

OEEF Grant Application

Application Type: GeneralGrant
Revision from previous application: S-19G028
Previous grant received:

Application #: S-20G036

Organization Information

Name: The Toledo Zoo and Aquarium
Web Address: www.toledozoo.org
Address: P.O. Box 140130, Toledo, OH 43614
County: Lucas

Project Information

Project Title: Teaching Conservation Through Applied Technology
Educational Priority: Other Environmental Education Projects
Target Audience: Pre-school to University - Primary, General Public - Secondary
Requested Grant Amount: \$26,262.00

Project Description:

We seek to educate students and teachers on the applications of open-source DIY technology in solving environmental and conservation problems by providing training through workshops. In addition to working with high schools, we will host two open to the public workshops at the Toledo Zoo to engage the general public. Each workshop will consist of the following components: brief introduction, soldering exercise, guided GPS logger assembly, use of code to operate the loggers, data download and visualization in GIS, casing, and customization options. Attendees will leave the workshop with their creations and, with hope, a strong desire to continue exploring innovative projects. Follow-up sessions include on-site visits, leave-behind activities, distance learning, and formation of a Google Group.

Anticipated List of Collaborators:

The Toledo Zoo and Aquarium and five participating high schools including New Philadelphia High School and Toledo Public Schools Aerospace and Natural Science Academy.

Additional Information

Have you ever attended an OEEF grant-writing workshop? Yes
Will this project have statewide impact? No
Which Ohio counties will the activities take place in? Statewide
Proposed Start Date: 09/14/2020
Proposed Completion Date: 06/18/2021

Audience Category

Formal Education: Secondary: 9-12
Non-formal Education - Visitors to: Zoos
General Public Education: Adults Generally, Parents, Neighborhood/Community/Organizations

Project Issues

Land Issues: Habitat Preservation, Land Laboratories/Outdoor Classrooms, Threatened and Endangered Species
Other Issues: Other: Exploring careers

Executive Summary

Audience Need:

An increasing number of research programs are relying on open-source technology as it promotes ingenuity and yields substantial cost savings. Those entering the sciences, particularly in the fields of biology and ecology, will find developing this unique skillset early will make them more competitive when entering the workforce. Our workshops employ a multidisciplinary approach that will educate high school students and teachers, and the public on the applications of open-source technology in conservation issues through hands-on activities and real-world examples. This project will bring hot-off-the-press and peer-reviewed techniques, used in current conservation projects, directly to students interested in the environmental research field, and will provide them with the skills and tools necessary to develop customized technology for their own projects.

Key Personnel:

This project will utilize the resources and experiences of Dr. Matt Cross at the Toledo Zoo and Dr. Pat Cain at Georgia Gwinnet College. Drs. Cross and Cain have backgrounds in conservation biology, worked together for 12 years, and hosted the proposed workshops for universities, high schools, the general public, and professional academic conferences.

Overall Project Objectives:

The main objective of this project is to educate interested parties on the benefits of open-source technology to conservation. Up to 100 high school students and 10 teachers, at five schools/districts in the state, and up to 40 people from the public will learn about the applications of open-source technology to conservation biology through hands-on workshops. At the end of the workshop, participants will be able to solder, wire circuit boards, assemble a GPS logger, use the Arduino computer language, and download and format data to display in a GIS. Additionally, we will provide further education through a pre-/post-workshop exercise incorporating spatial data into conservation planning to help students better grasp the applications of their work in solving environmental problems.

This meets the objectives of environmental education by increasing participant's knowledge of environmental issues, and awareness of how to help solve problems.

Major Activities:

Workshops

Activities include a brief introduction to open-source technology, basics of soldering via a customized circuit board soldering exercise, guided GPS logger assembly, introduction to Arduino, field testing, download and visualization of data in a GIS, casing and attachment, customization options, and use of technology in conservation research.

Conservation Applications

To showcase the use of open-source technology, like GPS loggers, we will have pre- and post-workshop exercises that make use of spatial data to inform conservation plans for three species. We will provide ongoing and real world examples of the use of these loggers on multiple species, and how they are applied to help solve environmental problems.

Public Involvement

The Toledo Zoo will host two, open-to-the-public workshops and have displays displays of other applications of DIY technology for fieldwork along with build instructions, bill of materials, and source code.

Overall Cost:

We request \$26,262 with \$5,361 matching from the Toledo Zoo for a grant total of \$31,623.

Project Description

Audience Need:

Researchers frequently rely on technology to quantify ecological phenomena, thus driving technological advancements for collecting data in a movement termed "technoecology"[1]. New and developing technologies have the potential to revolutionize data collection and transform our understanding of ecosystem function and dynamics[2]. In turn, these data will inform environmental management and conservation planning.

Many scientists are interested in technology, but do not have the technical knowledge or skillsets to take full advantage of the opportunities technology can provide. Wide-spread use of commercial products is often limited due to price yet the technoecology movement, allows for the ability to create low-cost technology. Low-cost, configurable devices are poised as an alternative to cost-prohibitive, commercial products, and will facilitate widespread collection of ecological data and add value to traditional studies.

An increasing number of programs are relying on open-source technology as it promotes ingenuity and yields substantial cost savings. Biology is currently experiencing a technological metamorphosis as an increasing number of researchers are making the shift to do-it-yourself biology (DIYbio), a global phenomenon poised to transform the face of "traditional" research using low-cost, open-source technology[3]. This is evidenced by the marked increase in the number of scientific papers referencing the terms "Raspberry Pi" or "Arduino" and journals dedicated to promoting open-source technology in the sciences[4]. Moving forward, those pursuing careers in the sciences, particularly the fields of biology and ecology, will find developing a unique skillset early will make them more competitive when entering the workforce[5].

To foster the relationship between open-source technology and ecology, and provide students with skills to solve environmental problems, we developed a workshop that will educate students and their teachers on applications to environmental sciences and provide them with an introduction to skills like soldering, coding, and use of GIS. We propose hosting workshops for 100 students and their teachers at five schools throughout the state of Ohio, ideally representing geographically distinct regions. Additionally, we would host two workshops (20 people each) at the Toledo Zoo that would be open to the public. Our workshops focus heavily on the iterative design process and multiple learning strategies (e.g., interactive, hands-on, and inquiry-based). We employ a multidisciplinary approach that will provide the foundations for students and teachers to apply open-source technology to their own projects, fostering a sense of curiosity that will lead to developing their own technologies for use in class projects (e.g., environmental loggers, RFID readers, remote operated vehicles, etc.).

This project aligns with many of the benchmarks and goals of Next Generation Science Standards and Ohio's Learning Standards for Science and Technology for grades 9-12. Content standards will also be addressed in environmental science and physics regarding wildlife management and electricity. The project also aligns with the broader goals for creating an environmentally literate citizenship through environmental education. Students will gain awareness, motivation, and skills for working towards solutions of ecological and environmental problems.

This project will promote the Toledo Zoo's mission statement of "Inspiring others to join us in caring for animals and conserving the natural world" by encouraging students to pursue their own conservation projects and presenting them with a real-world example of the integration of science and technology. We hope this work will not only motivate early-career scientists or engineers to collaborate outside their discipline, but also encourage those who are more technically inclined to realize their skills have applications outside their particular field of interest.

Qualification:

Matt Cross, Ph.D. is a Conservation Biologist at the Toledo Zoo and has been employed there since 2016. He holds M.S. degrees in Conservation Biology and Geographic Information Sciences (GIS) from Central Michigan University, and received his Ph.D. in Ecology from Bowling Green State University. Matt's work primarily focuses on the landscape ecology of reptiles with a strong outreach component. Matt routinely engages citizen scientists in his research and has a local network of volunteers who report turtle sighting and submit pictures for individual identification.

Pat is a Lecturer of Biology at Georgia Gwinnett College with a Ph.D. in behavioral ecology from Indiana State University, M.S. in Conservation Biology from Towson University, and B.S. in Biology and Music from Central Michigan University. Pat's work has included assessing territory size in salamanders, investigating the effects of commercial harvest on snapping turtles in Maryland, the evolution of signaling traits in lizards, and using antlions (Family Myrmeleontidae) as a teaching tool for introductory biology students. More recently, Pat has dedicated himself to applying his passion for technology to developing low-cost tools for fellow researchers including a moonlight sensor for bats, robotic lizard models, infrared trackers, GPS loggers, VHF transmitters, and using 3D imaging to evaluate habitat characteristics.

