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Humboldt State University  
818-747-3847

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Earthwatch Foundation  
1380 Soldiers Field Rd  
Boston, MA 02135

To whom it may concern,

Good day, my name is Ryan Kim, and I am an aspiring scientist and naturalist that wishes to contribute to the body of knowledge that helps keep the natural systems of our world running smoothly. I am currently enrolled as a student of Environmental Science at Humboldt State University with a focus on natural resource recreation. As both a student of this subject and an avid outdoorsman, I have made it a personal goal in life not just to learn as much as I can about these systems that I have grown to admire so much, but also to think of ways in which I can contribute to its health both directly and indirectly. It is my desire to be selected for the community involvement for a healthier ecosystem grant that you offer.

The proposal I present for your consideration focuses on some of the smaller and more easily forgotten participants of the systems that I mentioned previously, the bees. I and many other scientists across the globe believe that there is a serious problem regarding the health of the population of bees of all different kinds of species, and that it is also an issue that without proper attention and care can lead to catastrophic consequences to the organisms that rely on their diligent and tireless work.

With \$3,408.75 of funding from your organization, I hope to be able to help alleviate the pressure felt by local bee populations through the construction and installation of suitable habitats. Further value will be realized through the educational and observational potential of these installed units, with plans to pass on upkeep and data observation responsibilities to a combination of community scientists and environmentalists as well as local educational institutions. It is my belief that the objectives and spirit of this proposal are in line with your organizations mission statement, and that successful completion of it will lead to clear and tangible benefits for not just the bees, but for the population of the local ecosystem as a whole.

Sincerely,

Ryan Kim

Ryan Kim:

Installation of bee habitats for species preservation and observation

<b>Applicant Name (PI) and Contact Information</b>	<b>Ryan Kim</b>		
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	<b>Phone</b>	<b>818-747-3947</b>	
	<b>Email</b>	<b>Rhk14@humboldt.edu</b>	
<b>Project Title</b>	<b>Installation of Bee Habitats for Species Preservation and Observation</b>		
<b>Organization</b>	<b>Name</b>	<b>Ryan Kim</b>	
	<b>Address</b>	<b>1 Harpst St, Arcata, CA 95521</b>	
	<b>Phone</b>	<b>(707) 826-3011</b>	
	<b>Email</b>	<b>esm@humboldt.edu</b>	
<b>Amount Requested</b>	<b>\$3,408.75</b>	<b>Project Start Date</b>	<b>03/01/2021</b>
		<b>Project Duration</b>	<b>6 months</b>

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### **Abstract**

Pollinators are facing an unprecedented threat to their existence due to a variety of factors, specifically a loss of suitable habitat. My proposal hopes to alleviate this burden by installing appropriate habitat in suitable locations. It will also produce a system in which further information pertaining to the newly installed habitats can be collected and analyzed. This will be done through the design and installation of bee habitats in and around the greater Arcata area.

Additional objectives include involving the local community in upkeep and observation of these habitats, thus fostering additional seeds of interest and curiosity regarding the bees. If proper steps can be taken to involve outside individuals who can act as stewards for the installations after the proposal has run its course, follow up projects involving additional habitat installation could be done much more easily. Involving the local institutes in the decision making and upkeep process has the potential to transform habitats into endless sources of inspiration for aspiring entomologists.

The final funding value requested has been calculated to be \$3,408.75. Around half of the funding would be to compensate the PI for services rendered, with the other half being spent entirely on materials and tools. Already existing research on both suitable types of habitat as well as species that respond well to specific types of structures also reduces time needed for research and development of habitats. The PI in question is Ryan Kim, also the author of this proposal. A student in Environmental Science at Humboldt State University, he is both qualified and eager to carry out the project. As a student at the University, facilitated access to the various software suites and hardware that are necessary for the proposal is available.

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### **The Problem**

The world around us is filled with intricacies that we can go an entire lifetime without ever noticing. Every natural process has a huge number of participants that each contribute in their own way to help create the world we exist in today. Unfortunately for us, this inability to pay close enough attention to these processes has led to a startling decline in the population of one of the unsung heroes of this natural system, the pollinators. All throughout the world, Scientists are making similar observations of reduced populations of pollinators across the board (Powney, 2017). Though we take them for granted, a huge amount of our agricultural output would not exist if not for their diligent and unending work. And of these pollinators, perhaps the most significant and well known are the bees. There have been numerous studies observing the pollination abilities of the bee, and they act as an excellent mascot to help bring attention to the plight of pollinators. These bees are living in a world that is increasingly hostile towards their existence and are in dire need of any support that is available to them.

