

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Biogeochemical Cycling in Pacific Northwest Forest Ecosystems			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Abir Biswas	biswasa@evergreen.edu	(360) 867-6433	2
Project Description			
<p>This project seeks students working on aligned studies investigating nutrient and trace metal cycling in higher elevation young and old-growth forest ecosystems in the Pacific Northwest. The SURF student(s) would contribute to mapping trees and soil plots across long-term forest research plots at Mt St Helens, in addition to contributing to soil sampling and vegetation identification at the research plots.</p> <p>Our study area at Mt St. Helens is an excellent location to study the effects of vegetation on soil development because the entire area is underlain by the same geology in the form of tephra (ash) that was deposited during the 1980 Mt St. Helens eruption. We have been sampling in old-growth forests and in adjacent ~35 yr old forests (that grew in areas clear-cut just prior to 1980), and these sites offer an excellent opportunity to study the effects of forest canopy from different species (incl. silver fir and western hemlock, as well as douglas fir and yellow cedar) on mercury scavenging and deposition from the atmosphere. In addition the proposed tree and soil plot mapping allow for subsequent spatial studies into the effects of specific trees on nutrient use and availability at the landscape scale.</p>			
General Expertise Required of Fellowship Applicants			
<p>Students with prior field experience, prior experience with GIS (particularly using field data), or an interest in developing these skills would be preferred. Potential researchers would ideally be able to commit 20-40 hrs/week to this project, and would ideally have strong skills in scientific writing and working with primary literature.</p> <p>In addition, experience in the laboratory, particularly using analytical instruments including the ICP-MS, mercury analyzer, or CHN analyzer, could be relevant. Students who are interested in developing biogeochemical sampling and analysis skills over this summer (and hopefully into the future), could also develop complementary field and laboratory skills while focusing on studies of mercury (a bio-accumulating toxin), to quantify its distribution in different ecosystem compartments in these regions.</p> <p>The research conducted at Mt. St. Helens will likely require extended field time away from the Evergreen campus, especially later in the season. Students should expect to camp during these field excursions, and be prepared for all weather conditions, mosquitoes, and work in both exposed high elevation sites and remote old-growth-sites. Following each field excursion however, students should also expect extended laboratory time processing samples and analyzing results. The schedule will likely include intensive weeks where a large amount of time is required, followed by “down weeks” where research activities will be minimal or not scheduled. Ideally, students should have access to their own transportation or be able to drive a manual transmission.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>In support of this proposed work, students will have a significant responsibility in conducting fieldwork to collect soils and GPS mapping of soil plots and trees at field sites at Mt St Helens, in addition to some component of processing soil samples in the laboratory.</p> <p>In the the field, student(s) will develop skills in using GIS in a field setting, and will become proficient in soil sampling and perhaps plant identification. In the lab, depending on student interest, the students could pursue spatial analyses of data collected, using GIS, or chemical analyses of soil collected using laboratory techniques and instrumentation on the Evergreen campus, including but not limited to the ICP-MS, mercury analyzer, or CHN analyzer. The student will also become familiar with the scientific literature associated with biogeochemical cycling in forest ecosystems.</p>			
Anticipated Progress			
<p>The proposed work is part of an ongoing long-term research project at Mt St Helens. One to two SURF student would be integral to completing the work of GIS mapping the trees and soil plots at our research sites (in collaboration with faculty D. Fischer). An additional SURF student is desired to support the GIS mapping component in addition to processing and analyzing soil samples during the 2016 summer.</p>			
Additional Information (if applicable)			
<p>Interested students are strongly encouraged to contact the faculty (Biswas) directly to discuss how their academic backgrounds and/or previous research experience fit with these studies and would allow them to be successful in this research framework.</p> <p>The faculty on this project will work side-by side with the student(s) on these projects, provide all necessary training for the research projects, and will meet with the student(s) weekly to reevaluate project design and progress. Meetings early in the season will be particularly important as they will set up the research designs, schedules, and appropriate use and access to equipment.</p>			

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Research On Moss-Cyanobacteria Symbiosis In South Puget Sound Prairies Of Western Washington			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Lalita Calabria	calabril@evergreen.edu	(360) 867-6415	2
Project Description			
<p>In this project, fellow(s) will research moss-cyanobacteria symbiosis and nitrogen-fixation dynamics on South Puget Sound prairies. Nitrogen-fixing cyanobacteria associated with mosses contribute significantly to bioavailable nitrogen in boreal forests, tundra, temperate rainforests, and island environments; these associations have not been previously investigated in prairie ecosystems. The south Puget Sound prairies are an imperiled ecosystem, covering only a fraction of their former land base. Prescribed burning is frequently employed as a restoration strategy for removing invasive vascular plant species and preventing encroachment by woody plants. Prescribed fire has been shown to reduce moss cover and to alter bryophyte community composition in south Puget Sound prairies, but to what extent these processes affect prairie nitrogen-cycling is not known.</p> <p>Fellow(s) will participate in a field study to determine the abundance (% cover) and mat depth of nitrogen-fixing-mosses on the prairies utilizing a standardized Forest Inventory and Analysis (FIA) plot design. These data will be used to develop ecosystem level estimates of standing biomass, elemental content (carbon and nitrogen) and nitrogen-fixation rates for moss-cyanobacteria associations in Puget Sound prairies. In the lab, fellow(s) will quantify moss-cyanobacteria nitrogen-fixation rates utilizing an acetylene reduction assay and GC-MS. Fellow(s) will also examine new moss species for the presence of cyanobacteria and will record and compare colonization rates between species. This project has the potential to influence area conservation and management decisions for PNW prairies and to advance our understanding of an otherwise unknown source of total nitrogen fixation in this ecosystem.</p>			
General Expertise Required of Fellowship Applicants			