Matt and Pat began hosting educational workshops in 2017 where they teach attendees how to solder and program their own GPS loggers for use in field research. These workshops have been held at national and international conferences, the Toledo Zoo and Aquarium, and a local high school. The loggers featured in these workshops were the subject of a recent peer-reviewed publication: (<https://doi.org/10.1016/j.ohx.2018.02.002>). This paper was featured in an online review on engineering.com: <https://www.engineering.com/Hardware/ArticleID/16623/Researchers-Build-DIY-GPS-Trackers-for-Eastern-Box-Turtles-from-Open-Source-Hardware.aspx>.

Literature Cited

1. M. AB, G. ND, Daniel I, Jeremy V, Pin KL, G. RE. Futurecasting ecological research: the rise of technoecology. *Ecosphere*. 2018;9: e02163. doi:doi:10.1002/ecs2.2163
2. Snaddon J, Petrokofsky G, Jepson P, Willis KJ. Biodiversity technologies: Tools as change agents. *Biol Lett*. 2013;9. doi:10.1098/rsbl.2012.1029
3. Landrain T, Meyer M, Perez AM, Sussan R. Do-it-yourself biology: Challenges and promises for an open science and technology movement. *Syst Synth Biol*. 2013;7: 115-126. doi:10.1007/s11693-013-9116-4
4. Cressey D. Age of the Arduino. *Nature*. 2017;544: 125-126. doi:10.1038/544125a
5. Barraquand F, Ezard THG, Jørgensen PS, Zimmerman N, Chamberlain S, Salguero-Gómez R, et al. Lack of quantitative training among early-career ecologists: a survey of the problem and potential solutions. *PeerJ*. 2014;2: e285. doi:10.7717/peerj.285

Continuation and Replication Plan:

Our workshops are typically organized such that they are sustained through registration fees, and can therefore continue indefinitely. In fact, we anticipate hosting workshops in the future showcasing how to construct other conservation-related technology such as VHF transmitters, RFID readers, and weather stations. As technology advances, so will our workshops. We will continue to seek additional funding to bring the workshop to other institutions at a reduced cost. By making teachers part of our workshops, we will provide the training and equipment necessary to incorporate lessons learned into existing classes or future projects. The workshops that would be funded by this grant could serve as a model for including conservation technology into high school curricula throughout Ohio, and possibly even expanded to include other states.

Non-consumable equipment for our workshops (soldering irons, stands, flush cutters, wire strippers, helping hands, and safety glasses) will be retained by the Toledo Zoo upon completion of this project. Having these supplies on hand will help reduce the cost of future workshops for other interested schools and organizations.

The Toledo Zoo will launch a strategic outreach plan that will include a press release and multi-media campaign covering this project which will reach the Zoo's estimated worldwide network of >18 million people, including 180,829 Facebook followers, 37,800 Instagram followers, 16,600 Twitter followers, 60,000 members, and 55,100 individuals on the e-mail list. If our "Technology in Ecology" weekends are successful, we will leverage our social media outreach to promote these events.

Budget Narrative:

The requested funds would pay for 100 students and 2 teachers/school (10 teachers total), and up to 40 interested parties from the Zoo's annual attendees to participate in the proposed workshop.

Personnel

We request \$2,750 for the salary of Matt while running and organizing the workshops. The Toledo Zoo will provide match in the amount of \$3,438 for workshop organization, planning, and travel time, and \$1,250 in consulting from the Education Department to develop pre- and post-workshop assessments.

Supplies

We request \$11,301 for consumable supplies related to construction of the GPS loggers including 30 of each: solder (\$2), solder braid (\$2), hookup wire (\$2.50), and solderin iron tips (\$20); 150 of each: transistors (\$0.05), GPS receiver (\$16), Arduino Pro Mini (\$9), batteries (\$14), FTDI adapter (\$14), USB cable (\$2), extra-long male headers (\$0.75), LCD screen (\$2.07 + shipping), battery charger adapter (\$5 + shipping), switches (\$2 + shipping), and blinking exercise kits (\$10); and materials to construct display technologies for museum exhibition (\$455).

Equipment

We request \$5,798 for major equipment including 30 of each: soldering station (\$90), flush cutters (\$7), wire strippers (\$5), third hand (\$5), and safety glasses (\$1), and 10 notebook computers (\$250). We request 30 of each major piece of equipment to account for replacement equipment and to allow us to loan equipment to more than one class at a time following the grant. After running several iterations of this workshop, it became clear a major source of error was allowing students to bring their own computers. Each operating system works differently and we have had more success if everyone uses the same equipment. We will purchase notebook computers that will be pre-loaded with the Arduino IDE and Google Earth to avoid issues involving software updates, multiple operating systems, and IT delays. Having these computers on-hand will also allow us to work with schools and groups with limited on-site computer access.

Printing

We request \$238 to cover the cost of color printing for workshop instructions (14 p.), and the pre- and post-workshop activity (2 p.) for 110 attendees (2160 p. total at \$0.11/pg).

Travel

We request \$3,753 to cover Pat's travel from Georgia to Ohio, travel within Ohio to partnering schools, and overnight stays while running workshops. The Toledo Zoo will provide mileage match in the amount of \$273.

Contractual

We request \$2,500 to contract Pat Cain at \$40/hr to assist with hosting workshops: 8 hrs per workshop (40 hrs), and an additional 22.5 hrs of pre-workshop development, research, preparation, and development of workshop-related technology. The Toledo Zoo will contribute \$400 in match to cover Pat's within-state travel time.

Project Objectives and Associated Activities & Outcome Measurements

Objective Title: Applications of open-source technology to conservation

Objective Description:

The main objective of this project is to educate students and teachers on the benefits of open-source technology in conservation and environmental research. Up to 100 high school students and 10 teachers, at five schools/districts throughout the state, will learn about the applications of open-source technology to conservation biology through hands-on, educational workshops. We have made contact with the following schools: Toledo Public Schools Natural Science and Technology Center, West Clermont High School, and New Philadelphia High School. At the end of the workshop, attendees will be able to solder, wire circuit boards, assemble a GPS logger, use the Arduino computer language to program their GPS loggers, and download and visualize data in a GIS. In addition to the training provided by the workshops, we will provide further education through a pre- and post-workshop exercise incorporating spatial data into conservation planning. These exercises will more explicitly connect students with applications of the technology for solving environmental problems and engage students with the entire inquiry process utilizing science and engineering practices.

Workshop attendees will take home with them: their custom soldering exercise, self-made GPS logger, a copy of the Power Point presentation (containing visual aids), typed assembly and use instructions, and links to parts list and purchase locations. Remaining, non-consumable equipment will remain with the Toledo Zoo and be used to reduce the cost of future workshops or loaned out to schools interested in pursuing their own projects.

This work builds upon our pre-existing workshop design that has been tried and tested at national and international conferences, as well as featured in a peer-reviewed scientific journal article. These workshops typically run all day, but in the past, we have broken it up into three smaller sections to accommodate high school schedules.

The topics and skills in this workshop directly align with many of the topics and goals of the Ohio Department of Learning Standards for Science and Technology. This will contribute to such proficiencies as using digital tools to (Technology): construct knowledge, impacts of technology across disciplines and multidisciplinary approaches, collaboration strategies, use of engineering design to solve problems, and (Science): interpreting the natural world, generating and evaluating data, motivation to learn about the natural world, and thinking of themselves as contributing to science. This workshop promotes the iterative design process, multiple learning strategies (inquiry-based, hands-on, and active), multidisciplinary collaboration, and communication. Furthermore, our conservation planning exercise specifically addresses science inquiry and application by examining ecosystems, species interactions, and wildlife through real-world application.

Activity Title: Hands-on workshops

Start Date: 09/14/2020

End Date: 06/18/2021

% of Budget: 99.99%

Activity Description:

Introduction (20 min): We give an introductory presentation giving the audience some background about the motivation for this workshop, discuss the open-source movement and provide familiar examples (e.g., Linux, Mozilla, 3D Robotics), explain Arduino in terms of components and programming, show the breadth of projects created and shared by the online community, and explain the cost-savings benefits of open-source or DIY projects. We explain the goal of the workshop is to show how open-source/DIY projects provide tools for collecting data to answer environmental questions, using an inquiry-based approach and iterative design process.

