2012 George Melendez Wright Climate Change Youth Initiative

The 2012 awards supported 26 interns and 14 fellows. A short summary of all project descriptions and park units participating is provided below.

INTERNSHIPS

Apostle Islands National Lakeshore – Ashland, WI – assist with climate change literacy projects that integrate how climate change will affect the natural resources of the Great Lakes and subsequently impact traditional lifeways of the Ojibwe people.

Assateague Island National Seashore – Berlin, MD – implement climate effects monitoring through a robust aquatic resource monitoring program in activities like estuarine water quality monitoring, wetlands surveys and submerged aquatic vegetation surveys.

Boston Harbor Islands National Recreation Area – Boston, MA – develop a series of educational products like brochures, web materials, and kids programs to facilitate greater understanding among park staff and visitors of climate impacts to Boston Harbor Islands.

Buffalo National River – Harrison, AR – develop an adaptive climate change module for the parks 2012 Fire Management Plan that will address changes in the forest species phenology and provide basic recommendations on how to adapt prescribed management treatments.

Cuyahoga Valley National Park – Peninsula, OH – implement communication tools, such as formal evening programs, curriculum based programs, web content and exhibits to engage school groups and the general public with climate change topics.

El Malpais National Monument – Grants, NM – inventory and monitor the effects of climate change on ice levels within the caves of El Malpias, which are and have been an essential water source for wildlife and humans in an otherwise harsh arid environment.

Everglades National Park – Homestead, FL – develop a suite of educational products that showcase examples of change in south Florida that include content to be featured on the park website, creative solutions for highlighting sustainable operations and development of activities for the environmental education program.

Golden Gate National Recreation Area – San Francisco, CA – develop materials and establish relationships with schools, park partners and volunteer groups to shepherd the phenology monitoring program from the pilot phase into a fully developed, self-sustaining public education and monitoring program.

Great Smoky Mountains National Park – Gatlinburg, TN – with the assistance of citizen scientists, implement the phenology monitoring program in the Smokies to fine tune data sheets, establish study plots, pilot new protocols, and assemble background information for training materials.

Gulf Islands National Seashore – Ocean Springs, MS – develop geomorphological (changes in landforms) models of beach areas that are used as critical habitat for loggerhead, green, Kemp's ridley and leatherback turtles to identify areas that will be most affected by sea-level rise under several different sea level rise scenarios.

Indiana Dunes National Lakeshore – Porter, IN – investigate how variations in the topography of the dunes affect the habitat and wild lupine, the sole food source, of the endangered Karner Blue butterfly and establish whether landscapes in the park might be manipulated (by fire for example) to establish areas that will serve as refuges for the Karner blue in a warmer future.

Manassas National Battlefield Park – Manassas, VA – implement a wide range of natural resource educational and media products through the lens of climate change, including a module for the park's Junior Ranger program and an "on-cell" nature walk for one of the trails.

Mount Rainier National Park – Ashford, WA – collect and analyze water samples of meltwater runoff from the park's glaciers to determine the level of ice stagnation to help park staff and the public understand important climate related glacier changes in order to create action plans to help protect public and worker safety, and park infrastructure.

National Mall & Memorial Parks – Washington, DC – using GIS software, create a model showing water levels throughout the national mall under a range of Potomac River water level scenarios to identify which resources and locations are most sensitive to sea level rise in order to produce images that illustrate these effects on memorials, landscapes, and the cherry trees.

North Cascades National Park Complex – Sedro-Woolley, WA – keep a field journal while accompanying researchers, park scientists, and educational staff on research projects, field inventories and educational outreach in order to report their experiences using traditional or digital media to relay the magic of science to a broad audience.

Point Reyes National Seashore – Point Reyes Station, CA – develop a state of art multimedia climate change communication program for students and the public that utilizes a room sized, global display system, called Science on a Sphere, that uses computers and video projectors to display planetary data onto a six foot diameter sphere.

Saint-Gaudens National Historic Site – Cornish, NH – develop a bundle of educational and interpretive tools that will help make the issue of climate change easier to communicate in historic and cultural sites in the National Park System and more relevant to visitors at these sites.

Sequoia and Kings Canyon National Parks – Three Rivers, CA – produce a multimedia product (such as a short video) that communicates alternative climate/fire futures, highlights some of the possible effects on park resources (like giant sequoia trees), and describes potential management actions to prepare for or respond to climate change.

South Florida / Caribbean Network Office – Palmetto Bay, FL – monitor the ecotonal movement of mangroves from tidal marshes into freshwater marshes due to sea level rise and soil elevation to determine if mangroves can keep up with sea level rise in Everglades, Biscayne, and Big Cypress National Parks.

