GREEN FUND

Sustainability Through Student Innovation

Project Application

Green Fund Mission Statement: "The NAU Green Fund promotes student participation in and provides funding for projects that reduce NAU's negative impact on the environment and create a culture of sustainability on-campus."

Requirements for Funding:

- The project must be implemented on campus.
- The person submitting the project must be a NAU student, faculty, or staff member.
- Projects must provide all necessary documents, letters of support, and authorizations prior to submission.
- The Green Fund distributes funding on a **reimbursement basis**. Project teams should partner with an administrative office to provide upfront funding for the project. Once the project has been successfully completed, the Green Fund will reimburse the administrative partner.
- All project applications should be submitted to greenfund@nau.edu for review.

Disclaimer: All applications will go through a comprehensive vetting process. We highly recommend meeting with a Green Fund Committee member prior to submitting the application. The Green Fund Committee member will assist you with every step of writing your project application. If your project is approved, you may be asked to provide more detailed information regarding specific deliverables. The Green Fund is not responsible for acquiring the necessary permits, permissions, or approvals for a project, although we are happy to assist with this process if needed. Additionally, the Green Fund does not provide any ongoing maintenance costs. A sponsoring department must take responsibility for operations and management.

Review Process: Upon project application submission, the Green Fund will review your project within two weeks. At this time, the Green Fund will provide comments on the project. Incomplete applications will not be reviewed until all components are submitted. **Note:** The Green Fund Committee only meets during the academic year. All projects submitted outside of the regular academic year will be reviewed at the start of the next academic session.

Contact Information

Project Leader Name: _Karina Cocks_ Phone: (760) 552-5065 E-mail: kyc8@nau.edu

Project Advisor Name: Erika Nowak Phone: (928)523-7760 E-mail: Erika.Nowak@nau.edu

Sponsoring Department: School of Earth and Sustainability/Biology

Project name: Improving Sustainability and Expanding Capacity of NAU Gartersnake Research Facility

NAU Department/Unit for funding reimbursements (Attach letter of commitment from departmental representative): School of Earth and Sustainability

Project Overview

Executive Summary

Please provide a brief overview of your proposal. Please address how this project will support the goals of the Green Fund (student involvement, creating a culture of sustainability, and lessening NAU's impact):

NAU's Narrow-headed Gartersnake Program's captive husbandry and breeding facility currently houses 42 federally threatened Narrow-headed Gartersnakes, ranging from wild-caught adults to juveniles and neonates born in captivity between 2017 and 2019. All aspects of the captive husbandry program are run and co-managed by undergraduate student interns and graduate students (https://in.nau.edu/gartersnake-research-project/captive-breeding-and-husbandry-program/). The proposed project includes improving the sustainability of the program through: 1) the construction of two mini-vivaria; and 2) the rehabilitation of existing features in the semi-outdoor vivarium, which was funded in part by the Green Fund, and improvement of the functionality of indoor facilities

1) The mini-vivaria are structures that replicate the snakes' semi-natural habitat, and are modeled after the existing semi-outdoor vivarium. The living space will include treated soil, bark, and rocks to give the snakes a more natural setting. The construction of the mini-vivaria will aid in decreasing the amount of waste produced by the basic, daily care of federally threatened Narrow-headed Gartersnakes, thus improving the sustainability of our program. Each mini-vivaria will house up to four same-sex snakes and will prevent inbreeding, and by decreasing handling of the snakes, will aid in the reduction of stress in snakes (Lauger, 2019) and decrease potential disease spread between groups (e.g., Toth, 2019). During the snakes' active season, each snake must eat every five days; each group of snakes must be fed in separate tanks, which results in approximately 544 gallons of water used every year just for feeding. We will build fish habitat within each mini-vivaria; thus reducing the amount of water required for feeding by 136 gallons per year, since the snakes will be housed with their food source and will not require additional water during feeding. In addition, 483 gallons of water are used per year to provide snakes with fresh, clean water daily. By moving some snakes to the mini-vivaria, we will decrease our water need by at least 162 gallons of water per year. This decreased water need will decrease the amount of trips needed for students to drive across campus to acquire reverse osmosis water by one trip per week, which will reduce the amount of greenhouse gas emissions (CO_2) by 56 pounds per year (D. Huntzinger, unpubl. data). Due to biosecurity concerns (i.e., cross-contamination prevention and disease prevention), precautionary measures must be taken while caring for these snakes, such as the use of disposable gloves. The gloves must be changed between handling different groups of snakes and disposed of. The mini-vivaria will lessen the amount of handling, therefore reducing the number of non-reusable nitrile gloves by 300 pairs per year. Due to the switch to using native dirt in the mini-vivaria, we will also eliminate the need for 67.5 pounds of non-reusable, recycled paper bedding, per year.