Soldering Basics (~1 hr): We introduce students to the equipment they will be using, explain the function of each piece, and discuss safety. Students are given the customized LED blinker exercise and a diagram of how the final product should look, and are instructed to practice soldering by assembling the blinker. Components introduced include: resistors, LEDs, capacitors, transistors, on/off switch, and battery. The functions of these components are explained within the context of how the blinker exercise works. The LED blinker exercise is designed to function as a nametag holder and can be worn by the students.

GPS logger assembly (1-1.5 hrs): Students are given the components that will be used to create the GPS loggers and the function of each component is explained. The students assemble the loggers by following a step-by-step guide that includes new concepts like de-soldering, wiring, and use of specialized tools.

Introduction to the Arduino coding language (1.5-2 hrs): The Arduino integrated development environment (IDE) will be pre-loaded on the notebook computers. Students will work in pairs for this portion and will load a basic program to the microcontroller to learn how to work the Arduino IDE. They will then load sketches to the microcontroller that will allow them to control the GPS logger recording interval. Students will be instructed to set the loggers to record a point every two minutes. They will then take a break and walk around outside for 30-60 minutes to let their loggers record points.

Data download and visualization (1 hr): Students go back to the Arduino IDE and are given the microcontroller program needed to download data. Data are downloaded then brought into Google Earth or ArcGIS where the paths they walked on break will be visible.

Customization (1 hr): We highlight the customizability of the GPS logger, and other open-source projects, through: casing options, attachment methods, PCB design, and additional peripherals that can be added to the logger (i.e., temperature sensor, remote download, water sensor). A live demo of our newer, expanded memory loggers will be given to show the ease with which these loggers can be customized.

Outcome Title: Workshop Skills

Initial Outcome:

The initial outcome of the hands-on activities in the workshop will be the students' demonstrated proficiency completing of the following tasks: soldering, wiring, GPS logger assembly, code editing, and visualization in a GIS. Students will be led through the workshop activities in a step-by-step manner and troubleshoot along the way, thereby ensuring the whole group advances at the same pace, without issue. In the spirit of collaboration and cooperation, those who finish early will be encouraged to help their classmates. By the end of the workshop, all students will have completed the tasks and have their working blinker exercises and GPS loggers, and be able to replicate these skills on their own.

Long-Term Effects:

With a project like this, it is difficult to determine the long-term effects, as students will be trained with a skillset that could be used outside of the classroom. The skills and equipment from this workshop can be directly applied to a myriad of other projects. For instance, the Arduino Pro Mini, the microcontroller for the GPS logger, can be de-soldered and used to create a wide breadth of projects including environmental sensors and remote operated vehicles. We will schedule 1-2 follow-up visits (in person or virtually) with workshop attendees to assess the number of individuals using some portion of the workshop skills in classroom projects, hobbies, or in resume-building. We will provide a link to a Google Group, as well as open-source forums and data repositories, so students can contribute to the future development of this, or other projects, and ask questions of the user community as they move forward with their own work.

Activity Title: Conservation planning from an organism-based perspective

Start Date: 09/14/2020

End Date: 06/18/2021

% of Budget: 0.01%

Activity Description:

The introduction of the workshop focuses on the breadth of projects implementing open-source technology including weather stations and environmental sensors, RFID readers, and drones. We also discuss the cost of similar commercial devices and how open-source technology can allow researchers to gather orders of magnitude more data on the same budget. To explain the utility of open-source technology-derived data to conservation planning, we will provide students with real-world examples of the GPS loggers being used by researchers including: Ohio turtle research, greater prairie chicken studies, proposed projects, and similar technology in the published literature. We show students the loggers they just created have the same accuracy as any commercial GPS unit.

Prior to the workshop, students will be given a brief exercise wherein they are presented with a gridded sheet of paper containing different habitat types (e.g., forest, river, urbanized, etc.) and are tasked with creating reserves for three species (Appendix A). The students are given no other information beyond the name of the species for which they are planning the reserve and general habitat preferences. Students will draw out what they envision to be the idea reserve(s) for the target species. Following the workshop, the students will be presented with the same exercise, but are given species-specific spatial data (home range size, preferred or avoided habitats, etc.), similar to what could be derived from wildlife GPS collars. The students will once again be asked to design reserves. What students will find is the spatial data simultaneously provide guidelines for selecting reserves, but also make planning more difficult within the context of available habitat. Students will be asked questions pertaining to species interactions, habitat connectivity, invasive species, difficulties planning reserves, data that might help make more accurate predictions, technology that might help gather additional data, and the influence of climate change. Finally, students will be asked to propose a project where they can use their loggers, or other technology, to gather requisite data and speculate how said data would help them develop conservation plans.

Outcome Title: Incorporating concepts into conservation planning

Initial Outcome:

The initial outcome of this project will be immediately apparent in the differences between the pre- and post-workshop conservation planning exercise. Students will see a stark difference in their proposed conservation areas before and after gathering spatial data for the study species. The student's knowledge regarding science process skills and applications for conservation will be assessed through students' proposals for research. We will collect the workshop exercises and go over the results with the Toledo Zoo's Education Department staff to determine how successful this exercise was at conveying our message and where improvements could be made.

Long-Term Effects:

The exercise portion of the workshop will provide a realistic example of how data derived from open-source projects can influence conservation planning. The interplay of data, species-specific requirements, and habitat availability will present students with the opportunity to apply critical thinking skills in determining the best course of action. Overall, an understanding of how open-source technology can collect data to influence conservation planning is the goal of this activity. The interpretation of student results from the Toledo Zoo's Education staff will help shape future iterations of this workshop.

Activity Title: Increasing public awareness of the applications of open-source technology in ecology

Start Date: 06/01/2021

End Date: 09/01/2021

% of Budget: 0.01%

Activity Description:

While a large portion of this proposal focuses on training and educating students, we seek to expand our impact to include the public. We presented our work at the Cleveland Mini Maker Faire in 2018 and found hobbyists and tinkerers were intrigued by our applications, and even had suggestions on ways to modify or improve the designs. With this in mind, we propose hosting workshops associated with "Technology in Ecology" weekends at the Toledo Zoo during peak attendance season (June-September). Funds from this grant would provide loggers for up to 40 people to participate in the same logger workshop we run for the high school students. These workshops would be held in the Zoo's open-view conservation labs in the new Promedica Museum of Natural History, allowing the public to view the activities and interact with attendees and instructors. Attendees would work in pairs during these workshops to increase the number of participants. During these workshops, we will have interactive examples of various open-source and DIY technologies on display, including night vision goggles, LED blinkers, robotic lizard models, environmental sensors, water sensor, LCD screen GPS unit, customized PCBs, VHF transmitters, tape measure antenna, and receiver. Each display will have information regarding uses and applications, bill of materials, and source code.

Outcome Title: Public involvement and perceptions of technology in ecology

Initial Outcome:

Based on attendance numbers from previous years and clicker counts in 2019, an estimated 185,000 people visited the Promedica Museum of Natural History. By hosting our Technology in Ecology weekends during peak visitor season, we anticipate exposing a similar number of people to our work. Zoo education staff will keep track of attendance using handheld clickers.

Long-Term Effects:

Following the model of our membership surveys, which are designed to assess the impact of various Zoo initiatives, we will ask public workshop and Technology in Ecology attendees to fill out a brief survey as they leave the conservation lab area. In general, ~50% of our members respond to the survey. Since people attending our proposed activities are less likely to take the time to fill out a survey, we anticipate a response from ~10% of visitors (18,500) and all of our workshop attendees. Our survey questions will allow us to determine the public's awareness of the applications of open-source technology to our conservation programs. In turn, this will provide use with data to increase the impact of our message in the future. Individuals attending our open-lab weekends and workshops will be provided the same post-workshop information as the high school students (follow-up activities, links, Google group, etc.) so they can participate and contribute in discussions.

