quality degradation.

## *Hawaii*

### Kapālama Elementary School, Honolulu, Hawaii

*Mission, vision, and resolve integrating Hawai'i's unique culture into sustainability learning*

A modest school in a bustling working-class neighborhood, Kapālama Elementary School (KES) is multiethnic, with a substantial number of students who come from outside the school's normal attendance area. The mission, vision, and resolve at KES is to provide students a nurturing educational environment built on mutual respect that inspires each student to achieve their full potential, to be a contributing caring citizen, and to become a successful steward in an ever-changing global community.

Kapālama has reduced its footprint and expenses with a statewide, multidimensional energy program called Ka Hei, which includes energy-efficiency measures, renewable energy additions, and behavioral change. KES has reduced nontransportation energy use over two years by 68 percent and greenhouse gas emissions by 45 percent.

The first facet of the Ka Hei project was lighting upgrades. This project was organized to "right size" the school's photovoltaic system, first by identifying energy conservation measures that concurrently would reduce the school's electric load. The project was able to install 1,294 new dimmable LED fixtures, which created an 18 percent reduction in energy consumption. Building occupants learned about the importance of efficiency through in-classroom lessons throughout the school year in which the upgrades took place. KES features 480 270-watt solar photovoltaic modules that generate 129.6 kilowatts (direct current) of clean power on site, which represents nearly two-thirds of the school's energy needs, as well as enough power for the school's electric vehicle charger. The data collected from the solar panel can be accessed online and complements hands-on energy education.

Landscaping with drought-resistant plants has reduced irrigation. An annual campus beautification encourages students to keep the campus clean every day. KES uses campus vegetation to provide shade and reduce the need for air conditioning. First-grade classes maintain planter boxes and a small vegetable garden. KES water quality is monitored by the Hawai'i Department of Education.

Kapālama has reduced paper use by 80 percent using online communication tools. Families bring in paper and magazines that can be used for upcycled projects on campus. Eliminating Styrofoam from the cafeteria also has reduced waste. The administration encourages students to walk home together, and has created a safe

path for students to get to school by entering campus through a less-active road behind the school.

As part of the improved health and wellness of students and staff at Kapālama, there are numerous ongoing preventive efforts at the school. For example, effective cleaning on a regular basis and a monthly measure to prevent mold and moisture helps to control asthma triggers. Staff and custodians watch for wet spots and condensation, and they maintain gutters and storm drains to prevent flooding and moisture retention. Classrooms with air conditioning have filters that are inspected and cleaned monthly to reduce dust particulates. Outdoors, the grass is cut regularly and seeded to prevent dust bowls. To avoid pests, the KES staff conducts management efforts outside of school hours and only as necessary. Each building has walk-off mats at the entrance to reduce the amount of soil and dust that gets tracked into school buildings.

Families regularly are offered health-related workshops, including on nutrition and asthma education. KES sponsors outdoor fitness challenges and a field day, and provides flu shots and vision screenings. Students are reminded to drink water and wear hats when playing outdoors. School counselors have set up a program to support positive behaviors at school, involving earned tickets that can accumulate to earn items from the school store.

Every spring for over a decade, KES has hosted a dance-a-thon. Healthy eating options are available to students through the fresh fruit and vegetable program. Campus produce comes from a local vendor, and the principal offers a lesson on each new fruit and vegetable. Eating more local fruits and vegetables has inspired KES students to encourage their families to do the same at home. Fifth-grade students participate in intramural volleyball and basketball leagues with eight to 10 other elementary schools from the island. The Lions Club offers yearly vision screening, flu vaccinations are made available to the school community, and the nurse provides training on EpiPen use and other medical procedures.

Teachers are using Hawaiian history paired with NGSS to offer culturally appropriate cross-curricular learning. Students learn about water birds that live near the Kalihi stream, which runs through the community and to the ocean at the Pearl Harbor Hono'uli'uli Wildlife Refuge. After visiting the wildlife refuge, students stencil drains with "drains to ocean" logos to prevent rubbish from making its way into the stream. On a geology bus tour, students learn about the island's cultural tradition and the volcanic history for each stop of the tour, participate in a rock hunt, and learn folktales. Students can see different parts of the land and learn to identify the importance of these spaces to Hawaiian culture. The Hawaiian studies program provides students with the opportunity to engage in service learning that supports the environment. At the Lyon Arboretum, students engage in hands-on learning. At

the Hawai'i Plantation Village, students learn about the sugar plantation, immigration, and the influence that culture has on the islands. One of the most memorable experiences for fifth-graders is the annual trip to attend Camp Erdman for three days and two nights, where students experience team-building activities and the scientific process.

## *Illinois*

### Meadowview Elementary School, Grayslake, Illinois

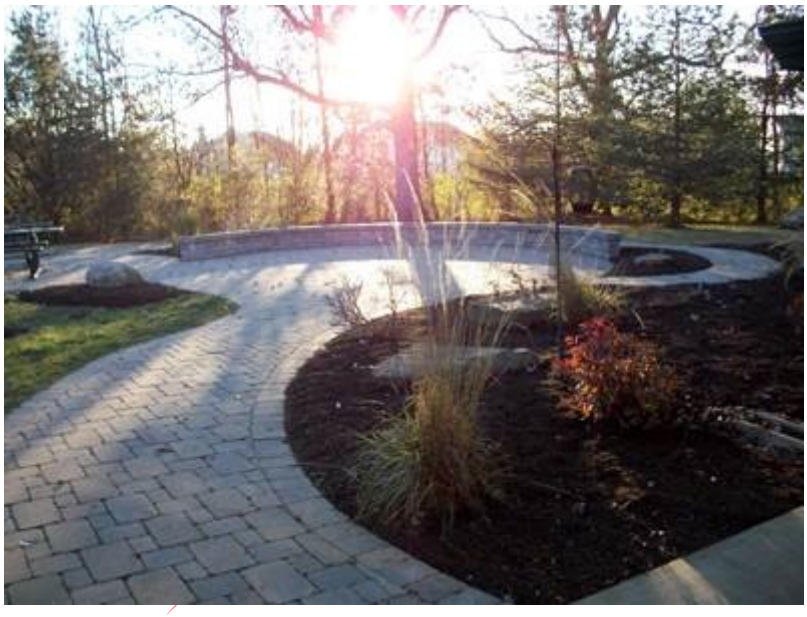
*Becoming habitat heroes in the adjacent woodland*

When the Meadowview School was built, it was outfitted with water sensors on all sinks and toilets. More recently, sensors also were added to lighting in all classrooms. A complete building automation system regulates elements such as boiler temperature and heating throughout the school. All hot-water heaters are shut down at night. The building has been recommissioned completely to ensure that all fans operate at optimal efficiency. Lastly, plans are underway at Meadowview to add a new roof and solar panels. The school currently purchases two-thirds of its energy from renewable sources. For irrigation, Meadowview has installed a rain barrel in the outdoor classroom, and it uses recycled containers to water plants in need during the hotter months or to support new growth.

First-graders oversee recycling collection. Students plan waste-free lunches and conduct educational campaigns through a morning broadcast. Third- and fourth-graders all have Chromebooks, reducing the amount of paper waste. All construction paper used is recycled and certified by the Sustainable Forestry Initiative. Third-grade students made a quilt out of recycled materials that hangs inside the school, reminding occupants of the importance of recycling.

Forty percent of Meadowview students walk to school, and 60 percent are designated as bus riders. Meadowview uses cold-water-based cleaning supplies that are green star rated, with metered dispensers. No pesticides are used on campus.

Health education and wellness is another priority at Meadowview School. Monday Morning Fitness is a whole-school weekly exercise program. The occupational therapist and physical education staff designed a movement and learning lab. Classroom teachers take the students to the lab for movement breaks, which focus on fine motor, gross motor, balance, cross-midline, and visual motor integration activities. The physical education staff sends home a family challenge in which students focus on being active with their families. Challenges to date have included a family one-mile walk, a play in the snow, and a tracking of the fruit and vegetables eaten over the weekend. Students return each week with their challenges completed and with pictures of their families exercising together. Partnerships with local businesses facilitate free physicals, vaccines, vision checks, and dental exams.



Meadowview's outdoor classroom is a center for outdoor learning. This space includes hardscape, a seat wall, nature path, native plants, a rain barrel, a bird bath, bird feeders, a bee house, a sundial, picnic tables, a mulch path wetland observation ledge, and a weather station. A schoolwide woodland project has students restoring the woodland by removing invasive buckthorn adjacent to the outdoor classroom space. A schoolwide "habitat hero" project helps students learn their role in taking care of the world around us. Meadowview has worked over the years to plant new trees and take care of the existing trees on campus. Each grade level has had a chance to help plant trees in collaboration with the local park district. Tree conservation has been a focus of Meadowview's work and a part of many schoolwide Arbor Day celebrations over the years.

Each Woodland Day includes research, activities, and lessons linked to the grade level's area of focus: for kindergarten, this is birds; for first grade, insects; for second grade, plants and trees; for third grade animals; and for fourth grade examining animal adaptations. Forest preserve educators bring invaluable resources and knowledge to enhance learning, including a live-animal experience; an exploration and identification activity in the wooded area; artifacts such as furs, bird nests, and

insect displays from the forest preserve collection; glacial and erosion simulation activities; and invasive plant studies.

The Meadowview Sprouts is a group of parents dedicated to helping the school community by researching and guiding efforts with students. Areas in which parents have become involved include environmental education, woodland restoration, buckthorn eradication, and tree health and maintenance. In addition, the Sprouts work to bring enrichment experiences to students, including lessons on the butterfly life cycle, growing microgreens, music in nature, bees, and organic farming.

The Woodland Advisory Group is made up of educators from all areas of Meadowview. This group studies standards, examines individual planning specific to grade levels, sets the vision for the schoolwide environmental education focus, and finds resources to support this work.

## Bloomington Public School District 87, Bloomington, Illinois

*Energy efficiency upgrades: a 9 percent return on investment*

Situated in a central Illinois community, Bloomington Public Schools District 87 is home to more than 5,300 students in its nine schools from prekindergarten through high school. The district is one of the oldest and most diverse in the state, with a mission to challenge, support, and inspire all students to learn and achieve to their highest potential in order to become productive citizens and lifelong learners. Through this mission, the district is committed to enhancing and maintaining sustainable practices and education in every building.

Over the last decade, District 87 has made numerous effective changes within its nine schools to improve energy efficiency, reduce waste, and increase the health and fitness of students and staff. The most innovative project implemented at Bloomington Public Schools has been a districtwide cafeteria composting and recycling initiative that was introduced in 2014. After every school meal, students empty the contents of their trays into three waste receptacles: compost, recycle, and trash. Any unopened food or uneaten produce is placed on a share table for students to take, and remaining leftovers are donated to local food pantries. Local companies — Midwest Fiber and Better Earth Compost — collect the recycling and compost. Disposable lunch trays and plasticware were replaced with reusable trays and flatware, saving each school approximately $4,700 per year. Since the start of the new waste management program, the district has reduced dumpster sizes by half, preventing over 50 tons of waste from entering area landfills.

To further reduce waste and help students in need, the high school hosts a resource room with donated clothing so students can borrow items as needed, like formal dresses and tuxedos, or professional clothing for job interviews. Art teachers recycle materials to turn into art. Family and consumer science class students recently collected t-shirts to turn into t-shirt quilts. A districtwide virtual backpack reduces the amount of paper waste sent home to families.

Since 2015, the district has reduced electricity use by an average of 34 percent annually and reduced gas use by an average of 47 percent annually, resulting in a total energy savings in excess of $500,000 each year. This energy efficiency was made possible through a multistep process — gradually upgrading HVAC equipment, controls, and lighting in each building. District 87 partners with contractor Alpha Controls to monitor temperature controls in every building and assist with HVAC services and upgrades. Alpha Controls maintains a summary chart of monthly ENERGY STAR scores. In 2013, the ENERGY STAR scores in the district were between 0 and10 out of 100. Today, the scores are between 40 and 50 out of 100 and continue to rise.

Beginning with a life safety survey in 2014, Bloomington Public Schools District 87's director of facilities presented findings of aging mechanical and control systems to the chief finance and legal officer and superintendent. District officials then sent an application to the Illinois State Board of Education for health life safety funding, and the district was awarded $10 million in bonds to address these systems. Assisted by contractors and design professionals, a multistep process was implemented to analyze, interpret, and measure the sustainability of each building's performance. This led to upgrading the lowest-performing elementary school the first year, followed by three additional schools the following year. The upgrades reduced greenhouse gas emissions 41 percent for the four facilities, equivalent to the environmental impact of taking 400 cars off the road. This corresponded to the economic benefit of saving $155,000 annually despite rising utility costs, a 9 percent annual return on investment.

The district created a 10-year comprehensive facilities improvement plan in the early 2000s. Since then, several major projects have been completed. All buildings have been extensively renovated, and infrastructure components have been upgraded. More than $70 million was spent on facility improvement and renovations and infrastructure upgrades. The largest and most recent construction project occurred at Bloomington High School in 2018. Due to growing participation in music programs, students were outgrowing the music education space. A new 10,000-square-foot fine-arts expansion was added to the school, and former classrooms were remodeled. At the same time, a synthetic-turf field was installed at the high school outdoor stadium. The new synthetic field allows for water to drain below ground instead of causing mud and puddles. This state-of-the-art irrigation system greatly reduced grounds maintenance for the field, eliminated the need for chemical use, and is safer for students.

More than 50 percent of toilets, sinks, and hand dryers are motion-activated in school restrooms. This reduces water consumption and waste from paper towels and improves sanitation.

The district highlights a harvest of the month, which is served in school meals and showcases produce from a local farmer. District 87 also partners with Midwest Food Bank to organize a weekly backpack program, sending bags full of pantry items home with low-income students. District 87 launched a unique branch of the summer feeding program, offering a mobile feeding unit in partnership with the local housing authority. District staff members drive a van to low-income neighborhoods and housing projects, which is parked for an hour every weekday to provide nutritious sack lunches to students. The district has partnered with local organizations like the Bloomington Public Library to offer educational enrichment at each stop.

Each school offers unique fitness activities, including Heart Start, a before-school activity allowing students to run or walk around the gym before the first bell; morning yoga before classes begin; and outdoor fitness activities on the weekends for students, staff, and families. Most buildings have an outdoor green space separate from the playground, which is used as a garden or outdoor classroom. The junior high offers a Junior Master Gardeners Club. Free dental clinics and health screenings are regularly offered at schools.

At one elementary school, students spent a day “camping” on school grounds. Classes learned how to set up a tent and cook food, while participating in outdoor learning and games. Many elementary school classrooms take all-day field trips to nearby Funks Grove Nature Center. Teachers can choose from a variety of programs at the nature center to tie into current curriculum, including Tracks, Scat, and All of That; Dead Tree Biology; Meet the Critters; Incredible Insects and

Invertebrates; and Plants, Flowers and Seeds. Classes also go on nature hikes, explore the creek, and play in the outdoor learning space known as Imagination Grove.

Sustainability and the environment are often woven into STEM teaching. Teachers worked with employees from State Farm to create STEM activities for each class, including ones that focused on natural disasters and the use of scarce natural resources. The Children's Discovery Museum brought in lessons about aerodynamics and wind power. The Ecology Action Center, a local nonprofit environmental organization, sends representatives to visit District 87 schools to teach about environmental responsibility.

All seventh-grade students attend an outdoor education program. Students visit a local camp for a week, where the outdoor instruction includes classes on environmental art, archery, canoeing, mountain biking, pond investigations, Dutch oven cooking, journaling, and silk-screen art. Representatives from the University of Illinois Extension Office work with teachers during outdoor education courses to boost understanding of commercial agriculture, horticulture, energy and the environment, and local food and small farms. Students in the high school can participate in the environmental club, and the junior high has a green team.

High school students can enroll in an environmental science course, where they investigate how current human activities are harming the environment, and they learn about changes that must be made to attain a sustainable world. Alternatively, they can enroll in an AP version of the class, which covers scientific analysis, interdependence of the earth's systems, human population dynamics, renewable and nonrenewable resources, environmental quality, global changes and their consequences, society and decision-making vs. trade-offs, and environmental choices for the future.

## Loyola University Chicago, Chicago, Illinois

*Sustainability as part of a mission of social justice in the community*

Loyola University Chicago has made a commitment to address climate change and the associated disruptions to natural and social infrastructure and systems as a key aspect of its mission of social justice. Announced as part of a series of events around the release of Laudato si', Pope Francis' encyclical letter on ecology, Loyola released "A Just Future," a university climate action plan with a carbon neutrality goal of 2025. Loyola is a gold-rated university in the Association for the Advancement of Sustainability in Higher Education's STARS program. As a

Catholic, Jesuit, urban university, Loyola addresses climate through three main strategies: campus, curriculum, and community engagement.

A transformation of the Loyola campus infrastructure has reduced carbon emissions by 38 percent from a 2008 baseline. Loyola is now home to 11 LEED-certified buildings across three campuses, and it has more green roofs than any other university in the Midwest. Loyola features dashboards, signage, and a "campus as lab" program that allows students to work on improving the infrastructure all around them. Loyola's student-run biodiesel program fuels shuttle buses and provides restroom soap, both made from waste vegetable oil. Two campuses feature large-scale geothermal installations.

Due to the urban nature of Loyola campuses, over 95 percent of students and 70 percent of employees take a sustainable transportation option while commuting, such as public transit, biking, or walking. Loyola supports these efforts with discounted bike share and transit benefits. The Lake Shore campus of Loyola is on the shores of Lake Michigan; it is a model for coastal development and stormwater management, with green infrastructure including rain gardens, permeable paving, and native gardens.

Loyola's green cleaning policy assures that over 95 percent of all cleaners are low- or no-toxicity to keep residence halls safe and sustainable and protect workers. A Green Labs program addresses exposure to harmful products while encouraging waste diversion and energy efficiency. Transportation-related programs such as GoMove! and Bike2Campus Week support healthy lifestyles and provide students and employees with incentives to participate. Dining halls provide nutrition information and vegetarian and vegan options, and Loyola just opened a new dining hall to accommodate those with allergies, or with religious or other special food needs. Through its LeanPath program and other initiatives, the university has reduced food waste by 30 percent with tray-free dining, smaller portions, and a food-recovery network chapter.

Loyola's Ramble Outdoors program takes students on outdoor excursions including kayaking and camping trips, including to its own Retreat and Ecology campus in McHenry County, Illinois. This campus is set up for retreats by including a student-run farm, ongoing ecological restoration, and a low- and high-ropes course for team-building and physical activity.

Loyola offers over 1,300 courses that address sustainability, and the University's Institute of Environmental Sustainability is creating solutions to the major issues of climate change and environmental justice by combining environmental science with policy, business, and public health. The Institute of Environmental Sustainability recently hosted its fourth annual Climate Change Conference. The event focused on the economics of climate, and it convened faculty and students from nine different countries as well as 13 of the 28 Jesuit colleges in the United States. Loyola offers nine different degrees that incorporate sustainability, including bachelor's degrees, graduate dual degrees, and minors.

A greenhouse living and learning community for 70 first-year students combines residence life and learning to improve academic outcomes within and outside of the classroom. The undergraduate core curriculum was updated in 2012 to incorporate foundational environmental literacy concepts for all students. In a survey of incoming first-year students, 47 percent said that Loyola's commitment to sustainability was important or very important in their decision to attend Loyola.

Academic efforts are not limited to the classroom or lab. Learning communities incorporate sustainability with the Greenhouse learning community, First Year Research Experience, and the Social Justice learning community addressing environmental justice and sustainability topics. Immersive learning experiences are offered in sustainability-focused study-abroad programs to Belize, China, Sweden, and Iceland. The engaged-learning requirement was recently expanded to explicitly identify sustainability efforts, and there are some 200 sustainability-related internships available both on campus and with off-campus partners each year. Student-run enterprises including the Loyola Farmers Market, Biodiesel Program, ChainLinks Bike Shop, Urban Agriculture, and the Retreat and Ecology Campus Farm all blend learning and work experiences in support of academics.

Loyola employees engage in sustainability efforts through direct service days in neighboring Chicago communities. Human resources-based programs such as Bike to Work Week, Go Move Challenge, and Fall EcoChallenge encourage wellness and sustainability. Recognized for community service and engagement by the Carnegie Foundation and the Corporation for National and Community Service, all students participate in engaged-learning requirements, serving the community directly throughout the year.

Loyola consistently is ranked in the top 10 universities in the nation for its commitment to sustainability through engagement with students, faculty, and the community. Loyola students helped develop a climate action plan for the Edgewater neighborhood in suburban Chicago. More recently, Loyola organized a new sustainability committee consisting of high-level administrators to oversee and implement the climate action plan and student sustainability fund. The Green Initiative Fund, a Community Sustainable Action Scholarship, the Compost Network, Storm-water Stories, food donations, and other sustainability programs bring Loyola's sustainability strengths into surrounding neighborhoods.

To address its endowment management, Loyola has updated its investment policy with new responsible and sustainable investing principles. These are being introduced to the school's money managers in order to remove any exposure to fossil fuel investments and create effective investments into emerging clean energy and socially just companies. This work builds off Loyola's shareholder advocacy committee, which led shareholder action (filings and co-filings) on several issues, including water privatization and fossil fuel extraction financing.

Loyola continues to broaden and deepen engagement efforts with the neighboring community and with the development of Lake Shore Community Partners, an initiative to develop relationships in four priority areas: health, business, education, and safety. A community clinic addresses health disparities; RogersEdge, a campus-community business improvement district, supports local small businesses; partnerships with area schools address education challenges; and partnerships with police and community groups create safe communities. All four of these initiatives have environmental elements that are community-driven and Loyola-supported. At Loyola, sustainability isn't just something that stays on campus; it is a critical part of the university's commitment to be an agent for social justice in the community.

## *Indiana*

### Goshen Community Schools, Goshen, Indiana

*An energy cost avoidance of over $4 million*

Goshen Community Schools (GCS) is a public-school system in northern Indiana, consisting of nine school buildings on nine campuses. GCS is a suburban district of approximately 36 square miles located in the city of Goshen in Elkhart County. The district has a combined enrollment of 6,655 students in prekindergarten through 12th grade, 65 percent of whom are eligible for free and reduced-priced lunch. Sixty-one percent of students identify as minorities, and 23 percent are English language learners. Each of the school buildings focuses on sustainability in its own unique way, but remains part of a larger unified district team. A staff representative from

each building serves on the district green team, which works together to promote sustainability.

In 2009, district administrators implemented an energy conservation program in collaboration with Cenergistic, and they have hired a full-time energy education specialist to guide the program. During the first year, Goshen gathered baseline data including weather information and utility use. Each Goshen school building has received an ENERGY STAR award. In, 2012 the district received an ENERGY STAR Leader recognition. The GCS energy conservation program has resulted in an energy cost avoidance of $4.4 million, representing a 25 percent savings. Seven of the nine GCS buildings have an average ENERGY STAR rating of 88, and GCS is resolving energy issues in the remaining two buildings. Thermal comfort is addressed by a comprehensive automated energy management system, which is used to remotely operate and monitor all buildings.

In addition to looking at the mechanics and the envelope of the building, the energy conservation program educates staff on how to reduce consumption of electricity, natural gas, water, and other utilities. Waterford Elementary School has 1,173 solar panels, each with 260 watts of capacity for a total system size of 304,980 watts. Goshen High School has 1,242 solar panels, each with 260 watts of capacity, for a total system size of 322,920 watts. High school students can access the data from the solar array as part of their curriculum.

The district has installed water-bottle filling stations. Every school has a purposeful recycling program that includes student involvement and education. A select few GCS campuses are equipped with irrigation systems, which are equipped with rain sensors, and they are closely monitored by groundskeepers to assure water-use efficiency and conservation. Due to the city's thoughtful planning and foresight, students attending Goshen schools have the option of walking and riding bikes on well-cared-for walkways and trails.

The GCS custodians in each building use carefully chosen, eco-friendly cleaning solutions manufactured to limit caustic chemicals. Microfiber cloths are used to reduce the use of chemical cleaners. High-traffic carpeted areas are vacuumed daily to remove potential allergens and to control asthma. A proactive pest management system is in place that uses sticky strips; the system also assures that any building cracks are immediately filled, and that door sweeps are repaired. Strict no-vehicle-idling policies are in place. When a fertilizer is needed to enhance the soil in specific greenways, groundskeepers use a fertilization mixture that is two-thirds organic.

A coordinated school health committee addresses and evaluates ways to improve the health and wellness of students and staff. Active members of this committee include community health professionals, parents, mental health professionals, Latino Health Coalition representatives, and school representatives from each of the eight coordinated school health components. GCS has its own health and wellness center, staffed by a physician, nurse practitioner, nurses, and medical assistants. Additionally, wellness screenings and health risk appraisals are available each year in each school building. Free nutritious snacks are available during after-school hours to students in all grades attending any after-school activity.

From 2016 through 2018, Goshen Health sponsored a community garden. Goshen Middle School students planted, tended to, and harvested garden produce. Goshen College athletes visit elementary schools to teach sports skills and nutrition. The college also offered a heart camp for students to focus on nutrition and physical activity. Indiana University dental school comes to Goshen schools yearly to check teeth and offer sealants to second- and third-graders. Since 2013, GCS schools have participated in a run the halls program, which encourages students to track their time and/or miles in after-school running and walking. GCS has used its purchasing power to advocate for healthier lunch options from vendors. Local foods have been showcased.

Students identify real-world sustainability problems and work to find solutions for them. Often, the results of their inquiries, projects, and findings are presented as solutions to the GCS board or at community events. Students have built an electric car through Greenpower, an electric car challenge for middle and high schoolers; addressed sediment from stormwater runoff as a major cause of pollution in waterways; and designed prosthetics for a calf born with malformed hooves. Other notable projects at the high school include the development of a super-mileage urban concept car and a solar-powered automatic chicken coop door for a local veterinarian. High school students who are fascinated with the oceanic world can travel to the Florida Keys to study marine biology over spring break.

From Early Years International Baccalaureate to project-based to expedition learning, elementary schools use a range of methods to offer environmental education. They study the nature of tornadoes, the damage they can cause, critical statistics, and other relevant points of inquiry. They prepare severe weather kits, host a meteorologist, and invite the community in for a presentation of their findings. They have participated in a carbon footprint reduction challenge, looking for opportunities to conserve and reduce waste. They researched having a school garden, wind turbine, and replaced all low energy-efficient light bulbs in the building.

Music classes repurpose common castoff items such as toilet paper tubes for percussion instruments and empty tissue boxes with rubber bands for stringed instruments. Partnering with Merry Lea Environmental Learning Center of Goshen College, one school celebrates an annual environmental learning day, during which students study geological features such as peat bogs, a marl pit, and glacial and gravel formations. At another school, students have tackled the problem that the wind can create sweeping across a treeless prairie. Their inquiry was followed by their proposal for a row of evergreen trees and the planting of a natural windbreak.

