Inventory & Monitoring Program
National Park Service
US Department of the Interior

SONORAN DESERT NETWORK
Inventory and Monitoring Program

CASA GRANDE RUINS ✷ CHIRICAHUA ✷ CORONADO ✷ FORT BOWIE ✷ GILA CLIFF DWELLINGS ✷
MONTEZUMA CASTLE ✷ ORGAN PIPE CACTUS ✷ SAGUARO ✷ TONTO ✷ TUMACÁCORI ✷ TUZIGOOT

Volume 5, Issue 2
Winter 2015

The Heliograph

Official Newsletter of the Sonoran Desert Network

Inside this Issue

Something in the Water: Emerging Contaminants Testing in SODN Parks

The chemical industry is a double-edged sword. While it brings the perks of modernization and industrialization, it can also have detrimental effects on the environment. Research in the last several years has shown that many compounds designed to offer improvements in agriculture, industry, or medical treatment can enter, disperse, and persist in various environmental compartments—and pose potential risks to ecosystems and human health. These compounds, known collectively as emerging contaminants (ECs), are pollutants that have not traditionally been tested for during water quality sampling and may not be adequately mitigated by current wastewater treatment methods.

In order to assess and monitor these possible threats, the Sonoran Desert Network (SODN) collected 90 water samples in several parks (see table) of the Sonoran Desert Network and Southern Plains Network (SOPN) from 2012 to 2015. The watersheds in these parks encompass a wide variety of geology, morphology, hydrology, and land use. Sampling locations include sites with streams predictably susceptible to contamination (e.g., downstream of intense urbanization), such as the Santa Cruz River (Tumacácori NHP) and Arkansas River (Bent's Old Fort NHS). Samples were also collected at sites with presumably little anthropogenic impact on the aquatic system, such as the Gila River (Gila Cliff Dwellings NM) and Beaver Creek (Montezuma Castle NM).

The US Environmental Protection Agency Region 8 Laboratory has analyzed these water samples for a suite of around 300 trace organic contaminants, including personal care products, pesticides, pharmaceuticals, and other drugs. Currently, the data from these analyses are being evaluated for information on the abundance and concentration of contaminants in the selected surface and ground waters. These findings will provide a reference point, allowing future sampling efforts to indicate possible changes.

Parks where EC data were collected.

Park	SODN	SOPN
Bent's Old Fort NHS		X
Fort Bowie NHS	X	
Gila Cliff Dwellings NM	X	
Montezuma Castle NM (Castle and Well units)	X	
Pecos NHP		X
Saguaro NP	X	
Tumacácori NHP	X	
Tuzigoot NM	X	

A separate project, using a subset of the original data, specifically focuses on the Santa Cruz River. At Tumacácori NHP, the river's baseflow is almost completely supported by treated effluent from the Nogales International Wastewater Treatment Plant, located 14 km north of the Mexican border. The plant treats approximately 12 million gallons of sewage per day from the twin cities of Nogales, Sonora, and Nogales, Arizona. In cooperation with professor David Quanrud of the University of Arizona, two hydrologists from the USGS Arizona Water Science Center in Tucson, and with assistance from

Continued on Page 3

Project Updates

Climate

We are working on a set of climate briefs for water year 2015, and preparing for station maintenance in all parks beginning in January 2016.