Budget Summary

Category	OEEF Grant % Total	OEEF Grant Amount	Applicant Match	Total
A.1. Salary or Wages	10.0	\$2,750.00	\$3,750.00	\$6,500.00
A.2. Benefits	0.0	\$0.00	\$938.00	\$938.00
A.3. Substitute Teachers	0.0	\$0.00	\$0.00	\$0.00
B.1. Supplies	43.0	\$11,301.00	\$0.00	\$11,301.00
B.2. Equipment	22.0	\$5,720.00	\$0.00	\$5,720.00
B.3. Printing	1.0	\$238.00	\$0.00	\$238.00
B.4. Other Costs	14.0	\$3,753.00	\$273.00	\$4,026.00
C.1. Contractual	10.0	\$2,500.00	\$400.00	\$2,900.00
D.1. Administrative	0.0	\$0.00	\$0.00	\$0.00
Total Budget		\$26,262.00	\$5,361.00	\$31,623.00

A.1. Salary or Wages

Employee Name	Title	Grant # of Hours	Grant Hourly Rate	Matching # of Hours	Matching Hourly Rate	Grant Annual Salary	Grant % of Salary	Matching Annual Salary	Matching % of Salary	OEEF Grant Amount	Applicant Matching Amount
TBD Toledo Zoo Education Staff	Education Staff	0	\$0.00	50	\$20.00	\$0.00	0.0	\$0.00	0.0	\$0.00	\$1,000.00
Matt Cross	Conservation Biologist	0	\$0.00	0	\$0.00	\$55,000.00	5.0	\$55,000.00	5.0	\$2,750.00	\$2,750.00
Subtotal:										\$2,750.00	\$3,750.00

A.2. Benefits

Benefits Description	Rate or % of Salary	OEEF Grant Amount	Applicant Matching Amount
Education Staff Fringe	25.0	\$0.00	\$250.00
Fringe: Matt Cross	25.0	\$0.00	\$688.00
Subtotal:		\$0.00	\$938.00

B.1. Supplies

Supplies Description	Quantity	Unit Price	OEEF Grant Amount	Applicant Matching Amount
Transistor	150	\$0.05	\$8.00	\$0.00
FTDI adapter	150	\$14.20	\$2,130.00	\$0.00
Switches	150	\$2.25	\$338.00	\$0.00
USB cable	150	\$1.95	\$293.00	\$0.00
Battery charger adapter	150	\$5.36	\$804.00	\$0.00
Blinker exercise kit	150	\$10.00	\$1,500.00	\$0.00
GPS receiver	150	\$15.95	\$2,393.00	\$0.00
Soldering iron tips	30	\$20.00	\$600.00	\$0.00
Adafruit shipping	1	\$7.00	\$7.00	\$0.00
Extra-long male headers	150	\$0.75	\$113.00	\$0.00
Hookup wire	25	\$2.50	\$63.00	\$0.00
Solder braid	25	\$2.49	\$62.00	\$0.00
Arduino Pro-mini board	150	\$9.45	\$1,418.00	\$0.00
LCD screen	150	\$2.07	\$311.00	\$0.00
Lipo battery	150	\$4.95	\$743.00	\$0.00
Materials for museum displays	1	\$455.00	\$455.00	\$0.00
LCD screen shipping	1	\$14.00	\$14.00	\$0.00
Solder spool	25	\$1.95	\$49.00	\$0.00
Subtotal:			\$11,301.00	\$0.00

B.2. Equipment

Equipment Description	Quantity	Unit Price	OEEF Grant Amount	Applicant Matching Amount
Safety glasses	30	\$0.64	\$19.00	\$0.00
Notebook computer	10	\$250.00	\$2,500.00	\$0.00
Wire Strippers	30	\$4.72	\$142.00	\$0.00
Soldering station	30	\$90.00	\$2,700.00	\$0.00
Flush cutters	30	\$6.75	\$209.00	\$0.00
Helping hand	30	\$4.99	\$150.00	\$0.00
Subtotal:			\$5,720.00	\$0.00

B.3. Printing

Printing Description	Rate Description	OEEF Grant Amount	Applicant Matching Amount
Printing	2160 color pages @ \$0.11/pg	\$238.00	\$0.00
Subtotal:		\$238.00	\$0.00

B.4. Other Costs

Other Costs Description	OEEF Grant Amount	Applicant Matching Amount
Pat Cain travel to Ohio	\$1,800.00	\$0.00
In-state travel	\$273.00	\$273.00
Overnight stays	\$1,680.00	\$0.00
Subtotal:	\$3,753.00	\$273.00

C.1. Contractual

Contractual Description	Contractor Name	OEEF Grant Amount	Applicant Matching Amount
Contracting Pat Cain for workshop activities	Pat Cain	\$2,500.00	\$400.00
Subtotal:		\$2,500.00	\$400.00

Applicant Contact

Contact Type: Project Director	Job Title: Conservation Biologist
Name: Matthew David Cross	
Primary Phone: (419) 385-5721	Primary Fax:
Primary Email: matt.cross@toledozoo.org	
Primary Address: Toledo Zoo and Aquarium, P.O. Box 140130, Toledo, OH 43614	
Alternate Phone:	Alternate Fax:
Alternate Email:	
Alternate Address:	
Alternate Start Date:	Alternate End Date:

Contact Type: Primary Collaborator	Job Title: Lecturer of Biology
Name: Pat Cain	
Primary Phone: (470) 389-2088	Primary Fax:
Primary Email: pcain1@ggc.edu	
Primary Address: School of Science and Technology, Georgia Gwinnett College, Laqrenceville, GA 30043	
Alternate Phone:	Alternate Fax:
Alternate Email:	
Alternate Address:	
Alternate Start Date:	Alternate End Date:

Contact Type: Authorizing Agent	Job Title: Senior Vice President and Chief Missions Officer
Name: Kent Bekker	
Primary Phone: (419) 385-5721	Primary Fax:
Primary Email: kent.bekker@toledozoo.org	
Primary Address: The Toledo Zoo and Aquarium, P.O. Box 140130, Toledo, OH 43614	
Alternate Phone:	Alternate Fax:
Alternate Email:	
Alternate Address:	
Alternate Start Date:	Alternate End Date:

Contact Type: Fiscal Agent	Job Title: Vice President, Finance
Name: David Fisher	
Primary Phone: (419) 385-5721	Primary Fax:
Primary Email: david.fisher@toledozoo.org	
Primary Address: The Toledo Zoo and Aquarium, P.O. Box 140130, Toledo, OH 43614	
Alternate Phone:	Alternate Fax:
Alternate Email:	
Alternate Address:	
Alternate Start Date:	Alternate End Date:



15 January 2019

To whom it may concern,

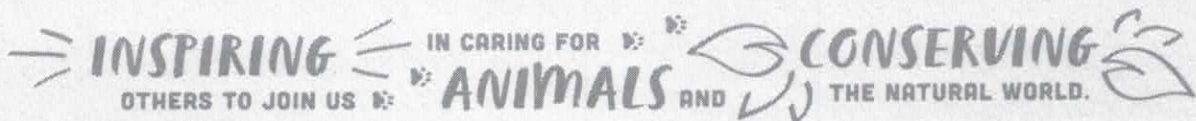
I am pleased to support the submission of the proposal "Teaching Conservation Through Wildlife Technology" the Toledo Zoo is submitting to the Ohio Environmental Protection Agency's Ohio Environmental Education Fund. This project embodies the Zoo's mission of "Inspiring others to join us in caring for animals and conserving the natural world" and will provide technical skills and conservation education to 100 high school students, and their teachers, throughout the state.

The Toledo Zoo has a long history of using technology to support its conservation imitates. If funded, the Toledo Zoo will provide \$5,361 in-kind support for staff time, travel, and contractual services. The Toledo Zoo is committed to hosting these workshops long-term and will continue to promote them through our various media outlets.

Sincerely,

Kent Bekker
Senior Vice President and Chief Missions Officer
The Toledo Zoo

P.O. BOX 140130 • TOLEDO, OHIO • 43614-0130 • 419-385-5721





Toledo Public Schools
Aerospace & Natural Science Academy
11600 West Airport Service Rd
Swanton, OH 43558

419-671-1700
Fax 419-671-1745

December 5, 2018

To Whom It May Concern:

Please accept this letter in support of the proposal for funding high school DIY GPS data logger workshops. The Aerospace and Natural Science Academy of Toledo (ANSAT) of Toledo Public Schools has 166 students enrolled, where 40% qualify for free and reduced lunch. The mission of Toledo Public Schools is to produce competitive college and career ready graduates, through a rigorous curriculum across all grade levels, by implementing Ohio's New Learning Standards with fidelity. These workshops would provide an opportunity that fulfills our mission and vision.

This project is the perfect fit for students enrolled in Natural Science Career Technical Programs; including, Wildlife & Sustainability, Animal Science, and Urban Agriculture. The Ohio Department of Education requires teachers in all three programs to instruct competencies in using GPS technology, tools, and solving real-world wildlife management problems. Active participation in this workshop will allow application of these skills in preparation of environmental careers. Additionally, the DIY GPS units can be applied to a project that monitors Eastern Box Turtle populations in our local metroparks.