Voyageurs National Park – International Falls, MN – investigate the temperature tolerance of moose and compare it to existing habitat temperatures in order to estimate their sensitivity to climate change and how that may impact other wildlife in the region.

War in the Pacific National Historical Park – Hagatna, Guam – identify and map the coral reef areas and coral colonies to be monitored for coral bleaching sensitivity in order to develop a monitoring plan that can be implemented throughout the year by youth volunteers.

Washington Communications Office – Washington, DC – oversee a project to publicize work accomplished and underway by other George Melendez Wright climate change interns and fellows by coordinating media contacts, interviews with interns, fellows, NPS staff, writing feature stories and acquiring art work for media stories.

Washington Interpretation & Education Office – Washington, DC – assist in the development and production of a series of short on-line videos that highlight a variety of topics related to the science of climate change and its effects on national parks.

Western Arctic Parklands - Kotzebue, AK – develop communication products that incorporate first-hand knowledge of the impacts of climate change on the environment and communities of northern Alaska by incorporating the voices of park staff, local community and tribal members.

Wupatki National Monument - Flagstaff, AZ – assist in the development of a vulnerability assessment for archeological resources at Wupatki by focusing on the potential effects of climate change on archeological sites along the Little Colorado River while establishing current baseline conditions.

Yellowstone National Park – Mammoth, WY – use *NatureServe's Climate Change Vulnerability Index* (CCVI) tool to determine which species and habitats within Yellowstone are most vulnerable to climate change.

FELLOWSHIPS

Gates of the Arctic National Park & Preserve – Soil in the arctic tundra holds a great deal of dead plant material that releases CO_2 into the atmosphere as microbes (bugs) in the soil break it down. How quickly that happens depends in part on how much the soil warms in a changing climate and on the broader food web of which the microbes are a part. This study will use experiments to determine how wolf spiders and temperature together ultimately affect the conversion of soil organic matter into CO_2.

Glacier, Grand Teton & Yellowstone National Parks – Climate models for the western United States predict increases in wildfire frequency and intensity which is likely to result in rapid and widespread changes in vegetation patterns and wildlife habitat. This study will examine how the severity of wildfires has changed over the past 26 years in forested national parks and surrounding wilderness areas of the northern Rockies in order to inform park managers who seek to understand how different forest habitats will respond to ongoing climate change.

Isle Royale National Park – As anyone who has dived down toward the bottom of a lake in the summertime knows, the water temperature can be quite pleasant in the upper layers but then suddenly get cold below a particular depth. These distinct thermal layers are due to seasonal weather patterns that create important habitat for the organisms that live in the lake. Algae collected from the bottom of Lake Siskwit indicate the thickness of the upper warm layer has more than doubled (from about 15 to 36 feet) over the 20^{th} century. It is not known, however, if such a change is within the natural range, how the change may affect the base of the food web, or whether the change has occurred in other lakes.

Kalaupapa National Historical Park – Hard corals create reefs that support the most biologically diverse communities in the world's oceans. Essential to the growth and survival of those corals is the presence, inside the coral animal's tissue, of symbiotic algae. As the algae undergo photosynthesis, they produce sugars the corals use to grow. When the surrounding water gets too warm, the corals evict their symbiotic algae, a process called coral bleaching. Global climate change is warming the surface waters of tropical oceans, and bleaching events are becoming more common and long-lasting. This study will compare the temperature sensitivity and the physiology of the coral-algae partnership in two coral species from Hawaii.

Lassen Volcanic National Park – The sediments that accumulate at the bottom of lakes provide excellent long-term records of past climate change and the effects those changes have on biological communities. Those sediments contain the skeletons of diatoms – microscopic single-celled algae – whose abundance and species composition depends on temperature, nutrient levels, pH, and other variables of the lake environment. This study will sample sediments from alpine lakes at the boundary of Sierra Nevada and Cascades ecosystems, and compare the changing history of diatom communities to the diatoms that are present in the water today. The comparisons will help reveal how these important aquatic systems respond to warming, local land use changes, increased nutrient deposition, and other environmental changes.

Mount Rainier National Park – Subalpine meadows filled with wildflowers are among the most-loved attributes of Mt. Rainier National Park. They are threatened, however, because trees from lower-elevation forests are encroaching on them. Why that is happening is not clear, though it may be due to some combination of past climate change, current climate change, suppression of natural forest fires, or absence of human-caused fires. This study will use sediment cores taken from subalpine lakes to reconstruct long-term history of vegetation and fire in these areas of the park. These histories will be combined with climate records in order to determine what role climate has played in the encroachment of forests into subalpine meadow habitats and whether it is likely to play a role in the future.