Northern Indiana Public Service Company has partnered with the GCS over the past six years, providing every fifth-grade student with an energy-reduction kit as part of their curriculum. The kits include LED lights, LED night lights, an air filter aerator, high-efficiency kitchen and bathroom sink faucet heads, high-efficiency shower heads, a water bag so that students can measure and record how much water shower heads and sinks are using in the house, and a digital thermometer.

At the middle school, over 500 eighth-grade students benefit each year from a partnership with Elkhart County Soil and Water Conservation District, which provides an outdoor learning day at the nearby Environmental Center and River Greenway Trail. Groups rotate through outdoor stations to study the river's macroinvertebrates and what they reveal about the health of the river. Students analyze the river's riparian vegetation, hike to discover terrestrial biomes, and learn the history of the landscape. They participate in hands-on fish identification, and they learn what the presence of various fish means about the river's pollution level. They study the river flow and velocity, and they perform in a civil-service project while learning about and removing invasive plants.

Goshen Middle School science classes problem-solved a drain-water issue and erosion on their school campus. Students developed proposals for applicable solutions, resulting in the use of rain barrels, water gardens, and drainage filters to stop sediment from entering the drain. Every summer, eighth-grade students may earn a high school physical education credit by participating in a trip to the Rocky Mountains in Colorado, where they camp, hike, and explore the great outdoors. The

middle school also contains a challenge education course, an indoor climbing wall, a climbing cargo net, and a swimming pool.

## *Iowa*

### Davenport Community School District, Iowa

*A utility benchmarking behemoth*

Davenport Community School District currently uses Utility Manager software and two benchmarking tools to monitor its natural gas, electric, and water consumption — ENERGY STAR Portfolio Manager beginning in 2000, and B3 Benchmarking beginning in 2010. Davenport uses SchoolDude to manage its facility work orders, helping to address issues quickly and return buildings to optimal performance with less waste. Fourteen Davenport schools have geothermal systems, and the district currently is reviewing solar proposals for several schools.

Analysis of data and trends has informed planning and decision-making districtwide. This has led to systemic upgrades; energy-efficiency projects; use of maintenance management software; adoption and implementation of temperature guidelines; new school board policies and administrative regulations; long-range facilities plans that use sustainability as a guiding principle; and an energy-management plan. Many schools have received LED fixture or light bulb replacements in the past several years. Davenport also incorporated occupancy sensors that control not only lights, but also HVAC in classrooms. Davenport has the lowest gas and electric cost per square foot of over 34 Iowa public school districts reporting utility data in B3 Benchmarking.

Davenport Schools has offered recycling in all school buildings since 1998. Tracking districtwide recycling showed that participating schools increased their recycling by 104 percent between the 2016–17 school year and 2017–18 school year. The district has saved over $8,000 in just three years by reducing use of disposable trays in cafeterias.

During demolition projects, the district's construction team repurposes items where and when possible. Other usable items, such as old doors, windows, and light fixtures, are taken to the local Habitat for Humanity's Restore Center to be used or recycled. Previously an intermediate school, the J.B. Young Opportunity Center (JBYOC) was renovated in 2018 with energy-efficient upgrades and repurposed to provide a collaborative learning space for community organizations.

The JBYOC has a commercial kitchen, which is available to the community for cooking classes. Students can volunteer and learn about food safety and sanitation,

customer service, food preparation, menu planning, and barista skills. The addition of an outdoor classroom as a formal learning space on every campus is required as a standard educational specification in the district's long-range facilities plan. Davenport uses biophilic design approaches in all major improvement projects.

In 2015, the district began offering every student a Chromebook or tablet for use during their learning career. With some 25,000 devices being used across the district, the introduction of this technology has meant a significant reduction in paper use. For over 10 years, all elementary, and many intermediate and high schools, have used interactive whiteboards, projectors, or Smartboards. By using the online platform Virtual Backpack, teachers communicate with students and parents without distributing paper flyers.

Davenport began offering food-share tables in September 2017. During cafeteria breakfasts and lunches at all schools, students are encouraged to place unopened, prewrapped items on a designated share table located in the cafeteria. Other students then are welcome to take those items for themselves. Food service staff members, teachers, and cafeteria posters remind students to take only what they will eat, allowing the district to donate thousands of pounds of food to local food pantries.

Davenport offers students free CitiBus services on all City of Davenport transit routes every day of the week. This has helped families organize their transportation needs, habituated students to using public transit, and reduced transportation emissions. Davenport started a pool-vehicle program to provide safe and efficient vehicles for employee and student travel. Through this program, employees may reserve a car, van, or SUV from the district's fleet, free of charge. This program is widely used, and it has significantly reduced the number of single-occupancy vehicles on Iowa roads. By rerouting district bus routes, Davenport reduced the number of miles buses traveled in the 2017–18 school year by 333,122.

Several sites include native plant gardens that reduce runoff. A few Davenport teachers have developed curricula focused on water management. These curricula are used in several science classes throughout the district, from elementary schools to high schools. Recognizing the value of stormwater management and water-quality conservation education that Davenport students are receiving, the City of Davenport Public Works Department has waived thousands of dollars of the district's stormwater fees.

The fresh fruit and veggie program provides students with the opportunity to sample some not-so-common fruits and vegetables. Students have been able to try rutabaga, turnips, jicama, watermelon radishes, parsnips, colored cauliflower, rainbow carrots, black grapes, and grapefruit. Educational menus are handed out to teachers so they can provide nutritional information to students when passing out the fruit or vegetable. Through Pick A Better Snack™, elementary schools offer gardens and nutrition education.

Davenport Schools has implemented a school-based mental-health model. Through face-to-face contact, as well as phone calls and email, Davenport's learning supports specialist for prekindergarten through 12th grade, as well as a the Project AWARE mental health manager, coordinate with several community organizations to make referrals, provide consultations, and/or discuss collaborative efforts to meet the needs of students and families Davenport also has a partnership with the Vera French Community Mental Health Center for professional mental health services in schools.

Davenport participates in Iowa Local Food Day, supporting local farmers and procuring produce through the lowest-emission method possible. A FoodCorps service member assigned to elementary schools works to improve student health

and wellness by offering educational programming through school garden clubs that introduce and encourage healthy food choices. Other lessons lead students through preparing a healthy and delicious dish to enjoy afterward.

Efforts spearheaded by the District Wellness Committee, including the District Wellness Policy, aim to improve student and staff health and wellness by integrating education into daily life in different and creative ways. Practices such as green cleaning, integrated pest management, and use of the EPA's IAQ Tools for Schools Action Kit reduce student exposure to harmful chemicals and particles and provide healthy learning environments.

Project-based learning and new outdoor learning environments have allowed Davenport teachers to teach their students that environmental concepts can be integrated into ideas beyond those provided in a textbook. Some Davenport high schools offer the opportunity for students to self-develop a capstone project, while others have several classes in which sustainability-related projects have been integrated and are ongoing. One high school offers a college-credit course that explores a range of environmental issues through project-based learning.

Davenport Community Schools have created outdoor classrooms and gardens in which lessons can be demonstrated. There are 10 outdoor classrooms, five school gardens, and two greenhouses, as well as several additional settings in which schools have created a hands-on learning experience for their students. These include the MidCity High School Urban Farm. This high school's environmental studies class runs the school farm during the school year, integrating engineering, plot planning, planting and harvesting, critical thinking, and collaborative learning.

The FarmBot was a collaborative STEM project developed with West High School technology students, who created a robot; Mid-City High School building trades students, who constructed garden beds; and Buffalo Elementary students, who benefit from a learning garden supporting their fourth- and fifth-grade STEAM curriculum. The FarmBot is used in the Buffalo Elementary school garden to plant seeds, measure soil moisture content, and water crops.

Kenya Water Project is a partnership between one Davenport high school and a village in Kenya to create water-filtration systems with regional materials. The collaborative STEM project gives students an opportunity to work on a real-world environmental problem that requires a sustainable solution. In another project, engineering and architecture students are transforming a teacher's home into a net-zero residence with solar panels.

In all Davenport middle schools, science classes are required to participate in an environmental project during the spring term. Sixth-graders work on a watershed

project; seventh-graders focus on a local environmental issue of their choice; and eighth-graders are challenged with choosing a project centered around a global environmental issue. Outside of the classroom, students have become engaged in environmental and sustainability learning through clubs and events.

The district has partnered with the University of Northern Iowa Green Iowa AmeriCorps' Sustainable Schools Program to host two full-time volunteer sustainability coordinators, as well as to offer high-school students summer positions and scholarship opportunities working on sustainability-related projects. These volunteers, who are situated within the district's curriculum department, have focused on integrating climate-change teachings and sustainability-based student projects into classrooms.

## Sioux City Community Schools, Sioux City, Iowa

*Super savers!*

Sioux City Community Schools has implemented an energy-management program using best conservation practices, human behavioral change, a culture of sustainability, and the latest, cutting-edge green technologies. Since September 2012, Sioux City Schools has become established as a leader in energy conservation in the state of Iowa. Over six years, the district has saved some $3.75 million in energy costs, representing 28.3 percent of an expected energy expenditure of $13.21 million, according to Energy CAP.

From 2013 to 2015, the district invested nearly $2.5 million in retrofitting windows, replacing insulation, adding covers to high school pools, adding frequency drives to motors, and retrofitting lighting with more efficient, lower wattage bulbs. The district replaced 50,000 lights with higher-efficiency bulbs in 18 buildings, and it opened the district's first all-LED building, contributing to a 22 percent reduction in energy used in lighting. Since 2012, the district has engaged in a wholesale cultural and behavioral management program that has reduced the annual electrical consumption from approximately 19 to 14 million kilowatt-hours annually.

To save natural gas, the district has built five new geothermal elementary buildings, with one more currently under construction. To save water, the district has developed water conservation purposefully, managing irrigation by having most practice fields watered naturally by irrigation wells. Sensors are used in more than 90 percent of the district's handwashing stations to conserve water. Automatic pool covers at the high schools that are deployable and retractable in 90 seconds have

saved thousands of dollars on chemical usage, natural gas for heating, and the evapo-transpiration loss of water that otherwise would occur.

The Sioux City Community School District participates concurrently with the ENERGY STAR Portfolio Manager and Energy CAP to track utility use.

Sioux City has six propane-fueled buses, and it is thoroughly committed to preserving the environment by mitigating waste. Throughout the district, water-bottle filling stations save hundreds of thousands of plastic bottles. In 2012, the district began saving $95,500 annually by initiating the use of hard plastic reusable and washable trays.

The district monitors humidity, carbon dioxide levels, and thermal comfort to save energy in accordance with EPA recommendations and guidance.

More than 1,000 staff engaged in free biometric screening and wellness programs offered by the district and incentivized by the health insurance company UHC. Some 500 staff members took advantage of a weight-loss program, collectively shedding more than 1,340 pounds. As a result of health-focused programs ranging from workplace safety education to flu shots to smoking cessation, hospitalization and time loss has decreased over the last five years.

For students, a robust physical education and sports program has been supplemented by a walking school bus program and grant-funded fun equipment, such as climbing walls and innovative exercise equipment. The district has had a JROTC program in which students engage in physical training weekly. Students are offered salad bars, and several schools are home to community gardens that allow students to taste the “fruits” of their labors. The district uses the I-Smile@School program, which provides dental screenings, dental sealants, fluoride treatment, and education to second- and third-grade students with a licensed dental hygienist and dentist.

The operations and maintenance staff use guidance from the EPA Energy Savings Plus Health: IAQ Guidelines. Staff discern proper humidity levels in new construction constant volume units by using humidistats. The also ensures plenty of fresh air in accordance with ASHRAE 62.1 through best practices, as well as by using carbon dioxide sensors to monitor levels in many areas of new construction. With the district's guidelines, thermal comfort is carefully considered, while balancing the goals of the energy conservation program. In the construction of new buildings, window design and "daylight harvesting" help provide natural sunlight, which has been shown to improve not only ambience but student test scores. Contaminant controls include high-quality Minimum Efficiency Reporting Value-rated filters in all HVAC applications. The district's Presto X integrates comprehensive, preventive pest management control with scheduled programmatic reviews to ensure the healthiest of classroom environments across all schools. All district chemicals, except for disinfectants, are green-certified by the EPA.

Teachers and staff consistently teach the value of conservation. West High students take a Future Ready course, in which they analyze the energy efficiency of their own school building, as well as of businesses in the community, with a cost-payback analysis in energy saved. The North High School Prairie Project has planted a short-grass prairie as an example of sustainability, as it requires zero maintenance, while students benefit from its aesthetics, biodiversity, and studying the economics of its production and maintenance. Several elementary teachers in the district provide aerospace lessons using educational materials from NASA, teaching the mechanics of gravity and allowing students to develop their own theories.

Districtwide, fourth-grade students participate in a program called KidWind, in which they learn about the importance of wind energy as they research, design, test, and improve wind turbine blades. Students in elementary schools work on Earth Day activities such as learning about the efficiency of cars, nature activities, and recycling. At all levels, the energy specialist for the district engages students and staff to see the quantifiable effect of their efforts.

## *Kentucky*

### Tates Creek Elementary, Lexington, Kentucky

*A Green Creek Team leads environmental learning*

Tates Creek Elementary (TCE), on the southeast side of Lexington, is home to 659 students and over 100 faculty and staff members. The student population is 33 percent white, 42 percent black, and 12 percent Hispanic. Almost 79 percent of

students qualify for free or reduced-price lunch, enabling all students to receive free and reduced-price breakfast and lunch through the Community Eligibility Provision. The TCE community includes 16 percent English-language learners and 18 percent special-education students.

Tates Creek has received several district sustainability honors and formed a Green Creek Team, which meets during the school day and includes students in grades one through five. The school also has hired a wellness coach and environmental coordinator.

The campus has a fully staffed pediatric health clinic on site for students and the surrounding community. The clinic, which offers flu shots, vaccinations, and check-ups, sees some 400 students per month. Dental and vision screening also are conducted on a regular basis. TCE has a resource center that provides clothing for students, food bags, and home visits to help with truancy issues. Wellness is a special class in the curricular rotation to help students focus on physical and mental health. TCE is the first school in its district to have a full-time wellness coach, and each classroom has a "wellness corner" to help students feel calm and focused. TCE offers yoga to adults after school and Girls on the Run for fourth- and fifth-grade girls. The faculty and staff receive Trauma Informed training.

Students cultivate a vegetable garden in the courtyard. In the spring, each class receives seedlings to plant. The physical education teacher, along with parent volunteers, students, and district representatives, help to prepare the beds. The produce goes to the cafeteria and to students' families.

The school is colocated on a campus with middle and high schools. When Tates Creek Middle and High work on rain gardens and sustainability initiatives, elementary students have the chance to collaborate on volunteering, advanced learning, and the sharing of resources. TCE was remodeled in 2012, putting more sustainable measures into place. Lights are on automatic shut-off. Bathrooms feature air dryers. New energy-efficient windows replaced the old windows, and more natural light was added. Rubberized nonslip flooring lessens the need for chemical waxing.

Tates Creek planted trees on school grounds in partnership with the local government, school district, and the University of Kentucky's Urban Forest Initiative. The Urban Forest Initiative met with the Green Creek Team to teach about the parts of a tree and tree adoption.

A regular recycling schedule has been established on Tuesdays and Thursdays. Small recycling bins have been replaced with large outdoor municipal waste receptacles that the school converted to recycling dumpsters. TCE ordered more class bins and now has one in every classroom and office.

Two water-bottle filling stations have been added, and students are encouraged to use refillable water bottles. A container for recycling plastic bags is in the front hallway and is emptied and taken to Kroger recycling bins about every two weeks. Faculty, staff, students, and parents have added a container to collect plastic lids, which will be used to create a third upcycled plastic bench.

The Green Creek Team has worked hard to learn what is and is not in Lexington, Kentucky. The team has visited a materials recovery facility, where Lexington's recyclables are sorted and sent off to recycling centers. The students have worked in teams to develop PowerPoint presentations on recycling to show to each class at TCE.

Instead of an open container with napkins, the cafeteria now uses napkin dispensers, as well as reusable or biodegradable plastic trays rather than ones made from Styrofoam. Straws at lunch have been eliminated. At events, the school has moved to cloth tablecloths, which are washed in our energy- and water-efficient washer and dryer. The school has implemented Chromebooks in grades two through five, with first grade on the way, and faculty uses Google Docs and Google Classroom to further reduce paper use.

Tates Creek celebrates a walk-to-school day in the fall to inspire more alternative transportation use.

Each month the Green Creek Team conducts an energy audit of each classroom. They give the classrooms a note on how they are doing concerning energy conservation. Each class has light switches labeled to remind students to turn off the lights. Each teacher receives a checklist to complete during school breaks to reduce energy consumption. Appliances in the school are ENERGY STAR-rated.

The school has reduced water consumption by 18 percent over four years.

The environmental curriculum has been coordinated with Bluegrass Greensource for supplies, information, and guest speakers, as well as with the NEED (National Energy Education Development) Project.

The Green Creek Team also had a visit from a community member who uses plastic bags on a loom to make rugs and upcycles old clothes to make items to sell at craft fairs.

In the fall of 2018, Bluegrass Greensource, along with the city of Lexington, offered a teacher environmental academy for five days. Several TCE faculty attended, from classroom teachers to special education teachers to math interventionists, as well as the STEM and environmental coordinators. Each day the academy focused on a different aspect of the environment. Water testing was done in conjunction with the wastewater treatment plant tour. Solid waste tours of a landfill, including leachate filtering and yard waste to mulch, was covered. Public transportation information was given to each participant, including details about electric buses, energy usage, and natural gas engines. The last day covered Project Wild, Project WET, and resources to use in class with all student levels. At the conclusion, each teacher received funds for a classroom project using information learned from the academy.

Bluegrass Greensource has an educator assigned to TCE. This educator's job is to help teach lessons on the environment, share information and supplies with classroom teachers, coordinate recycling pickup or questions, work with any grade level on projects to learn about the environment, and connect educators to community resources.

Tates Creek has formed a Kentucky Energy for Youth team. Students read a fictional story about using coal for electrical power. Then, students took an overnight trip to a coal town and toured a coal mine no longer in use. Several teachers also have attended NEED workshops to learn about energy sources and forms of energy. During a NEED workshop, teachers performed the same activities that students will do and received supplies for use in a classroom setting.

## Saint Agnes School, Louisville, Kentucky

*Passion for the environment leads to partnerships and big project plans*

Saint Agnes School (SAS) is a private Catholic elementary school in the Archdiocese of Louisville. Founded in 1914, and with a current enrollment of 453 students in prekindergarten through eighth grade, SAS' mission is to shape young minds to be good stewards and to lead faith-based, mindful lives.

Saint Agnes shares a 32-acre campus with Saint Agnes Church, the Passionist Monastery, and the Passionist Earth and Spirit Center. The collective grounds offer a natural classroom to raise awareness; learn, discuss, and experience the local environment; and see how students' positive actions can improve the communal space and provide a springboard to the local community and beyond. The SAS campus is home to a student-built and maintained pollinator garden, extensive wetlands that students helped create, a composting facility, and a center focused on Earth literacy.

A major focus for fourth-grade students is energy and environment. Students are taught about energy efficiency with the NEED (National Energy Education Development) curriculum, which focuses on what energy is, how it is generated, and how to use energy wisely. All aspects of energy efficiency are taught, from monitoring usage, to retrofitting existing spaces to increase efficiency, to building science. Students use project-based learning to make energy-usage measurements that directly influence energy efficiency policies around the school. These fourth-graders are then tasked as efficiency ambassadors, who teach other students about energy conservation.

Saint Agnes uses washable trays, glasses, and flatware in the lunchroom and encourages students to bring their own water bottles to school. Coffee grounds and vegetable waste are composted on site. Each classroom has dedicated recycling bins, and students oversee the recycling process. The middle-school grades have implemented the use of "digital lockers" to share documents, school flyers, and other large files, eliminating the need for excessive printing or emailing.

Recycling is integrated into SAS community events, as well. Saint Agnes hosts a carnival fundraiser each summer to support campus capital projects. Students from the Saint Agnes Boy Scout Troop 4 play a significant role in recycling materials from the carnival. The scouts walk the grounds of the carnival, collecting and separating waste from recyclable items. In 2018, 420 pounds of aluminum cans, 370 pounds of plastic bottles, 385 pounds of cooking oil, 450 pounds of cardboard, and 810 pounds

of sheet iron were recycled from the carnival. In addition, 138 pounds of food scraps were composted.

All students take part in a structured physical fitness curriculum. More than 70 percent of students participate in an organized sport at some point during the school year, with many students doing so every season. Saint Agnes has a no-cut policy, so every student can play on a team, regardless of ability or financial need. Prekindergarten, kindergarten, and first-grade students take part in the Minds in Motion curriculum, a kinesthetic approach encouraging students to integrate motion into the learning process, both in the classroom and on the campus green space. In the morning before the first bell, students are encouraged to use the gym. SAS takes part in the FitnessGram and the Presidential Youth Fitness Program.

All school employees are enrolled in Go365, a health and wellness program sponsored by Humana Health. Flu shots are offered to all staff, and 100 percent of the faculty is trained in CPR, first aid, and basic lifesaving techniques. Mindfulness classes are provided to all interested faculty, who in turn are encouraged to teach these practices to their students. Basic yoga is taught to prekindergarten and kindergarten students.

In the cafeteria, a salad bar is available every day. Sugary juices and soft drinks are not offered, and sweet treats are limited to special occasions.

Saint Agnes encourages neighborhood students to walk, bike, or carpool to school, offering crossing guards and bicycle racks. Students also learn about bike safety through an annual Bicycle Rodeo sponsored by Louisville's Norton Hospital. Students participate in some walking field trips. Saint Agnes is an "idle-free" zone for all cars and school buses. In addition, indoor air filtration systems are used and maintained continuously, and cleaning agents used in the school are chosen based on their safety profile. Positive mental health is supported by a multifaceted counselling program. One-on-one and group counseling services are available to all students and families. Students are taught coping skills to deal with everyday life issues such as anxiety, depression, and low self-esteem.

The school uses environmental concepts and ideas of sustainability to help teach science and engineering and to foster mathematical thinking across all grades. The science and math curricula rely on environmental examples to demonstrate the ideas that are taught. Students in prekindergarten and first and second grades use natural materials gathered from the campus to create art and learn about their environment, and they use recycled materials to learn about simple machines.

Saint Agnes has a step-by-step stewardship program that begins in kindergarten and continues through the eighth grade, with each grade having a different focus. The fifth-grade stewardship focus is on people who are thirsty. Throughout the school year, students learn about challenges the planet faces in getting access to safe water, as well as simple steps and solutions we can take to mitigate these issues. Through a partnership with WaterStep, a nonprofit organization with a mission to provide safe water to communities in developing countries, Saint Agnes students hear from speakers and take a field trip to the Louisville Water Towers for a day of activities focused on water purification. Students also create and promote a shoe collection drive across the community each fall. These shoes are donated to WaterStep to help fund safe drinking water projects all over the world, and to help keep unwanted shoes out of landfills.

Younger classes learn about trees and their important role in the environment. Each year, students get their own tree to take home, plant, and nurture. In 2016, the third-grade class created a pollinator garden in conjunction with the Louisville Nature Center, the Kentucky Department of Fish and Wildlife, and the University of Louisville. The students learned about the importance of pollinators in the environment, identification of indigenous Kentucky plants that attract pollinators, and threats from invasive species.

Students who take part in the daily after-school care program partnered with Common Earth Gardens and the Kentucky Refugee Ministries to build a garden with recently arrived refugees from Burundi in East Africa. Using a plot of land at the Earth and Spirit Center, the students and refugees learned from each other how to create an edible garden. During this process, participants were taught the concepts of sustainability, composting, nutrition, and self-reliance, and put them into action.

The middle grades use recycled aluminum in science class to build boats to learn about volume measurement and water displacement, dissect owl pellets to learn about the food web, and build roller coasters out of discarded foam and paper rolls to learn about force and motion. Eighth-grade students select from several art electives as part of their curriculum. The Project Planning and Design class remodeled a school bathroom and was able to restore and reuse old bathroom tiles for the remodel.

## *Louisiana*

### Brookstown Middle School, Baton Rouge, Louisiana

*Aquaman would be impressed by these aquaponics superheroes*

Brookstown Middle School (BMS) is a *Title I*, urban, neighborhood school located in North Baton Rouge within the East Baton Rouge Parish school district. It is home to 184 students in sixth through eighth grade, all of whom are eligible for free or reduced-price lunch. The student body is 96 percent African American, and 83 percent of the students are identified as economically disadvantaged.

Brookstown replaced an 80-percent-efficient atmospheric boiler with a 95-percent-efficient high-efficiency condensing boiler. T8 lightbulbs are used in all classrooms. Each room and hallway is equipped with lighting-occupancy motion sensors. Air conditioning and heating is turned off after school and during all weekends and holidays. All computer screens, Smartboards, and technology screens turn off after two minutes of non-use. The major school appliances, such as the faculty copier, school washing machine, school dryer, and refrigerator have ENERGY STAR labels. These upgrades, practices, and purchases have helped reduce energy consumption by 29 percent in the past three years, and they have reduced greenhouse gas emissions by 27 percent, as calculated in Portfolio Manager.

The school uses sinks and handwashing stations with motion sensors and automatic-timed water faucets. Water fountains require students to apply hand pressure to run. Outside water connections and valves are kept locked except when in use and contain supervisory switches. BMS has reduced water consumption by 14 percent over three years. All classes have moved to a paperless model, using Chromebooks to replace textbooks and assignments for students.

A large percentage of BMS students use alternative forms of transportation, such as bus riding (63 percent) and walking (21 percent). Sixteen percent of BMS students carpool to and from school. Athletic events are scheduled by the district middle school athletic director on the same day and at the same location for both boys' and girls' teams so that teams travel together to maintain optimal school bus fleet efficiency.

Brookstown, which recently installed a water-bottle filling station, has designated a green team comprising students, faculty members, and parents or guardians. The green team has sponsored recycling drives for items such as BMS sweatshirts and bottle caps. The team sponsors a Green Week, during which teachers focus lessons in their subject on an environmental theme.

The school follows EPA and Healthy Schools Campaign green cleaning guidelines. Routine cleaning is done when the building is unoccupied. Product inventory is maintained, copies of safety data sheets are kept, and product labels are read and followed. Products are inaccessible to students, are fragrance free, and meet Safer Choice standards and criteria. The city of East Baton Rouge and Brookstown also follow the EPA Tools for Schools criteria.

Forty-six percent of students are enrolled in health classes that teach students about portion size, dietary guidelines, and the physical and mental problems that can be associated with poor dietary choices and lack of exercise. All students are enrolled in physical education or U.S. Army JROTC, which provide physical and outdoor activity to students. Grades participate in the Presidential Youth Fitness Program. Students and faculty have joint athletic participation, with organized events such as the student/faculty basketball and volleyball games supporting activity together.

