**Broader impacts with samples from funded NSF proposals**

What are broader impacts?

The broader impacts of a research project are those components that, beyond the advancement of knowledge, have the potential to benefit society and contribute to achievement of specific desired societal outcomes. The National Science Foundation (NSF) requires proposals to address the broader impacts in addition to the intellectual merit of the project. NSF provides the following examples of desirable societal outcomes (broader impacts):

* full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM)
* improved STEM education and educator development at any level
* increased public scientific literacy and public engagement with science and technology
* improved well-being of individuals in society
* development of a diverse, globally competitive STEM workforce
* increased partnerships between academia, industry, and others
* improved national security
* increased economic competitiveness of the US
* enhanced infrastructure for research and education

The NSF and some private sponsors encourage institutions of higher education and nonprofit organizations to take an **institutional approach** towards achieving these societal benefits and Rutgers University – Newark’s role as an [anchor institution](https://www.newark.rutgers.edu/anchor-institution) provides opportunities to engage with the community in socially impactful activities. These activities include partnerships with local organizations (schools, community groups, the Newark Museum, the City of Newark and its offices, and private philanthropies. Partnering with existing campus-based programs, like the [Garden State Louis Stokes Alliance for Minority Participation (GS-LSAMP)](http://gslsamp.rutgers.edu/) which supports underrepresented populations in STEM, can contribute to a strong broader impact component. The RU-N [Office of University-Community Partnership](http://oucp.newark.rutgers.edu/) can also help identify opportunities for public engagement in science at all levels. Innovative ways of engaging students at all levels in hands-on participation in scientific work will also strengthen the broader impacts of projects.

Funding for these broader impact activities should be included in the budget. The NSF describes some elements of a well-written broader impacts section as follows:

A well-written broader impacts section should include activities that are clearly described; have a well-justified rationale; and demonstrate creativity or originality, or have a basis in established approaches. The proposer should have a well-organized strategy for accomplishment of clearly stated goals; establish the qualifications of those responsible for the activities; and demonstrate sufficient resources for support. A plan should be in place to document the results.

For a useful 3-page guide to developing broader impact activities for your proposal, please refer to the National Alliance for Broader Impacts’ [Guiding Principles](https://broaderimpacts.net/wp-content/uploads/2016/05/nabi_guiding_principles.pdf).

**General Resources**

* Perspectives on Broader Impacts (see Chancellor Cantor, p. 7 of 16)

<https://www.nsf.gov/od/oia/publications/Broader_Impacts.pdf>

* Broader Impacts webpage (NSF)

<https://www.nsf.gov/od/oia/special/broaderimpacts/>

* Samples of actual broader impact sections next page

**Sample Broader Impact Sections of Current or Recent NSF Proposals**

**Lee Slater**,Henry Rutgers University Professor in Geophysics, FASN - Earth and Environmental Sciences

[Collaborative Research: Investigating how transient electrical and magnetic signals relate to changes in recharge-driven redox state and iron mineral transformations](#Slater1)

[Collaborative Research: Towards a mechanistic prediction of methane ebullition fluxes from northern peatlands](#Slater2)

**Judy Robinson**,Assistant Research Professor, FASN - Earth and Environmental Sciences

[GP-EXTRA: A geoscience pathway field experience in near-surface geophysics to promote recruitment and retention of transitional students in quantitative geosciences](#Robinson1)

**Arthur Powell**,Professor, FASN - Urban Education

[Collaborative Research: Computer-Supported Math Discourse Among Teachers and Students](#Powell1)

**Zhengyu Mao**, Professor, FASN - Math and Computer Sciences

[Identities in Automorphic Descent](#Mao1)

**Sean Mitchell**, Associate Professor, FASN - Sociology and Anthropology

with Benjamin Junge (SUNY, New Paltz), and Charles Klein (Portland State)

[Collaborative Research: Social Mobility, Poverty Reduction, and Democracy in an Emerging Middle Class](#Mitchell1)

**Jessica L. Ware**, Associate Professor, FASN - Biological Sciences

[CAREER: Social networking: understanding sociality and symbiosis through the eye of non-Neoisopteran termites using molecular and morphological data](#Ware1)