<p>Potential fellows should have upper division coursework in bryophyte and lichen ecology and taxonomy and experience with ecological field collection and data analysis. Proficiency with using both compound and dissecting microscopes is required. Advanced instrumentation training including confocal microscopy and GC-MS is strongly preferred. Strong scientific writing skills, familiarity with statistics and data analysis would be very helpful, but faculty is willing to work with potential fellows to improve skills in these areas. Interested students are strongly encouraged to contact the faculty directly to discuss how their academic backgrounds and/or previous research experience fit with these studies and would allow them to be successful in this research framework. The position requires a commitment of 20-30 hours/week.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Fellow(s) will be expected to spend approximately 2-3 days a week in the field collecting samples and conducting fieldwork at multiple prairie sites, where they will gain experience with a variety of ground layer sampling methods including the Forest Inventory and Analysis plot method, a standard technique employed by the USDA in an effort to monitor climate and pollution gradients across the country. Students will gain experience with measuring cover, depth and functional group diversity of bryophyte and lichen ground layers which they will apply to estimating standing biomass and ecosystem level elemental content of carbon and nitrogen for south Puget Sound prairie ecosystems. Fellow(s) will spend approximately 10 hours a week in the lab, working on the identification of moss and cyanobacterial taxa, analyzing samples using an acetylene-reduction assay and quantifying nitrogen fixation rates of samples on the GC-MS. The fellow(s) should expect to spend 3-4 hrs per week with writing and data entry. The last few weeks of the fellowship may require additional hours of writing and data analysis while preparing their final report for potential peer-reviewed publication. The fellow(s) will be expected to work independently for some part of the time spent in the lab and the field. However, faculty will provide training and regularly meet with fellow(s) to troubleshoot data collection, analysis and writing progress.</p>			
Anticipated Progress			
<p>I expect that one fellow would be able to collect samples from a total of 5 prairie sites with at least 2 plots per site. From each site, I would expect that one fellow would be able to collect and analyze at least 30 moss samples. With one fellow, testing nitrogen fixation rates of individual species would be limited to three species and a few simple variables such as temperature and light that we could control in available growth chambers.</p> <p>Two fellows would allow field collection at 2-5 additional prairie sites with an additional 4-10 plots per site. The added benefit from a second fellow extends to data analysis because a larger data set would not require much more time to analyze than a smaller data set. With an additional fellow we would also be able to quantify nitrogen fixation rates of three additional moss-cyanobacterial associates and we could tests a greater number of variables including, the effects of desiccation and rewetting of moss samples and the effects of fire on cyanobacterial colonization rates.</p> <p>In summary, two fellows would allow for a greater number of field sites and field plots to be sampled, and therefore a more robust sample size. In addition, the project would greatly benefit from two set of eyes and hands while working in the lab and field to troubleshoot any issues that inevitably come up when conducting scientific experiments. If two fellows were selected, there would be a broader range of skills and experience to enhance the experimental parameters of the project.</p>			
Additional Information (if applicable)			
<p>The faculty recognizes issues of diversity and equality in sciences and therefore is especially pleased to receive applicants from under-represented minority groups including: women, racial/ethnic minorities (Black, Hispanic, American Indian/Alaskan) and LGBTQA individuals. Of course, all eligible applicants will be considered and are welcome to apply.</p>			

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Patterns of Diversity of Limno-Terrestrial Tardigrades (Water Bears) in the Pacific Northwest			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Clarissa Dirks	dirksc@evergreen.edu	(360) 867-6612	3
Project Description			
<p>Limno-terrestrial tardigrades inhabit interstitial water on mosses, lichens, plants, and tree bark, and are found in leaf litter and soil. The meiofaunal community, which includes tardigrades, as well as nematodes, rotifers, and microciliophora, play a foundational role in food webs and nutrient cycling within aquatic and terrestrial ecosystems and are very diverse. They are locally abundant and easily sampled, making them an excellent system to address fundamental questions in the ecology and evolution of these microorganisms, as well as serve as indicators of climate change. Much of what is currently known regarding tardigrade distributions and the broader meiofaunal community comes from localized regional studies or opportunistic collections, and as such do not offer a sufficient basis to consider the factors that shape tardigrade distribution. Environmental factors, including soil pH and nutrient availability, have been shown to influence the meiofaunal community but systematic studies of the entire community and tardigrades in particular, which may be the hardest member, are lacking.</p> <p>We are studying the composition of the meiofaunal community, with a particular emphasis on tardigrade ecology and diversity, over spatial and climatic gradients in the Southwest and Pacific Northwestern regions of the U.S. to characterize these communities and infer how biodiversity may respond to future climate change. Research interest in limno-terrestrial tardigrades has increased in recent decades, but there remain numerous unanswered questions about their broad scale distribution patterns and the processes shaping them. Moreover, it has been estimated that approximately 15% of all tardigrades have been identified thus far, providing us with opportunities for describing many new species. This project will fill a void in our understanding by providing insights into the diversity, biogeography, ecology, and conservation status of these woefully understudied groups.</p>			
General Expertise Required of Fellowship Applicants			
<p>Students should have completed a full year of general biology. The project has many aspects to it that make it ideal for training students at all levels.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>While some of the fieldwork for this study was already conducted by Dr. Dirks and her students, there are more samples that need to be collected. Undergraduate fellows will participate in field studies to collect moss and lichen samples in select Pacific Northwest areas. Samples will be collected along elevation transects approximately every 1,000ft, photographed, and information about the biotic and abiotic factors such as dominant canopy species, aspect, and substrate will be recorded. In the laboratory, samples will be processed to extract and isolate tardigrades and the meiofaunal community.</p> <p>For each sample, all meiofauna will be counted and tardigrades will be grouped based on morphological characteristics. DNA from at least one tardigrade from each morphogroup will be isolated and subjected to PCR for the 16S rRNA or CO1 gene. This DNA will be sent to an off-site facility for sequencing and sequences will be used for phylogenetic and molecular evolutionary analyses.</p> <p>In addition to learning field techniques, students will gain hands on experience working with meiofauna and learn valuable skills in taxonomic identification. Students will learn advanced microscopy techniques to accomplish photograph and accurately place tardigrades into known taxonomic groups or to identify novel tardigrades. Students will also gain experience in molecular biology techniques (DNA extraction, PCR) and learn basic bioinformatics.</p>			
Anticipated Progress			