2) A few existing structures also require rehabilitation and improvement to enhance sustainability and improve functionality. In the existing semi-outdoor vivarium, there is a water feature that currently wastes about 15-20 gallons of water per week through leakage. Fixing this feature would decrease the amount of water that the facility uses by 780-1,040 gallons per year. The vivarium also contains a rock wall to create a more natural experience for the snakes. Unfortunately, the rock wall has provided snakes with the ability to wedge themselves in crevices, becoming lost and unavailable for routine health checks. The rock wall has been taken apart and rebuilt many times to fix this problem, but in order to decrease student labor and increase snake safety, the wall must be cemented to fill in these crevices.

To reduce the use of non-nitrile gloves and water usage for the snakes that will remain in indoor enclosures due to lack out outdoor space, self-feeding tanks will be connected to existing living spaces. This will further decrease the 544 gallons of water used during the feeding season and decrease the use of nitrile gloves. All proposed improvements will decrease handling time for the snakes, and also decrease the amount of time students spend caring for snakes, which will create a healthier and more sustainable work environment.

Please answer the following questions detailing the components of your project:

1. Does your project require space or construction on campus? If so, where? Please review the "Space Committee Document" located on our webpage and follow the steps to begin requesting a location.

   The NAU Narrow-headed Gartersnake program is currently housed in dedicated space in the Avian Cognition Lab (building 76), so additional space or construction is not needed.

2. Have you obtained all necessary approvals for this project? Please attach all letters of support to this application. Letters of support should include confirmation from the sponsoring department that the sponsoring department will cover all upfront expenses and work with the Green Fund Business Manager to acquire reimbursement after project completion. If any ongoing operations and maintenance is required of your project, provide a letter of support from the entity that will be covering those costs and/or services.

   See attached. The sponsoring department for this proposal is the School of Earth and Sustainability. Ongoing operations and maintenance are covered by the US Forest Service, Coconino National Forest, Red Rock Ranger District, and by donations to the NAU Foundation.

3. Will this project provide funding for student wages?

   Yes, the proposal includes the wages of the undergraduate vivarium manager, Karina Cocks, to oversee new interns that will be working in the animal care facility, constructing the mini-vivaria, rehabilitating the existing vivarium, creating improved indoor habitats for snakes, and providing outreach at local and regional environmental festivals.

4. Please list all additional sources of funding you have pursued. Include departments, grants, ASNAU, Graduate Student Government, etc.

   We have received a grant of $3,500 for the construction of one mini-vivaria from the Friends of the Forest and the Langstrom Family Foundation, primarily for materials. We received $1,790 from private donors through the NAU Foundation during the 2019 NAU Gives Day for materials. We will use previously donated materials and materials previously purchased with funding from the Coconino National Forest, which supports the majority of the annual costs of the gartersnake program's facilities maintenance. These materials have a total value less of than $500. The NAU Green Fund provided support for the construction of the original large semi-outdoor vivarium, that the mini-vivaria are modeled after, during 2015-2017.

5. Have any of the Green Fund Committee members been involved in this project?
   a. If Yes, please identify all committee members:

      At the recommendation of former faculty member Michele James, Genevieve Conley met with Karina Cocks to look over and give advice for filling out the Green Fund project application.