Data Management

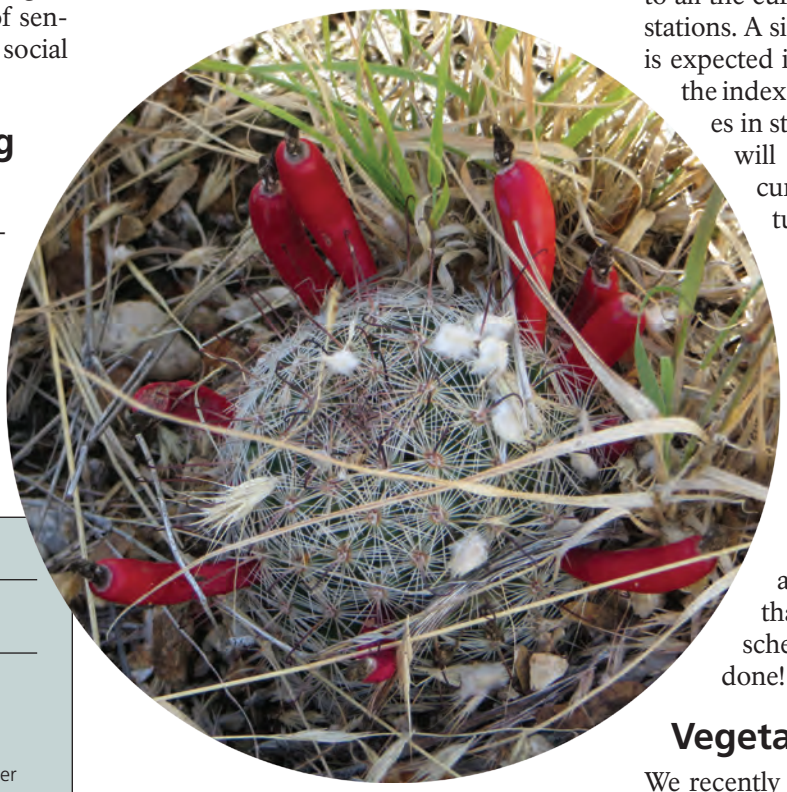
Data management staff has assembled the necessary data for an analysis of which statistical model will work best for identifying landbirds trends, and developed a system for managing data and photos from the SWNC wildlife cameras (see Heliograph 5(1):5). We are also improving the automation of SODN reporting and preparing to develop guidance for the handling of sensitive species information relative to social media and citizen science platforms.

Desert Research Learning Center

With emergency hire Elise Dillingham on board to coordinate our efforts, we planted the Father Kino heritage orchard, hosted the annual "Notch Neighborhood Watch" meeting, participated in Watershed Management Group's Homescape Harvest Tour to showcase our water catchment systems, and had 28 volunteers participate in National Public Lands Day (see page 3). We are working on launching an evening public lecture series.

Flora Project

Andrea Hazelton is the new US Fish and Wildlife Service botanist on the Flora Project. Andrea, who was the rare plants botanist at the Navajo Nation for the past five years, will work on a field guide for Sevilleta National Wildlife Refuge (NWR) in New Mexico, and help with the transition from our current database format into one that will be fully accessible through SEINet.



Landbirds

We are gearing up with our partners at Tucson Audubon and the US Fish and Wildlife Service for a full round of landbirds sampling at all 11 parks starting in spring 2016. We are testing a new grid sampling design at both Organ Pipe Cactus NM and Cabeza Prieta NWR, and working on occupancy models for all 11 SODN parks. Field-crew training for landbirds monitoring will begin in January 2016.

Riparian Vegetation

This monitoring, technically part of the Streams protocol, is scheduled for next July at Pecos National Historical Park.

Springs

We are currently investigating the operational limitations of using temperature loggers as tools to measure hydroperiod in spring systems. We are also preparing to pilot SODN springs monitoring in 2016.

Streams

Streams monitoring continues, with visits to all the current SODN and SOPN index stations. A similar level of implementation is expected in water year 2016. Several of the index sites have experienced changes in stream channel location, which will require moving or adapting current monitoring infrastructure.

Uplands

To date, the uplands crew has completed plots at Montezuma Castle NM, Saguaro NP (RMD and TMD), and Organ Pipe Cactus NM. We have dealt with a few extenuating circumstances this season—such as weather, bees, and backcountry logistics—that have stressed the sampling schedule, but we will still get it all done!

Vegetation Mapping

We recently hired Jeff Galvin into a vegetation mapping role (see page 4) and have been working hard on the mapping of Saguaro NP (TMD) and developing community descriptions for Saguaro's RMD. We completed two accuracy assessments this summer and aim to have reports completed soon for Gila Cliff Dwellings and Montezuma Castle NMs.

Washes

We are currently planning for limited piloting of washes monitoring in SODN parks during spring 2016.

National Park Service
US Department of the Interior

The Sonoran Desert Network is one of 32 National Park Service inventory and monitoring networks nationwide that are implementing vital signs monitoring in order to assess the condition of park ecosystems and develop a stronger scientific basis for stewardship and management of natural resources across the National Park System.

