



The Heliograph



Official Newsletter of the Sonoran Desert Network

Climate Monitoring Heats Up *Ham Radio Technology Provides Low-Cost Data*

You've listened to the wind blow and rain fall, but have you heard the air get hotter? Sonoran Desert Network staff will soon be doing just that, as the network introduces the use of low-cost Davis weather stations as part of our climate monitoring protocol—the last protocol scheduled for implementation under the SODN Monitoring Plan.

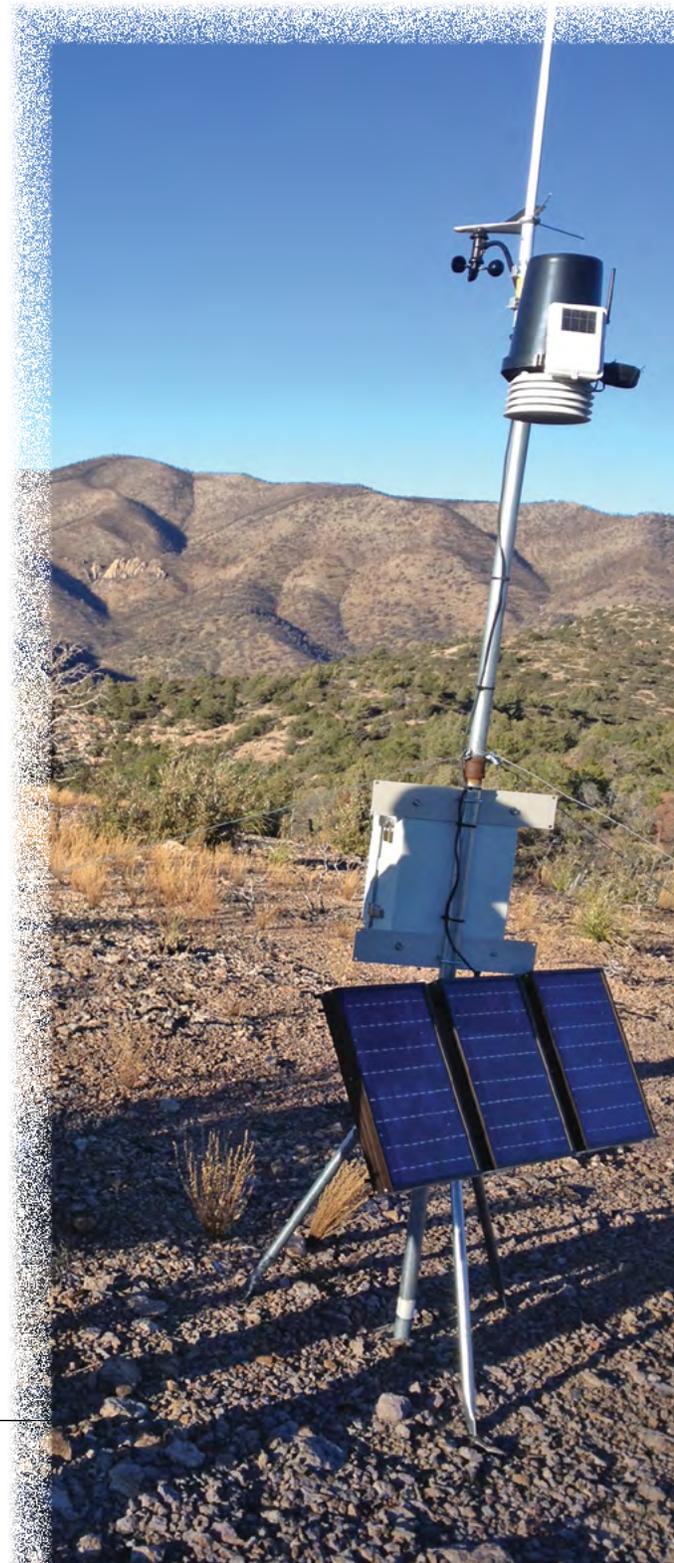
Equipped with instrumentation to measure air temperature, precipitation, wind speed and direction, solar radiation, relative humidity, and, in some cases, soil moisture and temperature, the Davis stations collect weather data and then use ham-radio technology to translate it into a series of sound signatures that will be transmitted to the SODN office in Tucson every 10 minutes. There, the tones will be received and translated back into weather data, which

will be automatically archived and managed by the National Oceanic and Atmospheric Administration (NOAA) Citizen Weather Observer Program. Each weather station costs approximately \$1,100 (plus periodic repair and maintenance), has a range of approximately 100 miles, and requires no subscription fee.