Project Specifics

Please address the following questions. One or more of these questions may not apply to your particular application. Answer as many questions as are applicable to your project.

Relationship to NAU Climate Action Plan (CAP)

1. How does your project align with one of the seven CAP categories (Energy, Water, Transportation, Waste Minimization, Sustainable Landscaping, Environmental Justice, Communication)?

   This project aligns with CAP in the areas of water, transportation, waste minimalization, and communication. The goal of this project is to build mini-vivaria and rehabilitate and improve existing facilities in order to reduce the yearly amount of water and disposable materials used to house and feed snakes, and to reduce the use of fossil fuels by decreasing the number of trips that students must take to north campus to fill RO water containers. Another major goal for this project is to increase the amount of public outreach for the program during communication at local and regional environmental justice events. We plan to do outreach events at NAU's Earth Jam, Earth Day, and Science Day, the city of Flagstaff's Science in the Park and Earth Day, and continue annual exhibits at Slide Rock State Park's Fall Festival. We will also start a social media page (Facebook) to help the public virtually interact with our animals, as well as the students who work hard to take care of them.

Community

2. Is there a public outreach plan? How will faculty, staff, and students learn about this?

   Yes, part of our project includes improving our public outreach. Currently, we have a website through NAU (https://in.nau.edu/gartersnake-research-project/captive-breeding-and-husbandry-program/), including a livecam of the original vivarium (https://www.youtube.com/watch?v=2doTzfAZmEU), and we do one outreach event at the Slide Rock Fall Festival every year. We plan on increasing our outreach by setting up booths at Earth Jam, Earth Days, Science in the Park, and NAU Science Day. We also plan to start a Facebook page to allow to public to virtually interact with our program.

3. Are you working with other groups on or off campus? If so, describe your partnership.

   Yes, our facilities are operated under NAU's animal care program, overseen by the Northern Arizona University's Institutional Animal Care and Use Committee, from which we have an approved protocol modification specifically for this work. We work with Dr. Matthew Salanga (Biology) to ensure a secure food supply (zebrafish) for newborn snakes, with Dr. Joseph Mihaljevic (SICCS) to ensure the health of our snakes, and have worked with the NAU Research Greenhouse to provide plants for the original vivarium. Dr. Deborah Huntzinger (School of Earth and Sustainability) calculated greenhouse gas emissions for our project. Dr. Erika Nowak works closely with AJ Smith, Director of Development for College of the Environment, Forestry, and Natural Sciences (CEFNS) to raise donor funding for the

gartersnake program. Off campus, we work under permits provided by the US Fish and Wildlife Service and the Arizona Game and Fish Department, and receive annual funding and other support from the Coconino National Forest's Red Rock Ranger District. We continue to work closely with Dr. David Ward of the US Geological Survey on all issues related to fish husbandry and maintenance of the vivarium's water feature; he will assist us with its rehabilitation. The Arizona Game and Fish Department supplies feeder trout from its hatcheries and occasionally other captive-bred native fish as well.

Project Parameters

4. What are the environmental costs and benefits associated with your project?

   This project entails many environmental benefits for the NAU Gartersnake Program, such as decreasing the yearly amount of water usage, decreased fossil fuel use, decreased single-use glove and bedding usage, and creating a healthier environment for a federally threatened, native snake species while decreasing handling time by student workers. The environmental costs of this project include the amount of energy and materials needed to produce and build the mini-vivarium structures and materials used to improve existing facilties. These materials, however, will provide long-term environments that will decrease unsustainable practices that are currently in place in the program.