Sonoran Desert Network
12661 East Broadway Blvd.
Tucson, Arizona 85748

Phone
520-751-6860

Internet
http://go.nps.gov/sodn
https://www.facebook.com/npssodn

The National Park Service cares for the special places saved by the American people so that all may experience our heritage.

Emerging Contaminants

Continued from Page 1

SODN staff, we will look at the dynamics of varying concentrations of organic compounds in the upper Santa Cruz River. The goal of this project will be to understand the environmental processes that control those concentrations. Specifically, we are interested to know how natural processes can attenuate some of these compounds once they are released to the river, and to evaluate the potential impacts to ecosystem and human health in this area.

We are currently examining field and laboratory quality data to ensure that the collected data adequately represented actual environmental conditions. By combining different statistical procedures, such as maximum likelihood estimation and survival analysis, we are exploring a possible correlation between discharge and contaminant concentration in the river as it flows through the park.

Funding to support this collaborative monitoring between SODN and SOPN was provided by the central office of the Inventory and Monitoring Division.

—Finnian Freeling
International Volunteer-in-Parks

Finnian Freeling earned his MS in Hydrology at the University of Freiburg, Germany, in March 2015. His research interests include analytical chemistry, the transport and fate of contaminants in natural and engineered systems, the remediation of surface waters using mitigation strategies (e.g., wetlands), and soil physics. Before coming to the US, he worked for the soil and water laboratory of the Forest Research Institute in Freiburg, and in the hydrochemical laboratory of the University of Freiburg.

At the Desert Research Learning Center

The Desert Research Learning Center (DRLC) facility continues to shape up. On National Public Lands Day (September 26), 28 volunteers graciously provided their muscle power to complete the main interpretive trail; plant, prune, weed, and mulch the grounds; and install irrigation to the new Father Kino Orchard (see photos below).

In the late 17th and early 18th centuries, Jesuit missionaries, such as Father Kino, introduced fruit trees to Southwestern missions, including Tumacácori NHP. According to Jesús Garcia, Principal Investigator for the Kino Heritage Fruit Trees Project, the "trees included peach, quince, pear, apple, pecan, walnut, fig, and pomegranate. Together, they made up a portion of the mission community's agricultural livelihood that also depended upon grape vineyards, grain fields, vegetable and pharmacy gardens, as well as livestock."

Garcia's project seeks to replant the Spanish Mission Era orchard and garden at Tumacácori NHP and other historic sites with cultivars that can be traced to those introduced by the Spanish missionaries. As we continue to transform the grounds of the DRLC into a sustainable showcase of landscape features typical of network parks, we are excited to also be able to interpret some of the network's cultural history.

To start our orchard, we purchased six heritage tree saplings from a local native plant nursery: one each of Quitobaquito pomegranate, San Javier pomegranate, Oracle plum, Turner quince, Oro Blanco fig, and guava. With careful nurturing, these trees should mature within 3–5 years and start to bear fruit.

In other news, Elise Dillingham has been hired on a short-term appointment as DRLC program coordinator. Over the next few weeks, she will organize a number of youth/public outreach programs at the DRLC. For instance, a group of 10 high school students will learn about field techniques and equipment that scientists utilize for inventory and monitoring protocols, and a group of Alternative Break college students will learn about our newly established tinaja. In addition to running programs, Elise is also assisting with planning events for the upcoming year, including the launch of an evening public lecture series.

Orchard saplings.

Elise Dillingham.

Arrivals and Departures

This issue's "Arrivals and Departures" might be more aptly titled, "Arrivals, Departures, and Moving Around." Over the past several months, we've re-envisioned our approach to staffing our protocol sampling. Moving forward, the duties of our field crew leads will be delineated less according to individual protocols than by protocol groupings and what the calendar allows.

Unlike I&M networks in many other parts of the country, SODN does active monitoring year-round for its two most labor-intensive protocols, streams and uplands. After vegetation crews in more northern climes have packed up their equipment for winter, for instance, our vegetation crew is just gearing up—their busy season is August–January. As such, we've recognized a need for a modular, rather than pigeon-holed approach to staffing our field work, and are making some changes.