Because the Davis station data are downloaded so frequently, the results are highly scalable, which will allow the network to target a range of parameters and time periods of interest to certain vital signs. Temperature and precipitation, for instance, could be charted over the course of a five-year cycle of uplands monitoring or examined for a previous growing season in a certain type of bird habitat. Download frequency will also help capture the magnitude of stochastic events—such as cloudbursts, windstorms, and frosts—that can be temporally brief but extreme, with long-term ecological consequences. See story on [page 4](#) for more.

The affordability and flexibility of the Davis weather stations relieves what has been a significant barrier to effective SODN climate monitoring: geographically

... Continued on page 3



Inside this Issue

Project Updates.....	2
Weather Stories.....	4
See What You're Missing Online!.....	5
Where Are We?.....	6
New Documents Available	6

Project Updates

Groundwater

Groundwater monitoring for Water Year (WY) 2012 was completed in October. The WY 2012 database has been updated and QA/QC (quality assurance/quality control) of those data is underway. Data collected by parks were received, data collected by the Arizona Department of Water Resources and U.S. Geological Survey is being gathered, and the updating of master files of continuous data for selected wells is ongoing. Winter-quarter groundwater monitoring was completed in early February. The water supply well at Tonto National Monument was investigated for monitoring options but cannot be monitored due to lack of sounder accessibility.

Invasive Exotic Plants

Recent work in exotic plants has involved QA/QC, delivery of data to Exotic Plant Management Team crews, and field summary reporting. **Field summaries** of work completed in 2012 are now available. Implementation of this protocol is being constrained due to the effects of

the federal budget sequester implemented on March 1.

Landbirds

QA/QC of data collected in 2012 has been completed, along with verification of new bird sightings. Training was planned for the last week of February at the Desert Research Learning Center. Field work is scheduled to begin in March.

Natural Resource Condition Assessments

Information gathering and processing, map creation, and report writing continue on the NRCAs for Montezuma Castle/Tuzigoot NMs, Tumacácori NHP, Gila Cliff Dwellings NM, and Tonto NM. In particular, draft sections on vegetation and soils for MOCA/TUZI and TONT, mammals and herps for MOCA/TUZI and GICL, and chapters 2 and 3 for GICL and TONT are in progress. The target date for completion of these reports was extended due, in part, to unanticipated medical leave and commitments related to the monitoring program. Our goal is to have the NRCA reports completed by the end of this fiscal year.

Streams

SODN has been conducting monitoring fieldwork in all Southwest Network Collaboration (SWNC) parks where streams are monitored. We have collected macroinvertebrate samples at Pecos NHP and Gila Cliff Dwellings NM, measured water quality data at all parks, and surveyed post-fire channel morphology at Gila Cliff Dwellings NM. Quarterly sampling will continue at all SWNC parks. Riparian vegetation will be sampled at Tumacácori NHP in March. **Briefs** detailing the 2012 monitoring season are now available.

Springs

SODN staff, with Glen Canyon National Recreation Area botanist John Spence, is working on methods for monitoring

vegetation at springs. Field sampling and presentation of results for this protocol will be cancelled due to the effects of the federal budget sequester.

Uplands

In October 2012, at Chiricahua NM and Coronado NMEM, crews wrapped up several months of repeat sampling of plots burned during the 2011 fires. Also in October, 12 new uplands monitoring plots were established at Organ Pipe Cactus NM. During November and December, crews worked to establish new plots at both districts of Saguaro NP. **Field summaries** of work completed in 2012 are now available. Reporting activities will continue over the next few months.