**Michele Pavanello**, Assistant Professor, FASN – Chemistry

CAREER: CDS&E: Nonlocal and Periodic Density Embedding (MPS-CHE) .pdf only  
  
[Electron-Rich Oxide Surfaces (MPS-DMR)](http://sites.rutgers.edu/orsp/wp-content/uploads/sites/261/2019/09/Pavanello-description.pdf) .pdf only

**Tracy Tran**,Associate Professor, FASN - Biological Sciences

[Plexin-A4 Signaling Regulates Diverse Cellular Morphologies in the Developing Nervous System (BIO-OIS)](http://sites.rutgers.edu/orsp/wp-content/uploads/sites/261/2019/09/Tran_NSF-BroaderImpacts-funded-grant1556968.pdf) .pdf only

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**Collaborative Research: Investigating how transient electrical and magnetic signals relate to changes in recharge-driven redox state and iron mineral transformations**

**Lee Slater, PI**

**Proposed project: 10/1/2017 – 9/30/2020**

**Broader Impacts**

*From Project Summary*

This multidisciplinary project will provide new data relevant to other areas of geobiology where biogeochemical hotspots result in iron cycling and natural biogeobatteries generate geophysical signatures, e.g. in marine sediments where electrons are reportedly transported by filamentous cable bacteria from deeper sediments to the surface of the sea bed. Widespread adoption of geophysical methods for long-term, non-invasive monitoring of transition zones requires the development of predictive relationships between geophysical observations and biogeochemical parameters; this project is primed to establish such relationships. The field campaign and laboratory experiments will engage underrepresented minority (URM) undergraduate students from three LSAMP programs in a unique research experience, providing exposure to a team of scientists that have accumulated decades of knowledge working at the site. Professional development will be promoted by providing opportunities for graduate students to serve as mentors to undergraduate researchers. A biogeophysics workshop will be convened to bring geophysicists together with hydrologists, geochemists, and microbiologists to further awareness of the growing knowledge base of geophysical signatures driven by hydro-biogeochemical processes.