<p>Our previous work in the Grand Canyon National Park (GCNP) was very similar to this project (except for location) and many students who worked on the project are currently writing up research papers for publication. Given that tardigrades and other meiofauna are so understudied, our data gathered tends to be very compelling (in GCNP we identified two new species. The project has been very successful as a collaborative project between students. While one student can significantly move the project forward, the more students who work together have a better chance to complete the investigation. Three students would be able to sample the PNW area, extract meiofauna from the samples, identify them taxonomically and also complete the DNA analysis. It is unknown how many tardigrades we would find in such a sampling protocol, so it is not possible to truly identify the scope of work. Regardless, every student will learn a tremendous amount and the more students we have working together the more likely we are to complete the project.</p>			
Additional Information (if applicable)			
<p>This research project was designed to understand tardigrades and meiofauna abundance and distribution across climate and elevation regimes in the face of imminent climate change that is proposed to result in warmer temperatures and potentially greater drought conditions in the near future. Our progress thus far suggests this data set appears well-suited to provide baseline information and data that will be important when considering the effects of climate change in these regions (both the Southwest and Pacific Northwest), and also appears to offer important information regarding the ecology of tardigrades and meiofauna across western North America. This project fills an important need to survey poorly-studied tardigrades and other meiofauna in order to preserve a record of their abundance and community composition prior to future expected changes in distribution of flora.</p>			

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Unravelling the Political Theology of the Muslim Brotherhood in Egypt			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Sarah Eltantawi	eltantas@evergreen.edu	(360) 867-6386	3
Project Description			
<p>Since Egypt's military retook power in June, 2013 from the democratically-elected Freedom and Justice Party, a quickly formed Muslim Brotherhood party in the wake of the 2011 revolution, scholars have turned intense attention to the history and ideology of the Egyptian Muslim Brotherhood. To make sense of Egypt's dramatic political events, analysts have sought to understand former president (and Muslim Brotherhood candidate) Mohammed Morsi's political and ideological missteps during his rule. Surprisingly, though, few accounts have convincingly demarcated and understood the border between the Muslim Brotherhood's political and theological commitments. The question of where the Muslim Brotherhood's politics end and their theology begins is still very much an open one, and the answer facilitates our understanding of the ultimate aims of Islamist movements generally.</p>			
General Expertise Required of Fellowship Applicants			
<p>I seek two-three research fellows: one to two that are native or near-native reader(s) of Arabic, and/or one to two with excellent research skills and the ability to think historically/in terms of intellectual genealogies. I) A fluent reader of Arabic (or two) to assist me with gathering and summarizing Arabic sources, particularly the Muslim Brotherhood's theologically-related writings from 1928-present. II) A student (or two) who is/are able to think historically about the rise of the Muslim Brotherhood in Egypt from 1928-present. I want to track the movement's intellectual history, particularly with respect to theology, and concomitant political history. Examining how the political and the theological intertwine is the puzzle of this project.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Map of all available sources on the political/theological history of the Muslim Brotherhood in Egypt in English and Arabic. Work with me to develop a plan for getting through these sources. Read and summarize them. Find book reviews and scour bibliographies. Find electronic sources and articles. Find proceeds of conferences. Read and examine the difference between western and non-western scholarship on this topic. Students will learn to do deep library research, learn to read and summarize, and what it means to conduct research in a thorough manner that engages scholarly research. Students will also be exposed to how to formulate a research question and how to set about answering it. Students would also be encouraged to keep each other and myself accountable in our reading and writing commitments. I would aim to have them as excited about unraveling the political theology puzzle as I am!</p>			
Anticipated Progress			
<p>With one fellow with fluent Arabic skills, significant progress could be made mapping Arabic sources. Two fluent Arabic speakers might well finish that leg of the research. An additional student who can map English sources would hopefully complete the research gathering for the project. One English/one Arabic would be extremely helpful.</p>			
Additional Information (if applicable)			
<p>Must be enthusiastic about research and learning new things. Interest in religious studies and background in the history of the modern Middle East is a strong plus. Having taken classes with our faculty that teach Middle East Studies is a strong plus.</p> <p>Also desirable: French, German, Persian, Turkish, Urdu, Spanish, Italian (other European or "Islamic" languages) reading ability.</p>			

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Plant Communities at Mount St. Helens: Temperate Forest Plant Communities Response to Volcanic Disturbance			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Dylan Fischer	fischerd@evergreen.edu	(360) 359-1426	1
Project Description			
<p>In this project, students will primarily concentrate on conducting plant community ecology work in a series of long-term forest monitoring plots at Mount St. Helens, WA. This year will be the 36th anniversary of the eruption of Mount St. Helens, and student researchers will join faculty in participating in a research re-measuring long-term vegetation plots in high-elevation forests near the mountain. The work will require a month-long stay at Mount St. Helens in July (housing will be provided). The specific research work will primarily be based on detailed re-measurement of over 450 understory plant plots in old growth forests just outside the blast zone (the main impact zone from the eruption). The faculty will work side-by side with the fellow(s) on all aspects of both of these projects, and provide all training needed. Faculty will also meet with the fellow(s) weekly to reevaluate project design and progress.</p> <p>Students will also have the opportunity to work with the ongoing Evergreen Ecological Observation Network (EEON) project, measuring plant communities in the Evergreen forest reserves. An additional project may involve measuring root growth of Douglas fir trees in a collaborative project with the Forest Service south of Olympia.</p>			
General Expertise Required of Fellowship Applicants			