5. Provide an economic cost/benefit analysis for your project. Focus on identifying specific cost savings.

Costs-Economic	
Mini-vivaria Construction	$282
Original Vivarium Maintenance	$2,053
Indoor Facility Improvements	$3,385
Salaries	$13,680
Total Direct Costs	**$19,400**

Costs-Intangible/Sustainability
Higher electrical load
Use of plastic to build structures
Water used to initially set up feeding tanks and mini-vivaria

Benefits-Economic	
Decrease in use of non-nitrile gloves	$11.52/year
Decrease in costs of medical treatment of crowded and stressed snakes	$166.67/year
Decrease in time spent by student workers	$8,160.00/year
Decrease in use of bedding	$42.53/year
Total Benefits	**$8,380.72**

Benefits-Intangible/Sustainability
Decrease in fossil fuel usage (decrease in 56 pounds of CO_2 emitted per year)
Healthy student work environment
Decrease in water loss from pond, and water use during feeding and water changes (1,078-1,338 gallons per year)
Decreased use of non-reusable products to increase sustainability

6. Is this a one-time expense or will you require future funding?

   This project will require future funding for ongoing maintenance. However, the US Forest Service has an ongoing agreement with NAU to provide most of these costs, and NAU Gartersnake Research program will seek other sources of funding for future needs. As an example, two donors recently contributed $5,000 to fund maintenance costs of the gartersnake vivarium through the NAU Foundation; this will be used as a challenge grant during the 2020 NAU Gives Day.

7. When your project members no longer attend NAU, who will be responsible for running the project?

   Dr. Erika Nowak will be the long-term project manager for this project.

8. How will you monitor the impact of your project after implementation?

   After implementation, the project will be closely monitored by Dr. Erika Nowak as well as our team of students to ensure that sustainability and animal safety are maintained. The NAU Gartersnake Program is largely student-run, which allows undergraduate and graduate students to

conduct research on a federally threatened species. The impact of the mini-vivaria on the stress levels and health of the snakes will be closely monitored during student projects.

Project Budget

Please include a thorough breakdown of all project costs, **as well as a 5% line item for contingency**.

	Item	Brand	Quantity	Units	Cost per unit	Contributed during NAU Gives Day	Contributed by Friends of the Forest & Langstrom Family Foundation	Current need
Mini-vivaria	insulated mini-vivarium container + s/h	Pentair	1	ea.	$1,500.00	$1,500	$1,500	-
	screen for container tops		10	ea.	$25.00	-	$500	-
	weatherproof heat lamp(s) and basking bulbs	Zoo Med	1	ea	$20.00	-	$40	-
	heat tape (4 feet)	Zoo Med	2	ft.	$5.00	-	$20	-
	heat tape rheostats (controllers)		1	ea.	$100.00	-	$200	-
	48-quart coolers for hibernation boxes	Igloo	1	ea.	$20.00	-	$40	-
	vaccum hose (4 feet)	Kuri-Tec	2	ft.	$4.00	-	$16	-
	mini pond insert (2)	MacCourt	1	ea.	$140.00	-	$280	-
	recirculating 60 gpm power-head pump	Aquatic Ecosystems	1	ea	$300.00	-	$600	-
	filtration box container	Pentair	1	ea	$20.00	-	$40	-
	pea gravel (1 cu. yd)		1	ea.	$33.00	-	$66	-
	plastic reptile hide box		4	ea.	$12.00	-	-	$48
	air stone	Pawfly	2	ea.	$17.99	-	-	$36
	bubbler pump	Pawfly	2	ea.	$26.99	-	-	$54
	air stone silicone tubing	Deep Blue	25	ft.	$21.86	-	-	$44
	bark/wood enrichment	A & P Sawmill, Flagstaff	1	ea.	$100.00	-	-	$100
Rock Wall and Water Feature Stabilization, Original Vivarium	307 FR Lite Fire Retardant Sculpting Epoxy Putty	Polygem	1	2 gal.	$50.00	-	-	$50
	15' X 15' 60 mil pond liner	Lifeguard	1	ea.	$563.00			$563
	NAU animal facility space rental		3	mo.	$480.00			$1,440
Indoor Facility Improvements	10-gallon fish tank	Aqueon	4	ea.	$15.00	$60	-	$60
	40-gallon terrarium	Zoo Med	2	ea.	$130.00	-	-	$260
	vaccuum hose and fittings; silicone	Kuri-Tec	4	ft.	$8.00	$32	-	$16
	1.25" diamond coated glass drill bit /hole saw	Aquacave	1	ea.	$20.00	-	-	$40
	diamond glass bit guide	Aquacave	1	ea.	$22.00	-	-	$44
	Aqueon submersible fish pump and filters	Aqueon	4	ea.	$37.49	$150	-	$75
	VitaLight UV bulbs	VitaLight	4	ea.	$12.00	$48	-	$24
	Cage rack	Metro	1	ea.	$2,000.00	-	-	$2,000
	small gravel (1 cu. yd)		1	ea.	$33.00	-	-	$33
	10-gallon tank lids	ExoTerra	6	ea.	$21.69	-	-	$130
	air stone	Pawfly	6	ea.	$17.99	-	-	$108
	bubbler pump	Pawfly	6	ea.	$26.99	-	-	$162
	bubbler silicone tubing	Deep Blue	25	ft.	$21.86	-	-	$22
	60-watt working clamp lamp fixture	Woods	3	ea.	$8.00	-	-	$24
	60-watt basking bulbs (16-pack)	EcoSmart	1	ea.	$17.00			$17
	water-resistant fluorescent light rack	Metalux	3	ea.	$110.00	-	-	$330
	bedding	Envigo	2	ea.	$20.00	-	-	$40
Items on Hand/Previously Donated	cinder sand/soil	Oak Creek Orchards						
	reptile heat rocks and under-tank heaters	ZooMed				-	-	-
	biobeads (filtration beads)					-	-	-
	filter basket parts					-	-	-
	aquarium heaters					-	-	-
	aquatic plants	Carex sp.				-	-	-
	rocks					-	-	-
Salaries	Student Project Manager (20 hrs/wk x 24 wks)		480	hrs	$16.00	-	-	$7,680
	NAU Machine Shop Foreman		80	hrs	$75.00	-	-	$6,000
5% Contingency								$970
Total Improvement Costs						**$1,790**	**$3,302**	**$20,370**