National Park of American Samoa – Some coral species, populations, and even individuals are more resistant to heat stress than others. Understanding how and why sensitivity to temperature is so variable is essential for conserving these critically important organisms. This project will compare the temperature sensitivity and coral bleaching responses of two colonies of *Acropora hyacinthus* that live in adjacent pools in American Samoa, one with high and variable temperatures, the other with more stable temperatures. Short and long-term exposure to different temperatures will reveal how readily the corals can adjust to heat shock, and molecular genetic techniques will reveal which genes confer temperature tolerance.

National Park of American Samoa – Atmospheric carbon dioxide not only increases the average temperature of the planet, it also increases the acidity of the ocean. The ability of corals and other marine organisms to build hard skeletons will be hampered as ocean water becomes more acidic. Thus, it is important to understand how temperature and acidity (pH) together affect coral growth and to understand how corals adjust over the short and long term to changes in their environment. This study will compare, through observation and experiment, the growth and environmental sensitivity of a coral species that naturally experience different combinations of temperature and pH on the same reef in American Samoa.

Several Hawai'i National Parks – Anchialine pools are small bodies of brackish water along the coast connected to the ocean only through underground passages. Four national parks on the Big Island of Hawaii protect these unique habitats, the endemic species they harbor, and the values they have to indigenous Hawaiian culture. The pools will be severely affected by rising sea level, but specific impacts are difficult to predict and manage because basic information is lacking. This study will map existing pools, including the distribution of key native and invasive species, identify possible future pools at higher elevation, and assess habitat condition. As a result, park managers will be better able to plan on how to adapt to rising sea level.

Shenandoah National Park – Amphibian species are suffering from some of the highest extinction rates in the world. One cause of population decline is an infectious fungus, *Batrachochytrium dendrobatidis* (*Bd*). In recent years some amphibians have been found with naturally-occurring bacteria on their skin that protects them from *Bd* infection. This study will identify the bacteria that live on the skin of two salamander species in the park and examine how the abundance of those bacteria and of the *Bd* fungus differ between low elevation (warm) and high elevation (cool) habitats. The results will suggest how the threat of infectious disease may change under future climates. The study will also identify particular anti-*Bd* bacteria that could be intentionally used to fight future *Bd* epidemics and thereby help prevent salamander extinction.

Saint Croix National Scenic River – Native brook trout in the St. Croix River tributaries are, as in many places in North America, a dwindling native species. Competition and predation by introduced brown trout, increasing temperatures, and other factors are taking their toll. Protecting and restoring brook trout populations in this watershed requires knowing where the right stream temperatures exist and where the healthy populations are. In this project, temperature recordings and fish surveys will help park managers understand which stream reaches are the most important to protect or restore now and in the future in order to ensure that native trout remain part of this river ecosystem.

Sequoia, Kings Canyon & Yosemite National Parks – Within the Sierra Nevada Mountains are many plant species whose southern-most populations occur in places where cold air consistently pools in mountain valleys. Because they are cool, these spots represent potential refuges for rare plant species as climate warming accelerates. Many of these locations are also places where natural forest fires were suppressed for decades and are now filled with abundant fuel. This study will map the cold refuges, determine how their fire ecology compares to that of adjacent forest areas, and infer how vulnerable the refuges and plants they host are to future fires. As a result, park managers will have a framework for considering the distinct ecology of these unique refuges as they develop strategies for managing fire under a changing climate.

Wrangell-St. Elias National Park & Preserve – Phenology is the timing of life events like flowering and migration, and long-term change in phenology is a good indicator of how species and communities are affected by changes in the climate. To gain enough data over a large area and time period relevant to climate change, researchers often make use of historical datasets like old photographs and journals, rely on the traditional ecological knowledge of local residents, and engage non-scientists to help collect data near their homes. This project will collect phenological observations made by residents in and around Wrangell-St. Elias since before the park was founded in 1980. Such citizen-generated observations will complement the contemporary data collected by resource managers and scientists and demonstrate how ethnographic research can be used to answer natural resource management questions.

Yosemite National Park – The American Pika is a small rabbit-like mammal that lives on high elevation rock fields. In the Rocky Mountains, increasing temperatures associated with climate change has made many rock fields unsuitable for pikas, and in some places pikas have become locally extinct as their required temperature ranges move upslope. Whether that is happening as well in the Sierra Nevada Mountains is not clear. This study will inventory pika populations in the Sierra Nevada and compare their distributions to historic records and to patterns observed in the Great Basin and Rocky Mountains.