Nutrition also is supported through the school's robust aquaponics program. During the 2017–18 school year, students harvested 21 different types of lettuce from the aquaponics program, resulting in over 120 pounds of lettuce grown and served to students in the BMS school cafeteria, guests at school functions, school board members, and East Baton Rouge parish staff and faculty members. During the first semester of the 2018–19 school year, BMS harvested more than 140 pounds of leaf lettuce, helping to provide fresh, nutritious meals to students.

Students take ownership of the aquaponics program and labs. Students research the crops grown, water quality, effect of pollution on water, plant nutrition requirements, fish nutrition and health, environmental requirements for sustainability, crop diseases, fish diseases, growing mediums, and components of a successful aquaponics system.

The aquaponics class has a testing manager that assigns and oversees water-quality testing. A communications/media manager maintains an aquaponics website, takes photographs and videos, edits the videos, and submits a weekly "AquaChat," which highlights achievements and challenges. The class chief operations manager oversees all management positions, maintains biosecurity and lab safety, and meets and greets lab visitors. The class systems manager ensures that the clarifiers and rooms are clean and all standard operating procedures for the aquaponics systems are followed. The class botanist is responsible for overseeing all harvesting, planting, transplanting, measuring and weighing, observing, and documentation procedures involving the plants (including cafeteria delivery and scheduling). The class zoologist is responsible for overseeing all activities that involve the fish, ranging from calculation food requirements to weighing to harvesting the fish when they are ready.

The aquaponics class promotes STEM interest, confidence in STEM skills, and enhances students' value of and access to STEM careers. This class focuses on real-world issues, applies rigorous math and science in context, immerses students in hands-on activities, uses open-ended exploration guided by the engineering design process, allows for student creativity and choice, and involves students in productive teamwork and leadership skills.

In addition to hydroponics, aquaponics, and health courses, the school's Junior Cadet Corps has an environmental component that includes participation in community cleaning projects. Environmental careers in the military are an area of focus. The school's speech course integrates environmental debates, while the marketing class addresses how companies are addressing sustainability issues when advertising.

English Language Arts teachers also use environmental articles in their reading lessons when teaching reading and writing skills. Writing topics are assigned to students throughout the school year. In art class, students design posters to participate in annual district environmental outreach competitions. The social studies curriculum includes units on the history of oil spills and their environmental impact, human and natural disasters affecting the environment and ecosystem, farming, and agriculture.

The science curriculum includes environmental and sustainability-focused units on energy, food webs, ecosystems, coastal erosion and preservation, the water cycle, body systems, diseases, climate and weather, natural disasters, human effect on the environment, natural resources, renewable and nonrenewable resources, conservation of energy, plants, and animals. The student-centered instruction develops skills such as asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting

data, using mathematics and computational thinking, constructing explanations, and designing solutions.

## *Maryland*

### Captain James E. Daly Elementary School, Germantown, Maryland

*Our neighborhood, our watershed*

Montgomery County Public Schools (MCPS) was a 2013 U.S. Department of Education Green Ribbon School District Sustainability Awardee, with 206 schools in the district. Of that number, a handful stand out for their sustainability pursuits. Captain James E. Daly Elementary School (Daly) is a *Title I* school, with 75 percent of its students qualifying for free and reduced-price lunch, and 45 percent in the English for Speakers of Other Languages program. Daly's motto, recited every day during morning announcements is "A = Act responsibly; B = Be respectful; and C = Care for ourselves, others, and the environment, because if we do then you will be a Daly success!"

Daly students and staff focus on energy conservation, reusing and recycling, water conservation, and living healthy lives in harmony with the environment, while simultaneously teaching and learning environmental education through formal and informal instruction. Daly was first certified a Maryland Green School in 2012 and recertified in 2016. The school now is working on its second recertification, due in 2020. The school celebrates an annual Earth Day Fair and it is the recipient of multiple awards for energy conservation and recycling.

Kindergartners study mealworms to learn the life cycle of the dark wing beetle, plant grass seeds and lima beans. Students also compare life cycles of various living organisms and visit the MCPS Kingsley Environmental Center (KEC) to observe plants and animals. Kindergarten students observe bird beaks and build model beaks. First-graders use the story of the "Three Little Pigs" to study sustainable structures as they build houses and test strength. They also make art from recycled materials, learn about the Chesapeake Bay watershed using the Enviroscape program, and look at ways to protect the environment. To focus on conservation, students learn about and build animal habitats, grow plants from seeds, and even measure the water needed to wash hands.

Second-grade students learn science and nutrition as they plant salad greens, care for them, collect data on them, and, finally, eat them. They learn about different ecosystems, and they visit the KEC to study the effects of erosion on forest and streams. They also learn about protecting the environment, and they produce informational writing regarding the water cycle and water conservation. Third-graders learn the positive and negative effect of human-made items on the environment. They observe organic and inorganic materials and observe decomposition rates; learn about reducing, reusing, and recycling; and visit the KEC to learn about invasive species.

Fourth-grade students learn environmental sustainability through a project-based learning unit called Our Neighborhood, Our Watershed. They research renewable and nonrenewable resources and compare the environmental impacts of each. Fifth-grade students study human effect on environments, and they build robots out of trash to practice resource conservation.

Some 90 percent of Daly staff has participated in professional development in environmental and sustainable education, including Project WET, Project WILD, and Project Learning Tree. The environmental field is well represented during an annual career day for young pupils.

Daly has one of the strongest and largest school-based School Energy and Recycling Team (SERT) groups among all elementary schools in MCPS, which consists of 40 fourth- and fifth-grade students and is led by a school counselor and the building service manager. While all schools in MCPS have school-based SERTs, Daly consistently has had the largest and most active school-based team. Green team student leaders wear SERT aprons and go through the building collecting recyclable products. They visit classrooms to teach other students about proper recycling, post signs about water conservation, and recycle crayons. Annually, SERT students visit the local recycling center to witness the full process of recycling. Students come back to school highly motivated to continue their efforts.

Many teachers use task lamps at their desks instead of overhead lighting when the classrooms are not occupied. The staff and students monitor to ensure that doors

and windows are kept closed to avoid outside air from entering. The school reduced its electricity use by 16 percent over two years.

Hazardous chemicals from Daly are picked up by a licensed hazardous waste contractor for disposal in accordance with applicable regulations. The school's green team works diligently to make sure all school discarded material, including lunch trash and recycling, is separated and placed in the proper bins to eliminate contamination. Ninety percent of all cleaning products in use are Green Seal-certified.

To manage IAQ, the school's HVAC systems are equipped with MERV 8 air filters. Air filters are changed quarterly to ensure optimum filtration and good IAQ. To manage elevated humidity, portable dehumidifiers are provided where necessary. Wi-fi sensors that monitor temperature and humidity remotely also are placed in areas where excessive indoor moisture has been documented. Through the implementation of an integrated pest management program, exposure to asthma triggers is reduced.

Daly uses the Whole School, Whole Child, and Whole Community model, which encompasses all of the eight critical components of coordinated school health. A school wellness committee has overseen mindfulness, yoga, and restorative justice initiatives. Teachers encourage students to participate in the breakfast-in-the-classroom program, which is available to all students at no cost. In addition, the school offers flexible seating in all classrooms; a Girls on the Run club; and dental, vision, and counseling clinics on-site.

Daly collaborates with the Audubon Naturalist Society, which provides an afterschool environmental club, called Unplug and Play, and assists with the salad table instruction for second-grade students. Another partner, Manna Food, a local food bank, sends a special bus to Daly school a few times a year to teach nutrition and present healthy recipes to students and their families. An important partner for Hispanic students at Daly is Identity, from which students receive assistance with academics, including environmental literacy.

## Calvert County Public Schools, Prince Frederick, Maryland

*A generation of environmental education on the Chesapeake Bay*

Calvert County, Maryland. is a mixture of rural and suburban areas. The district encompasses some 2.5 million square feet of facility space and has a $3.25 million electricity budget. Calvert County Public Schools (CCPS) currently enrolls 16,077

students in prekindergarten through grade 12 and is the largest employer in Calvert County.

The first Calvert County school was certified as a Maryland Green School in the spring of 2009. Now all 24 prekindergarten through grade 12 schools, as well as and one technical academy in the district, are certified Maryland Green Schools, making Calvert the only county in the state to have 100 percent of its schools certified in this statewide program. The vast majority also participate in at least one other green school certification program. NWF's Eco-Schools USA is an internationally recognized school sustainability program. A school striving to become an NWF Eco-School can pursue sustainability pathways as it progresses through the seven-step process. There are 22 CCPS institutions currently registered as NWF Eco-Schools.

The district reduced energy consumption 17 percent over a 10-year period. CCPS has three schools that use geothermal energy as the source of heating and cooling, and it has one geothermal school under construction. The district also has one school under construction that is expected to become LEED Silver-certified. CCPS employs a dedicated energy and environmental specialist, whose priority is to reduce energy consumption. Projects include LED upgrades, HVAC upgrades, and the promotion of behavioral change. Nearly all CCPS schools and administrative offices operate on a building-automated system that helps to reduce energy consumption.

Two full-time water specialists are on staff for all testing of nonpublic water systems in the district. Individual schools work toward water conservation and education through storm drain stenciling, rain gardens, cisterns, native plantings, public awareness posters, announcements, and erosion and sediment control.

Paperless initiatives to reduce costs and waste have increased CCPS' recycling rate by 4 percent over one school year. The district has acquired laptops for all third- and sixth-grade classes for a one-to-one device experience. CCPS has implemented an online learning management system called Schoology that teachers use to post classwork and homework electronically.

As a rural community, CCPS relies on buses to help reduce the number of vehicles on the road. Over the past two years, CCPS aggressively has replaced its aging maintenance fleet with more fuel-efficient vehicles, and the district purchased its first electric vehicle in the summer of 2018. Schools post no-idling signs.

The whole district pest management policy permits pesticides to be used only after determining that the nontoxic options are unrealistic or have been tried unsuccessfully. The least hazardous pesticide is then selected, with the potential for exposure minimized. All school custodial cleaning agents are nontoxic.

Each school has a wellness policy, and all negotiated labor agreements offer a stipend for employees through a partnership with the local hospital and fitness center. In addition to participating in an annual farm-to-school celebration, CCPS has worked to increase its local food offerings every year. Local meats, corn-on-the-cob, and an assortment of dark leafy greens have been incorporated into school meals with overwhelming acceptance. Other nutrition efforts include fruit and vegetable bars, a food backpack program for needy students, and student food shows.

Environmental education began at CCPS over 25 years ago as a single-grade-level program collaboration between the local department of natural resources and the school district. This collaboration has grown into the CHESPAX districtwide environmental education program through which students in kindergarten, first, second, third, fifth, seventh, and eighth grades engage in field experiences connected with their class-based science curriculum. Students in fifth and seventh grades engage in a MWEE. In this way, CHESPAX programming works with approximately 10,000 students each year.

The first-grade student service-learning project allows students the opportunity to learn about the importance of pollinators. Students use their schoolyard site to become familiar with the basic elements of insect needs and structures. They travel to Battle Creek Cypress Swamp or Ward Farm for more advanced study. At these sites, students learn how different pollinators have their needs met and pollinate the food we eat. As another component of the lesson, students engage in an "Engineering is Elementary" unit to create a hand pollinator.

In fourth grade, students learn through science instruction about energy and the amount needed to run various electrical devices. Students then apply that understanding in language arts classes in a unit related to their energy footprint. They read the book *Energy Island,* and then investigate their school as an "energy island." They use the energy reports created in the facilities department to see how their school's current energy use compares to prior years' energy use.

The middle school science service-learning curriculum provides a meaningful service to the community. For over 20 years, seventh-grade students in Calvert County have helped the U.S. Fish and Wildlife Service in a study of submerged aquatic vegetation throughout the Chesapeake Bay. These underwater grasses play a critical role in the health of the bay as a filter for nutrients and sediment, which can be detrimental to the environment. Additionally, these plants serve as important habitat for crabs and spawning fish in the bay and its tributaries.

All eighth-grade students learn about biodiversity. To increase relevance and connections, students investigate the macroinvertebrates from a stream near their school. Students participate in a 10-day, inquiry-based science unit centered on an environmental concern. Students can self-select an environmental interest, and they are provided with structured materials related to biodiversity, natural resources in the waste stream, water quality, and energy consumption.

The district student service-learning coordinator works with high school teachers to create a menu of opportunities to give biology students an environmental educational experience and a service-learning experience.

## *Massachusetts*

### Boston Green Academy, Brighton, Massachusetts

*Exhibiting all things green*

Boston Green Academy (BGA) serves a diverse population: 80 percent of students are considered high needs; 67 percent are economically disadvantaged; 32 percent are students with disabilities; 35 percent are students for whom English is not their first language; and 93 percent are students of color. BGA is an example of how a community of staff and students can use partnerships, relevant and engaging curriculum, and leadership opportunities to transform a turn-of-the-century building into an environmentally sustainable one.

The BGA green building advisory committee created an action plan with the goal of making BGA a sustainable building model for the Boston Public Schools and beyond. This committee comprises the director of sustainability at BGA, the

sustainability manager at Boston Public Schools, the energy manager of the city of Boston, and a host of green building experts from the private sector.

Boston Green Academy is an ENERGY STAR building with a score of 94. Boston Green Academy receives 48 percent of its energy from renewable sources. Boston Public Schools, National Grid, and Steam Trap Systems recently repaired and replaced 203 steam traps at BGA, yielding a 25 to 30 percent savings. All classrooms and offices have been equipped with occupancy sensors.

Students in the Career Technical Education (CTE) program are conducting a cost-benefit analysis to explore retrofitting current school lighting with LED bulbs. They also are learning to use thermal-imaging cameras to collect internal and external readings of the facility in order to assess the building envelope and window efficiency. Students in middle school use Kill A Watt meters to figure out which devices in BGA use the most electricity. They make sure these devices are only plugged in when in use and that all vampire devices are unplugged on weekends and holidays. Ninth-grade students are working with the city on a solar feasibility study for a solar array on the building.

All 23 BGA bathroom sinks are equipped with faucet aerators that reduce the flow of water. In addition, all bathroom sinks are equipped with self-closing metered faucets. Students in the Urban Ecology class, as well as CTE students collect and reuse rainwater in the garden, and custodians do not irrigate lawns. When BGA first moved into its building in 2014, it did not have access to tap water and received weekly bottled water delivery. The school worked with the district environmental division to test the tap water supply and installed 11 water fountains and refillable bottle stations throughout the building. All BGA students receive a free stainless-steel water bottle at the beginning of the school year.

Boston Green Academy is registered as a Massachusetts Department of Environmental Protection Green Team school, and the academy works with the agency yearly to update recycling equipment, signage, and curriculum. BGA maintains a single-stream recycling system. The recycling program is managed by the school's Learning for Independence program as a way of integrating math and life skills. CTE students started a composting initiative in the lunchroom. A share table in the cafeteria helps reduce untouched food waste. Students and staff compost all waste in the garden, and all yard waste produced by landscape services is composted through the Boston Public Works Department.

Twenty percent of students walk or bike to school because they live within a mile of BGA. Another 63 percent of students take public transportation. The remaining students require door-to-door transportation and take a school bus.

The school adheres to district policies for green cleaning, integrated pest management, environmental audits, and no-idling, among other areas of school environmental health. BGA's chemistry teacher is trained and supported by Beyond Benign, a nonprofit that provides educators with the skills and tools to teach green chemistry in their classrooms and laboratories. The Office of Counseling and Wellness consists of social workers, guidance counselors, counseling interns, and a school nurse. To support school culture, BGA incorporates restorative justice approaches and other social-emotional learning models.

During an annual project week, students spend an entire week off campus — hiking, biking, cooking, meditating, teaching, dancing, sailing, painting, protecting, exploring, discovering, and engaging — with the greater Boston community and beyond. Each BGA middle school grade stays on Thompson Island for an immersive three-day outdoor environmental science learning adventure each fall and participates in a one-day teambuilding and leadership experience each spring. The entire eighth-grade class visits the White Mountains in New Hampshire every spring for a three-day, two-night outdoor leadership experience. All sixth-graders visit Hale Reservation in Westwood, Massachusetts, for a day of outdoor teambuilding and leadership training.

The school's entire south-facing lawn has been converted into an outdoor classroom and garden for students, which was designed, built, and is still maintained by students. There are 11 4 x 8-foot raised beds for growing produce, eight outdoor tables for working and eating al fresco, and six work benches for planting, growing seedlings, and collecting the harvest. During the fall and spring, students plant, grow, and cook with produce from the garden, all while developing healthy recipes and nutritional practices. The Learning for Independence program created and manages the BGA Café, in which students develop menus and cook healthy meals for staff members every Thursday. The program builds life skills and basic culinary skills and teaches nutrition.

Boston Green Academy employs a full-time director of sustainability to oversee all sustainability-focused courses, programs, opportunities, trainings, committees, and green building updates.

The director of sustainability created Green Milestones, a continuum of green-focused academic and career opportunities. The directors work with each grade-level team to ensure that all students (1) establish a meaningful relationship with the community and earth; (2) grapple and engage with real world, sustainability issues; and (3) engage with leadership opportunities that promote sustainability. The school's director of sustainability also works with the director of teaching and learning to create at least 10 hours of sustainability professional training per year.

Each year, all grade levels and all content teams in the high school complete a term-long interdisciplinary project focused on sustainability called Green Exhibitions. Students explore important environmental, social, and economic issues while feeling empowered to create change in their own lives and beyond. All juniors and seniors complete a four-hour job-shadowing experience in a sustainability field, and all seniors complete a six-week, 150-hour sustainability internship. All BGS high school students create an online green portfolio that shows their challenges, growth, and development from freshman to the end of their junior year, which they present and defend in front of a panel of judges and the community.

Urban Ecology is a required class for all sixth- through eighth-grade students. Students study energy and water systems, investigate climate change both locally and globally, engage with the food system and food justice, and solve engineering challenges through the lens of sustainability. BGA offers environmental science and technology and sustainability management pathway programs. All ninth-grade students take Environmental Science, an interdisciplinary, project-based learning course that embraces topics including geology, biology, environmental studies, environmental science, chemistry, and geography. All 12th-grade students take Green Physics. Green Engineering and AP Environmental Science are elective classes offered to 11th- and 12th-grade students.

The school leverages the following STEM tools for sustainability learning: a weather station, a classroom observation beehive, aquaponics system, a bike that converts human energy into electrical energy, a parklet (a sidewalk extension that provides more space and amenities for people using the street), and a Makerspace.

## Ipswich Middle-High School, Ipswich, Massachusetts

*Putting green-er every year*

Ipswich Public Schools owns one-third of a wind turbine that is located about three miles from the Ipswich Middle-High School (IMHS) building. The school district sells this energy to the town's electric light department, which then uses the energy to power the electricity needs of the school buildings. The IMHS was constructed in 1999 and is heated by a boiler fueled by natural gas. The boiler also heats the hot water for the facility. Only 30 percent of the building is air-conditioned, and all the classrooms can open windows to cool the rooms naturally. All windows and doors are fitted with weather stripping. A new air-conditioning system was installed in 2016 and boasts a 90 percent efficiency rate. The months of October and May are "zero energy months," when the building does not use heat or air conditioning. As interior lights stop working, they are replaced with energy-efficient, long-lasting LED lights. The parking lot lighting has been upgraded to LED, and timed motion sensors are in every classroom.

As part of the curriculum, students in engineering and environmental science classes tour the town's wastewater facilities, where they read and analyze water quality. Working together, the high school Environmental Club and the middle school green team raised funds with which they purchased and installed four water-bottle refilling stations around the school. The school's outdoor garden is hand watered using rainwater collected in rain barrels. Athletic fields do not require irrigation or fertilizer. The main athletic field is made of synthetic turf, which was installed in 2016.

Composting has been in place for eight years, and food is served on compostable plates. Students recently audited waste and negotiated four more compost bins and a second weekly pickup. They also held a mandatory waste-sorting educational assembly. Students are not allowed to bring in single-use plastic or Styrofoam bottles or cups; they must instead use reusable mugs or cups. The IMHS technology department recycles old electronics, working with a company that resells the old electronics to be used or broken down for parts. Twice a year, IMHS holds an electronics drive, where town residents can drop off old electronics for recycling. These drives benefit partner Ipswich Sustainable Education.

Bike to School Day is an annual event, and always results in an increased number of bikers and increased enthusiasm. The Environmental Club is working with the physical education department to increase participation in this event.

Every three years, the building is tested for overall air quality. The school also has been tested for radon, and no issues have been found. There are rarely problems with humidity; in the few instances when a mold or mildew has been discovered, the area has been quarantined and safely treated. All custodians are trained in the proper use of cleaning supplies and dilute products appropriately. Students began working with the town facilities director and the school committee in 2017 to start using cleaning supplies that are more environmentally safe.

In 2017, the middle school green team raised more than $20,000 to build a school garden in front of the building. The garden consists of raised beds for vegetables and flowers, as well as fruit trees and an outdoor classroom. Food grown in the school's garden is brought directly into the cafeteria for consumption, and extra produce is delivered to a local food pantry. In the IMHS cafeteria, salads and soups use the kale, chard, and carrots from the garden, which food service workers pick and serve the same day. The school also purchases locally from nearby farms.

Social-emotional health is supported by the guidance department, a school adjustment counselor, and a clinician, who is grant-funded through the Lahey Behavioral Student Assistance Program. This assistance program hires graduate-student clinicians to be on site at local middle and high schools for 30 hours per week.

Many courses throughout the IMHS curriculum incorporate topics in environmental issues, renewable and nonrenewable energy, and human systems. The Environmental Science class studies the integration of physical, biological, and informational sciences by examining the ecology, physics, chemistry, economics, and social implications of human effect on the environment. The Earth and Space class examines natural resources, climate change, and energy use. The Marine and Coastal Science class looks at human effect on the environment. The AP seminar class has a unit titled Science and Nature, which incorporates topics from the latest report from the Intergovernmental Panel on Climate Change and the fate of island

nations such as Kiribati in light of rising sea levels. The Global Studies course introduces students to the past, present, and future trends of globalization with a unit on sustainability, which discusses population, energy, and the environment.

Sustainability is the theme of the sixth grade, in which all projects and units have a component of sustainability. The high school offers a sustainability course, in which students spend the year working individually or in small groups to tackle local sustainability issues. Students analyze wind turbine data; improve waste management in the cafe and on athletic fields; conduct feasibility studies for solar panels; reduce straw use townwide; create art from recycled materials; intern with the town recycling coordinator; build a hydroponic station; and advocate to amend local plastic bag and Styrofoam bylaws. Currently, students are working on a cross-discipline project between the art club and the sustainability class to paint a mural, featuring themes of pollinators, on a wall bordering the main parking lot in the downtown business area of Ipswich.

The high school racing team allows participants to drive the 3-D printed and hand-built remote-controlled race cars, which they used in competitions one year. Each year, their challenge is to create a new way of charging the vehicles sustainably. One year they used a solar panel, and the next a human gerbil wheel, to charge the batteries.

With the town located right on the Atlantic Ocean, students arrive at school with a natural curiosity about the environment. In the seventh grade, students spend two weeks on field trips learning about the history of the coastal town and how the environment has affected it. Students visit Crane's Beach, which is owned and managed by the Trustees of Reservations, a group for which many students work during high school. Students also visit Appleton Farms, and they go on a whale watch, where they learn about whale migration and get to see whales up close. One of their favorite outings is the two days they spend canoeing on the Ipswich River. There, they study the natural habitat of the river, perform water- quality tests, and learn to conserve local natural treasures. Students have been presenters at the Coastal Science Conference for the last 22 years.

Another popular middle school STEAM project involves the putting green assignment. In this innovative project created by the art department, sixth-graders create a mini-golf-style putting green using math concepts (angles and equations), topography, writing, and science (effect on wetlands, using pesticides and fertilizers, maintaining habitats). After students complete the mini-golf course, students in other grades are invited to test it out.

A favorite tradition in Ipswich is Crane's Beach Day. In 1911, the Crane family invited the entire town to Crane's Beach for their son Cornelius' birthday. Every year

since, elementary- and middle-school students and families all go to the beach instead of school one day in June. The love that Ipswich students learn for their environment is evident even in small details such as senior portraits, which students often take on protected lands such as the local beaches, Strawberry Hill, and the Crane Estate.

## Wellesley Public Schools, Wellesley, Massachusetts

*Developing heads, hearts, and hands through sustainability*

Wellesley Public Schools (WPS) serves more than 5,000 students at one prekindergarten school, seven elementary schools, one middle school, and one high school. The WPS system recognizes the importance of reducing environmental impact; to do so, it has collaborated with many town departments, students, faculty, parents, and local nonprofits.

Student involvement, interschool collaboration, and sustainable planning provide the driving force to reduce greenhouse gases. All sustainable systems and projects complement and enhance the district's mission of developing the heads, hearts, and hands of its students; together, these systems and projects have inspired them to be the critical thinkers, problem-solvers, artists, and innovators who contribute to their communities, our nation, and the world.

The efforts to conserve and reduce energy throughout WPS have been motivated and supported by many factors: the city's adoption in 2011 of municipal energy codes that go beyond state requirements; its fuel-efficient vehicle policy; its goal to reduce greenhouse gas emissions 25 percent below 2007 levels by the year 2020; and its 2017 designation by the Massachusetts Department of Energy Resources as a Green Community. WPS has reduced greenhouse gas emissions 19 percent over 10 years.

Energy-saving measures in WPS include using MassEnergyInsight to identify and improve the district's least energy-efficient buildings; identifying energy-saving occupant behavioral change; and launching programs aimed at encouraging such changes. The district has decreased the exterior lighting used overnight, and it has put computers on automatic standby/hibernate settings. Wellesley High School has a demonstration solar array and geothermal system.

Wellesley students have actively focus on energy conservation. High school students "green-certify" elementary school classrooms. This is a way for older

students to inspire, empower, and educate younger students on ways to reduce their environmental footprint.

Wellesley does not apply any fertilizer to school lawns, which keeps both surface runoff and groundwater cleaner. Elementary students learn about water conservation during the green classroom certification process.

The WPS Bates School was the first in New England to participate in the EPA's Food Recovery Challenge. After assessment, goal setting, and project implementation, the resulting recycling and food waste diversion project resulted in a 40 percent reduction of the school's cafeteria waste. Now, the program has been expanded to two more elementary schools, which are implementing share tables, aiming to eliminate food waste, and providing food to those in need. In addition, all WPS cafeterias across the district now collaborate with area colleges as part of a Food Recovery Network to donate unused, cooked food to Food For Free, a Cambridge-based nonprofit. Food For Free distributes single-serve meals to people who are food insecure, including students at MassBay Community College in Wellesley, Massachusetts.


Wellesley switched from plastic straws to biodegradable straws, which are available upon request. Reusable "clamshells" are being used for cold lunches instead of plastic containers in several schools. Some 700 pounds of food scraps from the Wellesley Middle School kitchen go to the town recycling and disposal facility as part of a food compost to bio-gas pilot project.