First, we've hired **ED KUKLINKSI** as crew lead for monitoring of uplands, riparian vegetation, and exotic plants. Ed comes to us from Organ Pipe Cactus NM, where he spent four years in a variety of resource management roles. **GREG GOODRUM** will remain part of the uplands crew but will lead the crew(s) for springs, washes, and (occasional) aspen monitoring. **LAURA PALACIOS**, who previously focused on streams monitoring, will lead the crew(s) for monitoring of streams, groundwater, and climate. Finally, **JEFF GALVIN** will continue to assist with uplands monitoring but will direct most of his efforts toward analysis and product development for our vegetation mapping projects.

We are grateful to have the assistance of several volunteers this quarter. Joining us via the Student Conservation Association are **GWEN SCHNEIDER**, **MADDIE HALLORAN**, and **ANNIE JACOBS**. Gwen and Maddie will work with the uplands crew until December 18. Annie is assisting with data management activities, and will be at SODN until the end of January. Our current International Volunteer-in-Parks is **FINNIAN FREELING** (see page 1). Also joining SODN this quarter (though not as a volunteer) is **ELISE DILLINGHAM** (see page 3).

Laura Palacios

Annie Jacobs

Sarah Studd | Ed Kuklinksi | Jeff Galvin | Gwen Schneider | Maddie Halloran | Greg Goodrum

Odds and Ends

Polliwogs!

In early November, hundreds of lowland leopard frog polliwogs began dropping out of an egg mass in our tinaja at the Desert Research Learning Center. The tinaja is home to approximately eight adult lowland leopard frogs. While the DRLC grounds have been visited by bobcats, tortoises, and Gila monsters, our efforts to keep bullfrogs out of the tinaja (see Heliograph 5(1):5) have been successful to date.

New Feature

This issue of the Heliograph introduces "Around the Network," an occasional feature that will highlight notable resource management projects happening in SODN parks. Around the Network will serve as a way for parks to find out what their colleagues are doing and, ideally, identify common solutions to common challenges. To be featured in Around the Network, contact Elise Dillingham or Alice Wondrak Biel.

We're on Instagram!

You've seen us on Facebook, but did you know that SODN is now on Instagram? Check us out at sonorandesertnps.

Around the Network:
Resource Management Highlights

If you'd like to be featured in Around the Network, please contact Elise Dillingham or Alice Wondrak Biel.

Chiricahua NM: Post-Fire Archeological Survey

Since 2011, the National Park Service (NPS) has worked closely with the University of New Mexico (UNM) to complete a post-burn archeological survey at Chiricahua National Monument following the Horseshoe II fire. To date, approximately 7,500 acres have been surveyed. The survey crew has consisted of four graduate students supervised by Dr. Bruce Huckell, a well-known professor of anthropology at the UNM. The crew has identified more than 55 previously unknown archeological sites representing nearly 3,500 years of human history within park boundaries.

Of particular interest is the discovery of many historic Apache sites. Apache people were often on the move during the historic period, never staying in one place for long. As a result, evidence of their presence is difficult to detect. Most Apache sites are simple rock rings with historic artifacts buried nearby. To detect these sites, the UNM and NPS have used a combination of pedestrian survey, metal detection, and mapping. The information collected by UNM is helping NPS archeologists to better understand land use and settlement patterns utilized by Apache people during the historic period. The survey is scheduled to be completed in the summer of 2016.

For more information, contact Matt Guebard at matt_guebard@nps.gov.

UNM and NPS archeologists map a historic Apache site at Chiricahua National Monument.

Organ Pipe Cactus NM: Pronghorn Captive Breeding

The endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*) occurs in Organ Pipe Cactus National Monument, primarily in the two-thirds of the monument west of Highway 85. This species was included on the first list of endangered species in 1967, and has existed in critically low numbers ever since. Following a population crash in 2002, approximately 21 animals remained in the United States. This led the US Fish and Wildlife Service to create a captive breeding program on the Cabeza Prieta National Wildlife Refuge.

Each winter, pronghorn specialists from the refuge, the Arizona Game and Fish Department, the National Park Service, and others capture animals in the breeding pen, fit them with ear tags and radio collars, and transfer them to Organ Pipe Cactus NM and other nearby lands. After transfer, the pronghorn spend up to a month in an eight-acre temporary pen, which is designed to help them acclimate to their new surroundings. After the acclimation period, the animals are released into the monument and tracked by NPS biologists. Between 2011 and 2014, 30 pronghorn were released into the monument. In addition to the capture-and-release program, park staff participate in annual aerial surveys in the US and Mexico, track animals on the ground, document new fawns as well as mortalities, and assist the University of Arizona with a human-disturbance study.