<p>Applicants should have a working understanding of plant community concepts in forests, and a willingness to learn how to collect detailed data on plant communities in square meter plots. Experience in field identification of forest plants is also helpful. This work will require experience with plant taxonomy, use of dichotomous keys, and plant sampling techniques. Experience living and working in rustic environments is a preferred qualification. Finally, applicants should have access to their own transportation, or be able to drive a manual transmission vehicle. Students should also be willing to learn to use advanced equipment for measuring root growth, and how to set up remote weather stations.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Applicants should be prepared for rustic accommodations, all weather conditions, mosquitoes, and work in remote high elevation sites and old-growth sites. They should expect to work an average of 20-40 hours per week on the projects, with a schedule that includes intensive weeks where a large amount of time is required, followed by “down weeks” where research activities will not be scheduled. Participants will be expected to use field opportunities to develop their own specific research questions. Frequent meetings early in the season will be especially important, as they will set up the research designs, schedules, and appropriate use and access to equipment.</p> <p>Applicants will learn about plant community composition in northwest forests at high and low elevation. They will learn cutting edge approaches in measuring diversity and ecosystem function. They will also gain access to a community of researchers working in forested and disturbed ecosystems throughout the northwest and the world. Fellows will have opportunities to participate in presentations at international conferences, and become authors on manuscripts in professional peer-reviewed journals.</p>			
Anticipated Progress			
<p>This project can be completed with one junior-senior student ready for advanced work in plant science.</p>			
Additional Information (if applicable)			
<p>Students are invited to meet directly with the faculty member prior to applying. More information is available upon request! Contact via e-mail.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Archaeological Field School at the Bush Homestead, Second Season			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Ulrike Krotscheck	ulrikek@evergreen.edu	(360) 867-6017	2
Project Description			
<p>This project is the second season of the archaeological field school at the site of one of the first local homesteads, owned by George Bush. This project will be part of the summer curriculum, and we have been given lab and storage space at Evergreen in which to conduct our post-fieldwork study of the artifacts. Associated with this project will be a number of unprecedented opportunities for undergraduate research in local history and archaeology. The student fellows would help with the setup and organization of the field school and be responsible for at least the completion of one published field report and one conference talk. Pending finds, however, more opportunities for research and publication may become available. My goal is to train one or two student fellows in all aspects of running an archaeological field school, including the publications resulting from the finds and the conservation and display of any artifacts. Public outreach is also an important part of the project.</p>			
General Expertise Required of Fellowship Applicants			
<p>The fellows should have college-level experience in history or anthropology and should be able to demonstrate solid academic writing and research skills. GIS and mapping experience is preferred but not required. More important for the applicants than formal academic training is the ability to handle a large amount of responsibility independently and to be curious about local history and community outreach.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>The bulk of the work will occur in the second summer session and beyond, and fellows should be prepared to work very intensively at that time. Fellows will help manage a finds database, map out the site, and assemble all equipment. During the field school, they will assist with excavation, processing, and documentation of any finds, as well as lab work. They should be prepared to lead public tours at the site. Finally, they will help prepare the excavation report and a conference paper. Depending on the results of the excavations, this project may well result in a number of independent research projects and a continuation of the field school in summer of 2017. This opportunity will work best for students who are interested in pursuing a career in anthropology, history, museum studies, or Pacific Northwest studies, and who are looking for opportunities to publish co-authored papers about our local history, as well as present independent research at one or more academic conferences in 2016. The experience the fellows will gain includes, but is not limited to: independent research project design and implementation; field and lab supervision; conservation and documentation of finds; publication of finds; conference paper presentation and submission; and possible independent subsequent research projects.</p>			
Anticipated Progress			
<p>The permit-granting agency, DAHP, requires for the permit that the PI be on site at all times when excavation is being conducted. Due to the high volume of public outreach, which includes tours at the site, and the training of up to 12 undergraduates and volunteers, one fellow has to also be on site. With two fellows, I could staff the lab and the field at the same time. With one fellow, only one of these two work centers would be staffed, which means that we would get about half of days on site and half of them in the lab. This translates into fewer artifacts recovered and fewer tour days.</p>			
Additional Information (if applicable)			
<p>The work load will be lighter in the first session, but extremely intense in the second session, including evaluation week and possibly beyond. Fellows should have minimal additional time commitments during August and early September, as work will be full-time.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Stream Surveys at Mt St Helens, Elwha River, and closer to home			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Carri LeRoy	leroyc@evergreen.edu	(360) 867-5483	2
Project Description			
<p>This research experience will be focused on learning techniques used to understand the structure and functioning of stream and river ecosystems. Dr. LeRoy is a stream ecologist who has done research on streams, rivers, and lakes in UT, AZ, CA, WA, NV, and Siberia (http://academic.evergreen.edu/l/leroyc/). Her research mainly focuses on the interactions between streams and their landscapes, as well as the input of terrestrial carbon to headwater streams through leaf litter fall. Fellows involved in this summer research experience will have the opportunity to work with her surveying streams that were newly formed after the eruption of Mt St Helens, preparing an in-stream leaf litter decomposition experiment for the Elwha River, and monitoring three watersheds in the Evergreen Ecological Observation Network (EEON; http://blogs.evergreen.edu/eeon/). We have just over 1000 acres of forest on campus and there are both 44 long-term terrestrial and 9 stream monitoring sites.</p>			
General Expertise Required of Fellowship Applicants			
<p>Students should be at an intermediate or advanced level, having completed at least one year each of college biology and chemistry. Additional experience in field ecology and statistics is preferred, but not required.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>The specific measurements for this project include: assessing algal production (chlorophyll-a analysis by spectroscopy), collecting and identifying algal species, identifying fungal conidia, collecting and identifying aquatic macroinvertebrates, analysis of nutrients (nitrate and phosphate), dissolved oxygen (DO), dissolved organic matter, and alkalinity, quantifying the amount of coarse and fine particulate organic matter, and determining the composition of this material (C:N ratios). Students will also measure basic hydrological variables in streams (slope, sinuosity, substrate type, depth, discharge).</p> <p>Fellows will also contribute to long-term leaf litter decomposition studies in WA and AZ. Samples will be dried, weighed, ground, and analyzed for C, N, ash-free dry mass and overall decomposition rates. Fellows can expect to spend significant amounts of time in the field and the laboratory. Some of this time will be supervised and some will be independent. Fellows should be self-motivated, eager to learn and excited to participate in a variety of research projects.</p>			
