## Project Summary


### The network

Here we propose to establish a network of 95 field sites across the United States, Costa Rica and Panama. These sites span all the domains of the National Ecological Observatory Network (NEON). At each, we will inventory species, build online site-specific identification guides, and collect high-quality data to monitor changes. Across sites, we will provide web tools for data management, analysis, and dissemination.

We will train and employ teams of students at each site to follow rigorous research protocols. They will use digital cameras and other means to record observations accurately in time and space, up-load images to personal albums, and manage associated data on-line. We will use geo-referenced identification guides, crowd sourcing, automated programs that flag unusual events, and the oversight of taxonomic experts to facilitate species identification and ensure that determinations are correct. We will initially collect information on readily identifiable plants, pollinators, moths, macro fungi, slime molds, lichens, amphibians, and other groups.

### Intellectual merit

Contributors will collect 'life lists' of photographed species into albums on Discover Life (www.discoverlife.org), a website that integrates databases, species pages, maps, and analysis tools. By querying across albums, web users will be able to assemble inventories and monitor changes over time. To facilitate analysis for this proposal's research questions, we will integrate our field data with (1) historical museum and herbarium collection records obtained from the Global Biodiversity Information Facility (GBIF) and other sources, (2) weather station data from NOAA's National Climate Data Center, (3) NASA's MODIS satellite summaries on vegetational changes, and (4) air quality data from NEON. To predict the impacts of climate change, invasive species, and pollution on biodiversity, we will analyze the phenology, distribution, abundance, and interactions of representative species. By modeling data across sites, we will predict how potential long-term changes in temperature and rainfall patterns and other large-scale factors could affect communities and their ecosystem services.

### Broader impacts

We will recruit students from under-served communities, historically black colleges and universities, tribal colleges, and community colleges. With faculty mentors and web support, students will work at NEON sites, Long Term Ecological Research (LTER) sites, field stations, parks, schools, and other locations. Each student will specialize in the identification and natural history of a group and conduct an independent research project. By the proposal's third year, we will employ over 100 undergraduates and 150 high school students annually, many of who will be from under-served communities.

We will make all data publicly available via Discover Life and GBIF. At the local level, our data will enable site managers to respond rapidly to invasive species and other threats. Our customized identification guides will overcome the taxonomic impediment that hinders much ecological research and management.

We are implementing a completely new and radically more efficient way of collecting data on species and their interactions. Our hope is that the proposed network and its associated technology will become widely accepted and will develop into a much denser network of study sites to better understand and manage our environment globally.