Project Timeline

The timeline should include significant implementation dates for your project. Please add information such as shipping time and consider any holidays or breaks.

Example:

NAU Narrow-headed Gartersnake Mini-Vivaria Timeline		
Action	**Parties Involved**	**Month/Year**
Sterilizing soil and cinders	NAU Research Greenhouse	March 2020
Ordering and installing 2 structures	Gartersnake Research Team	February-March 2020
Designing and building structures	Gartersnake Research Team	February-June 2020
Supervising students working on the project	Project Lead-Karina Cocks	March-August 2020
Installing soil, pond, plants, fish, hibernation, boxes, etc.	Gartersnake Research Team	August 2020
Testing livable conditions for fish and snakes	Gartersnake Research Team	August-September 2020

Project Checklist

Please ensure you have completed all of the following items before submitting your application:

- ☒ Meet with a Green Fund Committee member
- ☒ Obtain all necessary letters of support (sponsoring department, ongoing maintenance, etc.)
- ☒ Project Overview
- ☒ Project Specifics
- ☒ Project Budget
- ☒ Project Timeline
- ☒ Complete Project Checklist

Thank you for your submission. We deeply appreciate your commitment to sustainability at NAU, and we look forward to working with you.

Literature Cited

Toth, Heidi. 2019. “NAU Student Researchers Contribute to Discovery of Emerging Snake Pathogen in Arizona.” *NAU News*, Northern Arizona University, 21 Nov. 2019, news.nau.edu/snake-fungal-disease/?utm_medium=email&utm_source=11-22-19%2Bedition&utm_campaign=NAUNews&utm_term=internal&utm_content=Gartersnake_research_L&fbclid=IwAR1q3Mn4B3xtwmnJgSWjrQd7mhac9nGcIRMWsgvRSwZ4Vs-FgXIxVoO4kaM#.XkMJPGhKg2x.

Lauger, K. K. 2019. Stress physiology, behavior and growth of federally threatened narrow-headed gartersnakes in captivity. Unpublished master's thesis. Northern Arizona University, Flagstaff, Arizona, USA.