Vegetation Mapping

Data collected at Gila Cliff Dwellings NM have been entered into a database and quality-checked in preparation for analysis. All mapping data have been digitized in ArcGIS to create the first iteration of the vegetation map. A **field summary** of work completed at GICL in 2012 is now available. Over the next few months, the GICL data will be reviewed and analyzed. In addition, data will be analyzed, and a community type draft description prepared, for Saguaro NP (West) and Montezuma Castle NM.

Washes

SODN is testing methods for monitoring ephemeral streams (a.k.a. Washes) at Saguaro NP (East). In January, SODN staff downloaded data from pressure transducers located on Monument Wash. These instruments measure the elevation of water in the channel and will help us to understand the timing and intensity of flow events in wash systems. With the help of park staff, SODN will implement the next stage of testing: placing very small moisture dataloggers (the size of dimes) in the Monument Wash system to look at the spatial variability of flows.



National Park Service
U.S. 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
520-546-1607

Internet
<http://science.nature.nps.gov/im/units/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.

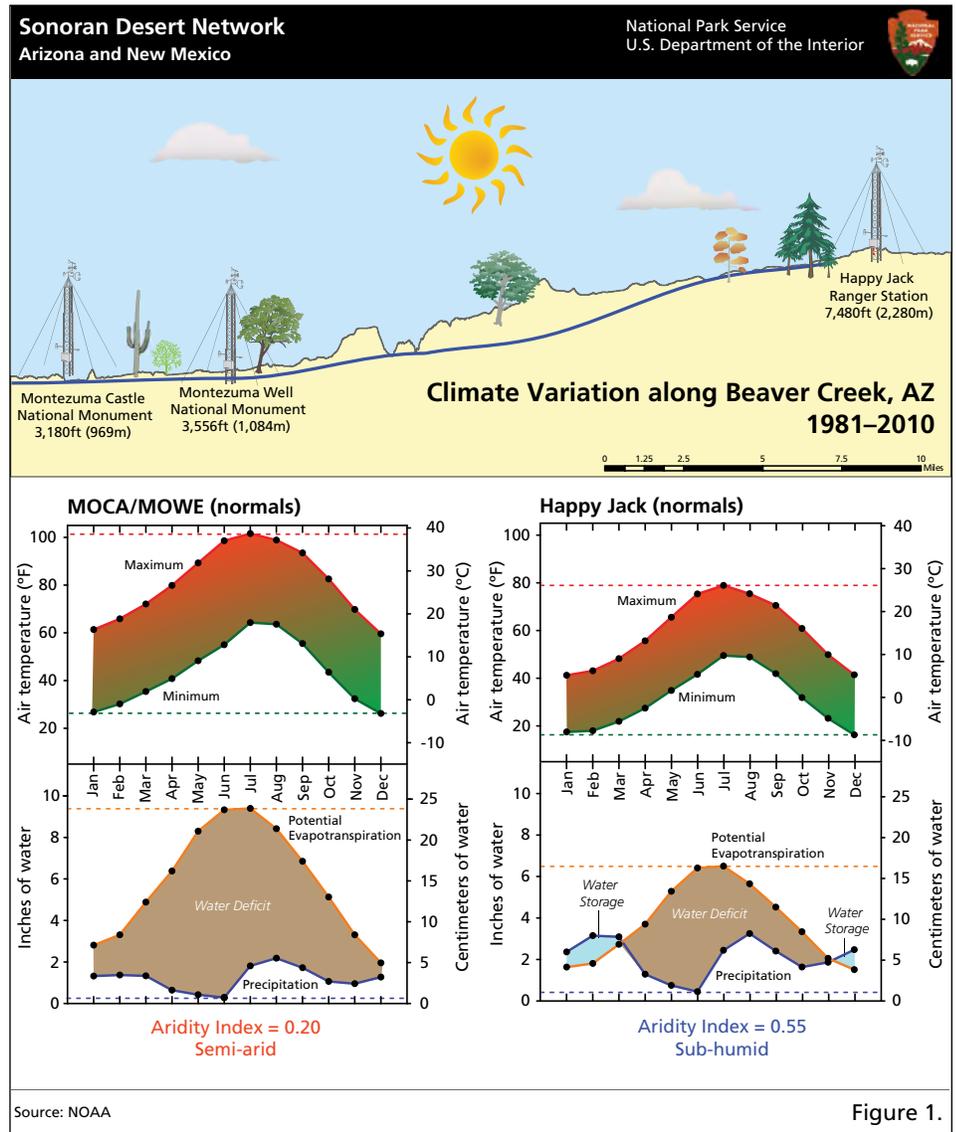
Climate Monitoring

Continued from page 1

appropriate coverage. While still harvesting climate data from extant weather station networks, such as the National Weather Service (NWS) Cooperative Observer Network (COOP) and the fire operations network of Remote Automated Weather Stations (RAWS), the Davis stations allow us to fill in the gaps in coverage—a critical need in the American Southwest due to the strong topographic drivers of climate over relatively limited spatial scales.

For instance, Figure 1 shows the differences in aridity at Montezuma Castle National Monument and the nearby Happy Jack ranger station, located on national forest land. Here, an elevational difference of 4,300 feet equates to a difference in average maximum temperature of about 20°F. As elevations drop, SODN parks see a concomitant increase in aridity that is associated with heightened potential for evapotranspiration. As such, high-elevation patterns of precipitation and water storage are not always reflected at downstream sites, as is also evident in Figure 1.