As a partnering school, we will provide a laboratory classroom set-up, computers, and 3 teachers to assist in facilitating thirteen students participating in the workshop at the ANSAT. The teachers will be actively engaged in the workshop. The skills learned can assist them to lead future projects, involving even more students, in constructing digital electronics that solve real world problems by monitoring local wildlife populations.

Sincerely,

Amy Daunhauer

Senior Director

Aerospace and Natural Science Academy of Toledo



New Philadelphia High School

343 Ray Avenue NW | New Philadelphia, OH 44663-1950
P 330.364.0644 | F 330.364.0633

PRINCIPAL
Eric Jurkovic

ASSISTANT PRINCIPAL
Steve Rippeth

ADMINISTRATIVE
ASSISTANT
Faith Deasy

October 10, 2018

To Whom It May Concern,

I am writing this letter in support of the proposal for funding high school DIY GPS data logger workshops. Our school district lies within western edge of the Appalachian Region of Ohio and has an average enrollment of approximately 3,000 students, 37% of which qualify for free and reduced lunch. Our mission is to offer students transformative educational opportunities that will allow them to reach their highest potential, and we feel that these workshops would provide such an opportunity.

This project dovetails well with the Digital Electronics course that we offer at New Philadelphia High School, empowering students interested in digital electronics with a more advanced set of skills than we are currently able to offer, and providing students with an excellent example of how digital electronics are used by people from a variety of backgrounds and careers to solve real world problems. Further, we hope to apply the DIY GPS units that are the focus of this workshop to a project that monitors Eastern Box Turtle populations in forest ecosystems of our region. This would build on our research examining the long term implications of surface coal mining on our region, and the in-house construction of these GPS loggers would allow for deeper levels of engagement across a wider array of students and teachers in this project.

As a collaborating school district, we will provide a laboratory environment, computer workstations, and 2 teachers to assist in facilitating the 13 students participating in the workshop at New Philadelphia High School. The teachers will be actively engaged in the workshop with the goal that the skills learned will empower them to lead future projects involving a wider swath of our district's students in constructing digital electronics to address real world problems such as monitoring local wildlife populations.

Sincerely,

Eric Jurkovic, New Philadelphia High School Principal

Workshop Scenario

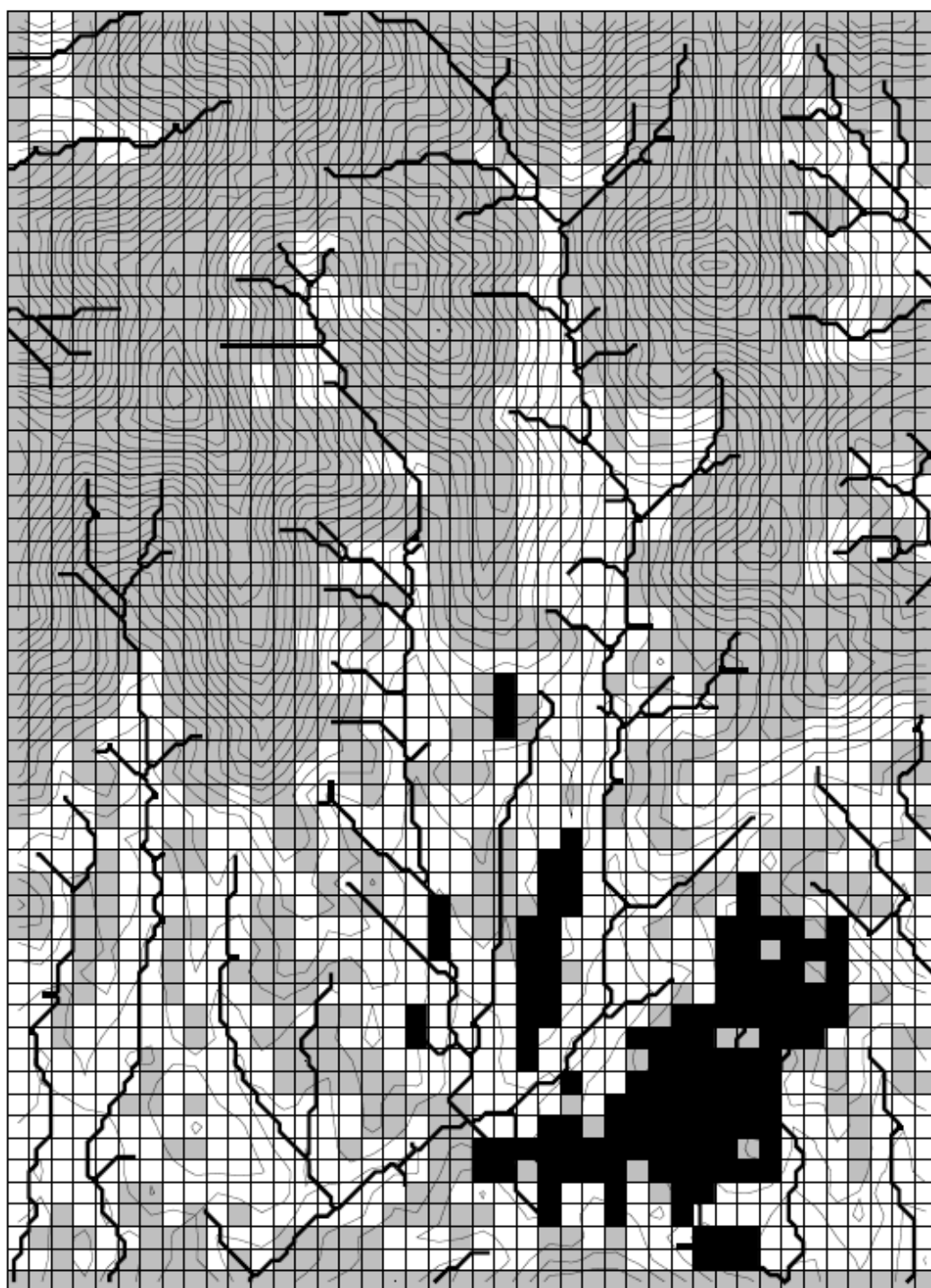
You are interested in determining where on the landscape these species might occur and what influences their long-term viability. Try to map at least three locations for each species on the attached map.

	Species	Habitat Preferences*	Mapping*
A	Ovenbird (<i>Seiurus aurocapillus</i>)	Interior forest sites at least 180m from non-forest or urban	Find at least nine cells together that are forest and not within two cells of non-urban or urban areas
B	Jewelweed (<i>Impatiens capensis</i>)	Stream sides or moist sites	Cells of non-forest (but not urban) cover immediately adjacent to or crossed by streams
C	Indigo Bunting (<i>Passerina cyanea</i>)	Forest edge	Forest cells adjacent to non-forest cells or non-forest cells adjacent to forest cells.
D	Mountain dusky salamander (<i>Desmognathus ochrophaeus</i>)	Forests with streams	Forest cells adjacent to or crossed by streams
E	House mouse (<i>Mus musculus</i>)	Urban areas and non-forest	Urban and non-forest cells, and cells adjacent to urban cells

**Habitat specifics and mapping guidelines will be withheld for the pre-workshop portion of the exercise, then later introduced for the post-workshop exercise to show the importance of obtaining data on focal species.*

1. Which species are likely to overlap in their distributions? Would one species affect the distribution of another?
2. Which species seem to be limited by available habitat? How easily will these species be able to disperse from one area of suitable habitat to another?
3. What are some of the difficulties you faced while mapping out areas for these species?

4. How might these change with the introduction of a generalist predator?
5. How might these distributions be affected if :
 - a. A wildfire burned the upper $\frac{1}{4}$ of the map making it unsuitable for forest species?
 - b. Urban runoff pollutes the adjacent streams, making the streams in the middle of the map unsuitable for riparian species?
6. Based on the species distributions, develop a claim for one way that ecologists could restore or preserve the function of local environments.
7. Propose one ecological question that could be answered about the local habitat using your GPS logger or another piece of open-source technology.






-  Forest
-  Nonforest
-  Urban

Figure 13.1. Land cover map of study area. Thin lines are 10-m contours; heavier lines represent streams. Each cell is 90 m x 90 m in area. The spatial extent of the map is 19.7 km² (3.78 km x 5.22 km).