The “Banquet in a Box" program allows the Wellesley school community to borrow reusable tablecloths and large water containers for various school-sponsored and team events. Wellesley Green Schools also catalogued event supplies and other items that can be reused at events across the district. Wellesley Green Schools has used resources through Massachusetts’ Safe Routes to School to encourage safer biking and walking to school. A fuel-efficient vehicle purchasing policy is in place.

Environmental health and safety, including IAQ, are among the highest priorities for Wellesley's facility management department, which provides custodial and maintenance support for all schools in the district. IAQ in all school buildings is monitored by a building management system (Metasys), which provides remote supervision of all HVAC systems. This allows an immediate response to correct problems that may affect student comfort, including ventilation, temperature, and humidity. The district is committed to providing appropriate IAQ on a long-term basis through its capital projects, which includes comprehensive HVAC "recommissioning" at all schools on a regular five- to seven-year cycle.

Wellesley uses an ionized water system for cleaning. This state-of-the-art system uses plain tap water for most cleaning applications. Not only is this a low-carbon-footprint system, but it also eliminates harsh chemicals and associated off-gassing, which can affect students and staff. The custodial staff uses "team-cleaning" in the middle and high schools to improve efficiency, as well as vacuums with HEPA filters, strategically placed walk-off mats, and "auto scrubbing" machines that eliminate the use of mops and buckets throughout the district. All schools use third-party-certified sustainable products, including paper and trash-can liners.

The WPS food service team purchases local rainbow chard, tomatoes, sweet potatoes, cauliflower, apples, squash, carrots, cheeses, butter, yogurt, eggs, and milk. Cafeterias offer meatless Mondays. Food service has partnered with eighth-grade students to serve hydroponic greenhouse garden greens the students have grown. A Tufts University doctoral degree recipient is working with Wellesley Food Services to identify ways the school menu can assist in further lowering the district's carbon footprint.

More than half of the schools in the district have gardens, and many have landscaping and outdoors clubs, offering alternative and unique outdoor time. Outdoor club activities include hikes on trails and visits to organic farms. Nonprofit programs provide physical activity before and after school, including yoga, flag football, basketball, dodgeball, spike ball, and cornhole.

Wellesley's educators have added new, thoughtful science curricula across the district. Each curriculum is based on the Massachusetts standards, and all curricula also reflect increased environmental awareness. This allows students to engage in dialogue about current events and have respect for, and understanding of, dynamic environmental, energy, and human systems.

Prekindergarten launches the development of young environmentalists with topics such as "made by humans, versus found in nature." Kindergarten through fifth grade have new units specifically related to environmental awareness — such as having kindergarteners explore ways that humans affect the environment (particularly

through trash, air, and water pollution) and how some effects can be minimized by reducing, reusing, and recycling. Second-grade students investigate natural and human-made solutions to problems of erosion. Fourth-grade students research nonrenewable and renewable energy sources. Fifth-grade students study the availability of fresh water on Earth; design water filters to clean polluted water; and consider how to reduce human effect on the environment by changing agricultural, industrial, or community practices.

The middle-school science department continues to improve and refine the curriculum, with topics such as climate change, weather, and energy, as well as with an engineering elective (hydroponic gardening). AP Environmental Science is offered at the high school. In this course, students partner with the local recycling and disposal center.

The High School Evolutions program (an innovative school-within-a-school educational program) allows students to work throughout the year on sustainability-themed projects, including investigating solar installation, aquaponics, tree canopy, renewable energy, and single-use plastic water bottle reduction.

## *Michigan*

### Interlochen Arts Academy, Interlochen, Michigan

*Celebrating the interconnectedness of built, natural, and artistic environments*

Established in 1962, Interlochen Arts Academy (IAA) became the nation's first fine arts boarding school. IAA is situated on a pristine 1,200-acre campus that comprises largely native forests, spectacular lakes, full and diverse prairies, and abundant native wildlife. Interlochen's student body today consists of over 530 students from 49 states and some 31 countries around the world. Over the past five years, the academy has made substantial advances in sustainability efforts. IAA continues to identify ways to reduce its environmental footprint and make decisions that will help the environment, as well as to improve the health and wellness of students, staff, and community.

Reducing environmental impact and costs has become extremely important to IAA. The school has a sustainability coordinator to monitor, document, and manage energy consumption on the campus. New and existing buildings are being upgraded with energy-efficient infrastructure, appliances, and utilities. LED lighting has been installed, along with lighting controls and sensors. Temperature controls also have been installed, as have efficient heating systems to reduce natural gas usage. The IAA greenhouse is powered with solar panels, and geothermal flooring heats the facility, allowing year-round growth in this northern Michigan climate.

Interlochen has three wells on the property that provide potable water, as well as its own water-treatment facility. IAA tests for bacteriological-quality levels monthly, and annually tests for E. coli, nitrates, nitrites, chloride, ammonia, phosphorous, lead, and copper. Initiatives to reduce water usage at the academy have been put in place as well, such as low-flow showerheads, low-flow toilets, and an efficient dishwasher in the cafeteria that alone will save 600,000 gallons of water a year. IAA has installed seven water-bottle filling stations to encourage healthy hydration and minimize single-use plastic bottles. IAA uses lake water for the limited irrigation required on a mostly native-plantings landscape. A small rain garden and water cisterns offer native wetland habitat and garden irrigation.

The school has made some major steps to reduce the amount of landfill waste produced on site. IAA recently installed an $80,000 on-site composting system that will allow the entire campus to compost its food scraps, organic landscaping material, grass clippings, compostable dishes, cutlery, and napkins. IAA actively encourages recycling, providing various receptacles around campus for staff and student use. IAA only purchases compostable disposables for the coffee shop and cafeteria. Employee offices are equipped with recycling bins, and each major office space has a composting bucket. Student residence halls are equipped with recycling bins, with plans to encourage recycling in dormitories as well.

Interlochen is a certified Monarch Waystation; has been certified by the National Wildlife Federation as a schoolyard habitat; and is a Michigan Native Perennial certified garden. The school has committed to sustainable logging practices on campus when any trees need to be felled. Trees are hand-cut, and then dragged out by horse-pulled logging rigs. IAA does not employ chainsaws or motorized logging rigs, in order to minimize the effect on the environment and the natural

rhythm of the surrounding ecology. IAA hosts a yearly tree-planting on campus to restore some of the trees that have been felled.

The school views the health of the environment, students, faculty, and staff as an incredibly important pursuit. The academy has taken steps to maintain campus grounds to ensure that any contaminants or chemicals are identified and removed as efficiently as possible. Interlochen has recognized that the systems of human, built, and natural environment are interconnected, and it has taken steps to promote overall wellness by opting for organic compost and natural cleaning supplies, conducting water quality tests, and maintaining their facilities in good condition through inspections and renovations. As a fine arts school, Interlochen ensures that humidity control and building-wide exhaust fans are operational in order to maintain the high quality of expensive instruments, and the school removes any contaminants that may otherwise have an adverse effect on students' health.

Interlochen's new recreation center and gym, the Dennison Center, focuses on physical and nutritional health and wellness by offering classes in yoga, TRX, Pilates, advanced ballet, and nutrition. Interlochen has monthly programs that encourage students and staff to integrate holistic practices of mindfulness, healthy eating, and physical activity into their daily lives. Special events include Planksgiving, Go Red for Heart Health, Movember, Wellness Bingo, Elf for Health, Health Week, Interlochen Triathlon, the Interlochen five-kilometer run, Holiday Hold Out, and Go the Distance.

Certain majors focus even more intensely than others on health, wellness, nutrition, and physical activity. For example, each dance major spends upwards of six hours in dance classes every day. Understanding how to nurture and care for their bodies is a key component of the students' study. Students involved in theatre also are involved in intensive dance, movement, and technique courses that require a tremendous amount of physical stamina. They also spend a considerable amount of time learning about health, wellness, and nutrition.

Interlochen's garden and greenhouse consist of a 20 x 40-foot hoop house, nine raised beds, a permaculture scape, a 20 x 40-foot greenhouse, and a functional fish and plant aquaponics system. Students in agricultural science classes meet in the greenhouse for each class, where they learn about the importance of sustainable farming practices, pollination, composting, aquaponics, botany, and soil science. The IAA greenhouse and garden space constitute one of two school garden areas in the nation that is Certified Naturally Grown. The garden supplies food for students and staff in the school cafeteria.

The school is home to a gardening club that hosts meetings of community members and classes on beekeeping, natural dyeing, seed saving, permaculture, and campus

cuisine. Employees can participate in a discounted and payroll-deducted 24-week community shared agriculture vegetable share through a local farm.

Several IAA classes focus entirely on the importance of the environment and sustainability. In chemistry classes, students explore the laws of conservation of mass at the atomic level to better understanding disposal and recycling. The classes also include units on air pollution, petroleum use in plastics and fuel, alternative fuels, and water and air quality. In ecology lessons, students explore streambeds and research macroinvertebrates and microinvertebrates, raise salmon in the classroom for a release program, study wetlands and native habitat restoration, and learn about freshwater aquatics. In agricultural science, students learn about composting, tilling, soil conservation, water quality, organic principles for growing sustainable crops, beekeeping, and pollination. Ecology and biology students are often outside in the field, conducting research and applying lessons from the classroom into the real-world environment. Astronomy class requires students to do evening observation journals of the night skies.

Art and ecology classes work hand in hand with the Wilson Arts project to create an art installment in the woods as a feature of a natural restoration and reforestation, combining both art and environment into two separate features that work hand in hand. Many theatre shows are related to the environment; and many poems in poetry classes address energy consumption, natural disasters, industrial catastrophes caused by humans, and the like. History classes examine equitable access to safe drinking water. In political science classes, students explore the major oil pipeline that conveys petroleum from western Canada to eastern Canada via the Great Lakes states.

Outside of the classroom, a student-led sustainability club encourages students to explore ideas or problems present in the Interlochen community and to present their solutions to the academy's administration. Students are encouraged to take ownership of their knowledge and experience of the environment and to discuss ways to contribute to sustainability.

## *Minnesota*

### Forest Lake Area High School, Forest Lake, Minnesota

*Natural resource management and outdoor education*

Forest Lake Area High School (FLAHS), located 30 minutes north of Saint Paul, Minnesota, serves nearly 2,000 students. Recently, the high school underwent significant construction, expanding and renovating spaces with a focus on environmental sustainability. In the fall of 2018, student enrollment increased as a

ninth-grade class was added to the school. Even with a larger building and 500 additional students, the renovated high school saw reduced energy use per square foot and energy use per student.

New and renovated spaces now include glass windows and doors, six refillable water bottle stations, and flexible spaces for collaborative student learning. The new, two-story addition added small group conference rooms, significant amounts of natural light, and science and agricultural spaces.

Energy-efficient LED lighting with motion sensors are in classrooms, hallways, and throughout the entire building. Approximately 1,500 solar panels (418 kilowatts of power) on the high-school rooftop provide 5 percent of the school's energy usage and save the school district some $70,000 per year. Energy-efficient boilers and an updated HVAC system use remote monitoring and zonal setbacks to reduce energy use. The motion sensors in each room identify occupied versus unoccupied spaces and automatically adjust room temperature. Occupied zones are set between 70–72 degrees Fahrenheit and unoccupied zones are set at 65 degrees Fahrenheit in the winter and 85 degrees Fahrenheit in the summer. The cumulative environmental impact of these energy-efficient renovations is a 39 percent reduction in greenhouse gas emissions on a square-footage basis over five school years. FLAHS uses the B3 Benchmarking program to track energy and water consumption in ENERGY STAR Portfolio Manager automatically, most recently receiving a score of 78.

Water conservation saved over 4 million gallons of water over six years. Changes in irrigation equipment (rain detectors) and practices (programmable sprinklers) significantly enhanced water conservation. A stormwater reuse project underway will use retention ponds for water storage before filtration and irrigation on athletic fields. Not only does the stormwater reuse project save on potable water use, but it also reduces stormwater pollution that otherwise would have been added to nearby Clear Lake. Further, the school's education curriculum will integrate reuse

technology and water conservation concepts into biology, agriculture, and Earth and space science courses.

High-visibility, four-gallon blue recycle bins are in all classrooms, and products for recycling are collected daily by students in the special education department. The cafeteria staff composts approximately 75 gallons per week of leftover and unusable food through the Food to Hogs program. Students implemented a lunchtime food-share table to reduce the disposal of unopened quality food. A Safe Routes to School grant for $471,795 provided walking path connections along nearby thoroughfares and connected Forest Lake with several neighboring schools.

Forest Lake proactively monitors and manages campus environmental health. Some efforts include carbon monoxide monitors, long-term radon testing, regular testing for asbestos, a new HVAC system, and a no-polychlorinated-biphenyls policy. A student from the environmental club is training custodians on sidewalk-salting best practices. Through recent renovations, the school has added more than 440 square meters of exterior windows in classrooms and hallways, contributing to a 60 percent increase in natural light in the buildings.

Staff and student well-being are supported through wellness activities, mental and physical health supports, and a diverse group of clubs and activities. Positive Behavioral Interventions and Supports is being implemented at Forest Lake over the next several years to improve overall school culture. Each fall since 2013, the school has screened incoming students for depression to identify those with mental health needs and provide them with the necessary support. One hundred and forty-nine junior and senior student leaders serve as mentors for ninth- and tenth-graders.

Student volunteer hours, measured through an online recording system and organized by the United Nations Sustainable Development Goals, surpassed 3,000 hours in the fall of 2018. Most of these hours supported the Sustainable Development Goals of quality education, sustainable cities and communities, and good health and well-being. In November 2017 more than 150 students participated in the global Paper Crane Project, celebrating the 2017 Nobel Peace Prize awarded to the International Campaign to Abolish Nuclear Weapons.

All graduating students participate in a science-based climate change education curriculum that includes both science and solutions. Environmental literacy, integrated in both required and elective courses, focuses on human interaction with Earth's four spheres (atmosphere, hydrosphere, biosphere, and geosphere). In the required world history course, students read primary sources, weigh evidence, and apply their own findings to the present day. The theme of environmentalism versus economic development is crucial to discussions about the Industrial Revolution and the link between health and environmental quality. Required biology, Earth and

space science, and physical education courses regularly use the natural environment for learning. Biology students conduct field analyses, Earth and space science students evaluate climate data, and physical education students engage in outdoor lessons.

Agricultural courses include fish and wildlife management, natural-resources science, alternative energies, and animal-science courses. The annual agriculture day showcase allows all students to explore a hydroponics trailer with Central Lakes College, information tables, and live animals. Science courses include environmental science and meteorology. In these courses students participate and initiate research projects that examine all aspects of environmental stability and the complexity of natural systems. Students collect data outdoors and analyze the way humans interact with their environments.

Forest's Lake's physical education offerings include two outdoor education courses. The fall- or spring-season course includes activities such as bicycling, canoeing, water safety, and orienteering. The winter season activities include Nordic skiing, Alpine skiing, snow caving, winter survival, broomball, and other outdoor recreational activities that promote physical fitness. The influence of recreational activity on the environment receives special attention in both courses.

The school's environmental club educates others on recycling practices, volunteers with local organizations, and collaborates with Youth Eco Solutions to complete projects, including the installation of an on-campus pollinator garden. Students in the environmental club partnered with Climate Generation, a Minneapolis-based nonprofit organization, to host a youth convening at the high school in the spring of 2019. For this event, students planned and facilitated a public community-wide event that focused on climate change science and provided local stories and solutions. The club also planted 128 native pollinator plants on campus; hosted an environmental film screening; collected over 600 pounds of old holiday lights during three seasons; planted more than 200 seeds in repurposed milk cartons to give away on Earth Day; and removed invasive buckthorn in nearby parks. Invited speakers have included a solar-panel technician; a volunteer from the local watershed district; a city government representative; an arborist; a forestry fire technician and a forester; a professor of fish, wildlife, and conservation biology; a horticulturist; a landscaper; a conservation officer; and various environmental nonprofit speakers.

## *Missouri*

### Claymont Elementary School, Ballwin, Missouri

*Test drilling for geothermal*

Claymont Elementary School has reduced its energy use by 6.8 percent kBtu per student per year since 2015. The school has reduced its non-transportation greenhouse gas emissions by 5.7 percent of metric tons of carbon dioxide per student per year since 2015. Energy savings come from conservation, including interior and exterior LED lighting, dimmable exterior lighting, a centralized PC power management system for desktop computers, and HVAC systems controlled by a centralized building automation system that allows for setback schedules and advanced sequence of operations. Claymont underwent a retro-commissioning service and implementation for the HVAC systems, resulting in energy savings. The school has a 25-kilowatt solar photovoltaic array on the roof. There is an online monitoring platform that actively displays the energy production levels throughout each day, providing an educational opportunity for students, staff, and community members.

A comprehensive single-stream recycling program has been in place for several years. Prior to that time, a source-separated recycling program had been in place since 1992. Commercial composting services are provided daily for the school's food scraps, compostable lunch trays, compostable cutlery, and more. The school has eliminated the use of plastic straws unless needed by a student who requires them for accessibility purposes. The school has a water-bottle filling station to encourage the use of reusable water bottles instead of single-use plastic ones.

Students worked with the Parkway School District director of sustainability and purchasing to conduct an audit of waste materials from a given day at Claymont Elementary School. Students weighed trash, recyclables, and compost and re-sorted them to determine the percentage of improperly sorted materials. This data was then compiled and shared with the student body and staff as a way to improve waste management behaviors within the building. In addition to student-led initiatives, Claymont has adopted many district-led programs that include LED lighting, solar panels, and single-stream recycling/commercial composting.

Water faucet aerators were installed on all restroom faucets, limiting water flow to half a gallon per minute. No outdoor irrigation is provided to the school grounds. Since 2015, water use has been reduced. Removal of invasive wintercreeper and honeysuckle is ongoing. A butterfly garden hosts plants native to Missouri, including common milkweed, swamp milkweed, elderberry, and flowering plants that support pollinators.

The Claymont school bus fleet has completely phased out all older diesel engines with higher emissions (model year 2007 and prior) and participates in the EPA's Clean School Bus program. In addition, 57 percent of the buses used at Claymont are fueled with compressed natural gas.

District programs ensure that building materials meet volatile organic compound (VOC) standards, while lead and asbestos management plans and an IAQ task force ensure that Claymont is a healthy place to learn and work. Physical and mental wellness programs for both students and staff help to ensure needs are being met with support. The green team has begun work on an indoor tower garden to bring fresh produce choices to the daily lunchroom salad bar. Claymont offers the staff a variety of wellness activities, as well as Pilates and yoga classes. Additionally, staff benefit from a book club, flu shots, and healthy luncheons.

Claymont partners with Comtrea to provide school-based oral health services to students, including screenings, cleanings, sealants, digital x-rays, diagnostic exams, and remediation services. Students can receive vision services through a partnership with the Kids Vision for Life van. Girls on the Run encourages physical fitness and life skills for girls.

Students have opportunities in kindergarten through fifth grade to read, write, and collaborate with others on environmental and sustainability topics. In upper grades, students develop written and oral arguments around various environmental topics, such as recycling, straw usage, composting, water consumption, and protection of the school's ecosystem. Teachers at Claymont provide all students, at every grade level, with opportunities for meaningful outdoor learning experiences tied to standards and content curriculum. Highlights of these experiences include the third grade Nature Unleashed program in collaboration with the Missouri Department of Conservation, kindergarten through fifth grade biodiversity walks, and a census of campus wildlife. Student groups regularly interact with community leaders and experts, who provide new perspectives and industry insight into real-world problems.

The students in grades three through five on the green team met with Trane engineers, geologists, and district personnel to understand a local energy problem and learn about sustainable solutions for the future, which included test drilling for geothermal energy.

Ecology club members and other students also have spent weekends in the spring and fall, and summer during the past two years, redoing a nature trail that originally was built by the class of 1978 behind the district's middle school. Students help with maintaining the wildflower garden on school property during the fall and spring. Students collect persimmons and wild grapes from the trees on the school grounds, and they make jam, cookies, natural dyes, and homemade paper for holiday cards to give to staff.

## Highcroft Ridge Elementary School, Chesterfield, Missouri

*Young conservationists set an example with recycling and waste reduction*

Highcroft Ridge has reduced its energy use by 17 percent per student since 2015 and its non-transportation greenhouse gas emissions by 18 percent per student since 2015. Funding mechanisms to support energy-efficiency upgrades have included utility incentive rebates and a Missouri Department of Economic Development Energy Efficiency loan. The school benchmarks performance with ENERGY STAR Portfolio Manager and the use of the Energy CAP software package; it has been awarded the ENERGY STAR award for several years, performing among the top 25 percent of comparable buildings for efficiency. Highcroft Ridge Elementary has a 25-kilowatt solar photovoltaic array on the roof of the main school building, with an online monitoring platform that offers an educational opportunity for students, staff, and community members. The array produces 5.2 percent of the school's energy needs.

Water faucet aerators were installed on all restroom faucets. Dual flush valves have been installed on all restroom toilet fixtures. Highcroft Ridge has a raised garden that was built by a former student for his Eagle Scout project. Students in second grade plant vegetables, flowers, and herbs for their science lessons. They are irrigated with the water collected in a rain barrel that was designed and installed by Girl Scouts. Classes use the wooded area in the back of the school for nature walks that are integrated with curriculum.

Highcroft Ridge uses a comprehensive single-stream recycling program, which has been in place for several years. Prior to its introduction, a source-separated recycling program had been in place since 1992. All the school's food waste is

composted daily, along with its compostable lunch trays and cutlery. There is a water-bottle filling station to encourage the use of reusable bottles, and plastic straws were eliminated except for accessibility purposes. All school surplus either is recirculated within the district, or is auctioned online, so that the equipment, materials, or products can get a second life. All paper towels and toilet tissue are Green Seal-certified and made with 100 percent recycled content.

Every year, physical education teachers coordinate a Walk to School Day. More than 85 percent of students use buses to get to school. The district has completely phased out all older diesel engines that had higher emissions (model year 2007 and prior) and participates in the EPA's Clean School Bus program. In addition, 50 percent of the buses used at Highcroft are fueled with compressed natural gas.

Excluding floor finishers and sealers, 96 percent of cleaning products used are third-party-certified. All paint purchased for the school is zero VOC-containing. Office furniture purchased is certified by the Business and Institutional Furniture Manufacturers Association's nonprofit association. The school has implemented a lead-in-drinking-water program using EPA's 3Ts (Training, Testing, Taking Action) for Reducing Lead in Drinking Water in Schools Program. In 2018, the school doubled recess time for all grade levels. The staff has participated in many wellness programs, including classes in yoga, Zumba, and barre. Highcroft Ridge partners with several organizations to provide school-based oral health and vision services.

During the 2017–18 school year, students voted to have the environment as their theme for the year. Highcroft Ridge hosted a speaker from the Missouri Botanical Gardens who helped students learn more about sustainability projects that would benefit the school and community. In groups, students brainstormed ideas for projects and then held an environmental day in spring 2017. Students completed various projects such as building birdhouses, planting trees, picking up trash, tracking the use of reusable snack containers, cleaning flower beds, creating an upcycled water-bottle chandelier, creating soda-bottle terrariums, and creating light

switch plates to remind everyone to turn off the lights. A new club, EcoBuds, grew out of this event.

During the first year of the program, the school's EcoBuds participants educated school community members about "reduce, reuse, recycle," which included a student-led effort to reduce the number of paper towels used by the school. Students researched hand-drying techniques and educated students and staff about better ways to dry hands to reduce paper towel usage in the restrooms. Highcroft replaced the towel dispensers with high-efficiency hand dryers in the summer of 2018. Students planted trees on school grounds in coordination with the city of Chesterfield. The club was involved in educating the Highcroft community about environmental issues during a STEM Night event. In its second year, EcoBuds is focusing on understanding, calculating, and reducing the school's carbon footprint. Club members have started a marker-recycling program through Crayola's Colorcycle initiative, where old markers are turned into clean energy. Other efforts improve waste sorting, encourage alternative transportation, and help students take these changes to their homes.

Second-grade students take field trips to Rockwoods Reservation and the Butterfly House to increase student engagement in STEM. Kindergarten and fourth-grade students take trips to the St. Louis Zoo to further engage students in the outdoors with animals while learning about their ecosystems.

## Herculaneum High School, Herculaneum, Missouri

*A clothing closet gives new life to outgrown articles and helps families*

To reduce energy use and greenhouse gas emissions, Herculaneum High School installed solar panels that reduced emissions by a total of 1,700 to 2,000 pounds of carbon dioxide each month. A new high-efficiency HVAC unit was installed in the gym; instead of running constantly, it only turns on when certain conditions are met, saving considerable energy. To conserve water, the school now has low-flow, auto-flush toilets. The Ecology Club wrote a grant to fund the creation of a 325 square-foot space to plant wildflowers and plants attractive to butterflies. The club also has worked with community volunteers to restore a trail originally established in the 1970s and to remove invasive plants on school grounds. To conserve material resources, the school installed a water-bottle filling station and provides an option for students to purchase refillable bottles at school. To reduce paper use, all students have a computer so they can complete and turn in assignments online.

In 2018, each classroom installed radon detectors. The school's maintenance department implements regular checks for mold as part of IAQ checks. The contractor uses natural and least-toxic materials for pest management whenever possible and sprays only in the summer when students are not present.


Herculaneum has a high poverty rate. In ninth through 12th grade home economics classes, students learn how to purchase healthy foods on a budget and create healthy weekly menus. They also learn how to remake leftovers. The school recently received a grant to have a dentist and psychologist in the district, whom students and their families can visit any time during school hours. Families are encouraged both to donate and take any clothing items from the school's sharing closet. Herculaneum has an exchange program for household goods, where families are encouraged to volunteer or use to get items they need. Free breakfast is offered to all students. For staff, there are 3,000-steps-a-day and weight-loss challenges.

Herculaneum offers a new research-based course, an outdoor learning space, and a community fair. The research course includes and expands upon the protocols from MO Dirt – Missourians Doing Impact Research Together, a statewide curriculum on soil health. The ecology department has created and maintains a butterfly garden to educate about nature and provide a peaceful study area. In March 2019, several departments came together along with members of the community and organizations to hold the second annual Green Fair at the school. More than 50 percent of the students at the school will be involved in composting efforts, recycling, repurposing projects, a recycled art fair, grant writing for green projects, environmental poetry writing, environmental statistics presentations about the school, and environmental student videos. The fair is open to the community and focuses on sustainability practices and environmental education.

## Raintree School, St. Louis, Missouri

*Nurturing inner scientists in wild landscapes*

Raintree School is a private Reggio Emilia-inspired forest school serving children ages 2 through 8. The school was founded on the belief that civically minded outdoor experiential education is a vehicle for community change and personal transformation. Raintree aims to guide students in developing civic character, a sense of place, and depth of knowledge through inquiry-based thinking and student-driven projects within the context of wild nature.