### **Specific Aims**

- **Install native bee habitats in strategic locations throughout Humboldt County.**
- **Create a database for observers of the habitats to upload and archive related data.**
- **Establish observational plans with local environmental groups and institutions.**

The goal of this proposal is the installation of native bee habitats in strategic locations around the city. Research conducted has suggested that native bees are capable of fulfilling >90% of our pollination requirements when honeybees are not available and can also act as a sort of biological insurance against any sort of unforeseen events. (Winfree, 2007) However, the process will not be as simple as mass installation of suitable habitat. Research done in both the USA and Canada have shown that when installed in non-ideal locations

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habitats known as “bee hotels” that were installed to boost native and introduced bee populations led to an increase in wasp populations and introduced bee populations, but a decrease in native bee populations (Vaughan, 1998). Installation would involve selection of a geographically suitable location, preparation of the location through removal of vegetation and planting of flowers that attract the native bees, as well as installation of man-made habitats to help persuade the bees to remain in the area.

The latter half of this proposal focuses on the time after installation is complete. A simple and website will be constructed for the sole purpose of data entry and archival for the habitats while the selection of installation sites is finalized. Hosting of this website will be done by Humboldt State University on-campus servers, since the required technological resources for it would be minimal. Data recorded will consist of frequency of visits to the habitats by local pollinator populations, as well as any other noteworthy observations related to the insect population of the area. An indefinite observation plan will be created with HSU, Eureka and Arcata High School, and the Eureka Sequoia Gardening Club with the target goal being a minimum of 5 years of observation and maintenance after the completion of the 6-month proposal. Maintenance would consist of basic tasks such as weeding and litter collection, non-specialized and capable of being done by most individuals. It is hoped that in addition to the tangible benefits seen by a healthier native bee population, the habitats will also act as a source of knowledge and inspiration for individuals who may observe or interact with them in the future.

### **Merits and broader implications**

The rapidly dwindling population of pollinators is not just a result of misinformed agricultural management practices and rapidly changing climate, but also due to an insufficient public interest regarding the matter. Although the ability to shelter homeless bees and gather useful data are the most obvious benefits to this proposal, its greater overarching ability of it to continuously act as a source of education and curiosity for aspiring environmentalists should not

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be understated. Additional incorporation of crowd-sourced data gather is also a component of my proposal that I believe will gain increased traction in the future. With the increasing ease in which measurement tools and relevant information can be acquired, it is only a matter of time before most of the scientific data gathering is either automated or performed by the layman with little to no real formal scientific education. Having pilot programs such as the one I have described will be important in creating more effective tools for the future.

### **Literature Review**

The benefits of a healthy pollinator population are not a new concept. In depth observational studies have proven the effectiveness of a healthy pollinator population on crop yields, which in turn translates directly into economic gain for the area (Stein, 2017).

Unfortunately, the rapidly shrinking population of these pollinators is an issue that is only recently being realized to its fullest extent (Powney, 2019).

The good news is that other studies have shown that even after pollinator populations have seen declines, restoration of suitable habitat and symbiotic species can have tangible benefits on organisms that are part of the pollinators ecological cycle (Paterson, 2019). Further studies have outlined that although habitat fragmentation is a leading cause of decline in population, native bees have a certain ability to thrive in isolated “reservations” of habitat, which provide optimism for locations where widespread habitat fragmentation is irreversible (Cane, 2001).

The idea to use improving technology for increased scientific engagement with the community is also not new. The Internet was found to be a powerful tool to help recruit non-professional environmentalists in data collection and observation (Graham, 2014). Through the collaborative efforts of many individuals recruited by a website to create and observe insect habitats, the organizers of the website gleaned valuable information such as what materials and designs attracted what sorts of insect populations.

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### **Methods**

The methodology for my proposal is split into three parts. The first is the selection of suitable locations for habitats to exist. The most suitable types of terrain will be open, accessible to foot traffic, and within a mile proximity of either agricultural crops or some community of native wildflowers. Suitable geographical locations can be searched for using google maps or other mapping software, with an in person visit to observe potential sites more closely. The habitats will be distributed as evenly as possible between different biomes. (Dunes, forest, meadow, etc.)

The second part of the proposal is the physical construction and installation of habitats. The standard bee habitat for this proposal will be a 3x2x2 foot wooden box with one of its sides being hinged plexiglass so that it can be opened for observation and maintenance. Inside of each of these boxes will be various sized tubes of cardboard and bamboo packed with insulation composed of the same materials the native bees use in the construction of their own nests. For example, *Anthidium manicatum* uses the fuzzy trichomes of *Eriogonum parvifolium* to insulate its dwellings. The habitats will share the same outside shell construction, but the insulation and material used as spacing and dividers will be specific to the local population.

The third and final part of the proposal would involve the data collection and broader community involvement of the project. While the chosen sites are being observed, a website will be created that will allow for the recording of data relevant to each site after installation is complete. Local educational institutions will be partnered with for future observation and longer-term maintenance.

### **Timeline**

- March: Survey key locations throughout the greater Humboldt area that would make for productive location of bee habitats.