OEEF Grant Staff Checklist

Application #: S-20G036
Application Type: GeneralGrant

Organization Name: The Toledo Zoo and Aquarium
Project Title: Teaching Conservation Through Applied Technology

A. Overall

1. Yes Project eligible?
2. Yes Project meets which of OEEF's Educational Priorities: Other Environmental Education Projects
3. Yes Organization eligible?
4. N/A Initials of staff member who provided pre-review, if any

Overall Comments:

Great proposal. Seems like a great opportunity for students to develop technological skills, especially for future jobs. Would like to see collaboration letters from the other three schools that are participating. Would also like to know more about whether activities need safety precautions and to see more detail about the travel expenses.

B. Application Cover Sheet

5. Yes Collaborators identified on cover sheet appear to be correct based on their role as described in the proposal
Comments: Two collaborating schools listed of 5 anticipated schools.
6. Yes Time lines and start date are realistic and consistent with OEEF Guidelines
Comments: Not entered
7. Yes Grant duration 30 months or less
8. Yes Audience identified by applicant is correct for the project. If not, re-assign to audience: Not selected
9. 0 points Under-served Audience: Award 10 extra points if the proposed project targets a regulated community primary audience.
10. Yes List of counties identified by applicant appears correct based on activities in project description
Comments: Not entered
11. 0 points Under-served Counties: Award 5 points if the applicant organization is located in (OR all the proposed activities will take place in) a county/counties that OEEF has defined as under-served (i.e., where fewer than two grants have been awarded). Award 3 points if some of the proposed activities will take place in counties that OEEF has defined as under-served.
12. Yes Is this a revision of a previous application? (check last 2 cycles) If yes, OEEF ID#: S-19G028
13. Yes Has applicant previously received OEEF grant(s)? If yes, OEEF ID#: F17G-005
14. No Was previous grant awarded in the past twelve months?
15. No Is any previous grant still open?
- Not selected If yes, is previous grant likely to close before the Council meeting for this current grant cycle?

C. Audience Categories and Project Issues

16. Comment if applicant appears to have made assignments in error
Comments: Not entered

D. Contact Information

17. Yes One person is not serving in all 3 roles (director, fiscal, authorizing)
Comments: Not entered

E. Project Description - Overall

18. Yes Project does not include political advocacy
19. Yes Project includes adequate safeguards for any potentially dangerous activities
20. Yes If this is a K-12 formal education project, it includes specific examples or a satisfactory explanation of the process that will be used to align student learning activities with New Learning Standards

Comments: 19: Safety is mentioned but it is unclear how activities will be unsafe and what safeguards are needed. There are safety glasses in the budget

F. Budget Narrative

21. Yes Itemized detail is provided
22. Yes Figures are accurate

G. Budget Spreadsheet

Personnel

23. Yes Salary
24. Not selected Benefits: Explanation of how calculated and % used for fringe.
25. Not selected Stipends or Substitute: OEEF is not asked to pay for both for the same teacher for the same day

Comments on Personnel section of budget:

Not entered

Non-Personnel

26. Yes Supplies: Identified, grouped, unit priced, and totaled
27. Yes Equipment: Itemized, grouped, unit priced and totaled
28. Yes Printing: Itemized, # of copies, unit price, and totaled
29. Yes Other: Categorized, method of calculation, and totaled

Comments on Non-Personnel section of budget:

28: More details in budget narrative; 29: Could be more detailed (e.g. amount of miles traveled?)

Contractual

30. Yes Name of party, organization, # of hours, hourly wage, total
31. Yes The combination of Personnel and Contractual costs does not exceed 35% of the budget. (If it does, add comment and note percentage)

Comments on Contractual section of budget:

30: Details provided in budget narrative

32. Yes There are no ineligible expenses
33. Yes There is no unacceptable pass-through of grant funds to a third party
34. Yes Overall, expenses are reasonable (if questionable, add comment)
Comments: 34: How many miles will Pat travel? The amount of funds going into travel expenses in the Other category seems like a lot.
35. 0 points Award five extra points if the applicant (with their collaborators) has provided a strong, well-documented cash or in-kind match that greatly exceeds 10% of the funds requested from OEEF. (Do not assign extra points for less than a 50% match)
Comments: Not entered

H. Letters of Collaboration and Support

36. No Collaboration does not appear to be needed for this project to succeed
Comments: Not entered
37. Yes If the project is collaborative, documentation letters have been received from all, partial or none of the collaborators
38. 0 points Award five extra points for projects with very strong, well-documented collaboration
Comments: Missing collaboration letters from three schools.
39. 5 points Award five extra points if the applicant has provided documentation of support for the project from members or appropriate representatives of the target audience. (Letters or applications from teachers of the targeted grade level will meet this criteria for the pre-school to university audience. Letters or applications from an established trade or professional association will meet this criteria for the regulated community audience.)
Comments: Not entered
40. Yes Attachments, if any, are relevant to the applicant's ability to successfully complete the proposed project
41. Not selected Other
Comments: Not entered

Checklist completed: Yes

Total Points Awarded: 5 out of 30

OEEF Grant Reviewer Score Sheet with Comments

Application #: S-20G036	Organization Name: The Toledo Zoo and Aquarium
Grant Type: GeneralGrant	Project Title: Teaching Conservation Through Applied Technology
Primary Target Audience: Pre-school to University	Application Status: Scoring Complete

Reviewer 1

A. Audience Need (up to 20 points)	Points Awarded	Maximum Score
1. The target audience is well described.	5	5
2. The need is a documented need of the target audience, not the applicant/provider organization.	3	5
3. The need for the project was determined in a valid way.	3	5
4. Meeting this need will yield substantial benefits to the target audience.	5	5
	16	20

Reviewer Comments on Need Statement:

Not entered

B. Organizational Qualifications (up to 10 points)	Points Awarded	Maximum Score
1. The applicant organization and/or its collaborators are experienced and well-qualified to work with this audience.	5	5
2. The applicant organization and/or its collaborators have appropriate expertise to conduct this project and ensure that the project information is scientifically valid and unbiased.	5	5
	10	10

Reviewer Comments on Organizational Qualifications:

Not entered

C. Project Objectives (up to 35 points)	Points Awarded	Maximum Score
1. The objectives define specifically who will benefit and what will be learned.	5	5
2. The objectives address the need of the target audience as presented in the Statement of Need.	5	5
3. The objectives are consistent with the mission of the applicant organization.	5	5
4. The objectives meet one of OEEF's educational priorities.	5	5
5. The objectives are measurable.	5	5
6. The objectives are realistic for the age group or audience being targeted.	5	5
7. The project does not appear to duplicate other available environmental education resources and programs.	5	5
	35	35

Reviewer Comments on Objectives:

Not entered

D. Project Activities (up to 35 points)	Points Awarded	Maximum Score
1. The project activities are specific, and the sequence of activities is appropriate.	5	5
2. The project activities are appropriate for meeting the stated project objectives.	5	5
3. Reasonable steps are taken to ensure that the project information is scientifically valid and unbiased.	5	5
4. The project activities are (or will be) aligned with the Ohio Department of Education's Academic Content Standards for K-12 education. (for pre-school or university audience projects, award 5 points)	5	5
5. The activities are age-appropriate.	5	5
6. The project does more than disseminate information: learners will engage in hands-on activities, problem solving, and/or skill-building.	5	5
7. The project makes good use of existing environmental education materials, or provides good justification for the decision to develop new materials.	5	5