*From Narrative*

Contributions to other scientific disciplines: This project builds on recent exciting evidence that natural biogeobatteries in the earth can be generated when the optimal redox conditions are coupled with an electron conductor. There is a growing inventory of tantalizing evidence that such biogeobatteries are also established in marine sediments where a type of sulfur oxidation generates the redox gradient and electrons are transported by filamentous cable bacteria from deeper sediments to shallower sediments (Meysman et al., 2015; Nielsen et al., 2010). Similar to the situation for a biodegrading hydrocarbon source zone, electronically conductive minerals (e.g. pyrite) are postulated to enhance the electron transport (Malvankar et al., 2014). Near surface organic contaminants are more accessible for study than marine sediments. Knowledge transferred from studies on the geobattery observed at Bemidji could provide valuable insights into mechanisms generating and regulating such geobatteries in marine sediments. Environmental stewardship: This work will advance the fundamental understanding of the information content of geophysical signatures arising from long-term natural attenuation of a crude oil spill. Continued US energy investment in oil supply, such as the proposed Dakota Access pipeline, emphasizes that accidental oil spills will continue to be an undesirable consequence of reliable energy supply. Geophysical measurements have unprecedented potential to be deployed for autonomous, long-term monitoring of natural attenuation at hydrocarbon contaminated sites. Monitored natural attenuation is increasingly being championed as an attractive alternative to enhanced remediation methodologies that often fail to have long-term impact on subsurface contaminant concentrations. Widespread adoption of geophysical methods for long-term non-invasive monitoring requires the development of robust relationships between geophysical observations and the biogeochemical measurements that are the staple established indicators of contaminant degradation. This work is primed to establish such relationships. Expanding collaborations: This project requires a collaborative effort between three academic institutions, supported by unique expertise and services provided by two branches of the USGS. Slater/Ntarlagiannis (RUN) and Atekwana (OSU) have a strong prior record of collaborative research in biogeophysics and have focused this effort on the Bemidji site in recent years. The new collaboration with Isaacson (BSU) provides opportunities for faculty and students local to the site to engage in the rich tapestry of research occurring on their doorstep. The engagement of the USGS provides outstanding opportunities to introduce undergraduate students to the mission of the survey, and its unique legacy of cutting edge research on long term natural attenuation of oil spills conducted at the site over the last 30 years. Educational activities and student professional development: The field campaign and laboratory experiments will engage underrepresented minority (URM) undergraduate students in a unique research experience, providing exposure to a long-term USGS research site and a team of USGS scientists that have accumulated decades of experience working at the site. All three institutions will leverage established NSF Louis Stokes Alliance for Minority Participation (LSAMP) programs to engage URM students. RUN is uniquely placed to engage URM students in research, being a Hispanic Serving Institution (HSI) that U.S. News & World Report has ranked the most diverse national university in the United States every year since the inception of the category in 1997. URM students accounted for 54% of the undergraduate majors in 2015, a striking contrast to the depressing national statistics reported for the Earth Sciences, which ranks lowest (~2%) in terms of national diversity statistics for undergraduate students earning STEM degrees. A pipeline of URM students into RUN is guaranteed by strong alliance with a network of minority serving institution (MSI) community colleges administered through the Garden State LSAMP (GS-LSAMP) program directed by RUN. Whereas GS LSAMP primarily serves Hispanics and African Americans, the BSU LSAMP program known as North Star STEM Alliance provides unique opportunities to engage Native Americans via its well established pipelines to Regional Tribal Colleges (particularly Leech Lake Tribal College). OSU also has a vibrant LSAMP program (OK LSAMP) that will serve as an additional resource for funneling URM students into this research. The PIs expect to engage six URM students per year in the field and laboratory research activities, with at least one student coming from each LSAMP program. Recruitment will target STEM-inclined students that have not yet decided upon a major in an effort to encourage URM students to pursue geoscience careers. All students will be provided with strong professional development opportunities through access to established LSAMP activities at the three institutions. The synergistic collaboration between RUN/OSU (research-focused national universities), BSU (a regional undergraduate institution) and USGS provides unique opportunities for simultaneously promoting undergraduate research and graduate student professional development. The Environmental Studies major within the Center for Environmental, Economic, Earth and Space Studies at BSU requires a senior thesis or internship. USGS collaborators (Bekins and Cozzarelli) will assist BSU students in the application procedure for competitive USGS internships to work at the site during summer months. All undergraduates involved in the research will be mentored in the presentation of results of their research at a national geoscience meeting. Graduate students of the RUN Geophysical Society, a highly active student chapter of the Society of Exploration Geophysicists (SEG), will engage in the project by training BSU undergraduate researchers on geophysical data acquisition methods used in the project. The RUN Geophysical Society is committed to advancing the use of geophysical methods for near-surface, environmental applications and also to promoting professional development activities for its graduate student members. This project will provide an opportunity for these RUN graduate student geophysicists to travel to BSU and mentor the undergraduate researchers working on the project. RUN Geophysical Society graduate students will also give presentations on hydrogeophysics to faculty and students in the Center for Environmental, Economic, Earth and Space Studies at BSU. Biogeophysics workshop: In 2008, Slater and Atekwana convened an AGU Chapman Conference on Biogeophysics that was partially supported by NSF, EPA and DoE. A workshop titled ‘Biogeophysics-10 years on’ will be convened in Fall 2018. Similar to the 2008 Chapman Conference, it will bring geophysicists together with geochemists and microbiologists to further awareness of the growing knowledge base of geophysical signatures driven by microbial processes. The workshop will be held at RUN due to its proximity to a major international airport. Co-PI Atekwana will lead in the organization of the workshop by soliciting participation of scientists and students in academia and federal research labs. The inventory of geophysical signatures observed at the Bemidji site will be used as a foundation of the workshop discussions. RUN, BSU, OSU and USGS will equally participate in the workshop.

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**Collaborative Research: Towards a mechanistic prediction of methane ebullition fluxes from northern peatlands**

**Lee Slater, PI**

**Project: 6/1/2016 – 5/31/2019**

**Broader Impacts**

*From Project Summary*

New collaborations will facilitate transfer of findings of this work from boreal peatlands to ongoing research on methane dynamics in other climates, including sub-tropical systems such as the Everglades, and Artic systems. Ultimately, the model developed may serve as the template for a mechanistically-based ebullition module that could be slotted into regional climate models to better represent methane fluxes from peatlands regionally and worldwide. Data acquired and models developed from this project will be made available to the peatlands community upon project completion. The team will actively participate in PeatDataHub, a new initiative (led by Univ. Leeds) to develop a repository for data from peatlands worldwide. Integration of minority students into the research will occur via connection to the Garden State LSAMP program at Rutgers-Newark. Two LSAMP scholars per year will serve as research assistants during intensive summer field campaigns. Three full-time graduate students will pursue PhD research on this project, and broad dissemination of results will be ensured through student and PI led presentations at national/international meetings and articles submitted to international journals.

