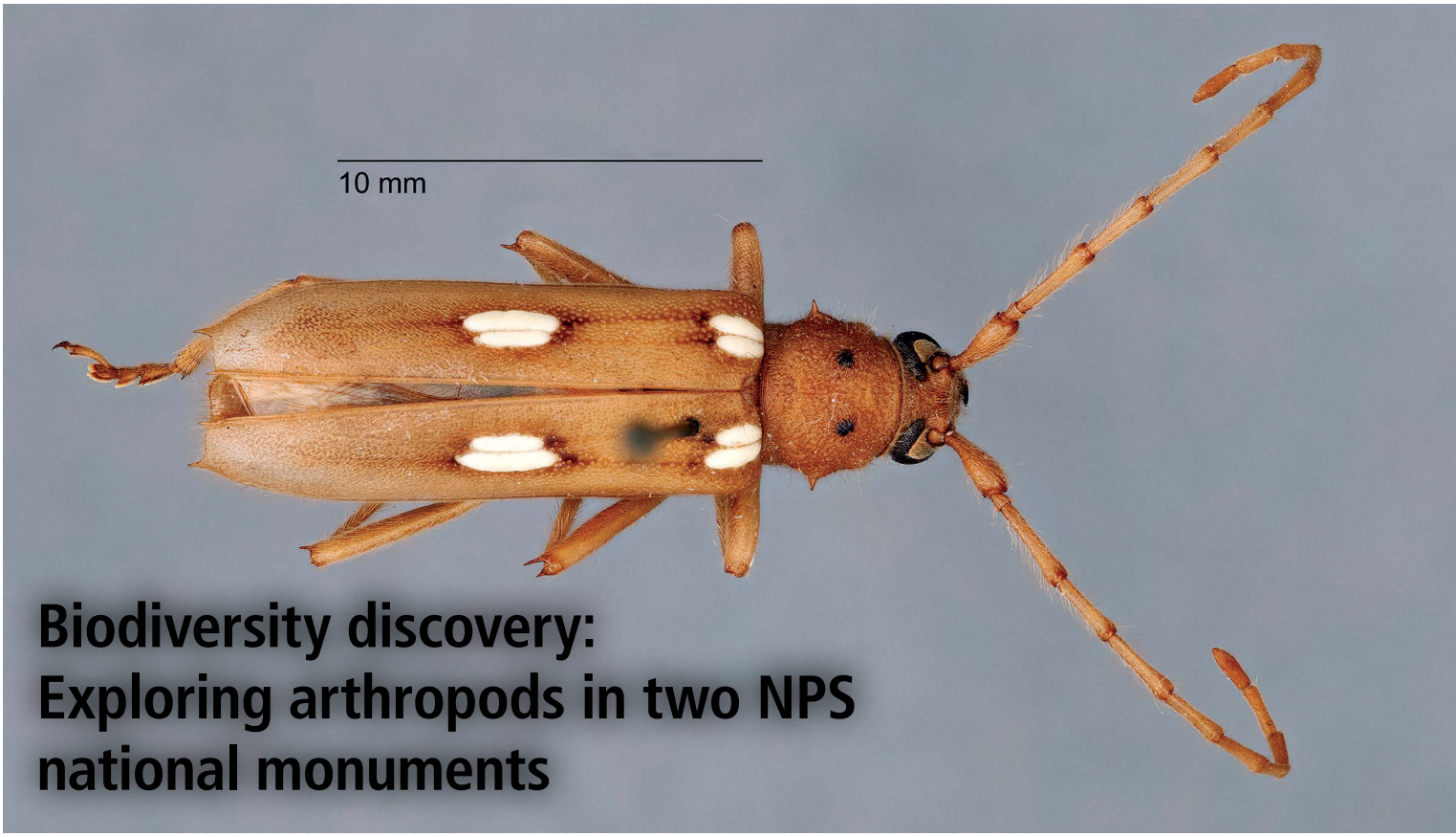
COLLECTION OF NORTHERN ARIZONA UNIVERSITY/COLORADO PLATEAU MUSEUM OF ARTHROPOD BIODIVERSITY



Biodiversity discovery: Exploring arthropods in two NPS national monuments

By Jennifer Leasor, Amy Muraca, Rijk Moräwe, and Neil Cobb

Figure 1. The ivory-spotted longhorn (*Eburia quadrigeminata*) beetle is one of the species collected, imaged, and cataloged during a bioblitz conducted at George Washington Birthplace National Monument, Virginia, through a partnership with Northern Arizona University. This beetle spends most of its lifetime feeding inside hardwood trees and can live up to 40 years.

SCIENCE IS SHOWING THAT parks that are thought of primarily as repositories for the nation's historical and cultural heritage should not be overlooked when it comes to biodiversity. George Washington Birthplace National Monument, Virginia, and Pipe Spring National Monument, Arizona, are two such parks. Both national monuments were part of the Inventory and Monitoring Program established by the National Park Service in 1992 to assist the 270 parks with significant natural resources assess and document the condition of those resources. Inventory and monitoring efforts have been ongoing, and recently Northern Arizona University (NAU) and the National Park Service have partnered to explore arthropods in these two parks as part of "Biodiversity Discovery." Biodiversity Discovery refers to multiple efforts of the National Park Service to explore and document our natural heritage that often focus on smaller life-forms such as arthropods. Biodiversity Discovery activities, like previous Inventory and Monitoring efforts, are helping to uncover the vast diversity of life found in these national monuments.