Anticipated Progress			
<p>This proposal is ideal for two student fellows. Two students would allow them to work together in the field and follow our safety protocol. There is often more gear to carry than one person can carry alone, and many students feel more comfortable in the woods when accompanied. I have found that having two students in the field allows more flexibility and is safer. In terms of our ability to complete field work, having two student fellows would significantly increase the pace of our work during intense field work at Mt St Helens. In addition, for quality control in the lab, it is often necessary for one student to check the other's work (in particular when sorting and identifying aquatic insects).</p>			
Additional Information (if applicable)			
<p>The SURF fellows will have opportunities to learn about experimental design, data collection and archiving, statistical analysis and scientific writing through weekly workshops and interactions with other faculty members and other fellows. Fellows will be expected to meet weekly with other fellows doing field ecology research to discuss progress, challenges and present findings.</p> <p>Successful research projects may be written and/or presented to diverse audiences at conferences.</p> <p>We will likely spend several weeks at Mt St Helens hiking and working under physically demanding conditions and camping at rustic locations.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Trouble the Water			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Naima Lowe	lowen@evergreen.edu		3
Project Description			
<p>This summer I have received Faculty Foundation Grant funding to complete work on a series of short video works exploring African-American relationships to the natural world. Within a contemporary Eurocentric epistemology, “nature” or “wilderness” is supposed to be an unmarked and peaceful place of escape from the constraints of culture. However, it has been my observation and experience that many African-Americans find it difficult to interact with the natural world comfortably. I believe that the historical circumstances of chattel slavery and its violent aftermath have shaped this fraught relationship. I have found that while there is no “essential” black relationship to nature, this area of inquiry represents fertile ground for understanding the unique experiences of displacement and cultural trauma associated with being Black in the United States. While my interests in this topic have been far reaching, I have found myself continually returning to the transformative role that water has played in shaping African-American identity. The Atlantic Ocean played a role in turning stolen African people into chattel slaves aboard slave ships during the Middle Passage. The Combahee River played a role in turning enslaved people into freedom fighters during the 1863 Civil War raid led by Harriet Tubman. The title of my film is taken from the song “Wade in The Water,” an African-American folk song that references the critical role of river crossings for slaves escaping bondage via the Underground Railroad.</p> <p>Water is a powerful symbol and cypher that has helped me to translate these broad cultural concepts into poetic and expressive visual language. I have already shot and edited 2 videos within the series, and I intend to complete 3 more this summer. The videos are based on a series of improvised performances, interviews and abstract explorations of water as a metaphor, substance and environment.</p>			
General Expertise Required of Fellowship Applicants			
<p>Students working with me on this project must have successfully completed Mediaworks, Non-Fiction Media or an equivalent combination of rigorous study in media theory, history and practice. Students should have proficiency in 16mm and/or HD video production. A background in African-American literature and/or art history is also desired. This opportunity is for advanced students.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Students will help with production planning, shooting, editing, direct animation, audio production, script/storyboard revisions for 2 short film and video projects shot in 16mm and HD video. Students will learn about the unique process of working on experimental film projects, gain technical skills in 16mm film, direct animation, HD video shooting and editing, and critique. Depending on the skills, interests and total number of fellows assigned to the project, students should expect to alternate between cinematography/camera crew, audio recording and assistant directing while on set. During pre- and post-production, students will work in a variety of roles including production planning, production design, logging and organizing footage, etc.</p>			
Anticipated Progress			
<p>My approach to film and video production requires thoughtful, flexible and skillful collaborators.</p> <p>With three fellows, I will be able to have a complete production team throughout the summer, and I feel confident in my ability to complete all of the shooting and editing that I have set out to create. With three fellows I would have all of my basic production roles filled: camera operator, audio operator and assistant director. Those students would be able to help recruit and train additional student volunteers for more complex shooting situations. I feel confident that I would be able to complete all three videos that I intend for the series.</p> <p>With two fellows, I will be able to fill two production roles: Camera operator and audio operator. Doing without an assistant director, or finding one from a pool of volunteers is fine, but would make it more challenging to take on more complex shooting scenarios. I would be able to complete only 1-2 videos due to the additional time needed for production planning in this scenario.</p> <p>With one fellow, I would probably need to greatly simplify my approach to shooting, and I would likely not be able to achieve more than the shooting phase of one of the videos. My audio production capacities would likely be compromised.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Using Bacteriophage in Bovine Medicine			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Mike Paros	parosm@evergreen.edu	(360) 867-6406	2
Project Description			
<p>Bovine mastitis is one of the most common forms of disease in dairy cows worldwide. Gram negative coliform bacteria are typically associated with severe clinical mastitis and Escherichia coli is often isolated from acutely affected cows while also playing a role in recurring subclinical intramammary infections. The widespread and routine prophylactic use of intramammary antibiotics on dairies is now under public scrutiny due to concerns over the transfer of antibiotic resistant genes to human pathogens. Bacteriophages are viruses that can infect bacteria and suppress their growth. A number of animal studies have demonstrated the safe and efficacious use of phages against E. coli infections. Utilizing a grant from the Washington State Dairy Products Commission, we have successfully isolated bacteriophages against mastitis causing E. coli strains, measured host range specificity, and have generated a cocktail of phages that could infect a variety of clinical coliform mastitis strains. We have tested the ability of phage cocktails to suppress E. coli growth in raw milk with a number of different carrier agents, as a necessary pre-cursor to clinical trials that would examine the use of bacteriophages to prevent E. coli mastitis. Finally, our lab has used a bovine mammary cell culture line to observe bacteriophage inhibition of intracellular invasion by mastitis pathogens. We currently have a grant proposal in to perform a challenge test with our bacteriophage in cows. In addition we are interested in studying how bacteriophage and E. coli interact in mammary cells over a long period of time in order to understand phage-bacteria-eukaryotic cell interactions that occur in physiologic systems.</p> <p>In a separate but related research project, our lab is interested in examining the role that bacteriophage play in the microbial ecosystem of the rumen. We will develop in vitro models of the rumen, and attempt to manipulate bacterial populations and their biochemical products they synthesize through the addition of bacteriophage.</p>			