*From Narrative*

This project will bring new quantitative insights into understanding of methane dynamics in peatlands and the contribution of peatlands to the atmospheric methane burden. Such research requires interdisciplinary teams with diverse skill sets; this project represents a new collaboration with co-PIs Varner and Mumford working for the first time with Slater, Comas and Reeve. Further work on carbon cycling in environmental systems is clearly needed to better understand the positive and/or negative feedbacks on CH4 releases from peatlands resulting from a warming climate. For example, increasing atmospheric pressure variability associated with more frequent tropical storms along the eastern U.S. might be expected to drive more ebullition events. Ebullition models must first be reliably calibrated prior to being used for predicting CH4 emissions under a warming climate with more storm activity. Because the proposed ebullition model directly incorporates changes in pressure and temperature with time, as well as methane partitioning between aqueous and gas phases as a function of temperature, it can be readily incorporated into studies of potential climate effects on ebullition at larger scales. Ultimately, the model may serve as the template for a mechanistically-based ebullition module that could be slotted into regional climate models to better represent methane fluxes from peatlands worldwide. Key project activities that will broaden the significance of our research are described below. Building a long-term database on CH4 measurements at Caribou Bog Members of our team have now been acquiring data in Caribou Bog for a decade. Data acquired under this new project will significantly expand this long-term database. The modeling effort will mine and utilize the earlier datasets from previous projects enhance the value of the long-term database at this field site and its availability to those performing research and education on CH4 cycling peatlands. The PIs will also participate in the development of *PeatDataHub*, a new initiative led by University of Leeds (UK) to serve as an open repository for data from peatlands around the world. *PeatDataHub* intends to include long-term datasets (3 years or more) on peat C fluxes, hydraulic and hydrological properties and peat & water chemistry. PI Slater will attend the kick off planning meeting in June 2016. In the event that *PeatDataHub* does not develop as expected during the first year of the project, the PIs will instead focus on using the CUASHI Hydrologic Information System (CUASHI-HIS) for open access data sharing.

Involving minority students in geoscience research

The ongoing Rutgers-Newark Garden State ‘Louis Stokes Alliance for Minority Participation’ (LSAMP) Program represents an alliance between nine schools in central and northern New Jersey with the primary goal of establishing a learning community to increase success and opportunities of minorities (primarily African Americans) in non-medical STEM. One of the opportunities that the Garden State LSAMP commits to offer its scholars is “research experiences in their area of interest in faculty laboratories”. Under EAR-1045084, LSAMP scholars were engaged in an immersive field research experience where they worked as undergraduate research assistants during a summer research campaign in Caribou Bog. These students grew up in the urban tri-state area with little prior exposure to the outdoor environment and the wilderness. The experience enormously benefited the LSAMP scholars, the PIs and the graduate students involved in the project. Given the success of this initiative, it will be strengthened in order to continue the pipeline of non-medical STEM students into geoscience research. Rutgers-Newark is uniquely position to enhance diversity in the geosciences. At least two Garden State LSAMP scholars will be recruited per semester (including the summer) to engage in research activities with the project team. Since 1997, the first year that U.S. News & World Report began ranking colleges on the diversity of their student bodies, U.S. News has rated Rutgers-Newark the most diverse national university in the United States. CO-PI Varner has also been involved in recruiting underrepresented students to her REU program and also as graduate students in her research group at UNH. She will continue to involve these students in her research and the workshop as part of this grant.

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**GP-EXTRA: A geoscience pathway field experience in near-surface geophysics to promote recruitment and retention of transitional students in quantitative geosciences**

**Judy Robinson, PI**

**Project: 7/1/2017 – 6/30/2020**

**Broader Impacts**

*From Project Summary*

The broader impacts, directly tied to our evaluation measures, of the proposed field experience are to:

(1) Increase recruitment and retention of participants as geoscience major students

(2) Increase the problem solving and quantitative skills of the participating students.

(3) Increase positive perceptions of participating students towards opportunities and industry demands for geoscientists.