Like many other SODN efforts, climate monitoring is being approached through a collaborative effort that includes the NOAA Tucson Office, the NPS Chihuahuan Desert and Southern Plains networks, and the new U.S. Fish and Wildlife Service I&M program for the Sonoran and Chihuahuan Deserts. We are also engaging local ham radio clubs in the development and deployment of this innovative technology.



The network expects to have the first round of Davis weather stations in place by 2014, budgets permitting. In the meantime, interactive data on climate and streamflow can be accessed from the [climate](#) and [park](#) pages of the SODN website. These data are collected by the NWS Coop program, the RAWS pro-

gram, and U.S. Geological Survey stream gages, and hosted by [climateanalyzer.org](#).

—Andy Hubbard, Program Manager
—Alice Wondrak Biel, Writer-Editor

SODN Climate Monitoring Objectives

- Determine biannual (warm season vs. cool season) status and departures from 30-year normals in monthly total precipitation, mean air temperature, and reconnaissance drought index on a park-by-park basis.
- Identify the occurrence of extreme stochastic events (low temperatures and exceptional rainfall) by season (warm vs. cool).
- Report this information in biannual resource briefs, and evaluate the data in relation to other vital signs in a covariate and data exploration context.

Weather Stories

(also known as stochastic events)

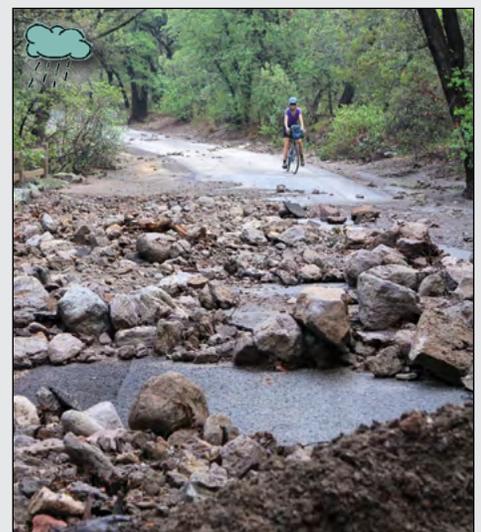


For monitoring purposes, stochastic events are short-term but often extreme occurrences with the potential for long-term consequences. The network's Davis weather stations are expected to capture the scope, magnitude, and timing of such events more effectively than traditional weather stations. Recent examples of stochastic weather events include the following.