	35	35
Reviewer Comments on Activities:		
<i>Not entered</i>		
E. Timetable (up to 10 points)	Points Awarded	Maximum Score
1. The start and end dates are realistic for completion of the activities.	5	5
2. The start and end dates show that activities will be carried out in a logical sequence.	5	5
	10	10
Reviewer Comments on Timetable:		
<i>Not entered</i>		
F. Outcome Measurement (up to 15 points)	Points Awarded	Maximum Score
1. The measurements are scientifically and educationally valid for determining if the project objectives were achieved.	5	5
2. The measurements describe success indicators, tools being used to measure, methods of analyzing the data, and who will be conducting the evaluation.	5	5
3. The measurements address both short-term and long-term effects of the project.	3	5
	13	15
Reviewer Comments on Outcome Measurements:		
<i>Not entered</i>		
G. Continuation/Replication Plan (up to 15 points)	Points Awarded	Maximum Score
1. The project includes a realistic plan for sharing the results with other educators.	3	5
2. The plan describes how the project can continue once OEEF funding ends.	3	5
3. The plan describes how the project can serve as a model for replication with similar audiences.	5	5
	11	15
Reviewer Comments on Continuation/Replication Plan:		
<i>Not entered</i>		
H. Budget (up to 20 points)	Points Awarded	Maximum Score
1. The budget table and narrative clearly explain all expenditures to be funded by the OEEF.	5	5
2. The budget is appropriate for this type of project.	3	5
3. Salary costs are reasonable as a proportion of the overall budget. (In general, salary costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
4. Equipment costs are reasonable as a proportion of the overall budget. (In general, equipment costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
	18	20
Reviewer Comments on Budget:		
<i>Not entered</i>		
I. Discretionary Points (up to 10 points)	Points Awarded	Maximum Score
Up to 10 discretionary points may be awarded by the peer reviewer in cases where the applicant has demonstrated that the project has unique characteristics and excellent overall quality, where this distinction does not appropriately fit into the categories previously listed. The reviewer must explain in the comment section why the discretionary points were awarded.	5	10
	5	10
Reviewer Comments on Awarding of Discretionary Points:		
<i>I like the potential of the project</i>		

Total points awarded by reviewer 1: 153 out of 170

Reviewer 2

A. Audience Need (up to 20 points)	Points Awarded	Maximum Score
1. The target audience is well described.	5	5
2. The need is a documented need of the target audience, not the applicant/provider organization.	5	5
3. The need for the project was determined in a valid way.	5	5
4. Meeting this need will yield substantial benefits to the target audience.	5	5
	20	20

Reviewer Comments on Need Statement:

Not entered

B. Organizational Qualifications (up to 10 points)	Points Awarded	Maximum Score
1. The applicant organization and/or its collaborators are experienced and well-qualified to work with this audience.	5	5
2. The applicant organization and/or its collaborators have appropriate expertise to conduct this project and ensure that the project information is scientifically valid and unbiased.	5	5
	10	10

Reviewer Comments on Organizational Qualifications:

Not entered

C. Project Objectives (up to 35 points)	Points Awarded	Maximum Score
1. The objectives define specifically who will benefit and what will be learned.	5	5
2. The objectives address the need of the target audience as presented in the Statement of Need.	5	5
3. The objectives are consistent with the mission of the applicant organization.	5	5
4. The objectives meet one of OEEF's educational priorities.	5	5
5. The objectives are measurable.	5	5
6. The objectives are realistic for the age group or audience being targeted.	5	5
7. The project does not appear to duplicate other available environmental education resources and programs.	5	5
	35	35

Reviewer Comments on Objectives:

Not entered

D. Project Activities (up to 35 points)	Points Awarded	Maximum Score
1. The project activities are specific, and the sequence of activities is appropriate.	5	5
2. The project activities are appropriate for meeting the stated project objectives.	5	5
3. Reasonable steps are taken to ensure that the project information is scientifically valid and unbiased.	5	5
4. The project activities are (or will be) aligned with the Ohio Department of Education's Academic Content Standards for K-12 education. (for pre-school or university audience projects, award 5 points)	5	5
5. The activities are age-appropriate.	5	5
6. The project does more than disseminate information: learners will engage in hands-on activities, problem solving, and/or skill-building.	5	5
7. The project makes good use of existing environmental education materials, or provides good justification for the decision to develop new materials.	5	5
	35	35

Reviewer Comments on Activities:

Not entered

E. Timetable (up to 10 points)	Points Awarded	Maximum Score
--------------------------------	----------------	---------------

1. The start and end dates are realistic for completion of the activities.	5	5
2. The start and end dates show that activities will be carried out in a logical sequence.	5	5
	10	10
Reviewer Comments on Timetable:		
<i>Not entered</i>		
F. Outcome Measurement (up to 15 points)	Points Awarded	Maximum Score
1. The measurements are scientifically and educationally valid for determining if the project objectives were achieved.	3	5
2. The measurements describe success indicators, tools being used to measure, methods of analyzing the data, and who will be conducting the evaluation.	3	5
3. The measurements address both short-term and long-term effects of the project.	3	5
	9	15
Reviewer Comments on Outcome Measurements:		
<i>Not entered</i>		
G. Continuation/Replication Plan (up to 15 points)	Points Awarded	Maximum Score
1. The project includes a realistic plan for sharing the results with other educators.	5	5
2. The plan describes how the project can continue once OEEF funding ends.	5	5
3. The plan describes how the project can serve as a model for replication with similar audiences.	5	5
	15	15
Reviewer Comments on Continuation/Replication Plan:		
<i>Not entered</i>		
H. Budget (up to 20 points)	Points Awarded	Maximum Score
1. The budget table and narrative clearly explain all expenditures to be funded by the OEEF.	5	5
2. The budget is appropriate for this type of project.	5	5
3. Salary costs are reasonable as a proportion of the overall budget. (In general, salary costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
4. Equipment costs are reasonable as a proportion of the overall budget. (In general, equipment costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
	20	20
Reviewer Comments on Budget:		
<i>Not entered</i>		
I. Discretionary Points (up to 10 points)	Points Awarded	Maximum Score
Up to 10 discretionary points may be awarded by the peer reviewer in cases where the applicant has demonstrated that the project has unique characteristics and excellent overall quality, where this distinction does not appropriately fit into the categories previously listed. The reviewer must explain in the comment section why the discretionary points were awarded.	7	10
	7	10
Reviewer Comments on Awarding of Discretionary Points:		
<i>Overall this is a new and innovative approach to teaching conservation and will provide the students experience with using an important tool as well.</i>		
Total points awarded by reviewer 2: 161 out of 170		

Reviewer 3

A. Audience Need (up to 20 points)	Points Awarded	Maximum Score
1. The target audience is well described.	3	5
2. The need is a documented need of the target audience, not the applicant/provider organization.	5	5
3. The need for the project was determined in a valid way.	5	5
4. Meeting this need will yield substantial benefits to the target audience.	5	5
	18	20

Reviewer Comments on Need Statement:

While 5 schools is the target number, only 3 have been listed as contacted. Are these "general education" high schools or specialized programs (career centers, STEM schools, etc.)?

B. Organizational Qualifications (up to 10 points)	Points Awarded	Maximum Score
1. The applicant organization and/or its collaborators are experienced and well-qualified to work with this audience.	5	5
2. The applicant organization and/or its collaborators have appropriate expertise to conduct this project and ensure that the project information is scientifically valid and unbiased.	5	5
	10	10

Reviewer Comments on Organizational Qualifications:

Not entered

C. Project Objectives (up to 35 points)	Points Awarded	Maximum Score
1. The objectives define specifically who will benefit and what will be learned.	5	5
2. The objectives address the need of the target audience as presented in the Statement of Need.	5	5
3. The objectives are consistent with the mission of the applicant organization.	5	5
4. The objectives meet one of OEEF's educational priorities.	5	5
5. The objectives are measurable.	3	5
6. The objectives are realistic for the age group or audience being targeted.	5	5
7. The project does not appear to duplicate other available environmental education resources and programs.	5	5
	33	35

Reviewer Comments on Objectives:

I believe this project meets the OEEF priority of "projects that encourage pre-school through university students to explore careers in the environmental sciences and environmental engineering" but I would have liked to see a direct explanation of how it does so in the application. I think the measurable objectives were great for the public presentation portion, but I wanted more detail about the follow-up visits to the schools. Because this is a guided activity in the classroom, it might be hard to measure increases in understanding about coding and/or open source technology after the initial workshop.

D. Project Activities (up to 35 points)	Points Awarded	Maximum Score
1. The project activities are specific, and the sequence of activities is appropriate.	5	5
2. The project activities are appropriate for meeting the stated project objectives.	5	5
3. Reasonable steps are taken to ensure that the project information is scientifically valid and unbiased.	5	5
4. The project activities are (or will be) aligned with the Ohio Department of Education's Academic Content Standards for K-12 education. (for pre-school or university audience projects, award 5 points)	5	5
5. The activities are age-appropriate.	5	5
6. The project does more than disseminate information: learners will engage in hands-on activities, problem solving, and/or skill-building.	5	5
7. The project makes good use of existing environmental education materials, or provides good justification for the decision to develop new materials.	5	5
	35	35

Reviewer Comments on Activities:*Not entered*

E. Timetable (up to 10 points)	Points Awarded	Maximum Score
1. The start and end dates are realistic for completion of the activities.	5	5
2. The start and end dates show that activities will be carried out in a logical sequence.	5	5
	10	10

Reviewer Comments on Timetable:*Not entered*

F. Outcome Measurement (up to 15 points)	Points Awarded	Maximum Score
1. The measurements are scientifically and educationally valid for determining if the project objectives were achieved.	3	5
2. The measurements describe success indicators, tools being used to measure, methods of analyzing the data, and who will be conducting the evaluation.	5	5
3. The measurements address both short-term and long-term effects of the project.	5	5
	13	15

Reviewer Comments on Outcome Measurements:

As stated earlier, I would like to see more detail about the follow-up visits to the schools. An "exit-survey" of the students might be helpful, by asking them to fill out a brief open-ended questionnaire about opensource technology and its uses to gauge comprehension directly following the initial workshop.