*From Narrative*

The broader impacts of this project stems from the strong collaborations and partnerships developed within the framework on this project between GP students, graduate mentors, faculty researchers and the connection with a student mentor post-field experience at RN and TU. Each component of our field experience is designed to promote discovery and understanding of the scientific process, geoscience concepts and related careers in a supportive and engaging learning environment. These impacts are reflected in the goals of the project which are to: increase recruitment and retention of participants as geoscience major students; increase problem solving and quantitative skills of the participating students; and increase positive perceptions of participating students towards opportunities and industry demands for geoscientists. A quantitative and comprehensive evaluation will be used to identify which components of the field experience have the largest impact on each of the stated goals. We also hope to create a program that can be used as a framework for similar student field experiences at other institutions.

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**Collaborative Research: Computer-Supported Math Discourse Among Teachers and Students**

**Arthur Powell, PI**

**Project: 9/1/2011 - 8/31/2018**

**Broader Impacts**

*From Project Summary*

The project designs, tests, integrates, evaluates and disseminates technology, curricular resources, pedagogical methods and analytic tools for use in math-teacher professional- development programs, classrooms of math students, home-schooling networks, online schools and the Math Forum community (over three million visits per month). Project results will support the use of math exploration technology within collaborative math-discourse approaches at diverse schools nationally through their spread to in-service teacher-training programs and services—bringing practical cyber- learning of math to at-risk and isolated math students. It documents the potential impact on both teachers and students of this computer-supported math-discourse approach quantitatively and qualitatively.

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**Identities in Automorphic Descent**

**Zhengyu Mao, PI**

**Project: 7/15/2017 – 6/30/2020**

**Broader Impacts**

*From Project Summary*

The PI's project has been used to mentor graduate students and postdocs in the past. The project will be part of  PI's future mentoring activities.    
  
PI serves as graduate director for Ph.D program in Rutgers-Newark, a university consistently ranked number one in the nation as the institution with the most diversified student body. The PI will co-organize Junior Number Theory Days conference (with Y. Sakellaris), a workshop aimed at helping young number theorists at the beginning of their career."

*From Narrative*

The broader impact of this project will be similar to that of my current project supported by NSF, which is described in section 1. This project concerns both the global and local aspect of the theory of automorphic forms. The result will establish well-known global conjectures on period of automorphic forms, increase our knowledge in global and local aspects of descent and theta correspondence, as well as local harmonic analysis.

The research will be carried out at Rutgers-Newark, a campus continuously ranked number one in diversity among all US colleges. I directed one graduate student at Newark and plan on directing more. Many of the local questions in the project   are accessible to graduate students.

I am serving as graduate director of our program. I am volunteering in local schools coaching teenagers on competition level mathematics, and contributing to Math Review and Math Zentralblatt.

I am requesting a budget to continue the Junior Number Theory Days workshop. The workshop invites graduating or newly graduated number theorists. (List of participants for 2015: J. Booher, I. Filip, J. Fintzen, E. Gazaki,  J. Guerreiro, B. Liu, M. Nastasescu,  J. Polak, B. Romano, N. Sardari, A. Shnidman, C. Tsai.) The young number theorists can show off their work, networking with others. We believe JNTD will be of big help for them at the start of their career. Rutgers-Newark has many faculty members with past or current interest in number theory (L. Guo, D. Keys, R. Sczech, D. Shelstad and J. Sturm). Our convenient location is served by Newark airport and train station; it allows us to host the workshop with a low cost.

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**Collaborative Research: Social Mobility, Poverty Reduction, and Democracy in an Emerging Middle Class**