George Washington Birthplace

George Washington Birthplace National Monument is a 550-acre (223 ha) colonial site on the Potomac River that encompasses a wide range of habitats, including hardwood forests, pine plantations, open meadows, brackish marsh, estuaries, coasts, freshwater ponds, and swamps. This natural environment supported an agrarian society in the mid-17th century that persists today as a fairly intact rural economy. In 2009 the partnership began an effort as part of the Biodiversity Discovery to develop an All-Taxa Biodiversity Inventory (ATBI) program for the monument, which built upon several previous small-scale bioblitzes, or rapid inventories. The creation of an integrated ATBI program, which is to be completed before the National Park Service's centennial in 2016, has three objectives: (1) increase by 10-fold the monument's biodiversity inventory, (2) involve at least 30 schools and universities in ATBI research, and (3) involve and train at least 50 volunteers in carrying out this scientific program.

NORTHERN ARIZONA UNIVERSITY/CHRISTIAN CLARK

The partnership at the national monument included outreach to local schools, professionals, and partners through activities such as presentations and a "birding weekend." However, NAU scientists focused on documenting what Dr. E. O. Wilson, the eminent American biologist and leading authority on ants, has called the "microwilderness," or the world of tiny creatures. General insect surveys at George Washington Birthplace conducted in 2008, 2009, and 2012 have so far documented some 377 species of arthropods, with more identifications expected as the process continues. For example, the inventory identified 144 species of Coleoptera (beetles) (fig. 1, previous page, and fig. 2), 105 species of Hymenoptera (ants, wasps, and bees), and 33 species of Lepidoptera (butterflies). Citizen scientists such as the Northern Neck Master Naturalists, who participated in several bioblitzes in an attempt to document the arthropod biodiversity found in the national monument, were critical to the work. Currently, George Washington Birthplace National Monument has a permanent collection of approximately 3,000 arthropod specimens on-site that are sorted by taxonomic order.

Pipe Spring biodiversity

Established in 1923, Pipe Spring National Monument is located in Mohave County, Arizona, surrounded by the Kaibab Paiute Indian Reservation. This 40-acre (16 ha) park commemorates the area's rich Native American culture and Mormon pioneer heritage. Listed in the National Register of Historic Places, the monument preserves archaeological sites, historical structures, and Pipe Spring, a year-round source of

Figure 2. Northern Arizona University researchers used sweep nets to collect arthropod specimens at George Washington Birthplace National Monument, Virginia. It is expected that 500 arthropod species will be documented when the specimen-identification process is complete.

water. The monument's natural springs are one of the few persistent water sources in this arid strip of desert situated between Grand Canyon and Zion National Parks, creating a small riparian ecosystem. Archaeological evidence indicates that springs have attracted people to the monument area for the past 8,000 years. Documented biodiversity of the monument includes at least 48 mammal species, 166 bird species, 12 reptile species, and 3 amphibian species. A recent bat study (NPS and Southern Utah University) increased the number of bat species found at the monument to 18 of the 28 found in all of Arizona (Taylor et al. 2013). As of 2013, inventory efforts have documented 335 vascular plant taxa for the monument, and the herbarium has vouchers for 275 (82%) of these species.

In 2012, park resource managers initiated an arthropod inventory, as arthropods represent a significant portion of the food base for vertebrate species, particularly the numerous bat and bird species that winter and breed on the monument. Additionally, very little was known about the monument's native arthropod populations and exotic species and their potential to affect native species and habitats. Northern Arizona University was asked to collect arthropod specimens; provide training in the collection and storage of the specimens to park staff, volunteers, and members of the neighboring Kaibab Band of Paiute Indians; create a reference collection for the monument; and develop a database to ensure that cataloged specimens would be available online. Standard insect-collecting techniques, including nets, malaise and pitfall traps, and night lights, were used during the summers of 2012 and 2013 to collect more than 8,000 specimens of aquatic and terrestrial invertebrates (fig. 3). Specimens are now being identified, imaged, and cataloged using state-of-the-art software that produces high-resolution images, allowing scientists across the country to access the collection online for research purposes.

NATIONAL PARK SERVICE/KODY CALLISTER

Figure 3. Park staff used pitfall traps to collect ground-dwelling arthropods, including beetles, ants, and spiders, at Pipe Spring National Monument, Arizona. In the summers of 2012 and 2013, pitfall traps and other standard methods were used to collect more than 8,000 specimens of aquatic and terrestrial invertebrates.

Clearly, historical and cultural parks of all sizes are important to documenting and preserving the nation's biodiversity. In the case of arthropods, we are just beginning to understand how little we know about these tiny creatures and the roles they play in natural systems. Arthropods may be the next frontier of discovering biodiversity. As efforts at George Washington Birthplace and Pipe Spring National Monuments illustrate, the NPS Biodiversity Discovery program has created opportunities for national parks to work with partners, engage volunteers, and focus on smaller life-forms to document the diversity of life found in the microwilderness.

Reference

Taylor, J. R., A. Bornemeier, A. Alfen, and C. Jack. 2013. Bat research and interpretive programming: Increasing public interest in Pipe Spring National Monument. Park Science 30(1):14–19. Available at http://www.nature.nps.gov/ParkScience/archive/PDF/Article_PDFs/ParkScience30(1)Summer2013_14-19_Taylor_et_al_3648.pdf.

About the authors

Jennifer Leasor *is curator at Pipe Spring National Monument.* ***Amy Muraca*** *is museum curator at George Washington Birthplace National Monument and Thomas Stone National Historic Site.* ***Rijk Moräwe*** *is chief, Natural and Cultural Resources Management, at Organ Pipe Cactus National Monument.* ***Neil Cobb*** *(neil.cobb@nau.edu) is director, Merriam-Powell Center of Environmental Research, Northern Arizona University.*