For Raintree School, the native landscapes that surround the school serve as the foundation for every child's experience, the curriculum, and the approach used in every classroom. On the nearly 11-acre wooded campus, creating and protecting the habitats of insects, birds, and other wildlife has been a priority. Raintree works to remove invasive species from the woodland while adding pollinator gardens and tall grasses in all landscaped zones and student-use spaces to develop school grounds as a haven for wildlife. The diverse landscape, created in collaboration with DJM Ecological Services, maximizes the campus' ecological benefit and adds value to the educational program as well as the community.

Raintree's focus is its grounds; however, the school also has made significant progress on the sustainability of its buildings. Raintree installed a 51-kilowatt solar array with 170 solar panels, which cover 75 percent of its rooftop and are projected to provide 80 percent of the school's electricity. Motion-activated lightning is installed throughout the building. The 2017 campus addition has 100 percent LED lighting. Ultra-efficient water heaters with exhaust recovery features serve the campus.

The establishment of native plant communities instead of lawns has allowed a 55 percent reduction in irrigation water use. All impervious surfaces, including paved surfaces and roof, drain to an engineered water retention basin with a native rain garden. This filters all stormwater runoff using native plantings and engineered soil. Two other highly effective green features on campus are (1) a one-acre-plus prairie for overflow parking in lieu of impervious parking surface and (2) plantings on every slope.

Raintree's greatest waste-reduction efforts come from composting 53 percent of food waste for use in the gardens. All paper, plastic, and glass are recycled or reused on campus. More than 50 percent of school supplies are made from repurposed material from recycled goods warehouses. Kitchen policies have

stopped the use of plastics and no disposables and ardently support reusing leftovers. One-third of the paper on campus was once-used and is supplied by area businesses and schools. The content of all purchased paper is100 percent post-consumer recycled. Raintree's recordkeeping and administrative operations are paperless. In February 2014, the campus ended use of paper towels in bathrooms, replaced by electric hand dryers powered by solar panels.

Raintree has two electric car chargers on site that are free and accessible to the public. Five percent of parking stalls are reserved for electric vehicles only. An online carpool database on the school website's parent portal provides parent driving schedules and addresses to aid in coordinating carpools.

The campus is a pesticide-free property. Only green-certified cleaning products are used. Raintree School does not use laboratory chemicals or solvents. All furniture is wooden; there is no plastic equipment indoors or out; and rugs are natural fiber. All paint and wood finishes in building are zero- or low-VOC. Radon is tested bi-annually.

At the center of the campus, the kitchen and dining room at Raintree School reflect a model school food program. School produce is purchased from local farms during in-season growing times, and it is frozen for use in winter and early spring to reduce or eliminate reliance on purchasing food out of season. School breakfast, lunch, and snack menus are based on farm availability. Dairy, bread, tofu, honey, pasta, eggs, and poultry are purchased from local suppliers who use only local products. Ninety percent of all food on campus is locally sourced. All students are required to eat food prepared in the school kitchen. Students are not permitted to pack a lunch, which reduces disposable bags and packaging and ensures that all food on campus is in line with the standards. Raintree aims to serve "adult" food and avoids cookies and treats. The school also prohibits juice on campus and reduces liquid milk with meals. Two full-time chefs are dedicated to preparing nutritionally balanced, locally sourced meals on campus. Both chefs hold degrees in dietetics and nutrition and oversee all aspects of Raintree School's food culture. They facilitate regular cooking and wellness classes for parents.

The entire school curriculum has been built to incorporate Raintree's forest landscape. Every semester, every student on campus is engaged in action projects that focus on the woodland or the neighborhood surrounding the forest. Raintree students' learning is guided by the needs of nature and the community, reflected in campaigns to protect waterways for toad populations and a public service announcement touting the effectiveness of a new, nonlethal technology to reduce deer-car collisions in town.

Though it has eliminated physical education class, students have a minimum of 18 hours a week of supervised, sustained gross-motor activity. As a forest school, Raintree has made play in wild outdoor spaces a regular, consistent part of the school week, year-round, rain or shine. Student outdoor gear policies ensure all students readily participate whatever the weather conditions. Students are required to have a wide-brimmed hat and sunblock on campus year-round, and sunglasses are encouraged. During the four non-forest school days each week, the school day begins and ends with a one-hour recess. A lunchtime recess of 45 minutes also is part of every school day.

A faculty and parent exercise group meets three times a week, and forest school sessions with students are a time of sustained exercise. The faculty meal program provides complimentary meals on campus and leftovers to take home for healthy dinners. Events that engage the school community include the Father's Day Hike, Mother's Day Hike, Grandparent's Planting Day, family lunch dates, forest school mornings in local parks, and school participation in locally organized mud runs.

All inquiry, art, science, math, and literacy instruction takes place outside in local habitats. Surrounded by homes, the woodland is the impetus for provocations of human environmental impact, which are documented and presented as part of formal project outcomes. All summer camps also are focused on the forest school pillars. Nursery school students study the evolution from seed to plant, exploring what food needs to grow in a garden and counting seeds. Preschool students use tracks, scat, feathers, field guides, and clues to determine the animal population in the woodland. After setting up motion-activated video cameras, preschool students write short nonfiction narratives on the activities of turkey vultures on campus. Kindergarten students use modern and art-based mapping techniques to create a usable map.

The first forest school established in Missouri, and consultant to new forest schools in the region, Raintree is a model in child-initiated, long-term community project work. To share lessons learned and keep the momentum going throughout the region, every member of the Raintree School faculty connects with other efforts in the region in a variety of ways, providing a pop-up outdoor school in local parks called Wildkin, and participating in the Gateway Children's Nature Connection,

Missouri Environmental Literacy Advisory Board, and the Development Committee of Experiential Education Exchange. Raintree also founded the Forest School Congress of the Midwest, Vaskebjorn. Finally, Raintree produced a documentary, Forest Hymn for Little Girls, a film that challenges adults to make space for little girls to take risks, roll in the mud, hunt mysteries, and nurture their inner scientist outdoors in wild landscapes.

## *New Jersey*

### Holland Brook School, Whitehouse Station, New Jersey

*Everybody buses to the Brook*

While strong leadership is critical for sustainability progress, ongoing success requires the buy-in of staff and students. Holland Brook School (HBS) students actively promote sustainable behaviors throughout the school community. Working with the Schools for Energy Efficiency program, student leaders assess classrooms on walk-throughs to see whether students and staff are following energy conservation behaviors by turning off lights and electronic devices and closing blinds for temperature regulation. These efforts have paid off, with the school reducing energy use by over 30 percent in four years. HBS purchases 21 percent renewable energy and generates 64 percent on-site with solar. A large monitor has been installed in the main hallway, relaying information about electricity generated by the array. Providing daily feedback about the energy being generated keeps the topic of solar panels and alternative energy in the forefront of students' minds.

Providing feedback to the staff goes a long way toward modifying teacher behavior and empowering students. Students in the environmental club raise awareness about the importance of recycling; they provide information how, what, and where to recycle; create bird feeders and organize recycled materials; and initiate voluntary recycling programs for hard-to-recycle items with TerraCycle and Crayola Colorcycle. In the cafeteria, the use of reusable trays and composting of food waste greatly reduces solid waste. Fifth-grade students lead composting efforts during their living systems unit of study in science. One hundred percent of paper is Forest Stewardship Council-certified. Upcycling and sustainability are infused into Innovation and Design and Discover Lab classes, in which students create race cars from 100 percent recycled materials and take apart old electronics to learn how they work before upcycling components into new items.

News Crew, the student-run news show, incorporates sustainability features in its monthly news shows. Students have embraced the HBS Chromebook 1:1 initiative and use Google suites to receive, complete, and submit assignments electronically, which, along with switching to electronic newsletters and report cards, has

dramatically reduced paper use. HBS uses 80 percent environmentally preferable cleaning products. Due to the school's rural location and 48-square-mile service area, most students take a bus to school, and under 10 percent are driven by parents or in carpools. Bus routes changed from a three-tier to two-tier system, resulting in improved efficiency, reduced fuel usage, and reduced emissions, and reduced wear and tear on vehicles.

Student and staff health, safety, nutrition, and fitness are enhanced through multiple partnerships, such as Healthy Schools, Healthy People for handwashing and hygiene; the Weller Health Education Center for sex education; Hunterdon Medical Centre for the Sunwise program; the New Jersey State Bar Foundation for professional development workshops related to harassment, intimidation, and bullying; MyFriendRyan to promote understanding of autism; and physical fitness through partnerships with Girls on the Run, Let me Run, Firefly Tennis and First Tee Golf. The HBS turkey trot two-mile fun run and full-day inflatables field day are a beloved part of HBS' fit and fun traditions.

Food-centric birthday and holiday celebrations have been eliminated, and children are encouraged to stay hydrated by refilling their reusable water bottles at water-bottle filling stations. Student recess time has been doubled, and all teachers incorporate brain breaks, with activities such as GoNoodle, into classroom learning, a bonus to both physical and mental health. The social-emotional learning initiative, HBS Bobcats ROCK (respectful, outstanding, caring kids) provides students with a yearlong program focused on self-awareness, self-management, responsible decision-making, relationship skills, and social awareness. The HBS cafeteria celebrates farm-to-school week and offers local produce choices year-round.

Student learning is not restricted to the classroom. Eighty percent of the HBS grounds are green spaces that include grassland; areas of forest, native, or regionally appropriate trees and landscaping; a solar field; an outdoor running track

through the forest; a naturally seeded retention basin; a preserved meadow; and an outdoor classroom. The HBS outdoor classroom and rural location lends itself to nature walks, which provide brain breaks and can be connected to classroom lessons. The fourth grade, in partnership with Raritan Headwaters, visits the river to learn about the interconnectedness of ecosystems by analyzing the surrounding environment, water quality, and biodiversity of wildlife present in the water. This involvement led to HBS becoming a river-friendly certified school. Open air learning is an option with an outdoor classroom, allowing teachers to move regular lessons outdoors. Students collect leaves for classification, observe the sun, and find Fibonacci sequences and spirals in nature.

Lessons about the environment and the importance of sustainability initiatives are infused throughout the curriculum. Students interconnect ecosystems, global warming, and plants; in science classes; they learn to read and draw graphs using climate change data in math; they discuss the problems caused by deforestation in music class. They learn about engineering houses with modifications to withstand natural disasters, and they plan a green redesign of the Township of Readington (in which the school is located) to reduce environmental impact and reliance on cars. Science units involving weather are enhanced by using data from the HBS weather station, which is posted on the school website daily, along with local air quality data.

Students also learn through assemblies focused on sustainability, which have included a presentation by solar provider Ameresco. Environmental and sustainability literature is required reading and is infused into many subject areas. For example, nonfiction reading units in language arts may be included in science or social studies instruction.

At a higher level, Readington Township wholeheartedly embraces sustainability, from the board of education and superintendent to the youngest students. The district's strategic plan includes reducing energy use, developing environmentally responsible facilities, enhancing sustainability education, adding sustainability electives, recycling and composting at every school, and having all schools earn Sustainable Jersey certification. The district not only has achieved those goals but has exceeded them, and these accomplishments have been featured in a local news report. In support of the Readington Township Schools' green initiatives, the board of education hired an energy efficiency coordinator who has increased energy consumption awareness, tracked energy consumption, and reduced usage dramatically. She provides sustainability lessons to students, professional development to teachers, and advice to principals, and discusses with the larger community how to incorporate energy savings into daily lives.

## Saint Leo the Great School, Lincroft, New Jersey

*Phasing in sustainability through faith-based learning*

Saint Leo the Great School (SLGS) is a nonpublic, Catholic school with the mission of developing youth entrusted to its care through spiritual, educational, social, and athletic activities. Its daily mission reinforces Pope Francis' teaching of personal responsibility for local and global environmental stewardship. Between 1960 and today, SLGS has grown from a school with 201 students in grades one through grade four to a school with 600 students in preschool through grade eight. The administrators, faculty, and staff guide the student body to a deeper knowledge and faith practice. The parish green team is under the leadership of the pastor, business administrator, and principal, as well as the leadership of the Diocese of Trenton. It has been implementing sustainable initiatives over the past five years with the aim of raising awareness of them and reducing the school's environmental footprint.

In 2017, the school established the position of director of operations, who, in collaboration with the New Jersey Building and Grounds Association, has brought expertise to SLGS' Clean School Initiative. SLGS focuses on grounds improvement, building management, and expanding the school's environmental practices, programs, policies, and curriculum. With the ENERGY STAR Portfolio Manager as its tracking mechanism, the school is using a holistic approach to view the interrelationships among policies, curriculum, utility usage, and facility management operations.

Significant campus projects are underway that already have produced cost savings and other efficiencies. A phased program is in progress to replace rooftop HVAC equipment with high-efficiency ENERGY STAR-rated units. A phased program to replace lighting with LED lights is underway. In addition, the school installed high-efficiency fans in classrooms and has begun a phased program to replace windows and insulation. Lastly, SLGS has installed a half-acre solar field, which produces 85 percent of the school's fossil fuel power needs. SLGS has started to reduce the amount of energy used and its costs from many of the measures described above.

The school uses water judiciously and continues to make efforts to reduce consumption further. The school grounds are home to over 22 native species of wild flowers, shrubs, trees, and grasses. The school uses plantings for erosion protection and slope retention as well as for natural/grass high-traffic parking area preservation. Also, a rooftop drainage system feeds into the courtyard for subsurface watering. In 2016, SLGS installed a well that irrigates the entire 17-acre campus. Underground irrigation in garden beds reduces water use. The SLGS athletic fields were rebuilt to be graded to drain off of a planted berm that feeds down into an outdoor picnic, chapel, and forested area, reducing irrigation demand.

Saint Leo the Great has installed water-bottle filling stations and has side-by-side trash and recycling bins around campus. The school has begun a pilot curriculum-based composting project, managed by students, in the cafeteria. One hundred percent of purchased paper is Forest Stewardship Council-certified, and all cleaning products are green-certified. SLGS switched to reusable cafeteria trays over a decade ago. Grass clippings and leaves are mulched in the cutting process. The school uses a printer vendor that reduces cartridge costs by approximately 12 percent, and it keeps cartridges out of the trash cycle.

Because students come from 28 different communities, 82 percent of them ride the bus. The bus routes are shared, however, with between five and 11 other schools in the area to consolidate routes. This makes for greater efficiency and lowers fuel use for all the schools and bus companies. Pest management and landscaping companies use natural solutions whenever possible, including cedar oil, citric acid, citronella, linseed oil, sodium chloride, white pepper, neem oil, boric acid, and diatomaceous earth.

In 2014, the school's nature courtyard, located in the center of the school building, was designated by the National Wildlife Federation as a Certified Wildlife Habitat®, serving as a living classroom for students. Many varieties of birds, insects, and other small animals visit the courtyard, which also serves as a meditation garden used for individual solitude and prayer.

The SLGS athletic facilities are home to an interscholastic sports program that involves over 60 percent of students. In every grade, the school integrates The Positivity Project, a national program model designed toward building character strengths on values found in the Scriptures. The Positivity Project establishes benchmarks and guidelines for character building. With the Gospel as its foundation, SLGS teaches total well-being in mind (meditation and coping techniques), body (physical fitness and nutritional wellness), and soul (spirituality

and Catholic faith). The preschool and kindergarten program is connected with The Positivity Project and combines the character-building traits with physical exercise, good health, wellness, nutrition, and yoga; as well as providing simulations for skiing, ice skating, group dance, and stretching to open hearts and minds.

Preschoolers grow butterfly habitats and release the butterflies into the courtyard wildlife sanctuary, while older students study New Jersey's native species and the role they play in the environment. Younger students build miniature wind fields and study the parts and lifecycle of seeds by planting pumpkins and watermelons, celebrating with fall and spring harvests. Third and fourth grades plant evergreen seedlings on Earth Day and transplant them around campus each fall.

Older students simulate oil spills and cleanups, studying the domino effect on affected life forms, and they research waste reduction and its effect on the planet. Students also construct functioning robots and design playground equipment and dams from recycled and upcycled materials. A STEAM lab has been outfitted with S+B USA's SpaceStation Science Lab to promote collaborative group learning with seating.

The school is particularly proud of the religious education program is provides, which extends SLGS' faith-based Catholic history through environmental learning experiences. The school reinforces Pope Francis's teaching of personal responsibility for local and global environmental stewardship. For example, SLGS led students through an African village environmental stewardship lesson, which included a water-scarcity relay race. The lesson demonstrates the issues of global clean water scarcity, as well as how the social justice teachings of the Catholic Church can help change this problem. The relay teams were given an empty bucket, and each team member was given a three-ounce paper cup, with instructions to collect clean water and return it to their village and fill the bucket in 30 minutes. In another example, the school provided a "brick building" exercise, which used environmental, engineering, and scientific principles by simulating the experience of the enslaved Israelites. Using top soil, straw, water, aluminum loaf pans, and large buckets, students recreated the mixture ancient Israelites used to make bricks during their enslavement in Egypt. Approximately 100 summer students from schools throughout the area formed building teams and used the raw natural material to make the bricks. They then placed them in the courtyard to bake into a hard brick in the summer sun. The children formed their own teams, allocated their own resources, and formed their own processes for work distribution.

## *New York*

### Sanfordville Elementary School, Warwick, New York

*A school that embodies green living and learning — while educating children to do the same*

When visitors arrive at the Sanfordville Elementary School campus and peek through a grove of newly planted pine trees, one thing becomes immediately clear: This is a school that's serious about reducing environmental impact.

The school's 120-acre campus is home to a 9,000-panel solar panel array — an array powerful enough to offset most of the electrical costs not only for Sanfordville Elementary School itself, but also for the entire Warwick Valley Central School District. The array is the largest solar farm operated by a school district or public agency in the state; conservative estimates indicate that it is producing a minimum of 2.9 kilowatt-hours of power per year. It's just one of many environmental initiatives at the school, which provides educational and support services to 710 students in kindergarten through grade five.

Sanfordville students are empowered environmental leaders. More than a dozen are members of the school's Green Cub Club, which meets regularly with a green team facilitator, green team teacher leaders, and district administrators to put forth ideas for new environmental projects. Recently, club members developed a composting program for every classroom in the school, as well as for the school cafeteria. These student activists designed and created public service announcement videos focused on water conservation and recycling; the videos were shared at the school and posted on the district website. Sanfordville's Green Cub Club members also are known to take their message of reducing environmental impacts into the community. During Warwick's Earth Day Festival, they enthusiastically interacted with community members, encouraging them to opt for reusable bags rather than plastic ones.

Reusable containers for food topped the list of environmental goals during Sanfordville Elementary School's Waste-Free Lunch Day Challenge. Students were encouraged to pack reusable containers and strive for zero waste on that day. As a result, the trash generated during lunch periods decreased from 16 bags of waste down to eight. Pupils were able to see how their efforts resulted in a 50 percent reduction in waste, and the school's goal is now to host a waste-free day every month!

To further reduce environmental impact, Sanfordville Elementary School monitors every single room through a virtual private network, meaning heating, cooling, and

lighting can be adjusted remotely to save energy and maximize efficiency. The school also uses the ENERGY STAR Portfolio Manage and has a score of 97.

Additionally, Sanfordville Elementary School is an integral part of districtwide efforts to minimize environmental footprint. This includes replacing all fluorescent light bulbs with energy-conserving LED bulbs, reconfiguring routes to reduce bus runs by 30 percent, purchasing propane-powered school buses, and adopting a broad-reaching, districtwide sustainability policy. This sustainability policy carries a requirement to integrate environmental and sustainability topics into all curricular areas in all grade levels, including the school's multiage classrooms. Sanfordville Elementary School supports this requirement by working with the Children's Environmental Literacy Foundation to provide professional learning opportunities focused on weaving environmental themes into class activities.


Sanfordville teachers approach the integration of environmental lessons in many ways. Some educators develop Earth Day projects related to net zero concepts in which students can become engaged. Others arrange field trips to farms, and other sites appropriate for environmental learning. Still others integrate sustainability themes into art projects and English language arts writing assignments.

Other environmental education-related initiatives at Sanfordville Elementary School include educators' use of the Engineering is Elementary curricular units on sustainability, which include fun and engaging project-based learning activities. The solar panel array provides invaluable opportunities for students to learn firsthand about green culture and technology, as they can access solar information kiosks through the district's website. The array also enables them to study the power that it generates and track past and current power usage.

Sanfordville's green education activities extend far beyond the classroom. Students partner with Sustainable Warwick, a local organization that focuses on environmental stewardship and sustainability, to carry out projects in the community that raise awareness of environmental issues. New in the 2018–19 school year is a

project in which pupils are working with artists to create a grove of trees in a local park using “plarn” (plastic bag yarn) and 3D printed materials; the activity was part of a communitywide Arbor Day celebration and the start of new environmental learning opportunities in the community.

An array of health and wellness programs complement Sanfordville’s commitment to improving the environment. The school uses produce and fresh foods from local farms, thanks to a cooperative purchasing agreement with other schools in the region. Under this agreement, local farmers are given preference when produce is purchased. Sanfordville Elementary School students, staff, and volunteers also maintain an organic garden, where food is grown that can be used in the school cafeteria. Inside, the school stocks only healthy snacks in vending machines, and classroom celebrations no longer include sugar- and fat-laden foods such as cupcakes and candy. Sanfordville has installed water-bottle refilling stations, so students and staff can stay hydrated while they cut down on the purchase of single-use plastic water bottles.

The school maintenance personnel are partners in the environmental stewardship, focusing on creating healthy educational settings by closely following green procurement policies for custodial and cleaning products. The school buys products through a cooperative purchasing process that ensures adherence to the strict requirements of New York’s Green Clean program.

Sanfordville Elementary School has a full-time school nurse, as well as an active wellness and child nutrition committee. Students’ social-emotional needs are supported through the services of a school counselor, as well as daily access to either a social worker or psychologist. Sanfordville educators also are integrating mindfulness-based, stress-relief activities into classes, and they often spend quiet time with children in a garden area that features a “peace wall” dedicated to those affected by the events of 9/11.

A partnership with the community-based Warwick Valley Prevention Coalition means students receive information on making healthy choices. Moreover, the school presents a regular series of anti-bullying activities, and it follows all requirements of the state’s *Dignity for All Students Act*. To improve physical health, Sanfordville educators encourage nature walks and outdoor physical education activities; the school property has beautiful woodlands and streams, along with a cross-country running area and lacrosse fields. Sanfordville Elementary School even has found a way to blend physical activity and learning with its kinesthetic learning lab, which is based on research showing a strong link between movement and academic performance. Pupils in the lab can be moving through an obstacle course, tossing bean bags, or exercising on a stair- stepper while they’re reviewing spelling words,

solving math problems, or engaging in other learning activities that are good for the body and good for the mind.

Taken together, Sanfordville Elementary School's countless daily activities devoted to reducing environmental impact, integrating ecological stewardship into education, and improving student and staff wellness are the embodiment of green living and learning.

## Warwick Valley Middle School, Warwick, New York

*A major EPA award propels environmental education to the next level*

Warwick Valley Middle School is nestled in a charming rural landscape approximately 55 miles north of New York City. The school, which has 1,075 students in grades five through eight and close to 100 staff members, is considered an environmental beacon in the local community and beyond, thanks to its commitment to ensuring a sustainable future for all.

This commitment is evidenced by the seemingly endless educational opportunities presented to students. Each eighth-grader is required to participate in 20 full weeks of sustainability education, which provides a foundation for developing environmentally and socially conscious citizens. As these students progress through middle school, they can opt to take such classes as Energy and the Environment and/or Computer Science for Innovators and Makers. A sequence of Project Lead the Way courses provides valuable additional hands-on STEM experiences for middle school students, too; these are complemented by the real-world learning about power usage and net zero energy usage that occurs when Warwick Valley Middle School students access and analyze data generated from the district's 9,000-panel solar farm.

Warwick Valley Middle School educators and students are breaking through traditional assumptions about what constitutes a learning space. In fact, classroom walls might well be considered a thing of the past, thanks to the school's newly constructed outdoor classroom. This is a place that provides the perfect setting for science experiments and observations, but also is a setting to promote creative thought, expression, contemplation, and appreciation of the planet.

Learners spend time in an outdoor courtyard area accessible from the school; this area provides space for students to plant gardens and test theories about environmental factors that affect plant growth. Students take advantage of many community-based learning experiences, as well. For example, pupils in the Green

Architecture class visit historic structures in the Warwick area to get a firsthand look at best practices for restoring buildings using sustainable construction practices. Fifth-grade students spend time at the Greenkill Outdoor Education Center each autumn, where they can take nature hikes, explore water and forest ecology, and participate in team-building activities.

Civic-minded endeavors for Warwick Valley Middle School students include cleaning up local parks, engaging in environmental projects in the community for Earth Day, and translating their classroom knowledge into social media campaigns focused on increasing sustainability and green living activities throughout Warwick. Pupils even can travel to virtual communities with one of the school's most high-tech and innovative activities. Using virtual-reality goggles, they immerse themselves in an endless array of biomes and environments — without ever leaving the classroom.

Warwick Valley Middle School educators, like their colleagues throughout the district, are required to incorporate sustainability and environmental concepts into curricula and class activities — and do so with creativity and enthusiasm. They often receive training and guidance from the Children's Environmental Literacy Foundation and Sustainable Warwick (a local organization committed to protecting the environment and reducing carbon emissions) on integrating green concepts and themes into daily activities. With that knowledge, they might be creating interactive lessons for the school's weather station one day, helping students recycle and refurbish furniture that originally was heading for the landfill another day, and developing projects to help the New York State Department of Environmental Conservation the following day. Many Warwick Valley Middle School educators also are involved in organizing the annual STEAM Fair, which showcases student-designed projects that never fail to impress even the most advanced and educated scientists and environmentalists in the Warwick Valley community. Warwick Valley Middle School students need only look around their school setting to gain an even greater understanding of how to

address sustainability and environmental issues effectively in a larger, real-world context. With all of its successes in reducing environmental impacts and costs, the school itself is a perfect model.

For instance, the school has improved energy efficiency through enhanced monitoring of energy usage, by installing LED lighting in all indoor and outdoor areas, and by using software that automatically powers down computers when not in use. Efficiency also is evident in the way middle school students are transported to and from school, as the district continues purchasing propane-powered buses. These vehicles run cleaner than traditional diesel buses and have almost no emissions. In addition, propane is approximately half the cost of diesel, and the propane buses require less maintenance, yielding an estimated 30 percent savings in maintenance costs. Even with these advances, the middle school's student-led green team continues to provide leaders at the school and district levels with more ideas to further improve energy efficiency and sustainability.

Educators, school leaders, and students also continually seek out ways to maintain a healthy, positive, and compassionate school climate. The middle school has significantly improved its school climate by using Positive Behavioral Interventions and Supports. With this program incorporates proactive strategies for defining, teaching, and supporting appropriate student behaviors to create a positive school environment. Additionally, all physical education teachers have trained extensively in mindfulness and stress-relief strategies and incorporate them in every class. Students are improving their focus by using the newly installed virtual golf facilities.