**Sean Mitchell, PI** with Benjamin Junge (SUNY, New Paltz), and Charles Klein (Portland State)

**Project: 7/15/2016 – 6/30/2018**

**Broader Impacts**

*From Narrative*

Brazil has long been seen as epitomizing extreme socioeconomic inequality—to the extent that deepening inequality and shrinking middle classes elsewhere in the world are often glossed as “Brazilification” (Coupland, 1991, p. 11; Green, 2013; Ortner, 2005, p. 273; Mitchell et al., n.d.). The popularity of the “Brazilification” trope highlights the significance of the rise of masses of Brazilians into a class widely understood to be a “new middle class.” Our project will make a substantive contribution to comparative discussions of poverty-alleviation initiatives in other parts of the world. Through rich comparative and longitudinal data, this project will shed crucial light on the cultural, political, and economic significance and broader impacts of Brazil’s emerging middle classes. The project’s findings will be of strong interest to social scientists and policymakers: Our data and analyses will illuminate how middle-class experience and changing class relations impact political identity and action in a historically unequal nation that has experienced significant reductions in inequality. Our findings, moreover, will have significance well beyond Brazilian studies. Piketty (2014) has recently marshaled extensive historical evidence to show that, over the long term, middle classes do not fare well in most capitalist economies. Yet, over the last decade, even as the middle classes of the Global North have shrunk, some nations in the Global South (Brazil, China, and India, in particular) have undergone unprecedented periods of economic transformation and reduction of inequality (Lakner & Milanovic, 2013). This project embraces a unique opportunity to investigate the political and cultural consequences of changes that, if these scholars are correct, are historically rare, possibly fragile, and of substantial historical significance.

Piketty’s work has been just one high-profile contribution to a growing conversation on the specter of deepening global inequalities, as well as on strategies for large-scale reduction of inequality. Most of the scholars conducting rigorous research in this area, however, are economists or political scientists studying changing class structure from a top-down perspective using quantitative methodologies. With a rigorous, comparative, ethnographic research program focused on the political and cultural aspects of inequality—in a time and place where it has seen reductions—our project will deepen this global conversation through anthropological theory, data, and analysis.

These impacts will be achieved through various presentations of findings at scholarly meetings, the preparation of a book-length ethnographic monograph, and several publications in refereed scholarly journals in the areas of cultural anthropology and Latin American studies. Because of the significance of and wide interest in this topic, we also intend to disseminate our findings through news and popular media, op-eds, etc. In addition, this project will provide educational training opportunities to undergraduate students at PIs’ home institutions, as well as students in Brazil, and will strengthen ties with Brazilian social scientists in the three field sites.

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**CAREER: Social networking: understanding sociality and symbiosis through the eye of non-Neoisopteran termites using molecular and morphological data**

**Jessica L. Ware**

**Project: 1/1/2015 – 12/31/19**

**Broader Impacts**

*From the Project Summary*

As an African American woman in a non-traditional field, I am enthusiastic about increasing diversity in science, specifically in entomology. Leading by example is a powerful way to inspire young people of color to enter non-traditional fields. This project involves direct mentoring of high school, undergraduate and graduate students, as well as collaboration with Guyanese students via a field course in Guyana. Additionally, my research program will feature extensive skills sharing/developing with underprivileged groups in STEM fields via the AIM HIGH program already in its fourth year at Rutgers. Aim High is a summer research experience program that recruits high school students from lower socio-economic backgrounds and provides them with lab and field based science experience. This hands-on interaction will directly increase their learning, which will lead to their recruitment to university, thereby increasing the diversity of our profession by encouraging these emerging scientists (many of whom are of color) to pursue academic careers. Rutgers Newark is a highly diverse, urban campus with a uniquely multicultural and multiethnic student body. We see this as a remarkable opportunity to recruit and retain diverse students in the fields of evolutionary biology and entomology by mentoring and working with Rutgers Newark students. The visibility of entomologists of color will be increased through the student production of videos and blogs in the field in New Jersey (NJ, USA) and Guyana for YouTube and my lab website.

*From the Narrative*

There are several outreach goals as part of this project. **(1)** YouTube video presence: 3-minute films about non-pest termite species, modeled after creature cast (http://creaturecast.org/) will be created by two NJ SEED summer high school interns and two selected Aim High High school students each year. Each will include footage from graduate student and postdoctoral lab trips to the field, and will overview basic termite biology, interesting life history strategies and behavior, and evolutionary relationships. The videos will be submitted to the Entomological Society of America's annual "YouTube Your Entomology Contest". **(2)** "*Mostly NOT pests: termite biology and systematics*", a series of local workshops that will be taught by undergraduate and graduate students in my lab for the public in Newark, NJ. **(3)** Termites on the web: Each graduate student and the postdoc will author multiple genus-level pages for the Encyclopedia of Life (eol.org) via our LifeDesks site http://Blattodea.lifedesks.org/. **(4)** Images of all specimens collected will be deposited in Morphbank, an online database for morphological dataset sharing*.* **(5)** Students travelling on field collection trips will blog weekly from the field, describing their experiences, and creating an online pictorial field guide for termites in each location.