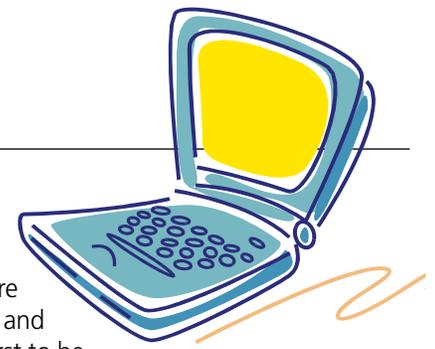
 On February 20, 2013, a late winter storm dumped several inches of snow on Tucson and its surrounding areas, covering the iconic saguaros and the rest of the desert landscape with an uncharacteristic blanket of white. National Weather Service records indicate that to date, there have been more days with freezing temperatures (23) this season (begin July 1, 2012, ending June 30, 2013) than in any other since 1916–1917, when the mercury dropped below freezing on 75 days.

 On July 17, 2012, after about a week of previous rain storms, a storm cell developed south of Chiricahua National Monument and began to move north. By late afternoon, all of the monument's large drainages, including Bonita, Rhyolite, Madrone, and Surprise Canyons, had reached full flood stage. Water and debris quickly swept over Bonita Campground and the visitor center. When rockfall, debris, and sediment left Bonita Canyon Road impassable, the monument was officially closed. The following morning, a SODN crew that had arrived in the park for monitoring activities on July 15 helped park staff to clear sediment and debris from the visitor center parking lot. At around 1 PM, the park was re-opened.

—Alice Wondrak Biel, *Writer-Editor*
—Greg Goodrum, *Biological Technician*



See What You're Missing Online!



Website re-designed, Facebook popularity grows

National Park Service
Inventory & Monitoring (I&M)

SONORAN DESERT I&M NETWORK (SODN)

Sonoran Desert Network

Quick Links

- SODN Overview Brochure (.pdf)
- Current Heliograph Newsletter (.pdf)
- SODN Social Media Pages
- SODN Monitoring Plan (.pdf)
- SODN Sharepoint Site (NPS only)

Featured Information

Monitoring Brief: Streams Monitoring at Gila Cliff Dwellings National Monument, 2012

This brief highlights work completed in the past year and discusses the effects of recent fires on the park's stream systems. Briefs are also available for Tumacacori National Historical Park and Montezuma Castle and Tuzigoot national monuments.

Video: It's Alive! Biological Soil Crusts in the Sonoran and Chihuahuan Deserts

All of the I&M websites are scheduled for **re-design**, and SODN's was one of the first to be completed. The new look is more in keeping with the NPS template and makes things easier to find.

SODN pioneered the creation of **"park pages,"** where you can go to learn about individual network parks and find everything we've produced related to those parks. Many other networks are now following our lead.

Facebook isn't yet widely used by the I&M program, but the SODN page continues to grow in popularity as the place to go for updates on our activities as well as posts about new research, job openings, park events, cool photos, and other Sonoran-iana. You can access Facebook from your government computer, and though we'd like you to Like us, you don't have to log in or even have a Facebook account to view our page, www.facebook.com/nps sodn.

Fun Fact: Through the wonders of virality, more than 10,000 people have seen the during-and-after photo comparison of the February 20 blizzard shown on [page 4](#) of this newsletter!

National Park Service
Inventory & Monitoring (I&M)

SONORAN DESERT I&M NETWORK (SODN)

Sonoran Desert Network Parks

To learn about a specific park and access Sonoran Desert Network reports, inventories, and outreach materials about that park, choose from the photos below or from the network map. To learn about which monitoring activities SODN is conducting in each park, see the table below:

Casa Grande Ruins National Monument	Chiricahua National Monument	Coronado National Memorial	Fort Bowie National Historic Site
Gila Cliff Dwellings National Monument	Montezuma Castle National Monument	Organ Pipe Cactus National Monument	Saguaro National Park
Tonto National Monument	Tumacacori National Historical Park	Tuzigoot National Monument	

facebook Search for people, places and things

Sonoran Desert Network 429 likes · 936 talking about this · 28 were here

Government Organization
The Sonoran Desert Network collects, analyzes, and reports on long-term natural resource data to inform National Park Service decisionmaking. <http://go.nps.gov/sodn>

About Photos Videos Likes Map

Highlights

Status Photo / Video Offer, Event +

Write something...