Warwick Valley Middle School has a full-time school nurse and three school counselors, as well as two full-time psychologists and social workers, to support and guide to pupils. The school also presents a regular series of anti-bullying and character education activities and follows all requirements of the state's *Dignity for All Students Act*. To increase overall safety, a school resource officer has been hired to work exclusively in Warwick Valley Middle School, allowing him to build sustainable relationships with students, staff, and families.

Improving pupils' physical health is another vital element in the school environment. Students can participate in the modified sports program, in addition to joining a crew team. The Girls on the Run club is popular with female students. Many teachers take advantage of outdoor spaces, leading children on hikes not only to build physical stamina, but also to expand students' knowledge of their environment. Also, students in the cooking club and consumer science classes learn about creating nutritious meals. This knowledge is reinforced through meal preparation in the Warwick Valley Middle School cafeteria, which uses organic produce sourced from local farmers and student gardens. With these fresh produce options, the

school's menu often exceeds the USDA meal pattern requirements for fresh fruits and vegetables.

With such an ingrained culture of green living, environmental awareness and education, Warwick Valley Middle School has been recognized on regional, state, and national levels. The school was honored by Hudson Valley Dirt magazine as one of the top three greenest schools in the region in 2018 and among the top 10 greenest schools in 2017. Additionally, the school was recognized by the Orange County Green Stars Schools program for its comprehensive efforts to reduce waste, and by the Children's Environmental Literacy Foundation for integrating sustainability topics into the curriculum at all grade levels. Finally, Warwick Valley Central School District, including Warwick Valley Middle School, was honored by the EPA with a $91,000 grant award in 2015 for its Envirocation project. The grant has allowed the school to develop and carry out even more green activities and continue its commitment to a sustainable future.

## *North Carolina*

### Abbotts Creek Elementary School, Raleigh, North Carolina

*From Trashmore to the Tomatosphere, these students have sustainability covered*

Abbotts Creek Elementary School (ACES) opened in the fall of 2015. The school was built adjacent to a recently closed, repurposed, landfill. Every day, as ACES students arrive and depart, they see "Mount Trashmore." This unique location has given ACES the ability to connect students authentically to sustainability and environmental issues and be active stakeholders in reducing environmental impact in the school and the community.

The ACES heating and cooling system is centrally controlled and differentiates conditions for different zones. This central control allows the building to maintain a given temperature without tampering with individual classrooms and areas. It also allows heating and cooling in individual areas to be turned off when not in use, saving electricity and costs. Students are only allowed to use certain doors to exit and enter the building, reducing the effect of outside air entering the building. With some 800 students entering and exiting multiple times a day, the reduction in access points saves energy. Each classroom and office space within the 103,724 square-foot building is equipped with motion sensor lights. The school has an ENERGY STAR Portfolio Manager score of 82.

Abbotts Creek has 74 bathroom sink faucets, of which 50 are water-saving, timed-push faucets, reducing water use and creating cost savings. All ACES landscaping was designed to feature native plants and other vegetation adapted to the local

climate and annual rainfall, eliminating the need for an outdoor irrigation system. A rain barrel positioned to collect water near the Monarch Waystation allows students and families to water the milkweed and pollinator plants during extended hot weather.

The school was designed and constructed with a stormwater runoff retention pond to help settle sediments before they can enter a nearby stream. Multiple stormwater drains around campus lead to the retention pond. The pond is an approximate one-acre wetland, which collects and treats stormwater runoff from the approximately 20-acre campus. Because a wet detention basin dilutes and settles pollutants in the initial runoff from a storm, the concentration of pollutants in the runoff released downstream is reduced.

School grounds have been certified by the National Wildlife Federation as a wildlife habitat.® To be recognized, ACES demonstrated the campus had food and water availability, wildlife cover, places to raise young, and sustainable practices. The campus has old growth trees, various native berry plants, shrubbery at varying heights, and multiple blue bird nest boxes.

Abbotts Creek is innovative in its waste reduction practices. The Environmental Research and Education Foundation (EREF) partnered with ACES to perform a waste stream analysis to determine how much and what type of waste was generated in the school cafeteria. Food waste was determined to be the bulk of the waste stream. With that knowledge, and the help of EREF, ACES developed a waste reduction plan. The first phase of the plan provided additional educational opportunities to staff and students on how to reduce waste while generating additional stakeholders by forming a parent green team. Cafeteria staff created and posted additional kid-friendly signs, helping students understand what food they were able to choose and how to correctly judge portion sizes, which has reduced the amount of food waste from the cafeteria. For the second phase, the parent green team initiated a small-scale food-waste diversion and enhanced recycling program. Every week, parents, with the help of students, collect two five-gallon buckets of food waste, along with additional

cafeteria materials that can be recycled, and bring them to the nearby convenience center for processing.

Other waste reduction initiatives include participation in Crayola ColorCycle, a "These Come From Trees" educational campaign about paper waste, and a partnership with Wake County Recycling on a classroom Feed The Bin program. The school is a proud partner in DonateSport.org, a charity started and operated by an ACES family to collect donations of used sports clothing. In 2019, ACES switched to compostable trays in the cafeteria.

The school does not use hazardous materials within the building. Ecolab is a Green Seal-certified product used for approximately 80–90 percent of cleaning, and ACES bathroom paper product supplier EcoLogo is certified for reduced environmental impact.

Approximately 71 percent of the ACES student population walks, bikes, takes the bus, or carpools to and from school daily. ACES participates annually in a Walk to School day and encourages healthy habits and the reduction of fossil fuel use. Through ACES innovative technology-based carpool loading, at least eight students are loaded simultaneously. Students are queued up prior to their car entering the loading zone through an online system. This significantly shortens carpool time and reduces car idling.

Abbotts Creek has a full-time custodian during the day and a night cleaning crew. A schedule is followed for dusting, mopping, vacuuming, and cleaning surfaces, which reduces allergens that could affect the health of students. The custodian also performs daily checks for any potential environmental or health hazards within and around the building. The Wake County Public School System (WCPSS) has multiple staff in all areas of the facilities to ensure that professionals address and remediate any environmental or health issues promptly. WCPSS believes in integrated pest management, which has significantly reduced the use of pesticides around campus. The district has implemented strict rules and regulations regarding the use of pesticides, which has reduced the potential for student exposure.

The ACES physical education teacher created a run club that meets twice a week before school. Students can participate in the districtwide First in Fitness Program, which allows them to compete with other schools in various events. The physical education teacher organizes meetups for students and parents to represent ACES at local five-kilometer races. Monthly Health Challenge calendars are sent home to encourage daily physical activity and promote healthy nutrition habits. Students can bring the signed calendar back at the end of the month to receive recognition for completion. Primary classroom teachers have initiated a Girls on the Run club to promote health and wellness for female students. ACES' annual Walk to School day

promotes physical activity while encouraging a reduction in carpool numbers. ACES media specialists initiated the tower garden within the library, a hydroponic growing system that is incorporated within the curriculum to promote healthy eating. The ACES music teacher initiated a staff health program with accountability, support, group activities, and weekly challenges to encourage members to get healthy while losing weight.

Counseling services at ACES include individual counseling, group counseling, classroom guidance lessons, and crisis assessments. Guidance is a special class that every kindergarten through fifth-grade student takes at least once per month. The curriculum follows the developmental competencies outlined by the American School Counseling Association. Topics include study skills, being a good friend, ending bullying, setting goals, test tips, and social-emotional learning (which includes lessons on coping skills). Individual counseling services are available for students who have both momentary issues and long-term needs. Students can self-refer or refer a friend for services. ACES uses a Positive Behavioral Intervention and Supports system.

Backpack Buddies currently supports 36 low-income students by providing them with 10–12 pounds of nutritious food to take home for the weekend. The Green Chair Project provides beds to students who are in need and helps furnish homes for families that are moving out of homelessness into permanent housing. The Raleigh Police Department provides monthly seminars on safety and wellness for all fifth-grade students. The Kerr Family YMCA provides onsite before- and after-school care promoting health and wellness activities. Scholarships are available for students who demonstrate need.

The science special curriculum for kindergarten through fifth grade has been developed with an environmental literacy and green STEM focus. The science specialist leading the charge is a former environmental engineer. Each of the 866 students keeps a science notebook. Students in kindergarten through fifth grade collect data through various citizen science projects such as CoCoRaHS rain gauge; NestWatch on four bluebird boxes; MonarchWatch, tagging wild butterflies; Tomatosphere, growing and collecting data on seeds that have been on the international space station; Shad in the Classroom to learn water quality analysis; Purple Air Quality Monitoring; and tri-motion sensor cameras to document wildlife found on school grounds.

Environmental STEM professionals visit or video chat with students, deepening their understanding of the environment and related professions. Unique partnerships with the North Carolina Natural Science Museum, Carolina Clean Air, and Wake County Solid Waste and Recycling have provided hands-on, authentic educational opportunities. ACES partnered with nearby state, county, and city parks to create a

Nature Passport. Students can take their passports to the parks and receive a stamp while learning and exploring nature. ACES also has developed an Explorer Backpack program. Students can take home backpacks for the weekend to encourage nature exploration with their families.

Abbotts Creek also has an Envirothon Team, through which students can dive deeper into environmental science and compete regionally. Every year, ACES organizes and runs Big Sweep Litter Cleanup within the school's watershed, and it organizes community outreach events such as a viewing of the documentary STRAWS. ACES' yearly science fair includes various green STEM professionals, such as the North Carolina State University Turtle Rescue Team, wildlife biologists, herpetologists, and solid waste engineers.

## Douglas Byrd High School, Fayetteville, N.C.

*Sun Stewards conduct green technology education in the community*

Douglas Byrd High School (DBHS) is an urban, *Title I* school that started a unique program 11 years ago called the Academy of Green Technology (AoGT). The program's mission is "to prepare students to be the innovators of the next generation as they pursue the technical and collaborative skills necessary to drive the emerging green and global economy." The first four years of the program provided a step-by-step addition of new course work as the incoming freshmen worked their way toward graduation. Since then, the program has emphasized outreach and the implementation of wider conservation principles, which the school at large has embraced and passed along to the local community.

The core of the AoGT program at Douglas Byrd High School is the green team. The green team is organized by the county's green schools program, but it is implemented and maintained at the school level and led by the AoGT director. Select teachers and staff meet monthly to plan sustainability programs, activities, and education to reduce DBHS' environmental footprint, while improving education and health offerings. In addition, a student green team runs the recycling program, conducts surprise room audits to ensure compliance with recycling and energy policies, and plans sustainability outreach projects.

The county's green schools initiative, which implemented the green team concept and the efforts of both AoGT students and DBHS students at large, have resulted in a collaboration that over the past 10 years has reduced the school's greenhouse gas emissions, water usage, energy usage, and waste. DBHS has reduced energy use by 70 percent and domestic water use by 37 percent over eight years. DBHS uses all Green Seal-certified cleaning products. Roughly 82 percent of students takes

buses to school and roughly 8–10 percent walk or bike. The school sponsors several walk and bike to school days.

Douglas Byrd has a dedicated school social worker and a unique peer-mentoring class that is active in developing and maintaining peer tutoring and mentoring across all grade levels. The social worker oversees multiple programs to assist with school climate issues. She maintains a school clothes closet for those in need. A Positive Behavioral Interventions and Supports team focuses on school pride and positive behavior. Students earn points and use them to purchase simple rewards.

The AoGT program conducts environmental education in the community through outreach programs. The Sun Stewards program features a 14-foot trailer equipped with portable solar panels, as well as a model room including lighting, outlets, and a sink (with access to a solar water heater). The trailer and students visit elementary schools, Earth Day fairs, and local events to teach about solar energy and energy conservation. Students create and teach the lessons they offer.

Supported by a recent grant, AoGT and the school's culinary-arts students have developed the Communities in Bloom initiative to teach gardening and help the local community grow its own fresh food. Students involved in the initiative provide containers, seeds, and tools, as well as programming in container gardening. They also visit local homes upon request to help start gardens. Students maintain a greenhouse to grow seedlings and raise fresh food for use in the culinary-arts department.

Another AoGT program is the Carbon Sequestration Research Project. Students have designed an experiment where they plant trees to assess carbon dioxide sequestration (and bank carbon). The project is coordinated through the district's green schools initiative and a local nonprofit organization. Students have multiple stands of deciduous trees for which they measure the carbon dioxide sequestration. They measure the comparative amounts of carbon dioxide sequestered from a

mixed tree stand, compared to a monoculture stand. The trees are part of the Cumberland County Schools Carbon Banking Project.

The DBHS ROTC program participates in green initiatives by identifying and raising air quality flags each day. Custodial staff uses green cleaning products. The cafeteria provides food scraps to make into compost for the Communities in Bloom program. The DBHS bookkeeping staff collects batteries, printer cartridges, and dry-erase markers for recycling, and AoGT periodically collects electronic waste to be recycled.

Several AoGT classes (Working Toward Sustainability, Sustainable Conservation, and Generating Clean Electrons) create educational posters, monitor drinking water, volunteer at the local Energy Summit, and participate in the World Climate Simulation. The Weather Balloon Team sends up experiments related to climate or solar curriculum.

## Immaculata Catholic School, Durham, North Carolina

*From a school courtyard in the South to outer space*

Immaculata Catholic School is an independent school and part of Immaculate Conception parish. The school was founded in 1909, and the current building was erected in 1951 as a one-story structure. A second level, fellowship hall, and additional two-story building were added in 1972 and 1994 as the school's population grew. In 2014, the parish founded a Green Faith committee and earned Green Faith status in 2016. Green Faith is an interfaith coalition for the environment that works with houses of worship, religious schools, and people of all faiths to help them become better environmental stewards. As a school that is part of a Franciscan parish, the Immaculata mission statement mirrors the teachings of St. Francis to produce students who are responsible citizens of the world. This means working to care for all of Creation — people, soil, water, plants, air, and all other living organisms.

Teachers thoughtfully select projects that are fun and memorable for students in order to ensure retention of important environmental lessons. For example, second-graders always look forward to their solar oven build project, because the "test" of their solar ovens is to cook a personal pizza and s'mores while they get extra recess on the playground. Immaculata's buddy system (matching older students with younger students) provides opportunities for younger students to learn from older students and for older students to model and represent stewardship concepts they have learned. During National Outdoor Classroom Day, many classes meet outside

to go on math scavenger hunts, write poetry, and play oversized xylophones, among other outdoor activities.

The middle-school language-arts teacher introduced the idea of using courtyard space to build garden beds in response to a class discussion about eating seasonal and local produce. The administration supported his idea and, in 2011, he started gardening and environmental clubs and electives. As students learned from him, they inspired more students to join in.

In 2019, the entire middle school is focused on increasing productivity in the Immaculata courtyard garden to provide food for the hungry in the community. Along the way, they are learning how other cultures garden; new technologies and methodologies in making use of space; connecting their results with the community; and a better understanding of hunger and malnutrition. Middle-school students are tasked with examining efficient and low-cost irrigation solutions for the plants they are researching, and they are steered toward native North Carolina plants wherever practical to reduce reliance on auxiliary watering. Immaculata recently received a grant to support this garden and outdoor-classroom effort.

While the courtyard portion of the project is geared primarily toward middle school students, elementary students participate in the Tomatosphere project, in which they grow two sets of tomato seeds. They collect data to submit to NASA, with the hope that their sets of seeds travel into space. They also aim to have successful and strong seedlings to bring to the courtyard garden in the spring.

The Environmental Club at Immaculata meets weekly and includes students from grades five through eight. Students work in the gardens on campus, upcycle various materials for whirly gigs and other fun garden displays, repair bicycles for students in need at other schools in Durham, and help with recycling and litter cleanup. They also have planted bulbs through a grant from Plants Keep Durham Beautiful. Religion classes, Girl Scouts, Boy Scouts, and Girls on the Run all have had a turn beautifying the campus.

Eighth-grade students visit labs, including that of Burt's Bees, a local company that makes various health and beauty products using only natural ingredients. Students learn about sustainable packaging, environmentally sound company practices and research, and they gain an understanding that you can be successful while using products that are good for the environment and for consumers. Elementary students have an enrichment assembly from the Duke Energy Program about how energy is produced and how we can conserve. Third-grade students hear from the Durham County Environmental Education Department about conservation in homes and neighborhoods.

Immaculata received a grant through NC Bright Ideas Foundation to install light switches with motion sensors to conserve electricity. Students learned how these switches function and affect energy consumption, analyzed the effects of these switches on Immaculata's usage one year before and after installation; and they worked with a professor at Meredith College to do a carbon footprint analysis before and after installation. An Earth Hour event in March invites families to turn off their electricity at home and come to the school to watch a National Collegiate Athletic Association tournament basketball game with minimal electricity on in the facility. Local electricity and conservation groups provide educational materials and fun activities for the event.

Signs are in elementary bathrooms reminding students to check that they have completely turned off the faucet to avoid dripping water. This practice includes the posting of picture signs in the preschool area. New water fountains were installed around the building with water-bottle filling stations. The church has a cistern, and the gray water is used for irrigation around the church and school grounds.

Immaculata designates "Trash-free Fridays" at lunch and distributes reusable lunch containers with utensils to support this effort. The school has completed a waste audit, and invited its recycling contractor to present the findings, in order to educate about and better target recycling efforts. Prior to the analysis, each classroom had just one recycling bin for all recyclable materials.

Many middle school texts are completely online, and assignments are turned in and graded online through the Microsoft Teams app. Friday newsletters are paperless, and Immaculata discourages the use of paper flyers. Primary-grade classrooms use individual whiteboards.

The school purchases only recycled paper products and uses reusable dishes, silverware, and coffee mugs. The laminating machine was recently upgraded to a more energy-efficient model. The school does not have a cafeteria and uses outside vendors for lunch, and vendors were asked to reduce the amount of waste created

through the catered lunch program. This led to significant changes in packaging. The school purchases only fair-trade coffee for urns and uses large-batch machines.

Several grades at Immaculata use public transportation or walk to field trips. Immaculata acquired two 12-passenger vans to assist with field trips and sporting events, so fewer parents need to drive their own cars. These vans also drive alumni students to the Catholic high school in Raleigh each morning.

Physical fitness is an important part of life at Immaculata at all levels. Immaculata does not cut athletes from sports teams in order to promote students' love of physical activity, athleticism, and sportsmanship.

Immaculata offers Soccer Shots for prekindergarten through first-grade students, Girls on the Run for third- through fifth-graders, a hip-hop dance club after school for second- through eighth-graders, and yoga for students in all grades. Summer camp programs include Girls for Empowerment, volleyball, basketball and cheerleading, and all other camps provide at least one hour of physical activity daily. Several teachers, especially in the first and second grade, use yoga in classrooms as a way of settling children — when they first arrive at school, during indoor recess on rainy days, or before or after large exams such as midterms, finals, or (for older students) standardized tests. Faculty participate in an after-school walking club and on a teacher and parent volleyball team.

## *Ohio*

### Graham Local Schools, St. Paris, Ohio

*An award-winning all-girl Energy Team*

Graham Local Schools is in Champaign County, Ohio. Graham is a rural district encompassing 154 square miles, or over half of the entire county. Graham has been recognized as an innovative leader nationwide as a member of the League of Innovative Schools, and by The School Superintendents Association. These honors and others have come from a student-centered culture, focusing on innovative ways to include students in leadership and having voice and choice in learning.

Graham began its green journey some 15 years ago when it implemented the first of multiple energy-savings projects. It was one of the first districts in its region to install light sensors in restrooms, and it implemented districtwide HVAC policies for energy efficiency and financial stability. Over the past 15 years, Graham also has partnered with Energy Optimizers USA and Waibel Energy Systems to put projects in place that have yielded savings of over $550,000 in energy costs, reducing total energy use by 48 percent over six years. These projects have included lamp replacements,

variable speed drives for HVAC motors and for well pumps, standardized HVAC controls across the district, and skylight installations. Graham has furthered its quest for green excellence by forming green teams lead by students across the district.

Probably the most exciting development has been students' work on a solar array to power the middle and elementary schools. This solar array will be installed in 2019, after a yearlong study with partners at Energy Optimizers and the long-term effort of Graham students, most notably the energy team at the middle school. The students worked with partners to design and develop a solar plan that will provide 75 percent of the electrical needs at both buildings through a power purchase agreement. Upon implementation, Graham will house the very first solar-powered schools in Champaign County.

Graham has been working to improve water quality, efficiency, and conservation. Students have installed low-flow fixtures in all restrooms. Water consumption at the elementary school was reduced by 35 percent with the installation of a UV light filter on the HVAC system. Graham has transitioned to all-green-certified cleaning products.

Student green teams in each building manage the district's recycling of paper and cardboard. Students go classroom to classroom weekly to collect paper, allowing each of Graham's three buildings to replace one trash dumpster with a paper recycling dumpster. With the use of routing software, Graham has been able to eliminate three bus routes.

Graham implemented a comprehensive wellness plan in 2017. Students are involved in menu planning for the food service program. Students have opportunities to lift weights; elementary and middle school have running clubs; and the district has implemented programs to increase water consumption. One of Graham's most innovative and exciting wellness initiatives for the staff has been an annual staff wellness day at which they have access to mobile mammography, a raft

of health screenings, yoga, meditation, and massage. The staff wellness day also is the kickoff to a yearly wellness challenge in collaboration with insurance provider Dayton Educational Purchasing Council.

With 12 acres of woods, as well as outdoor learning areas at the middle and elementary school campus, classes in many subjects can often be held outside. Students have designed and maintained the trail system; and they installed bird houses, planted food plots, and developed ecosystems to foster native habitats. With Falcon Farms, Graham students grow produce for the cafeterias, and they oversee the production of honey in beehives while learning important sustainability lessons. At the high school, there are over 30 acres of woods with activity areas, a pond for learning, and native prairie grasses for study.

One source of pride has been the formation of the Graham Middle School Energy Team. The team, made up of sixth-, seventh-, and eighth-grade girls, was created to address the overwhelming vocational need for women in STEM careers. The team has received grants from the Ohio Energy Project, which also was the site of a weeklong conference that team members attended. Additionally, the team has won multiple awards for leadership and for its green energy projects and practices across the state and region. Projects have included building an energy bike to be used for education, and leveraging the skills taught in the club to develop lessons for peers and elementary students. The Energy Team visits the local elementary school to teach students in kindergarten through fifth grade about energy conservation, green practices, and STEM careers. The team also plans and leads an annual energy education fair for peers and the community to demonstrate and educate about green practices. In addition, the team participated in the Dayton Area “Bring Your Green” challenge. Graham Middle School won this competition for 2017, collecting more points than any other school or business in the region and beating over 600 other facilities. The Energy Team won a prize of $3,000, which they are investing in more sustainability projects.

With the implementation of the Project Lead the Way curriculum at the middle school, Graham has been able to develop unique opportunities for students, such as an active Junior Beekeepers club, which manages and cares for a hive as part of its curriculum; in addition, the school has developed a working poultry learning space for students to learn about the care and support of poultry for sustainability. The district also won a $50,000 award from Battelle for Kids to install a greenhouse on the middle school and elementary property that will be used for education and green farming operations; and a $40,000 award from Monsanto to develop and implement a campus of Falcon Farms, which will be a student-led and student-driven farming operation.

## *Pennsylvania*

### Eden Hall Upper Elementary School, Gibsonia, Pennsylvania

*Outdoor classrooms and indoor biomes*

Students at Eden Hall Upper Elementary School (EHUES) in the Pine-Richland School District have an environment rich in learning opportunities, and they regularly participate in activities that are focused on engaging in a healthy and sustainable environment. At EHUES, murals and an interior color scheme throughout the school's 189,000 square feet represent the Earth's biomes — desert, grasslands, aquatic, tundra, and the forest. The school's 30-plus acres are part of the learning experience, as well. Outside classrooms are landscaped with trees that are native to Pennsylvania, as well as wildflowers and tall grasses, all of which attract wildlife. Outdoor classrooms also include an amphitheater, retention pond, and walking trails. Despite its size, the school provides an intimate learning environment for students in grades four, five, and six.

Eden Hall's science program has a strong emphasis on the environment in grades four through six. The natural setting of the school lends itself to highlighting the importance of the environment. Visitors might be surprised to see a little of the outdoors brought inside EHUES. The building contains six trees, representing creativity, achievement, knowledge, respect, responsibility, and health and wellness. In addition, the school contains two water features. A single stream of reused water falls from the second floor under each stairwell.

Sustainable features include natural lighting through skylights; plants and trees native to Pennsylvania on the school grounds; no-mow native grasses on the grounds; heat-reclaiming devices for efficiency; room sensors to monitor and control carbon dioxide, lighting, and heat; wood paneling to keep noise down; and a maker roof to reflect heat. Together, these features allow for excellent learning programs that provide students at EHUES with the knowledge and experiences to have healthy bodies, healthy minds, and a healthy environment as they learn and grow.

Eden Hall participated in a districtwide initiative to track consumption on all utilities, in order to visualize where conservation efforts could be made and to identify areas to become more energy efficient. The school demonstrated significant reductions from 2016 to 2017, resulting in a rebate. EHUES also participates in a voluntary energy-curtailment program to power down over the summer to conserve energy. The school also has contracted with a company to monitor and increase water conservation.

Water is tested periodically for lead exposure, and all toilets are low flow. Aerators and faucet screens are cleaned regularly. Routine testing is conducted to observe radon levels as well as water and air quality. In addition, all light bulbs, batteries, glass, chemicals, and electronics are recycled or neutralized for disposal. Old computers, monitors, and TVs are recycled as well, along with printer cartridges and cell phones. Green cleaning is the standard, with very few products used for nightly cleaning. The school is under contract with a transportation provider that predominantly uses propane fuel. No-idling signs are posted, and the drop-off area is at least 25 feet away from the building.


Eden Hall has participated in the Healthy Schools PA initiative. It also submits a school report card each academic year to be considered for an achievement award sponsored by Women for a Healthy Environment. The report card's categories include curriculum integration; community engagement; professional development; sharing successes; school philosophy and culture; air quality; water, waste, and recycling; energy; health and well-being; transportation; and school grounds.

Water-bottle filling stations have been installed in nearly every water fountain, and students are encouraged to bring refillable containers to school. In 2017, a group of students initiated a plan to begin recycling efforts at EHUES. They partnered with a corporate sponsor, obtained resources, and now regularly collect recyclables from classrooms. The group officially "relaunches" the program every year to the student body by creating public service announcements, commercials, and posters that are displayed throughout the building. The group is now expanding the program to the cafeteria, which is no small endeavor, as it feeds roughly 400 students at a time.

As part of the fifth grade's sustainable school initiative, a group of students ran a book drive asking students and staff to bring in gently used books. Students

partnered with a local contractor to use repurposed materials to build little book libraries placed throughout the building, promoting a love of reading and the value of reusing and sharing, rather than throwing away.

