



Natural Resource Monitoring at Tonto National Monument

The Sonoran Desert Network

The Sonoran Desert Network (SODN) covers the geologically and biologically diverse Sonoran Desert and Apache Highlands ecoregions of southern Arizona and southwestern New Mexico. The network comprises 11 national parks containing biomes ranging from low-elevation desert scrub to mixed conifer forests, as well as critical riparian systems associated with perennial rivers, ephemeral and intermittent washes, seeps, springs, and tinajas. The SODN is designing and implementing a long-term monitoring program to measure key indicators of ecological integrity, or “vital signs.” This coordinated, multi-perspective ecosystem monitoring effort will help inform managers and the public as to the condition of key park resources and provide an early warning system for potential problems. This brief describes SODN activities at Tonto National Monument (NM).



Lower Cliff Dwelling/NPS

Resource Inventories



USFWS/GARY STOLZ

Couch's spadefoot toad.

Managers need reliable data to maintain resources “unimpaired for future generations,” especially as conditions outside of parks rapidly change. Natural resource inventories are extensive, point-in-time surveys of plants, animals, and the physical environment. From 2001 to 2003, biologists from the University of Arizona and SODN conducted comprehensive field investigations of mammals, birds, amphibians, reptiles, and vascular plants at Tonto NM. These detailed surveys documented the occurrence and distributions of 240 plant species (65 new to park species lists). Species richness was equally impressive for such a small unit, as biologists documented 21 amphibians and reptiles, 97 birds (4 new to park species lists), and 11 mammals. One hundred forty-nine (40%) of the species were encountered in the vicinity of Cave Spring (located in

Cave Canyon between the two cliff-dwelling complexes), reflecting the importance of this relatively small riparian ecosystem.

Since 2001, SODN staff and cooperators have completed resource inventories on vertebrates, vascular plants, air quality and air quality-related values (updated in 2009), water quality, climate, hydrography, and a natural resource bibliography. Projects underway include geologic-resource evaluation and mapping (expected completion in 2011), soil resource inventories (expected completion 2012), and vegetation classification and mapping (expected completion in 2010). These inventories provide an important baseline for management and monitoring efforts to support effective park resource protection.

Vegetation and Soils



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Monitoring vegetation and soils.

Vegetation comprises or interacts with all primary components of terrestrial ecosystems. Vegetation dynamics can indicate the integrity of ecological processes, productivity trends, and ecosystem interactions that can otherwise be difficult to monitor. Soils and landform characteristics mediate available water in semi-arid systems, influencing vegetation composition, distribution, and production. By monitoring soils and vegetation (includ-

ing established exotic plants) in an integrated fashion, we can gain key insights into the condition and trends of Sonoran Desert ecosystems. The SODN will begin monitoring terrestrial vegetation and dynamic soil vital signs at Tonto NM in autumn 2009. A status report and resource brief will be completed in 2010. These detailed measurements will be repeated every five years to ascertain any trends in the condition of these important resources.

Landbirds



Ladder-backed woodpecker.

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Birds are a conspicuous component of many ecosystems. They have high body temperatures, rapid metabolisms, and occupy high trophic levels. Because they can respond quickly to changes in resource conditions, birds are considered effective indicators of ecosystem condition. Therefore, changes in bird populations and community structure may indicate key changes in the biotic and abiotic compo-

nents of the environments upon which they depend. The SODN initiated annual bird monitoring at Tonto NM in 2008, to provide insights into human perturbations and natural events. Status reports and resource briefs are produced annually and a detailed synthesis and trend report will be produced in 2012, based on five years of monitoring information.

Climate



Climate monitoring station.

NPS

Climate is a primary driver of ecosystem structure and function in the Sonoran Desert ecoregion. Spatial and temporal variability in precipitation and temperature extremes have critical consequences for flora and fauna, and set the limits for community composition and productivity in these semi-arid environments. Additional parameters, including wind

velocity, relative humidity, photosynthetically active radiation, and total radiation, provide insights into environmental conditions. The SODN compiles and analyzes climate information from existing long-term stations. Data are interpreted in annual climate monitoring reports and resource briefs, and are referenced in most reports for other vital signs.

Groundwater



Measuring depth to groundwater.

NPS

Water is the most limiting factor for ecosystem productivity in the Sonoran Desert, and groundwater is a critical component of the hydrologic cycle. Groundwater response to impacts can occur almost instantaneously, as happens when the water table rises during flash flooding, or may take place over extended time periods, such as when groundwater mining depletes springs and other surface waters. Because humans, vegetation, and wildlife require access to water for survival, understanding groundwater dynamics is essential to un-

derstanding ecosystem function and integrity. Monitoring groundwater availability also provides key insights into surface waters, as these systems are tightly coupled in semi-arid systems. In conjunction with park staff, the SODN compiles and analyzes depth to groundwater information at Tonto NM at one monitoring well. Data are interpreted in annual groundwater monitoring reports, and are referenced in other efforts, such as climate, vegetation, and dynamic soil function monitoring.

Seeps, Springs, and Tinajas



Cave Canyon Spring.

NPS

Seeps and springs comprise the perennial surface water across the mountainous landscape of Tonto NM. Seeps and springs vary greatly in size, permanence, and landscape position. Collectively, the importance of these distributed surface waters is inversely related to their size and frequency, as they provide critical ac-

cess to water for animals, plants, and humans in this semi-arid environment. Working with park staff, the SODN completed an inventory and tested potential monitoring techniques in 2009, with the goal of developing a monitoring protocol in 2010–2011.

Washes



Wash.

NPS

Washes (intermittent and ephemeral drainages) are important components of the hydrology and ecology of semi-arid environments. Washes serve as important travel corridors and habitat for many species, and support key vegetation communities. Washes also direct and mitigate floods and transport sediment within and between watersheds. In 2007, SODN staff and cooperators began monitoring channel morphology and vegetation

characteristics of major washes at Tonto NM. Evaluating these parameters provides insights into riparian system status and overall conditions in the watersheds they drain. Additional sites will be measured each year to ascertain the status of these expansive ecosystems, with repeated visits to each site occurring every 10 years. Status reports and resource briefs will be developed annually, with the first reports expected in 2010.

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For more information

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