For more information, contact Tyler Coleman at tyler_coleman@nps.gov.

Pronghorn prepared for release.

Saguaro NP: The Centennial Saguaro Survey

Saguaro National Park is celebrating the NPS Centennial with a year-long citizen science project that celebrates its iconic namesake, the saguaro cactus. With support from the NPS Climate Change Response Program and Friends of Saguaro National Park, we will enlist more than 300 volunteers—especially high school students—to help us locate, map, and collect data on saguaros throughout the park. The project goal is to learn more about patterns of recruitment and growth rates relative to climate.

Saguaro populations declined steadily in parts of the park from the 1930s through the 1960s, then rebounded. However, survival of very young saguaros has slowed in the past 20 years, possibly due to higher temperatures and a prolonged drought. Volunteers will study saguaros on historic research plots, some of which date to 1941. In some cases, they will measure the same plants researchers measured 75 years ago. A major goal of the project will be to locate, organize, and make publicly available much of the park's huge dataset on saguaros so it can be used by students, researchers, and others. In addition, we will connect with volunteers throughout the year via Facebook, Instagram, and a dedicated webpage.

For more information, contact Don Swann at don_swann@nps.gov.

Students and saguaros.

Where Are We?

Park	November	December	January
BEOL[1]	**Streams:** sonde retrieval, staff meetings, groundwater monitoring (11/21–24)		
CAVO[1]			
CORO		**Uplands** (12/2–9)	**Vegetation Mapping:** (1/11–14)
DRLC	**Springs:** Testing sampling methods		**Springs:** Training and preparation for pilot sampling
GICL	**Streams:** quarterly sampling (11/1–5); sonde retrieval, staff meetings, groundwater monitoring (11/21–24)		
MOWE	**Streams:** sonde retrieval (11/16)		
ORPI	**Uplands** (11/2–8, 11/15–22)		
PECO[1]	**Streams:** quarterly sampling (11/1–5); sonde retrieval, staff meetings, groundwater monitoring (11/21–24)		**Streams:** channel morphology (1/11–22)
SAGU (TMD)	**Vegetation Mapping:** field observations and map checks (TBD)		**Uplands** (1/4–8)
TUMA	**Streams:** fish monitoring (11/13); quarterly sampling (11/17)	**Streams:** sonde retrieval and water stress test	

[1] Southern Plains Network park. BEOL: Bent's Old Fort NHS, CAVO: Capulin Volcano NM, PECO: Pecos NHP
DRLC = Desert Research Learning Center. Acronyms for SODN parks are shown in the box below.

SONORAN DESERT NETWORK
Inventory and Monitoring Program

The Heliograph is a publication of the Sonoran Desert Inventory & Monitoring Network.

Program Manager
Andy Hubbard

Editing and Design
Alice Wondrak Biel

Contributors
Kristen Bonebrake
Tyler Coleman
Elise Dillingham
Finnian Freeling
Matt Guebard
Evan Gwilliam
Andy Hubbard
Sarah Studd
Don Swann
Alice Wondrak Biel

All photos in this document are courtesy of the National Park Service unless otherwise noted.

Visit us on the web at
http://go.nps.gov/sodn
https://www.facebook.com/npssodn

Sonoran Desert Network Park Units

Casa Grande Ruins NM (CAGR)
Chiricahua NM (CHIR)
Coronado NMem (CORO)
Fort Bowie NHS (FOBO)
Gila Cliff Dwellings NM (GICL)
Montezuma Castle NM (MOCA)
Castle unit (MOCC)
Well unit (MOWE)
Organ Pipe Cactus NM (ORPI)
Saguaro NP (SAGU)
Rincon Mtn District (RMD)
Tucson Mtn District (TMD)
Tonto NM (TONT)
Tumacácori NHP (TUMA)
Tuzigoot NM (TUZI)

NM = National Monument
NMem = National Memorial
NHS = National Historic Site
NHP = National Historical Park