Promo: Post

Recommendations

Philip Horeno WOW... over a year ago

Likes

Sonoran Desert Network 4 hours ago

Student Conservation Association 4 friends also like this

Where Are We?

Here's what we have planned for March, April, and May.

NOTE: Portions of this work may be cancelled due to the effects of the federal budget sequester.

Park	March	April	May
CAGR	Landbirds: 1st round of monitoring Exotic Plants: Regular sampling		
CHIR	Washes: Index station installation (tentative), Feb 27–March 6	Washes: Installation of index stations (tentative), April 15–19	
CORO	Washes: Index station installation (tentative), Feb 27–March 6	Washes: Installation of index stations (tentative), April 15–19	
GICL		Streams: Sonde deployment and station mount installation, April 22–26	Exotic Plants: Regular sampling Streams: Quarterly and macroinvertebrate sampling, May 5–9 Vegetation Mapping: Continued mapping
MOCA/TUZI		Exotic Plants: Regular sampling (MOCC, MOWE, TUZI)	Streams: Quarterly and macroinvertebrate sampling (MOCC/MOWE/TUZI), May 27–30
ORPI	Washes: Index station installation (tentative), Feb 27–March 6 Landbirds: 1st round of monitoring	Washes: Installation of index stations (tentative), April 15–19	
SAGE	Landbirds: 1st round of monitoring		
TONT		Exotic Plants: Regular sampling	
TUMA	Streams: Riparian vegetation, Mar 13–20 Exotic Plants: Regular sampling		Streams: Sonde deployment, May 3; Quarterly and macroinvertebrate sampling, May 21–22
PECO*		Streams: Sonde deployment and station mount installation, April 22–26	Streams: Quarterly and macroinvertebrate sampling, May 5–9
BEOL*		Streams: Sonde deployment and station mount installation, April 22–26	Streams: Quarterly and macroinvertebrate sampling, May 5–9

*Southern Plains Network parks. PECO=Pecos National Historical Park, BEOL=Bent's Old Fort National Historic Site. Acronyms for SODN parks are shown in the box below.



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

Program Manager
Andy Hubbard

Editing and Design
Alice Wondrak Biel

Contributors
Debbie Angell
Kristen Beaupré
Colleen Filippone
Greg Goodrum
Evan Gwilliam
Andy Hubbard
Sarah Studd
Alice Wondrak Biel

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

Visit us on the web at

<http://science.nature.nps.gov/im/units/sodn>
<https://www.facebook.com/npsodn>

Sonoran Desert Network Parks

Casa Grande Ruins NM (CAGR)
Chiricahua NM (CHIR)
Coronado NMEM (CORO)
Fort Bowie NHS (FOBO)
Gila Cliff Dwellings NM (GICL)
Montezuma Castle NM (MOCA)
Organ Pipe Cactus NM (ORPI)
Saguaro NP (SAGU)
Tonto NM (TONT)
Tumacácori NHP (TUMA)
Tuzigoot NM (TUZI)

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

NEW DOCUMENTS AVAILABLE FROM THE SODN WEBSITE

Briefs

Streams monitoring, 2012

Gila Cliff Dwellings NM
Montezuma Castle NM
Tumacácori NHP
Tuzigoot NM

Field Summaries

Invasive Exotic Plants monitoring, 2012

Chiricahua NM
Coronado NMEM
Gila Cliff Dwellings NM
Tumacácori NHP

Uplands monitoring, 2012

Field Summary Overview
Chiricahua NM
Coronado NMEM
Gila Cliff Dwellings NM
Organ Pipe Cactus NM
Saguaro NP (East)
Saguaro NP (West)

Vegetation Mapping

Gila Cliff Dwellings NM