General Expertise Required of Fellowship Applicants			
<p>Priority will be given to students with some basic laboratory skills in microbiology, and completed course work in upper level biology and chemistry courses. Priority will also be given to students who would like to commit to continuing their research over the next year.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Over the past four years, our laboratory has helped over a dozen Evergreen undergraduate students gain important research and laboratory skills in microbiology. A number of them are now doing graduate research in the biological sciences. A summer student research intern would be expected to work approximately forty hours a week where he or she would help design and execute experiments.</p>			
Anticipated Progress			
<p>It is our hope that the student will be able to generate enough data to present a poster at an upcoming meeting. An in vitro rumen model would be established and some basic information on rumen bacteriophage would be obtained. Depending on student abilities, we would be able to identify bacteriophage activity within eukaryotic cells.</p>			
Additional Information (if applicable)			
<p>Our lab is looking for intensely motivated self driven future research scientists who are passionate about their work in the lab. Students will need to initiate and maintain daily communication with Mike Paros over the course of their research.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Building an Object Oriented Language Interpreter Skeleton			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Sheryl Shulman	sherri@evergreen.edu	(360) 870-1303	2
Project Description			
<p>The purpose of this work is to extend the existing interpreter sequence introduced in Programming Languages, Principles and Paradigms. This book is an excellent introduction to many of the issues involved in defining a language, the role of type checking, scoping rules, how function calls are implemented, and models for stack management. However it is limited to imperative languages (languages that represent computation as a sequence of commands that change program state) and doesn't support object-oriented concepts. There are a number of recent language features that are difficult to explore in the context of this simple interpreter. Building on this implementation will allow us to explore these language features, understand precisely their semantics, compare the impact of different design choices, and investigate the interactions between different language features. Once implemented I plan to stage different sequences of extensions that will be accessible to the students allowing them to get a concrete understanding of some very abstract language features and understand both the benefits and the liabilities. There are many languages in use today, promoting a variety of paradigms, and conceptual models. It is also becoming increasingly popular to define hybrid languages that combine multiple paradigms. Yet it remains difficult to compare languages and to predict when a newly introduced features will interact with existing features. This lack of precision creates ambiguity: it is difficult to give a clean semantics in such cases. Having a uniform platform to experiment with different feature sets and to understand more precisely the independence and interdependence of features will be a positive addition to the field.</p>			
General Expertise Required of Fellowship Applicants			
<p>Ideally students should have a strong understanding of at least one Object Oriented language (such as Java, C++, C#) and type systems. This is material that is covered in Computer Science Foundations (Java and often Haskell) and Computability (Haskell, type systems, interpreters). Students should be strong programmers and understand the basics of language design (particularly the role of type systems and object-oriented programming). This is an advanced topic and students should be able to acquire the basics of a programming language with minimal supervision. Students should be able to read a description of a language from a formal language specification and understand the difference between syntax and semantics.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>This is an ongoing project. At this point a preliminary type system has been defined to support classes, subclass polymorphism, interfaces, and (single) inheritance. The next stage of this project is the implementation of the type system in the parser, implementation of the type checker, and implementation of the interpreter. Once completed, the next stage is to extend the type system to include other basic features in the Object Oriented class system, including type arguments, parametric polymorphism, multiple implementations of the same interface, and scoping. Once these basic features are completed, more advanced extensions could be considered such as OO pattern matching, multi-methods, lambda functions, and bounded polymorphism.</p> <p>Implementing the basic Object Oriented features would give the students experience in implementing a relatively large scale project from a set of formal specifications. They would gain experience in reading and understanding a large code base. They would also gain real world experience in testing an implementation against a formal specification and correcting any ambiguities that might arise. If they are able to complete the more advanced extensions they would also be in a position to compare their work to existing OO type systems and understand the pros and cons of various language choices.</p>			
Anticipated Progress			
<p>The basic implementation and first set of extensions outlined above could be implemented by one student working 20 hours a week, for 12 weeks. With two fellows, the basic implementation and first set of extensions could be completed in about half the time, and allow the more advanced extensions to be defined as well as a preliminary implementation. The outcome of this work would be a working implementation (of the basic system and/or the extensions) as well as documentation of the type system and the implementation. Time allowing, the student(s) would also compare the design to some existing languages and compare the capabilities of the languages.</p>			
Additional Information (if applicable)			
<p>Designing a type system, implementing the parser, type checker, and interpreter would give the students an understanding of the full process that goes into defining a language. Rather than see languages as a given, they will have an opportunity to consider different design choices, what impact those choices will have on the final form of the language, how extensible those choices might be, and how those choices affect the way solutions to target problems may be specified are all part of the language design process.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Intaglio Printmaking: Print Production and Materials Research			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Lisa Sweet	sweetl@evergreen.edu	(360) 867-6763	1
Project Description			