Eden Hall has a wellness committee comprising parents, community members, and administrators from the building, as well as staff members. The committee focuses on identifying and implementing initiatives that benefit the overall health and well-being of students and staff. Recently, the committee, with support from the parent-teacher organization, has provided stationary bikes that are available for use by all students and staff in the building. The school's nature trail, outdoor classrooms, and various play areas are used for recess and physical education classes to help provide an environment that is focused on the well-being of all students. Students at Eden Hall Upper Elementary School participate in health and physical education courses that empower them to develop habits of mind and body to support wellness throughout a lifetime. The health and physical education department also offers a monthly newsletter focusing on mindful moments, well-teacher tips, and brain breaks of the month. Other efforts to support the overall well-being of the child include classroom guidance lessons, Girls on the Run, Kids of Steel, flexible seating initiatives, Children's Grief Awareness Day, Random Acts of Kindness, and Mix It Up at Lunch days. EHUES offers a daily salad bar, offers a future chef contest, and has removed all vending machines.

Students stay engaged in the scientific process of observation, discovery, and reasoning through hands-on Foss and Asset science kits that pose questions to students and allow them to explore answers through hypothesis, experimentation, discussion, data collection, and analysis. The science program at Eden Hall incorporates science concepts in other subject areas, encourages an appreciation for the natural world surrounding the school, and provides learning opportunities that integrate STEAM topics.

The school has created a "think tank," similar to a Makerspace, for students use. This unique space allows students to use tools and materials, both physically and virtually, to build creative projects. Students have been trained in the use of the space, and teachers regularly receive professional development on using the materials and tools available. Overall, the space is used to develop lifelong skills through problem-solving, critical thinking, and teamwork.

The EHUES nature trail, located on the school's property, is used by students and the community for several science-related activities as well as other curricular activities. Science classes routinely use the trail and outdoor classroom to focus on elements of the curriculum relating to the earth, rocks, water, and other pertinent content. A focus on the environment and sustainability is included in the lessons, as well.

Fourth-grade teams participate in sustainability awareness campaigns aiming to educate, encourage, and engage students to live a more sustainable life. Each campaign must focus on one of the following sustainable practices: water conservation, waste reduction, energy conservation, or health and well-being. The fourth grade also participates in health and wellness independent inquiry projects, presenting their findings to peers.

Fifth-grade students participate in an interdisciplinary program introducing cold-water conservation education by raising brook trout, a native cold-water species, from eggs to fingerlings. Students learn how to raise brook trout by observing and monitoring a cold-water ecosystem in classroom aquariums.

Sixth-grade students participate in a sustainable design challenge working with Chatham University. Teachers and students partner with the Pittsburgh Historic and Landmarks Foundation, along with a team of architects, to repurpose an unused space on the university campus for a community purpose. The firm and Chatham keep all student blueprints and narratives, and they try to implement their sustainable ideas into the actual repurposing completed for specific buildings on campus.

Gifted classes in all three grades work with Chatham University's School for Sustainability to explore and participate in a variety of activities that broaden their awareness of the connections between food, energy, nature, science, and mathematics. Educators discover how to take those same principles of sustainability into their classrooms and create fun and educational lessons with broad applicability. This experience includes the use of Skype mentors, workshops, and a lending library.

Students in grade six regularly use a weather station. With this activity, every sixth-grade student can communicate lab results and scientific concepts they have learned through multiple applications. A team of sixth-grade students also attended the EcoChallenge supported by the Allegheny Intermediate Unit and Phipps Conservatory. Students designed sustainable communities, completed a scavenger hunt in search of sustainable and environmental features, and learned about life cycles and the environment.

## State College Friends School, State College, Pennsylvania

*Exploring social justice and environmental sustainability the Quaker way*

State College Friends School (SCFS) is a private prekindergarten through eighth grade school serving 104 students, guided and inspired by the Quaker testimonies of simplicity, peace, integrity, community, equality, and stewardship. In this unique school community, students become successful learners, who are confident, creative, and compassionate and ready to use their big ideas and values to help make the world a better place. As students move through SCFS, the Quaker values of social justice and environmental sustainability are explored in a variety of ways, with students learning how to make the world a more just and sustainable place.

The school has worked hard over the years to reduce its environmental impact in multiple ways, installing solar panels on its building and developing an accompanying curriculum for kindergarten through eighth-grade classrooms. These panels were the result of the school's collaboration with the West Penn Power Company. The solar panels, which are mounted on the roof above the kitchen and community room, produce about 3,500 kilowatt-hours of solar energy each year. The school saves some $250 per year on its electricity bill and earns energy credits for being a producer of clean energy. Additionally, about 20 percent of the school's energy use is purchased wind energy. SCFS gradually has changed lighting from incandescent and fluorescent bulbs to LED bulbs.

Since its inception, SCFS has implemented a vigorous recycling program, making use of local recycling opportunities as well as national ones. Students are taught to reduce, reuse, and recycle in all classrooms, and they take an active role in the recycling program at school. The school recycles soft plastic at a local market, brittle plastic with the county, fruit pouches and energy bar wrappers with Terracycle, markers through Crayola, and batteries with the Battery Outlet. SCFS reuses containers for starting plants for gardens, art projects, and other projects, and students use both sides of paper before recycling.

As part of the Borough of State College's composting program, SCFS composts paper waste used for food, meat, and pizza boxes. The school maintains on-site composting bins for vegetable and fruit waste, and the compost is used on the gardens. SCFS uses the Freecycle website to repurpose items the school no longer needs.

An educator who is an entomologist by training, and has completed coursework in IPM, is consulted if there is a pest issue to help determine the best extermination

approach. SCFS uses only organic methods for pest management and only nontoxic cleaning products.

Each Monday morning, classes participate in an all-school walk by doing laps around the outside of the building. This is an invigorating way for the children to begin their week of school. Children have outdoor breaks regularly, including 15–30 minutes of brain break in the morning and 30 minutes prior to lunch. Prekindergarten through first-grade classes also often take afternoon breaks. Parents are asked to provide children with weather-appropriate clothing and gear, including hats, gloves, snow pants, boots, and sunscreen. Children from kindergarten through middle school go outside for recess on all but the most bitter-cold days.

State College Friends School values outdoor education and play and has created natural areas on the playground — for example, by planting many trees. Parents pack healthy snacks and lunches for all children daily. Once a month, a local nutritionist and a team of parent volunteers create a hot lunch for those who purchase this option.

The school has offered cooking classes that expose students to healthy eating habits, and students are taught easy, kid-friendly recipes high in vegetables and nutrients. Eating lunch in the classroom encourages conversations about nutrition, local foods, packaging, and sustainable food production. Students have physical education and yoga twice a week. Throughout the day, teachers incorporate growth mindset concepts and mindfulness in the classrooms, and they participate in courses and readings on mindfulness.

Faculty members are current on environmental and social justice issues, instructional pedagogy, and environmental resources that enhance learning. Many of the teachers have been trained in programs including Project Learning Tree,

Project WILD, Project WET, Healthy Water/Healthy People, and Agriculture in the Classroom. The head of school is a facilitator for several of these programs, and the associate head of school was a former educator at Shaver's Creek Environmental Center.

Recently, fourth- through eighth-grade classes did an extensive study of watersheds and plastic pollution. Students constructed a large bulletin board to educate family members and friends of the school about reducing their effect on waterways. The middle school art class made an art installation for the school library using recycled water bottles and wrote an artist's statement to educate library users about plastic pollution.

Prekindergarten to third-grade students participate in planting, maintaining, and harvesting raised-bed gardens located near their classrooms. Kindergarten and first-grade students plant, maintain, and harvest a pumpkin patch and a local apple orchard each year and use the produce in cooking projects.

Ecology, conservation, sustainability, nature study and exploration and STEM are important parts of the science curriculum and are included in regular field experiences. Classroom teachers make use of the grounds to study seasonal changes in the natural world. They also use the school pond and pollinator garden as outdoor classrooms.

The school devotes Earth Day (and sometimes an entire week) each year to work projects and learning opportunities focused on environmental stewardship. Upcoming projects include the installation of two cold frames, a weather station, and more solar panels.

## Millersville University, Millersville, Pennsylvania

*Offering a net zero welcome*

Millersville University's efforts to beneficially influence the environment and human health permeate all aspects of university activities, from operations to academics to student life. The university's commitment to the various dimensions of sustainability are evident in its coursework, its administrative structure, and, increasingly, in its infrastructure.

Notably, Millersville has completed a net zero energy building. Located on the center of campus, the Lombardo Welcome Center is Millersville's new admissions building, welcoming nearly 10,000 prospective students and other visitors to the

university each year. A total of 528 solar panels on the roof generate electricity, 20 geothermal wells drilled 400 feet into the ground heat and cool the building, and several rain gardens treat storm water on site. An additional 20 solar panels are located on a ground array behind the building so visitors and students can view the technology up close. The building's furniture is made from 40,000 pounds of recycled materials, and the landscape consists entirely of native plant species.

The Lombardo Welcome Center greets every visitor with a message of environmental stewardship. In its first few months of operation, the center has generated nearly three times more energy than it has consumed. Excess energy is supplied to other campus buildings, reducing campus energy demand and greenhouse gas emissions while saving some $25,000 annually in electricity costs. Faculty from various departments brings their students through the building to explore green building design and discuss topics such as energy policy, sustainability, and innovation. In 2019, the university plans to conduct STEM workshops focused on advanced energy technologies for education majors, as well as for students from local elementary and middle schools.

While the Lombardo Welcome Center demonstrates Millersville's commitment to environmental performance and sustainability in a built structure, the university's efforts extend beyond this single building. A charter signatory to Second Nature's Climate Commitment, Millersville has a goal of being carbon neutral, has developed a climate action plan, and currently is assisting the local community with climate change response efforts. The university uses the results of its greenhouse gas inventory to guide energy management practices, and it has implemented numerous measures to conserve energy, increase efficiency, and transition to cleaner fuels.

Millersville University recently completed a multiyear, $11.5 million project to upgrade its electrical infrastructure to prepare for broader energy management and energy-reduction activities. The project entailed running over 42 miles of 15-kilovolt electrical wire and installing 41 loop feed switch boxes. As part of the electrical infrastructure upgrade, Millersville installed utility-grade meters on each of the 40 major campus buildings. The university developed an in-house energy management system extracting, compiling, and presenting energy-use data for each of these buildings every 15 minutes, and it has used the system to drive energy conservation measures. Within months of establishing the system, the university used the data to establish new thermostat set points during unoccupied hours, which reduced annual energy use by approximately 5 percent. This has saved the institution approximately $120,000 and reduced greenhouse gas emissions by about 800 tons of carbon dioxide annually.

The university also recently completed numerous energy-efficiency projects, including projects to convert the stadium lights to LED and upgrade the university's

data center. The data center energy-efficiency improvements resulted in a 20 percent increase in data center efficiency, and it reduced the university's electrical use by 280,000 kilowatt-hours annually. Annually, this has saved the university $24,000 and reduced greenhouse gas emissions by 110 tons of carbon dioxide

The university evaluated water use in residence halls and found that consumption was considerably higher than anticipated. Analysis revealed that toilet flappers were failing in the suite bathrooms, producing a spike in water consumption. The university replaced over 370 toilet flappers, resulting in a savings of 50,000 gallons of water each day. The university is beginning to implement measures to provide more sustainable landscapes, including several campus locations featuring rain gardens and native plant species only. The university is a certified Monarch Waystation and wildlife habitat.

Millersville maintains close relationships with the local waste management authority, hosting America Recycles Day and other events on campus. In addition to recycling, Millersville composts yard waste on site, as well as organics from the dining hall. Approximately 60 tons of organics from the dining halls are composted through a vendor and provided to local farmers. Millersville works with hazardous waste management specialists to dispose of materials from science labs and other locations on campus. Millersville also maintains a contract with an electronics recycler that has recycled more than 35,000 pounds of electronics from the university and annually hosts campus collection events. The university's waste diversion rate is 49 percent.

Millersville University was awarded Gold Star certification from Commuter Services of Pennsylvania in recognition of its advanced transportation efforts. The university partners with Commuter Services of Pennsylvania to provide online ride-matching services to its commuting population. Additionally, the university partners with ZipCar to provide a campus car share. Millersville has an on-campus shuttle as well as campus connections to local and regional bus services with connections to Amtrak. The bus services are free for use by students. The university has bike repair stations and electric vehicle charging stations located on campus. Information on advanced transportation options is incorporated into university events, including new-student and new-employee orientations.

The school's environmental health and safety program monitors IAQ and reports concerns, conducts site inspections, and provides for external consultation as appropriate. University personnel or contractors take corrective measures as needed to address any issues with HVAC, moisture, mold and mildew, and pests. Millersville's housekeeping department purchases environmentally preferable cleaning products aligned with the Pennsylvania State System of Higher Education's policies on green procurement.

Millersville University has a clear commitment to health and wellness, buttressed by its strong nursing program. Through the Center for Health Education and Promotion, student employees provide services ranging from flu shots to information on how to have healthy relationships. Upwards of 25 students annually are hired, trained, and evaluated to provide lifestyle workshops, education tables and outreach, and awareness events across campus. Millersville University is ranked by BestColleges.com as one of the safest college campuses in America. The school's employee wellness committee oversees numerous educational events and activities throughout the school year to encourage healthy behaviors within the university community.

The university increasingly is using the United Nations Sustainable Development Goals as an organizing framework for sustainability efforts. These 17 goals encompass all aspects of sustainability, ranging from no poverty and good health and well-being to climate action and supporting life on land. The goals provide a powerful organizing framework for the university's sustainability activities, with an emphasis on collaborations across disciplines and integrating efforts to address global challenges. As an example, the university's nursing program recently partnered with the Alliance for Nurses for Healthy Environments to raise awareness of the connections between climate change and human health on campus. Additionally, the local nursing Greek chapter, Xi Chi, committed to addressing global goals of zero hunger, good health and well-being, and climate action, with an emphasis on the interconnectedness between these goals.

Faculty in Millersville's educational foundations department collaborated with faculty members in the biology department and local community groups to establish a stream-quality study station on campus known as the Watershed Education and Training Institute (WETI). The WETI provides Millersville students with access to equipment to study water quality and stream health directly on campus in streams that feed a local river en route to the Chesapeake Bay. The WETI not only serves as an educational space for students, but also for members of the surrounding community, who regularly attend outreach activities.

A faculty member in the chemistry department researches techniques to reduce chemical use during experimentation; he recently was recognized by the American Chemical Society Committee on Environmental Improvement for incorporating sustainability into the chemistry curriculum. His research analyzes techniques used during experimentation to identify opportunities for reducing chemical use, which lessens demand for chemicals and abates he material and energy costs associated with chemical production. Students involved in the classes incorporate the sustainable lab practices into their lab activities.

Faculty and students in the biology department established an apiary on campus. The apiary currently has two hives, with a goal to expand to eight hives in the coming years. The facility provides the opportunity to conduct colony collapse disorder research on campus. Biology students completed research to assess threats to endangered species. Geography students completed surveys and analyses of sustainability competencies among their fellow students. They researched several topics to assess familiarity with the university's sustainability efforts and interest in alternative transportation options, energy efficiency, and climate change. The findings helped to direct the university's future sustainability programs.

## *South Carolina*

### Dutch Fork Elementary School, Irmo, South Carolina

*Helping South Carolina breathe better*

Dutch Fork Elementary School-Academy of Environmental Sciences (DFES) is a whole-school environmental sciences-themed magnet school located in the midlands of South Carolina, approximately 10 miles northwest of the state capitol, Columbia. As a public magnet school, DFES welcomes a diverse enrollment of students from the surrounding neighborhoods and across School District Five of Lexington and Richland Counties, which covers the three geographical areas of Chapin, Dutch Fork, and Irmo. The total student enrollment is 531, with 48 percent of students identifying as African American.

Dutch Fork prides itself on being a comprehensive, inquiry-based, hands-on program focused on immersing children in discovery and exploration, collaborative study, scientific research, the use of scientific tools and technology, and a strong sense of community. Since its inception, the school has committed itself to maintaining the highest education standards by using the natural environment and nature-human interactions as the catalyst for student learning outcomes and critical thinking. The school's curriculum aligns with state standards by grade level, following a themed continuum titled "from the mountains to the sea" that explores the South Carolina landscape within a global context.

The school has switched incandescent and compact fluorescent bulbs to LED. In addition to its more conscious use of energy, changes to lighting components have led the school to reduce energy consumption by approximately 11 percent in the last two years. DFES' school district has entered into a partnership with Cenergistic, a conservation education and technology company, to better understand how to

capture savings across all schools. This can be done by, among other things, by ensuring that units are running properly, verifying parking lighting schedules, and monitoring water usage. This partnership will help inform the school and the South Carolina Energy Office when creating a student-driven energy audit, which can be used to identify additional areas where the school can make conservation changes. As part of this effort, DFES has moved to a managed print system that has cut down on energy use and costs.

Water conservation has been a central theme for the school. This is evidenced by rationing experiments that show students how they can use less water, save on costs, and teach others to do the same. For example, the school has improved water conservation and efficiency by using rain barrels that collect water for the school's gardens. Also, students crafted rain chains (an alternative to traditional, closed-gutter downspouts) made from recycled materials. In addition, the school disconnected hot water in school bathrooms to save on energy costs.

The school initiated a food waste and compost program to divert waste from landfills. In the process, students collected data to show how much waste has been diverted in a given month. Current projections put food waste diversion at 5,000 pounds per month and a decrease in hauling fees of approximately $1,700 per year. Regular trainings are offered to the school community, with students as the leaders.

The DFES community instituted a schoolwide recycling program, managed by student recycling captains, for office and classroom paper products, plastic containers and jugs, aluminum cans, and cardboard. The school has a robust litter prevention campaign in the area around the car rider line. In this project, students have categorized and graphed the different types of trash found in the area and shared the results with the school community. Additionally, DFES works with unzoned students to facilitate carpooling opportunities. This reduces transportation costs, cars on the road, and vehicle emissions.

Dutch Fork participates in South Carolina Department of Health and Environmental Control's Breathe Better program, giving students the opportunity to audit vehicles for the purpose of instituting anti-idling policies. DFES' district contracts with Titan Termite and Pest Control for integrated pest management. School gardens and composting sites are controlled naturally through design and proximity to buildings to manage pests. Most products used for cleaning are supplied by EcoLab and composed of 99 percent water. All sites have contaminant controls in place, with chemicals under lock and key. Facilities staff perform an annual walkthrough and check under every sink at all sites for chemicals, removing any that are unnecessary.

The school has drop ceilings to improve acoustics. The cafeteria and gym have wall foam that helps reduce sound and improve acoustics on campus. Dehumidifiers are used when moisture is high due to the indoor mold potential in the region.

Dutch Fork has established a well-rounded approach to nutrition and fitness. The interpretive nature trail behind the school was completed in spring 2015 in partnership with SC Forestry Commission, AmeriCorps, Emory University, and Back to Eden. DFES participates in the Girls on the Run program. Similarly, the school has grown in its Five Areas of Fitness and FitnessGram programs, maintains a fitness club in the morning for fourth and fifth graders, and participates in Jump Rope for Heart.

Health and wellness also are tied to the school's participation in its adaptation of a farm-to-school pipeline. DFES offers Healthy Hands Cooking classes, giving students an opportunity to be exposed to methods to cook fresh meals from the garden produce that they have grown, and to teach techniques to family and peers. Cafeteria staff has received training by chefs in scratch-cooking methods, thanks to USDA's farm-to-school program and grants from Boeing.

The school has committed itself to providing effective environmental and sustainability education that incorporates STEM, civic skills, and green career pathways for its students. Third-grade classes collect plastic bags, write down the amount each bag weighs, calculate the total number of pounds of plastic collected each month, and perform accompanying readings. Prekindergarten and third-grade classes are trained by Richland County Soil and Water on how to start and maintain active worm bins. The students collect food scraps from the cafeteria to add to the worm bin, measure the mass of the food scraps, journal their observations, and then add the compost to the garden areas.

Teachers attend training each fall with Trout Unlimited in order to oversee Trout in the Classroom. Students completed a yearlong inquiry into the barred owl and how to increase its population in South Carolina because of concerns about its habitat.

DFES has committed itself to environmental and sustainability themes to develop STEM content knowledge and critical-thinking skills. One of these approaches includes the use of plants in the classroom. Second- and third-grade students research types of plants that are good for air quality and are cost effective. DFES has started a pollinator garden, monarch highway, and beehive, all designed to deepen curriculum for each grade. Other notable projects include solar ovens and solar huts to protect plants from the cold.

Dutch Fork has exposed elementary students to civic skills through upcycling projects and a silent auction. Second-graders collected used plastic bags and learned to make "plarn" for use as bedrolls for the homeless in South Carolina communities. They also set up collection stations around the school for old markers, which Crayola converts to clean fuel for vehicles and homes. DFES grows a variety of plants, including kale and cabbage, on campus to teach students about farming techniques and to participate in a local farmers' market and a compost and heirloom seed fundraiser.

## *Washington*

### The Northwest School, Seattle, Washington

*Leaving no trace in the wilderness; sprucing up school and grounds weekly*

The Northwest School views environmental sustainability — interacting with the natural systems on which we depend, in a manner that enables current and future generations to thrive — as one of the most existential and urgent social justice issues of our time. At Northwest, caring for the environment is integrated into daily routines, curriculum, institutional practices, and student leadership opportunities.

The Northwest campus includes four buildings and an urban farm/garden adjacent to one another in the heart of the Capitol Hill neighborhood of Seattle. The main school building is on the historic building registry, influencing many facilities and operations as they relate to environmental sustainability practices. The facilities department aims to reduce the environmental impact of its buildings and has adopted environmentally conscious procurement practices. The department strives to improve energy efficiency. It is currently engaged in an energy audit and building systems tune-up, having replaced incandescent and compact fluorescent lightbulb light bulbs with LEDs bulb throughout the main school buildings. Tube-style solar collectors on the rooftop of the gym and dining hall building provide energy for hot water. In addition, the facilities department employs an environmentally sound cleaning program, minimizes the use of toxic and harsh chemicals, and properly disposes of any hazardous waste.

The school recently acquired four parcels of land adjacent to campus and is in the early stages of expanding. Having a physical campus that reflects Northwest's commitments to environmental sustainability is core to this expansion process and the future of the campus. As part of its work, Northwest is exploring carbon-neutral and regenerative architecture.

There is no car parking for students and few spaces for faculty. All are encouraged to use the lowest carbon transportation possible. The school provides a secure bicycle shed with a capacity of several dozen, as well as highly subsidized public transit passes for faculty. The school encourages carpooling among students and faculty by making a carpooling app available. Students in the environmental student group organize an annual bike and walk to school day to raise awareness for lower carbon transportation. Students collect data on how their peers commute throughout the week.

Waste stream receptacles throughout campus occur in groups of three: compost, recycling, and garbage. An environment team tracks waste by weight each week. Annual waste-sorting training is provided to faculty members, as well as to the eighth grade, 11th grade, and 12th grade. Students empty all waste bins, so they are aware of the amount of material the community wastes. Northwest is developing zero-waste events guidelines for all campus events.

In the dining hall, leftovers are transformed into soup or salad bar offerings. The school donates leftover dry goods to food banks, and it is formalizing a partnership with Seattle Salvation Army Food Pantry and Meal Program to donate leftover meals. Meal prep scraps are worm-composted on campus, and other organic by-products are composted by the city. The dining hall has no single-serving packaging, and food is served on durables. All items at catered events are durable or compostable.

The eighth-grade earth science class works with Water1st International, an organization that supports sustainable water projects in developing countries around the world. This class then helps the school community understand relationships between water, society, and environment. Students analyze the school's water consumption with a goal of developing reduction strategies. Northwest has low-flow water fixtures in all bathrooms. Students installed Wi-Fi-enabled timed-drip irrigation and rainwater harvesting systems in the farm/garden to conserve water.

The environment program has been a core part of the school's culture and ethos since the school's founding. Three times a week, students and faculty work in more than 90 teams under the leadership of seniors to clean and care for the school and surrounding areas. This effort includes everyone at the school — more than 600 people. This program grounds Northwest's wider environmental sustainability ethic directly in its immediate surroundings, facilitates leadership development among seniors, and builds community. Each team is responsible for maintaining, cleaning, and caring for a specific part of the school. In addition to this physical work, each week teams discuss environmentally related topics from climate change to microplastics, food systems, and environmental justice.

Northwest has three groups that focus specifically on strengthening environmental sustainability practices at the school: First, with 15 faculty members, the sustainability committee has a mission of raising awareness about environmental issues; it makes recommendations to improve the school's sustainability practices and implements projects that further the community's understanding of and action on environmental issues. The committee meets every other week, and its members represent many parts of the school, including faculty, operations, facilities, finance, communications, development, and administration.

Second, the Student Environmental Interest Group (EIG) comprises more than 30 students in grades six through 12, with five student leaders and the support of two faculty members. EIG works to expand the environmental consciousness of every individual within Northwest to promote global change through concrete projects and advocacy. The group meets twice per week. Recent projects have included designing and building the campus farm/garden; conducting a dining hall food waste audit; writing letters to government officials advocating for strong environmental policy; and organizing a clothing swap.

Finally, Friends of Sustainability at Northwest is a group of more than 20 parents of current and former students and other friends of the school who meet three times per year. Friends of Sustainability supports the school's environmental sustainability efforts through hands-on projects, makes recommendations and shares ideas, and offers expertise in the field of environmental sustainability.

The dining hall program is an area of daily engagement in environmental sustainability for Northwest students and faculty, as everyone eats scratch-made lunch together. The dining hall is an expression of the school community and its values. Eating together and sharing food is one of the ways Northwest builds community, sparks conversations, and furthers its mission of actively caring for the environment and planet. The program is rooted in principles of cultural diversity, seasonality, sustainability, environmental and social responsibility, nutrition, and culinary innovation. Northwest aims to balance conscientious purchasing, customer preference, and financial responsibility. The school regularly reevaluates its processes, purchasing decisions, and practices. Northwest strives to graduate thoughtful eaters, who have a deep appreciation for the cultural, environmental, ethical, and community-building roles that food can play in life, as well as the complexities of the food system.

Over the past two years, more than 300 students worked together to design and build the 3,000-square-foot campus farm/garden, which includes 30 planter boxes, more than 20 types of crops, a greenhouse, composting systems, picnic tables, and a geodesic dome seating area. Many students engage weekly in the farm/garden and have lunch and classes in the space.

A comprehensive health and wellness program in grades six through 12 is dedicated to teaching students about time management, sleep, social dynamics, and the benefits of being outdoors. A mental health unit in the ninth grade has students keeping a sleep journal, learning to meditate, and taking steps to change aspects of their lives. A peer-mentoring program teaches juniors and seniors how to navigate the challenges that affect teens and young adults, so they can be informed resources for themselves, peers, and younger students. This group regularly visits local clinics and health agencies, explores community resources around mental-health issues, and participates in suicide-prevention training.