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- April: Observe the different types of species and their abundance, selecting appropriate habitats for the local populations. As these observations takes place, begin creation of website where data will be archived.
- May - July: Build and install the 10 habitats, noting details such as GPS coordinates, habitat types, and observed local insect population and health into the website.
- August: Coordinate an observational schedule with local institutions. Target observation frequency would be twice a month, with maintenance and upkeep being done annually.

### **Summary**

The future of pollinators is in jeopardy due to harmful anthropologic effects such as habitat destruction and pest removal. Studies have proven the reliance we have on pollinators for many of our agricultural sectors, and the objective of this proposal is to help the population in not just immediate and tangible ways, but also in a manner that extend beyond providing shelter and suitable habitat.

This will be done by creating suitable bee habitat in locations that are chosen for the high density of population of native pollinators. After installation is completed, an indefinite observation and maintenance schedule will be created through collaboration with Humboldt State University, Eureka and Arcata High School, and the Eureka Sequoia Gardening Club.



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**PROPOSAL TITLE:** INSTALLATION OF BEE HABITATS FOR SPECIES PRESERVATION AND OBSERVATION

**PRINCIPAL INVESTIGATOR:** RYAN KIM

BUDGET LINE ITEMS			FUNDS REQUESTED
A. Salaries	Salary (Rate)	Total Salary (per year)	
PI	\$7.50/hour	\$1500.00	
Co-PI(s)			
Other personnel			
A. TOTAL SALARIES			\$1,500.00
B. Fringe Benefits (15% of total salary)			\$225.00
C. Equipment (Only for items that are <i>individually</i> over \$500)			
D. Travel	Domestic	\$150.00	
	Foreign		
	D. TOTAL TRAVEL COSTS		\$150.00
E. Other Direct Costs	Supplies	\$770.00	
	Equipment (<\$500 each)	\$170.00	
	Publication	\$150.00	
	Consultants		
	Computers		
	Other		
	F. TOTAL OTHER DIRECT COSTS		\$1,090.00
F. TOTAL DIRECT COSTS (ADD LINES A TO E)			\$2,965.00
G. INDIRECT COSTS (USE 15% RATE FOR TOTAL ON LINE F)			\$444.75
H. TOTAL (DIRECT AND INDIRECT COSTS: LINES F + G)			\$3,408.75
I. AMOUNT REQUESTED			\$3,408.75
J. Other Support (other grants, matching funds or in-kind support)			

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### **Justification**

All salary funding is planned to be spent on compensation for the PIs work. \$1,500 is allocated as the total salary for the PI, who will be the sole individual being paid for this proposal. It is estimated that approximately 200 hours of labor will be required for the duration of the project. Travel fee will be purely domestic, in the form of compensation for fuel driving to and from project locations.

All but one of the tools required for the project can be supplied by the PI. The only tool that would need to be purchased would be 1 Stanley brand miter Saw priced at 170.00.

The supplies needed for the construction of these habitats are do not need to be specialized or particularly expensive. Standard lumber planks can be purchased from the hardware store in bulk quantities due to the standardized nature of the habitats.

The price for a single habitat can be calculated thusly:

**One \$12 2x4 plank of pine, one \$10 2x2 beam of pine, one \$5 box of 20 Stanley brand nails, two \$2.50 generic hinges, one \$20 sheet of plexiglass, \$10 worth of Bear brand paint and sealer for the wood, and \$15 worth of generic brand cement to secure the posts into place.**

This brings the total price of one unit to \$77, with the total for 10 planned units calculating out to \$770. The goal for the paper is to be published, but in a smaller scale journal that reflects the simpler nature of the study. For this reason, \$150 has been budgeted for publication costs. Adding together the rest of the predicted costs, this brings the total cost of the project, as well as the amount I will be requesting in this proposal, to \$3,408.75.

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### **Bibliography**

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# Ryan H. Kim

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**Education:** **B.S: Environmental Science and Management** June 2021  
**Minor in Geospatial Sciences** GPA: 3.4  
Humboldt State University

**Experience:** **Academic Tutor** 2019 - Present  
Humboldt State University, Arcata, CA

- One on one academic tutoring and coaching

**Ski Valet/Bell Services** 2017 - 2018  
Aya Niseko Resort, Niseko, Japan

- Guest Services/Reception
- Handling of guest luggage and gear

**Restaurant Manager** 2015 - 2017  
Yakitori Daruma Sake Bar, Queenstown, NZ

- Customer Service (Waiting, Host)
- Roster Scheduling
- Till management/Bank Deposits
- Employee Interviews and management

**Skills:** ArcMap 10.8.1  
Microsoft Office Suite  
Fluent and literate in Japanese and English  
Conversational Italian

**MEMBERSHIPS/ POSITIONS:** HKN Epsilon Nu Chapter, Board Member (Web Correspondent)  
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