

Background: BBCS Research Group

Our planet faces enormous challenges that will become more daunting and fundamental. At stake is the fate of biodiversity and ultimately the security of humanity. Given projected rates of climate and land-use changes there are numerous grand challenges associated with projecting the future of biodiversity and its linkages with human well-being (e.g., see ICSU Future Earth Program, www.futureearth.org). These challenges are difficult, in part, because they bridge the traditional boundaries of the natural, physical, and social sciences and ramify to influence public health and economic, environmental, and national security.

The University of Arizona has considerable strengths in ecology, evolutionary biology, natural resources, conservation biology, environmental policy, climate change, agriculture, public health, medicine, and informatics. However, exploiting the potential and benefits from synergies between these strengths has been incomplete.

During the spring semester of 2016—with support from the Institute of the Environment (IE)—nearly two-dozen UA faculty members and others gathered in a series of facilitated workshops, which became known as the Bridging Biodiversity and Conservation research group. Within the inspired openness of these meetings, the participants in the group discussed how a broad and integrated view of biodiversity and conservation research could lead to cutting-edge science, and how that could be the target for higher-ROI investment in the near future. The group developed a white paper for IE about how to better support integrated biodiversity research at the UA. The group also developed “aims pages” of potential research proposal ideas (Table 1).

Embedded within each of the research proposals is an interconnected hypothesis.

Biodiversity conservation provides an “adaptation tool”:

- *to mitigate the effects of climate change, urbanization, and globalization on the resilience of food-production systems (food security);*
- *to combat the spread of invasive species (foundational biodiversity) and vector-borne infectious diseases across boundaries (public health); and,*
- *to moderate the effects of climate change on future operating environments and on environmental stressors that can lead to socioeconomic and political instability (national security).*

Thus, the Bridging Biodiversity and Conservation research group identified four themes in which to undertake research and proposal development: (1) *biodiversity science*, to understand the critical ecological processes that create and maintain biodiversity and then to project the fate and distribution of biodiversity in the near and far future; (2) *public health and epidemiology*, to understand how changing patterns of biodiversity will influence and shape the spread of

pathogens, disease vectors, and the spread of invasive species; (3) *governance of future environments*, to determine the key elements of and create institutional structures to conserve and protect biodiversity while addressing these challenges to human well-being and security; and (4) *informatics*, to integrate techniques of big data and network analysis across themes 1–3.

While the initial core the research group comprises 12 UA faculty members from diverse disciplines and units (see below), the group’s aim is to be as inclusive as possible. The activities proposed here would be open all researchers at the UA who have interests in the objectives of the BBC and who are willing to participate in the group’s meetings, proposal development, postdoctoral scholar support, and other activities.

In March 2016, the University of Arizona Office of Research, Discovery and Innovation, provided the funds to support 3-4 two-year research appointments in the recently established postdoctoral cluster hire, Bridging Biodiversity and Conservation Science (BBCS): Forecasting Future Operating Environments.

Plan for Postdoctoral Research Experience

The BBCS postdoctoral research associates will contribute to the development of: (i) synthesis papers, (ii) pilot (“proof of concept”) data, and (iii) at least one of several planned major research proposals (\$2-5M) that connect biodiversity science with public health, governance, informatics, and security to be submitted during FY2018 or FY2019.

The postdocs will be supervised collectively by the BBCS program manager and by at least two Proposal PIs (UA faculty members) from different disciplines (i.e., **Liz Baldwin**, public policy & governance; **Brian Enquist**, biodiversity science; **Kacey Ernst**, public health & epidemiology; **Laura López-Hoffman**, conservation biology & public policy; or other BBCS members as appropriate) who will lead the proposal development with significant contributions from the postdoctoral researchers.

Other members of the BBCS team (and potential Proposal PIs) include: **Greg Barron-Gafford**, geography & environmental studies; **Dave Breshears**, ecohydrology & macrosystems ecology; **Kirk Emerson**, public policy & governance; **Dan Ferguson**, climate change, environmental studies, & Indigenous nations; **George Frisvold**, agricultural economics; **Gary Nabhan**, ethnobotany & food security; **Kristen Pogreba-Brown**, public health & epidemiology; **Stephanie Carroll Rainie**, public health & Indigenous nations data sovereignty; and **Christopher Scott**, geography, public policy, & food-energy-water security.

The postdoctoral research associates will work with Proposal PIs to develop novel cross-cutting science to be published in high profile papers. This will include tackling large questions that lie in the interface between existing strengths on campus and will advance the goals of BBCS. The postdocs will be situated in offices of the UA Institute of the Environment (ENR2 Building) and will spend time in the labs or in lab meetings of the respective faculty PIs, and participate in regular meetings and training sessions of the broader BBCS team.

Characteristics of the postdoctoral research experience include:

- connection to an exciting science interface addressing “global grand challenges”
- an opportunity for interdisciplinary training to assist in developing and submitting one or more large-budget, high-ROI research proposals
- supervision by at least two Proposal PIs from different disciplines (who will lead the proposal writing, with significant contributions from the postdoctoral researchers)
- access to excellent core facilities
- engaging in a team approach, with a common shared office space, cohort development, and a mentoring program
- a balance between research and proposal development by authoring innovative, big-picture synthesis and review papers
- a competitive salary (1.0 FTE for 2 years) with the UA benefits package

Table 1. Possible BBCS Proposal Development and Submission, Years 1 & 2

<u>Target</u>	<u>Proposal PI and Team</u>	<u>Topic</u>	<u>Theme</u>	<u>Amount (\$ million)</u>
*NIH Vector Biology	Ernst (Proposal PI), Pogreba-Brown, Pivo, et al.	Conversion of native desert vegetation and the emergence of mosquito borne infectious disease	<ul style="list-style-type: none"> • public health & epidemiology • biodiversity science • governance • informatics 	3.5
NSF MacroSystems Biology and Early NEON Science Program	Enquist (Proposal PI), Breshears, et al.	TBA	<ul style="list-style-type: none"> • biodiversity science • informatics 	3
*NSF Coupled Natural-Human Systems	Baldwin (Proposal PI), Emerson, Schlager, Ernst, López-Hoffman, Scott, et al.	Prospective development of institutional arrangements to use native vegetation as a barrier for the cross-boundary spread of invasive species and mosquito-borne pathogens	<ul style="list-style-type: none"> • governance • public health & epidemiology • informatics 	1.9
DoD DTRA	Ernst (Proposal PI), Pogreba-Brown, Enquist, van Leeuwen, Tong & Monaghan (NCAR), et al.	Projecting infectious disease outbreaks by understanding land use change and patterns of biodiversity	<ul style="list-style-type: none"> • public health & epidemiology • informatics 	5

**Aims pages developed for these proposals during the BBC research group meetings, Spring 2016.*