The outdoor program has been a key part of Northwest's extracurricular offerings since the founding of the school. Each year, Northwest offers 10–12 outdoor trips, providing opportunities for students to hike, snowshoe, build igloos, backpack, kayak, and cycle. More than 200 students participate in the outdoor program each year, from all grades and experience levels. The school loans out gear and covers trip expenses for students who receive financial aid to make the program accessible to everyone.

Each of Northwest's science classes include units relating to environmental sustainability. Units across grade levels allow students to research alternative energy sources and storage methods, design and build wind turbines, study the chemistry of liquid fuels to investigate environmental impact, explore toxic chemicals in personal care products, study ocean acidification, and discuss overfishing.

A 12th-grade humanities course examines the ways nature has been conceptualized in the United States from the Colonial Era to the present. Students study texts from a range of fields as they look at the multiple and conflicting ways that Americans have attempted to answer the question "what is nature?" Throughout the year, students are assessed and receive feedback on their level of literacy and engagement.

Northwest's Summits program of two-week intensive classes has a strong focus on environmental education. Nearly all Summits have some connection to the environment, and about a third relate directly to environmental education, including Summits on the Duwamish River; urban agriculture; the history of the cedar tree; food justice; landfill philharmonic; as well as a course on cooking, chemistry, and community.

Northwest's recently published strategic framework integrates environmental sustainability throughout, and it includes direct connections to environmental sustainability in 36 percent of the its 11 areas of engagement. Northwest's endowment recently has been transferred to 100 percent environmental- social-, and governance-screened investments.

## Lake Washington School District, Washington

*Unlimited access to fresh produce at lunch*

Sustainability efforts in Lake Washington School District No. 414 (LWSD) rely on the participation of every student and employee. Parents, community organizations, and volunteers are valuable partners. LWSD's vision is "Every Student Future-Ready." This vision requires understanding and taking responsibility for the effect of one's decisions and actions, as well as contributing to a better future for the next generation.

District sustainability efforts contribute to future readiness through implementation of a comprehensive districtwide resource conservation management program; green building practices; kindergarten through 12th-grade curriculum and student learning focused on sustainability/environmental concepts; and professional development for teachers and staff.

In 2006, the district adopted a resource conservation management program focused on conservation and cost savings. Student enrollment has grown 26 percent in the last decade to 29,987 students at 43 sites in a district with over 76 square miles. LWSD serves students in Kirkland, Redmond, Sammamish, and unincorporated

King County. Despite growth and rising energy rates, the district continues to reduce utility costs through proactive management. The McKinstry powerED Performance Dashboard helps LWSD identify ways to conserve energy and water, reduce waste, educate students and staff, and use sustainable building and maintenance practices.

Since the 2005–06 school year, LWSD has reduced electricity usage per square foot by 30 percent. Natural gas usage has decreased 37 percent. Benchmarks were reset in 2014. Since then, LWSD has reduced energy usage by 11 percent. LWSD's resource conservation management program has focused on water conservation initiatives since 2008. Since then, LWSD has decreased domestic water usage 30 percent per student, and irrigation water usage by 80 percent. Native plants are used in all landscaping. Irrigation is provided only for secondary school playfields and two elementary schools where fields are used by community athletic programs. LWSD partners with cities and community groups to share playfields. This allows community groups to enjoy activities without building their own fields.

In the 2008–09 school year, garbage pickup frequency was reduced at 13 schools, and 15 garbage truck trips per week were eliminated by "right-sizing" dumpsters. Waste-reduction and recycling efforts have reduced costs by $120,000 per year since 2008. As of December 2018, 31 LWSD schools are participating in the King County Green Schools Program; 19 have achieved level one, seven have achieved level two, and one has achieved level three. LWSD is an eight-time winner of the King County Best Workplaces for Waste Prevention and Recycling. All schools recycle, and some 75 percent of schools collect organic food waste for composting at a regional facility. Since August 2016, new water-bottle filling stations at secondary schools have filled nearly 775,000 bottles of water, reducing the need for single-use disposable bottles.

District students receive bus service if they live outside a school's walking area. Approximately 75 percent of LWSD buses were built after 2007. The rest were retrofitted with extra particulate exhaust filtration, drastically reducing emissions. In

August 2018, the LWSD transportation division received a $560,000 grant from Washington State University's Department of Ecology to purchase 16 low-emission school buses to reduce emissions by up to 99 percent. All school bus drivers receive instructions to avoid idling, and enforcement occurs using technology on buses.

Students have unlimited access to fresh fruits and vegetables in lunch garden bars. Local Wednesday features locally sourced foods. Elementary students have physical education twice per week, in addition to morning and afternoon recess each day. Middle school students take physical education each year, and high school students earn 1.5 credits of physical education and .5 credits of health to graduate.

Lake Washington has five pesticide-free schools. LWSD is one of 12 districts in the nation to receive Excellence in Integrated Pest Management star certification by passing a rigorous 37-point evaluation in 2014–15. In 2017, LWSD received the Green Cleaning Award from *American School and University Magazine*. The green cleaning initiative began in fall 2012 by using a reduced number of cleaning chemicals while increasing the use of cleaning paper products made of 40 percent post-consumer recycled content.

The district is committed to teaching and assessing NGSS in kindergarten through 12th grade. NGSS topics include interdependent relationships in ecosystems, weather and climate, energy, Earth's systems, human effect on the environment, and human sustainability. Prior to graduation, the typical capstone course for students is Physics in the Universe, which includes a full unit with standards addressing climate change. LWSD career and technical education courses include Environmental Science, Sustainable Design, and Urban Gardening.

Lake Washington integrates environmental and sustainability literacy into school culture. For example, a waste audit at Kirk Elementary School, in partnership with King County Green Schools, found that the school recycles correctly 96 percent of the time. Natural outdoor spaces enhance curriculum, like during Wetlands Week at Dickinson Elementary, where students removed invasive plant species and learned about the important role wetlands play in the ecosystem. Students at Emerson High School learn about green sustainable design technology, and in a career and technical education course, students built a hoop house and raised beds for the school's urban garden.

Programs such as Sustainability Ambassadors inspire students to initiate and measure sustainability goals in their communities. One student group, Schools Under 2C, at Tesla STEM High School, challenged schools around the world to reduce greenhouse gas emissions. Students received the President's Environmental Youth Award from the EPA's region 10 in 2017.

The district publicizes school sustainability efforts on its website and through e-newsletters and social media to recognize efforts and motivate schools to continue and expand their efforts. LWSD encourages teachers to deepen their knowledge of sustainability instruction and problem-based learning. Professional learning programs and partnerships are available through organizations such as Washington Alliance for Better Schools, Cascade Water Alliance, and Sustainability Ambassadors. Fellowships and externships bring teachers together with industry partners and university professors to explore questions to bring back to their classrooms.

Lake Washington is teaching today's students about sustainability, while using green building practices to construct the schools of tomorrow. By 2020, 27 percent of the district schools' heating will come from high-efficiency geothermal, including 75 percent of heating in its high schools. LWSD has the largest solar energy capacity of any district in the state at 615 kilowatts. School building projects must meet detailed requirements to receive funds from Washington State's School Construction Assistance Program, including the incorporation of natural lighting, which reduces electricity costs and enhances student learning environments.

In 2008, Carson Elementary School was the first public school in the state built with a green roof, which covers two sections of the school and reduces rain runoff. LWSD is exceeding state energy standards on its 2016 bond projects by implementing LED lighting inside and outside. All-new portable classrooms installed since 2013 (about 40 classrooms) are high-efficiency Smart Academic Green Environment units. LWSD's resource conservation manager is involved with capital projects during design and construction to ensure efficiency standards.

The Lake Washington Parent Teacher School Association (PTSA) Council established a district PTSA sustainability committee, with parent representative chairs in every school. The PTSA sustainability committee collaborates with the newly established district green team, which includes district staff from support services and administrators representing instructional programs. The district green team is responsible for setting sustainability-focused district priorities and goals and ensuring that sustainability efforts are sustained over time.

## Lopez Island School District, Lopez Island, Washington

*Expanding a pioneering farm-to-school-program*

Through partnerships with organizations and the greater Lopez Island community, Lopez Island School District (LISD) has successfully built one of the few articulated

kindergarten through 12th grade farm-to-school programs in the state, if not the country. LISD believes that every student needs a balanced nutritious meal and the kind of understanding about the environment that only a place-based education can provide. LISD serves some than 70 percent of the meals sourced on campus or on the island, offers a garden enrichment course for kindergarten through fifth-grade students, and offers career and technical education courses in sustainable agricultural practices and culinary arts to secondary students. This program exemplifies what is best about LISD: pride in rural roots, an appreciation of the environment, and holistic education applicable to individual lives.

The district's Lopez Island Farm Education (LIFE) program was founded and is supported by local farmers, the Lopez Island Land Trust, the Lopez Island Family Resource Center, the Lopez Island Gleaners, students, and the Lopez Island Locovores. LISD also has partnered with Kwiáht, a local environmental nonprofit providing work experiences for students.

The school district has two gardeners, who maintain and keep the production garden active all year long. The LISD cook works tirelessly alongside them in planning the planting schedule to align with what is served in the kitchen. Students are provided breakfast, a nutrition break, and lunch. Many of the meals are made from scratch, and it is not uncommon to have community members join LISD students for lunch. LISD monthly menus often have a "LIFE Lunch" feature, which are meals entirely grown on the island. The culinary class often will produce some of the menu items the day before using food harvested from the LISD gardens. This helps students develop a full circle understanding of the source of their food. LISD also hosts a San Juan County Food and Farms tour in support of local farmers to showcase this farm-to-school effort.

Support staff and teachers dedicate many hours to enhancing the district's educational offerings. The administration staff is highly involved in advancing sustainability education with higher education partners and a NextGen working group, as well as with the University of Washington Marine Science laboratory.

The district is committed to paying for half of the farm-to-school program, while the rest of the funds are raised or given through private donations. The district plans in the next three years to further embed the program's curricular aspects into classes and to connect with other schools and districts seeking to establish or enhance their own farm-to-school programs. LISD also is expanding publicity for the program by spearheading "Lopez Lunches," where everything served for one month is sourced within a 50-mile radius of the island.

Most LISD students are engaged in extracurricular sports, which is significant because, as island residents, they must carefully manage their time due to ferry schedules. LISD offers weeklong seminars on specific topics, known as intensives. Many students choose options that emphasize being outside and physical stamina: rock climbing, wilderness survival, personal fitness, and biking the San Juan Islands.

The district has established IAQ management plan and an asthma management plan and works to limit students' exposure to chemicals that can trigger asthma attacks. District buildings were constructed to reduce exposure to radon. LISD also has chemical management and green cleaning programs in place.

In 2016, the community passed a bond measure dedicating $9.6 million to modernizing and increasing energy efficiency in LISD buildings. In partnership with the Bonneville Environmental Foundation, the school district installed 9.9 kilowatts of solar panels. To conserve water, LISD installed low-flow water fixtures, drip irrigation, landscaped with native plants, and reduced irrigation of athletic fields.

As an island community, students and faculty are extremely aware of the solid waste produced. LISD composts food scraps, donates leftover meals, and recycles extensively. In an innovative project, students designed a process that creates 3-D printer filament from recycled milk jugs. LISD also coordinates a public free swap

space, where community members can take or leave items including clothing and household goods.

The district participates in the Safe Routes to School program. The district is just two buses short of completely replacing its yellow school bus fleet with new, lower-emitting buses. The district has a well-publicized idle-reduction policy that applies to all vehicles. LISD offers electric charging stations free of charge for drivers of electric vehicles. In 2016, an LISD senior used his culminating project to design and propose the construction of a bike lane that would connect the ferry landing to Lopez Village. San Juan Island County responded positively to this suggestion and is currently working to make this happen.

Environmental and sustainability education are woven into core curricular topics and daily routines throughout the school year. LISD emphasizes careers in environmental and sustainability fields through two career and technical education courses, Marine Biology and Sustainable Agriculture. A course called Career Paths requires that senior projects include a local or environmental component. Among other projects, these two have led to the construction of a wood-fired truck, awareness of orca pods, and an environmental survey of Fisherman Bay, which was used by San Juan County in drainage studies. The district currently mandates 20 hours of community service before graduation, ensuring students' civic engagement. Beginning with the class of 2021, that requirement will become 60 hours.

An advanced science lab features equipment valued at over $600,000. The Bureau of Land Management and the school have coordinated a "hands on the land" after-school club called Muddy Boots for grades three through five, in which students do research at one of the island's ponds. With all these activities, students graduate with an awareness and appreciation of their role and place in the environment and day-to-day activities that influences not only their personal health, but the health of the world.

## Oak Harbor Public Schools, Oak Harbor, Washington

*A loaded landfill leads to environmental stewardship*

The traditional core values of Oak Harbor Public Schools (OHPS) — growth, collaboration, accountability, and compassion — are central to the district's mission of providing environmental and sustainability programming. Environmental instruction is offered in all OHPS schools, connecting Common Core state standards and NGSS by using engaging and interactive project-based learning opportunities.

What sets OHPS apart from neighboring districts is the schools' ability to work together to strengthen each other and grow. OHPS students and staff have engaged in projects that vary from schoolwide vermicomposting and recycling, to green classroom certifications in waste, water, and energy reduction, community work, designing and building tiny, high-tech homes for the homeless.

The OHPS high school offers a backpacking survival course, as well as other environmental science courses, that get students out into local areas to collect and analyze environmental data. The high school also partners with community organizations to promote citizen science. An example of this is a partnership between the Oak Harbor Marina, the high school science department, and the elementary schools to work on salmon restoration and study the waterfront at local beaches.

OHPS residents live on an island in Washington with a completely full landfill. For this reason, all trash generated in OHPS is transported some 300 miles away to a landfill in the south-central part of the state. This has led to a great awareness about the importance of waste reduction in schools. These efforts include composting, use of reusable silverware and lunch trays, recycling. OHPS collects one-sided paper to reuse as scrap paper; sends newsletters and parent correspondence electronically; and uses digital projectors, whiteboards, iPads, and Chromebooks whenever possible. Confidential papers are shredded and bagged, then used for compost bedding or recycled. Share tables help to reduce food waste.

A variety of afterschool clubs allow students to work on ways to reduce the OHPS environmental footprint. Many classrooms across the district make action plans to reduce energy consumption and educate students on the importance of reducing energy consumption, offering easy steps they can take to support the district-run

green classroom certification program. The district has taken the initiative to upgrade lighting to energy-efficient LED lights. The most recent upgrade was at the high school, where 70 outdoor fixtures were replaced, leading to a reduction of energy use by 80 percent.

Over the past several years OHPS has slowly integrated propane school buses into its fleet, reducing greenhouse gas emissions and reaping a savings of $35,000 on fuel costs in one year. A Safe Routes to Schools program encourages alternative modes of transportation.

A districtwide sustainability team and a designated garden and sustainability teacher support all elementary teachers in STEAM integration based on the three pillars of sustainability. Students in prekindergarten and kindergarten take part in play-based climate science education through station work.

All five elementary schools feature learning gardens and student-led vermicomposting systems on site. Students receive composting education in fourth grade, and then become the student leaders who teach younger classmates all about vermicomposting and the cycle of decomposition. Landscapes use native and drought-tolerant plants, and feature pollinator gardens and certified wildlife habitats. Rain gardens lessen the effects of carbon and ocean acidification in local waters.

OHPS focuses on rich environmental learning and nutrition in these outdoor classrooms, and some schools even raise school chickens and rabbits. The district partners with Washington State University and Island County to host family outreach programs and nutritional cooking classes. These provide access to healthy alternatives through school gardens for students from a variety of backgrounds, including low-income and underserved communities.

Oak Harbor Public Schools has a comprehensive green cleaning program. The OHPS custodial staff has been trained in green cleaning procedures, hazardous chemical storage, and response to hazardous spills. HVAC filters are replaced and monitored three times a year. OHPS an asthma management program in place to limit environmental asthma triggers, including replacing carpeting with nonpermeable rubber tile flooring that is 100 percent recycled content. The district uses policies and procedures outlined in the EPA's Tools for Schools for IAQ management. All IAQ concerns are addressed in less than 24 hours and meticulously documented. Three years ago, the district began replacing carpets exclusively with modular carpet tiles. This plan allows for the selective replacement of high traffic or stained areas instead of the entire room. An IPM plan reduces the use of harsh chemicals in school buildings and on school grounds.

## *West Virginia*

### Junior Elementary School, Belington, West Virginia

*Casting a fly rod into the community*

Junior Elementary School (JES) is a small rural school within a community of roughly 685 residents located along the Tygart Valley River. The school houses one class for each grade from preschool through grade four. Each class at JES plans an annual field trip, where students enjoy the beauty and scope of their home state, with each child experiencing at least six West Virginia adventures before moving on to middle school.

Preschool and kindergarten JES students visit the nearby Game Farm each year to learn about local wildlife. They also journey to Rich's Farm to explore forests, pumpkin patches, and a variety of landscapes. The first-grade class makes an annual day trip to hike to Seneca Rocks and participates in a guided tour of Smoke Hole Caverns. Second-graders enjoy a day at historic Prickett's Fort to experience 18th-century living and frontier traditions such as weaving, blacksmithing, candle making, and carpentry. The third-grade trip exposes students to the natural splendor of Blackwater Falls and riding horseback through the hills of Canaan Valley Park. Pupils in fourth grade return to Blackwater Falls during the winter to participate in sledding events and then visit nearby Timberline Resort.

Whole-school trips near campus include a water-sampling experience and nature walks. Experiential learning through water sampling at Spruce Knob, the highest point in the state of West Virginia and the summit of Spruce Mountain, exposes students to science, health, math, and social studies they can apply to their lives outside of school. They also explore the local watershed, riparian buffer zones, and ecosystems outside of classrooms. The school works with community partners, including the West Virginia Department of Environmental Protection and the West Virginia Division of Natural Resources, the U.S. Department of Agriculture, the Lions Club, and local coal miners in its outdoor education efforts, particularly for fly fishing days. In the winter months, students participate in sledding and other snow activities during their physical education classes. The JES school community also can tap sugar maple trees.

The school participates in an Adopt-A-Highway project each spring. Students take a leadership role in collecting and disposing properly of trash and litter along the roadway between the river and the school.

Following each field trip, students complete written and discussion-based reflections on the experience, sharing their questions, opinions, and highlights. Students follow the same process after monthly visit from West Virginia University Extension Service agents, who are community-based experts in each county who share research-based knowledge throughout the state. A new Experience Learning Curriculum offers deeper and more robust exposure to watershed studies, water sampling, and buffer systems.

Students participate in "brain breaks" to keep their focus during classroom instruction. Teachers have started a "Daily Mile," pausing classroom instruction for 12 minutes to have all students walk or jog a mile, or do 12 minutes of dancing or relay races. These 12 minutes away from their seats refresh students so they return to instruction more focused and ready to learn.

The tri-annual Pop-Up Garden Market allows JES students and families to sample, shop (for free), and make recipes from assorted fruits and vegetables. "Taste It Tuesdays" during physical education classes allow students to taste-test a new fruit or vegetable, which then is added to that week's lunchtime salad bar. School cooks provide healthy snacks during reading classes twice weekly thanks to the fresh fruit and vegetable program. Third- and fourth-graders grow microgreens in the cafeteria during winter months.

The school was awarded a West Virginia Sustainable Schools grant that facilitated the purchase of a class set of mountain bikes, two staff bikes, and tricycles. The bikes are used for brain breaks, recess, and physical education classes. Families can check the bikes out after school to ride with their children. The school's "Travel West Virginia" project provides pedometers for each child to wear daily. Each day, the total mileage for each JES class is recorded, and totals are transferred to a centrally located bulletin board with the shape of the state and all major landmarks pictured. JES marks each classroom's mileage as they "travel" the state, making connections to history and geography lessons.

The school has arranged with a nearby medical clinic to provide free flu shots for its students and staff annually. JES hosts the WV SMILE mobile dentist program twice annually to provide students with opportunities for dental exams, cleanings, fillings, and extractions at school without affecting their attendance. Germ City is a popular program provided for students by the county extension service twice yearly to teach the benefits of cleanliness in staying healthy. The school offers hand sanitizer stations and has daily desk cleaning time. The WVU healthy kids coordinator is scheduled for six weeks of supplemental lessons in grades one through four to promote healthy living and movement education.

Maintenance Direct software manages the school's integrated pest management needs. JES replaced the school HVAC system in 2010 to meet ASHRAE ventilation standards. The school has new radon-resistant construction features and replaced its playground in 2013 to remove any unsafe materials. The school prohibits bus idling and the use of air fresheners. The district conducts monthly inspections for environmental health concerns. As part of participation in a district energy management effort in collaboration with Edison Energy Institute, the school has saved some $135,000 in energy costs over 11 years. JES also reduced water usage by 5percent over the course of one year. A system of water diversion ditches and collection points on campus prevent flooding of the property and the surrounding area, especially the 100 yards or so between the school and the Tygart Valley River. Over 50 percent of cleaning products are natural or eco-friendly, and copy paper is Forest Stewardship Council-certified. Nearly 95 percent of the students who attend JES arrive on school buses or in carpools. The remaining 5 percent either walk or ride bicycles to school.

## *Wisconsin*

### Schlitz Audubon Nature Preschool, Milwaukee, Wisconsin

*Blending water conservation, early childhood play, and environmental education*

The Nature Preschool at Schlitz Audubon Nature Center was founded in 2003. Located on the shores of Lake Michigan, this suburban school serves 144 early learners in morning and afternoon classes. The preschool is a member of the Natural Start Alliance, which is part of the North American Association of Environmental Education and a founding member of the Wisconsin Nature-Based Early Childhood Association, which is, in turn, a part of the Wisconsin Nature Action Collaborative for Children.

Housed in a LEED Gold-certified building, the preschool has three classrooms, each with enormous glass windows overlooking prairie, woodland, and natural play spaces. The teachers often keep the lights off due to the natural light that pours in

through the windows, thus reducing energy costs. The school uses geothermal, photovoltaic/solar electric, and active solar thermal energy sources, which provide 50 percent of total energy use, and it sells renewable energy back to the local utility company. Schlitz also implements computer-power management settings; thermostat and hot water temperature setpoints; and uses a central control system to remotely monitor and control heating and cooling equipment. The school monitors energy usage by tracking monthly energy consumption and costs; follows a schedule for regular maintenance of HVAC equipment; and has upgraded to energy-saving equipment.

The school's drinking water comes from a well on school property. The facilities manager is certified to conduct water tests annually. Schlitz installed water-bottle filling stations to encourage healthy hydration and reduce single-use bottles. The school's educators showed the children how rain barrels work and now allow preschoolers to collect water for play and for watering the gardens. In another play space, classes take turns measuring the daily precipitation with the rain gauge and then use walkie-talkies to report their findings to the nature center land management team.

In fall of 2018, Schlitz began installing a rain catchment system alongside one of the play areas to catch and hold 90 percent of the water from the nature center rain gutters. The water is held in a cistern. When the spout to the cistern is opened, the water runs along a homemade funnel system, through the play space, and out into an educational rain garden. This system allows water conservation, early childhood play, and environmental education to be seamlessly blended.

The school was built with a combination of sustainable woods, including black locust and Norway spruce harvested from the property. The teachers made a commitment to eliminate plastic as much as possible in classroom furnishings and tools, and instead use natural materials, including several items taken from fallen trees on the property. Every few years, a preschool art festival called Ash-to-Art is held, during which children and their families create art on large cross sections of ash wood taken from the ash trees coming down on the property. This experience is combined with lessons and activities about the emerald ash borer.

The preschool uses as many recycled, upcycled, natural, and environmentally sustainable products in the classroom as possible, from educational materials to cleaning supplies. The preschool teachers make a point of reducing, reusing, and recycling in classrooms and teaching this behavior to students. The preschool uses an educational three-bin compost system, and it aims to become a zero-waste school either by repurposing materials, such as play dough and paper, into new art projects; or by recycling; or by composting everything eaten. Schlitz has a dishwasher and sanitizer that allows the school to avoid paper plates and utensils, and the school serves food family-style.

Students learn about the importance of caring for themselves and others. Students and staff hike daily, transitioning from short distances at the start of the year to a mile by the end. Preschoolers play outside in all weather, and they spend up to two hours and 45 minutes outside daily unless the temperature is below zero degrees Fahrenheit or there is lightning. Families and children learn how to dress appropriately for all temperatures and kinds of weather. Students and staff wash hands several times a day. A yoga class is offered on Mondays, and staff members are encouraged to spend their breaks outside on the 185-acre campus. Teachers get emotional support through staff outings and social gatherings, and they are encouraged to stay home when sick. The staff is united by a common passion and mission, which makes the overall working environment more appealing.

The center supports organic, fair-trade, and local suppliers, and buys local fruits and vegetables as often as possible. While the half-day preschool program doesn't offer meals, the staff cooks healthy foods with the children as part of programming whenever possible, such as during their summer camp called "Dirt Made My Snack." At the camp, preschool children learn the connection between healthy soil and healthy food and make homemade organic snacks daily.

The preschool incorporates environmental concepts into all programs, which serve children between 6 months and 6 years. The Audubon Babies program is primarily sensory-based, giving small children opportunities to touch, smell, listen, and experience nature with their whole bodies. Once the children enter preschool, they begin each day outside in nature-based play areas. These include gardens, trees, logs, a water area, a digging area, a mud kitchen, trees for climbing, and loose items from nature, such as rocks, sticks, and branches. Students are provided tools that help them learn to interact with nature — and each other — in positive ways, using items including shovels, spades, watering cans, dishes, twine, scoops, brooms, trucks, and wheelbarrows. Classes have daily access to the Lake Michigan shoreline, prairies, woodland, oak savanna, and ponds. Students spend between 50 and 100 percent of their time outdoors every day, year-round.

During their time at Nature Preschool, children learn about water, animal habitats, recycling, and seasonal changes; they participate in maple sugaring, gardening, and composting; they care for animals in the classroom, on the trails, and through the onsite raptor center. They develop a sense of community and connection to the land that will outlast their time in preschool. They plant and harvest a large vegetable garden; look for worms and insects under logs; experiment with mud and water; climb on structures made from fallen trees; run, play, ask questions, explore, and engage. They participate in citizen science programs by monitoring monarch butterfly populations, keeping track of birds, and discussing invasive species. They may spend time on the beach at Lake Michigan, visit one of the many ponds on the property, climb the 60-foot tower, or rake leaves. Their hikes change daily based on what is happening seasonally.

Preschool teachers practice what they teach. Several have taken master naturalist training and participate on the school's sustainability committee. Staff have written extensively and presented at conferences about the social, emotional, cognitive, motor, and overall health benefits of playing outside, which fosters a deep sense of environmental awareness and connection to nature. The goal of the Nature Preschool at Schlitz Audubon is to help children develop a connection to nature and the environment that will remain with them long after they leave the program and will result in their becoming stewards of the earth.

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