<p>The research I am proposing will take place in the college printmaking studio and address two threads: (1) the production of color intaglio prints and (2) research and testing of a photo-sensitive etching film (commercial name: ImageOn).</p> <p>(1) Two Sponsored Research Grants and one Foundation Grant have supported advancements in my artistic printmaking practice, enabling me to shift from oil painting to printmaking, specifically etching. The grants permitted me to build instrumentation for the college printmaking studio, and learn the most current non-toxic etching techniques at the facility generating the most significant research. With all the technical “parts” in place, I am (finally) making work in color etching. Last summer I was awarded an artistic residency to learn color etching in Massachusetts. This summer, I plan to produce a series of mature works. This part of the project will include techniques and experiences that are common in professional, collaborative printmaking studios.</p> <p>(2) ImageOn is a light-sensitive film used by intaglio printmakers to create high-resolution digital and photographic images on copper plates. In “fits and starts” I’ve explored the medium since 2004 when it first appeared on the market. Since then, the material composition has been modified by the manufacturer every few years, requiring new tests for digital specifications and chemical processing. This part of the research will adapt my earlier research for the current version of ImageOn film. The objective will be to determine how to use the film successfully, reliably and consistently. This research, will require the fellow to set up an experiment, test the variables in the process and reach conclusions for reliable results. This work is common in any technical field, including visual art, in which new materials must be researched and tested thoroughly.</p>			
General Expertise Required of Fellowship Applicants			
<p>The successful applicant will possess introductory intaglio techniques (and either excellent craft or considerable experience with introductory techniques), proficiency in color ink-mixing, a thorough knowledge of, and experience working with, Evergreen’s printmaking studio protocols, excellent and concise verbal and written communication skills, and strong time-management skills. A student with conceptual and/or historical understanding of printmaking and/or a good sense of design will be the most effective collaborator on the production of my work. This work requires an assistant who can work/print directly with me, and who is comfortable providing technical and artistic feedback on the work.</p> <p>Research on ImageOn will require the fellow to revisit my suspended research from 2010, research the current version of the film, and determine how to successfully use ImageOn. This work will require the fellow to conduct multiples tests addressing variables such as digital image output, exposure, and chemical processing durations. The work requires an individual who can organize an experiment based on a specific outcome, read failed outcomes, adjust the process and proceed with testing. The fellow must be fastidious in measurements, and recording the details of each test. While this research picks up from my previous tests, the fellow will be the lead researcher on this project, and I will serve as an aide and consultant on this part of the project.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Intaglio print production will require the fellow to work on every aspect of production, from plate preparation to printing. The fellow will need to anticipate “next steps” as images and plates develop. Knowledge and experience gained will be identical to the collaboration between printers and artists in professional printmaking studios. A unique opportunity/skill available in this project will be “steel-facing” (electroplating) plates. This is not available or taught in any undergraduate or graduate program that I am aware of, and is rarely used in commercial print shops. Yet it is a necessary part of color etching on copper.</p> <p>Working with the photo-sensitive film will similarly offer the fellow experience with an excellent material/technique not explored in most academic settings. The research will require the student to analyze prior research, and carry out new experiments precisely in the manner that a scientist or artist working with new materials would. The fellow will be responsible for updating the research and processes for using the current version of ImageOn.</p> <p>Both experiences will provide the student with advanced knowledge and experience exceeding those available in most academic printmaking contexts, be they research universities or art schools. These experiences would constitute resume highlights distinguishing the fellow from other candidates when applying to graduate school or seeking employment in a fine arts printmaking studio or publishing house.</p>			
Anticipated Progress			
<p>With an organized plan, a single fellow will successfully carry out the ImageOn research to the extent that I, and other faculty, can teach the technique/material to students in programs and courses. My goals for my own work are less concrete because images must still be conceived and developed. I anticipate making significant progress on 3 - 5 original images (utilizing 9 to 15 plates). My goal is to advance the prints to the point where all or most of the plates are completed, and editioning has begun or been completed. Undoubtedly, the progress on my own images will be at least doubled with the support of a collaborator-fellow. The more collaborative and knowledgeable the fellow, the more progress will be made.</p>			
Additional Information (if applicable)			
<p>A specific work schedule for the intaglio print production component will be established in consultation with the fellow prior to embarking on the work. Once agreed upon, that work schedule is considered a commitment and will require consistent, on-time attendance for the duration. The work is physical and requires a level of focus and attention that can be fatiguing.</p> <p>In contrast, the schedule for ImageOn film research can be carried out by the fellow on a largely independent and flexible basis — providing the fellow meets the hourly expectations of the fellowship. Formal, weekly check-ins will be scheduled with the faculty to consult on results, monitor research progress, and discuss next steps.</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Research in Cyber Security: Privacy-enhancing Apps on Mobile Devices			
Faculty Project Leader	Email	Campus phone	Number of Fellows Requested
Richard Weiss	weissr@evergreen.edu	(360) 867-6871	2
Project Description			
<p>Privacy on mobile devices is a major issue. For example, several research groups have been able to create Apps that use accelerometer data to capture passwords, and others are able to capture video data from the users camera and send it to a malicious website. Another example is indoor localization, which is locating the mobile device within a building where GPS is not available. Some research labs have found solutions to the indoor localization problem, but they have not addressed the privacy issues.</p> <p>The goal of the project is to create an App for localization that takes into account the issue of privacy, allowing the user to control the accuracy and precision of the accelerometer and gyroscopic data that can be collected by untrusted Apps.</p> <p>This project would build on the Sensibility Testbed created by Prof Cappos and his students at NYU. This framework is already capable of capturing sensor data and adds an additional security layer between an untrusted App and the operating system that captures the sensor data. This security layer is called a reference monitor, and the project would explore ways in which reference monitors could block indoor localization, preventing the App from tracking the user's precise location using accelerometer and gyroscopic data from the device.</p> <p>The primary tasks will be to design, implement, and test filters for blurring sensor data to determine how the level of blurring impacts malicious Apps. For several years, Richard Weiss has been collaborating with Prof Cappos, who has expressed interest in this project and working with a team from Evergreen.</p>			