G. Continuation/Replication Plan (up to 15 points)	Points Awarded	Maximum Score
1. The project includes a realistic plan for sharing the results with other educators.	5	5
2. The plan describes how the project can continue once OEEF funding ends.	3	5
3. The plan describes how the project can serve as a model for replication with similar audiences.	5	5
	13	15

Reviewer Comments on Continuation/Replication Plan:

I was a bit confused on the replication of this model, especially in the schools. How much will be charged for workshops at the zoo? Will this be enough to cover the entire cost of consumable items and/or subsidize lower-cost programs in schools? Will aid to teachers in the form of Matt's or Pat's presence and guidance be available in schools across the state? The application mentions "additional funding" but is not specific about possible sources. If additional funding cannot be attained, would continuing at a more local level (less travel, time costs) be feasible? What might a "reduced cost" look like for a school?

H. Budget (up to 20 points)	Points Awarded	Maximum Score
1. The budget table and narrative clearly explain all expenditures to be funded by the OEEF.	3	5
2. The budget is appropriate for this type of project.	5	5
3. Salary costs are reasonable as a proportion of the overall budget. (In general, salary costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
4. Equipment costs are reasonable as a proportion of the overall budget. (In general, equipment costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
	18	20

Reviewer Comments on Budget:

Travel costs for Pat seemed vague. Does this cover driving or flying? Food? Car rental? How much are you estimating for each line item or per visit? I would have liked to see a breakdown of cost. The budget breakdown implied that Pat would be attending the 5 school sessions (noting 8 hrs per workshop for a total of 40 hrs), but not the sessions at the zoo, though I didn't see any reasoning or specific mention of that anywhere in the application.

I. Discretionary Points (up to 10 points)	Points Awarded	Maximum Score
--------------------------------------------------	---------------------------	--------------------------

Up to 10 discretionary points may be awarded by the peer reviewer in cases where the applicant has demonstrated that the project has unique characteristics and excellent overall quality, where this distinction does not appropriately fit into the categories previously listed. The reviewer must explain in the comment section why the discretionary points were awarded.	5	10
	5	10

Reviewer Comments on Awarding of Discretionary Points:

I have awarded 5 points because I believe this application shows a workshop format that has been previously tested and demonstrated, with a real potential to make an impact on the awareness and understanding high schools students have about spatial and open source technology. I believe much of the merit of this project lies in the hands-on nature of the activities, which I personally found to be the most effective teachers for me in my field and scientific career path.

Total points awarded by reviewer 3: 155 out of 170

Reviewer 4

A. Audience Need (up to 20 points)	Points Awarded	Maximum Score
1. The target audience is well described.	5	5
2. The need is a documented need of the target audience, not the applicant/provider organization.	5	5
3. The need for the project was determined in a valid way.	5	5
4. Meeting this need will yield substantial benefits to the target audience.	5	5
	20	20

Reviewer Comments on Need Statement:

The audience need is well defined. I believe this project will greatly benefit the workshop participants.

B. Organizational Qualifications (up to 10 points)	Points Awarded	Maximum Score
1. The applicant organization and/or its collaborators are experienced and well-qualified to work with this audience.	5	5
2. The applicant organization and/or its collaborators have appropriate expertise to conduct this project and ensure that the project information is scientifically valid and unbiased.	5	5
	10	10

Reviewer Comments on Organizational Qualifications:

Not entered

C. Project Objectives (up to 35 points)	Points Awarded	Maximum Score
1. The objectives define specifically who will benefit and what will be learned.	5	5
2. The objectives address the need of the target audience as presented in the Statement of Need.	5	5
3. The objectives are consistent with the mission of the applicant organization.	5	5
4. The objectives meet one of OEEF's educational priorities.	5	5
5. The objectives are measurable.	5	5
6. The objectives are realistic for the age group or audience being targeted.	3	5
7. The project does not appear to duplicate other available environmental education resources and programs.	5	5
	33	35

Reviewer Comments on Objectives:

My only concern with the objective is that it is mentioned that five schools/districts will be participating, however, contact has only been made with three schools. This leads to concern that two schools may not be found, reducing the impact of the project by up to 40%.

D. Project Activities (up to 35 points)	Points Awarded	Maximum Score
1. The project activities are specific, and the sequence of activities is appropriate.	5	5
2. The project activities are appropriate for meeting the stated project objectives.	5	5
3. Reasonable steps are taken to ensure that the project information is scientifically valid and unbiased.	5	5
4. The project activities are (or will be) aligned with the Ohio Department of Education's Academic Content Standards for K-12 education. (for pre-school or university audience projects, award 5 points)	5	5
5. The activities are age-appropriate.	5	5
6. The project does more than disseminate information: learners will engage in hands-on activities, problem solving, and/or skill-building.	5	5
7. The project makes good use of existing environmental education materials, or provides good justification for the decision to develop new materials.	5	5
	35	35

Reviewer Comments on Activities:

Not entered

E. Timetable (up to 10 points)	Points Awarded	Maximum Score
1. The start and end dates are realistic for completion of the activities.	5	5
2. The start and end dates show that activities will be carried out in a logical sequence.	5	5
	10	10
Reviewer Comments on Timetable: <i>Not entered</i>		
F. Outcome Measurement (up to 15 points)	Points Awarded	Maximum Score
1. The measurements are scientifically and educationally valid for determining if the project objectives were achieved.	5	5
2. The measurements describe success indicators, tools being used to measure, methods of analyzing the data, and who will be conducting the evaluation.	3	5
3. The measurements address both short-term and long-term effects of the project.	3	5
	11	15
Reviewer Comments on Outcome Measurements: <i>I am somewhat confused by the connection between raw visitor numbers and exposure to the work done in the zoo workshops. I suggest adding more detail on how the general zoo visitors will be exposed to the work enabled by OEEF. If there will be some type of display or materials available for viewing at all times, please add more detail on this. I also suggest adding more information on success indicators in the outcome measurement.</i>		
G. Continuation/Replication Plan (up to 15 points)	Points Awarded	Maximum Score
1. The project includes a realistic plan for sharing the results with other educators.	5	5
2. The plan describes how the project can continue once OEEF funding ends.	3	5
3. The plan describes how the project can serve as a model for replication with similar audiences.	5	5
	13	15
Reviewer Comments on Continuation/Replication Plan: <i>Leveraging the zoo's network is a great way to disseminate the results of the work. Some additional detail on how the 18 Million people network size was determined would help clarify this portion of the plan.</i>		
H. Budget (up to 20 points)	Points Awarded	Maximum Score
1. The budget table and narrative clearly explain all expenditures to be funded by the OEEF.	5	5
2. The budget is appropriate for this type of project.	5	5
3. Salary costs are reasonable as a proportion of the overall budget. (In general, salary costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
4. Equipment costs are reasonable as a proportion of the overall budget. (In general, equipment costs should not exceed 50% of the total OEEF budget for the project. Higher amounts should be very well justified by the applicant)	5	5
	20	20
Reviewer Comments on Budget: <i>Not entered</i>		
I. Discretionary Points (up to 10 points)	Points Awarded	Maximum Score
Up to 10 discretionary points may be awarded by the peer reviewer in cases where the applicant has demonstrated that the project has unique characteristics and excellent overall quality, where this distinction does not appropriately fit into the categories previously listed. The reviewer must explain in the comment section why the discretionary points were awarded.	3	10
	3	10
Reviewer Comments on Awarding of Discretionary Points: <i>Well documented collaboration. Letters from each participating school would be helpful if available.</i>		

Total points awarded by reviewer 4: 155 out of 170