General Expertise Required of Fellowship Applicants			
<p>Students who apply should have good programming skills. The level of study is intermediate to advanced. Students will study techniques in security and will develop Apps for Android devices. Good mathematical skills will also be an advantage.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<p>Students will be responsible for learning how to develop Android Apps for the Sensibility Testbed. This platform uses a restricted version of Python. Students who participate will be able to achieve a deep understanding of reference monitors and App security. They will be working with a well-designed code base. They will learn software engineering skills and how to build secure systems. The students will be part of a collaborative effort. There will be discussions and design reviews with students and faculty from Evergreen and NYU. The student will be able to pursue original research that could have a significant impact on privacy on mobile devices. Students will be required to make a poster showing their results that could be presented at a conference, and they will write a final report.</p>			
Anticipated Progress			
<p>This project can accommodate two fellows since there are many parts to the problem of building an App for indoor localization and writing the blurring filters to limit it. In addition, with a second fellow the project could be extended to use data from multiple mobile devices to create a model of an indoor space for the purpose of stealthily mapping an environment.</p>			
Additional Information (if applicable)			
<p>NYU Polytechnic is one of the leading research universities in cyber security, This would be an opportunity to work with an internationally recognized research lab.</p> <p>More information can be found at https://sensibilitytestbed.com/projects/project</p>			

2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects

Solarizing Evergreen - Phase 2			
Faculty Project Leader	Email	Phone	Number of Fellows Requested
E.J. Zita	zita@evergreen.edu	(360) 705-1559	3
Project Description			
<p>We will continue a student-initiated research program to:</p> <ul style="list-style-type: none">Investigate opportunities for renewable energy on campus.Develop physics, engineering, and planning skills to evaluate and design renewable energy projects on campus.Take advantage energy funding opportunities to improve campus facilities.Work with and learn from Facilities, Sustainability staff, the Grants office, and other experts on and off campus to develop potential grants proposals for funding renewable energy installations on campus. <p>1. We look forward to a solar thermal pool heating installation for the CRC. Facilities is now planning a grant proposal to the Department of Commerce, using our 2015 work on unglazed flat panels (available). We hope this grant will also include facility upgrades to the CRC.</p> <p>2. We aim to scope out and design another solar thermal heating system for hand washing and shower water to complement the first. Glazed flat panels heat the water hotter. With the solar pool and some on-demand heaters, we may be able to turn off TESC’s boilers, saving about \$80,000 per summer (more than the estimated cost of the CRC thermal pool heating system, installed).</p> <p>3. We propose design research on solar photovoltaics (PV) for the Covered Recreation Pavilion, with a large and highly visible roof at a favorable angle. We will collaborate with planners on ideas for best future uses of this facility. Transparent PV on the lower roof slope may make it a brighter, more welcoming space. Energy grants may permit building renovation.</p> <p>4. We propose to evaluate Building Management Software for possible acquisition by Evergreen (with Facilities and Sustainability staff). BMS would consist of a network of performance monitors that would save time, energy, and money. Facilities would fine-tune building performance manually.</p> <p>5. Bonneville Energy Foundation wants to work with us to solarize the Evergreen Tacoma campus. We propose to start that planning process this summer.</p> <p>We will meet in a classroom.</p>			
General Expertise Required of Fellowship Applicants			
<p>Key knowledge, skills and abilities: Quantitative reasoning, critical thinking, teamwork, good ability to use web-based tools for research and communication.</p> <p>Level of study: intermediate, precalculus at least, calculus a bonus.</p> <p>Course work: physics or energy studies</p> <p>Other required characteristics of the successful applicant: organized, reliable, stable, focused, personable, good listener and communicator. Good reading and writing skills. Gentle sense of humor a bonus.</p>			
Responsibilities of Fellows and Knowledge and Experience To Be Gained			
<ul style="list-style-type: none">Contribute to renewable energy solutions on campus, by pairing the implementation of carbon- and money- saving technologies with capital improvements. By writing grant proposals with Facilities, we can accelerate renewables implementation and help make needed infrastructure improvements, even when budgets are tight for higher education.Meet our team at least 3 times per week, ordinarily. Work independently on your part of the project as required.Ask questions, share ideas, and contribute to project planning.Learn how to create a workable plan that can make a significant difference.Do calculations together and independently, scope out project analyses.Learn how to set up analyses of complex projects, break them into manageable questions, and figure out how to solve them.Write up results throughout the summer, and synthesize work in a final presentation and paper.Learn how to coordinate planning, discussion, and writing for a grant proposal, with a team. <p>Other aspects: Technical aspects will look at electrical generation capacity, basic system design, and net benefits regarding electricity usage and carbon emissions. Policy aspects will investigating college goals, state rules, and national policy. Funding aspects will look at potential grants for installations. Agency coordination is critical when working with multiple levels of governments and separate agencies within organizational structures. On campus, we may meet with Facilities, Administration, the Clean Energy Committee, the Campus Land Use Committee, RAD Services, the Athletics department, and others. We should also look at other capital projects The Evergreen State College has in the ten year plan, and consider other campus improvements for a renewable component.</p>			
Anticipated Progress			
<p>With only one, we will see how many glazed flat panels and on-demand heaters we need to turn off campus boilers in summer. It will be lonely work for just one. Last year, we had great synergy with 2.</p> <p>With 2 SURF students, we can try to turn off boilers, evaluate PV for the CRP, and/or evaluate Building Management Systems.</p> <p>With 3, we can do all of the above comfortably, and follow up on solar thermal CRC pool heating with Facilities. Three is a perfect team size, and these projects are complementary.</p>			
Additional Information (if applicable)			
<p>It's fun. Dozens of Evergreen students have contributed to projects like these since 2014, and they have made a difference. Check out the Greeners Sustainability Projects Network — GSPN online. More coming at the end of winter 2016.</p>			

**2016 Summer Undergraduate Research Fellowship (SURF) Program
Faculty Projects**