



# NCRN Natural Resource Quarterly

SUMMER 2013

## The Global Reach of Air Pollution

Doug Curtis, NCR Air and Water Resources Coordinator

Air pollution ignores borders. Acid rain taught us that, but now we're learning what that means for pollutants like ozone too.

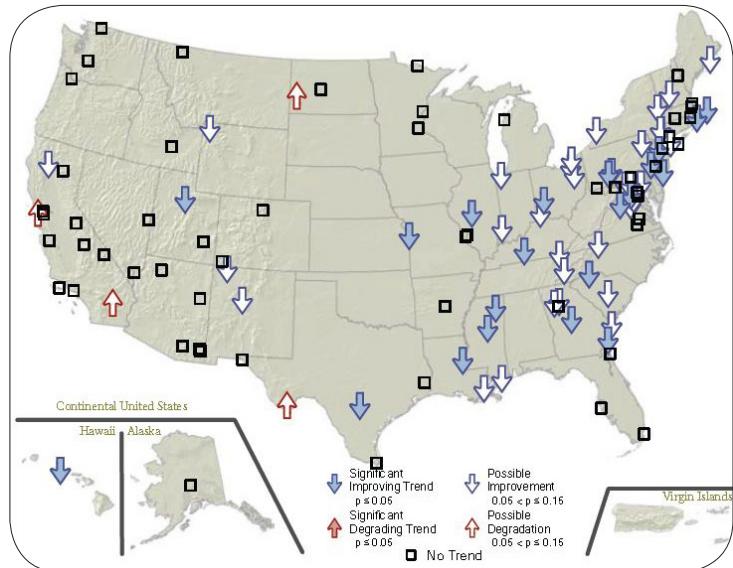
The NPS Air Resources Division administers an extensive air monitoring program looking at conditions and trends of air pollutants affecting National Parks. A recent study by Cooper et al. using data from NPS air stations and from Clean Air Status and Trend Network sites across the U.S., uncovered an interesting set of trends in levels of ozone and the chemicals that mix to create ozone.

Thanks to the Clean Air Act, levels of the compounds that mix together to form ozone<sup>1</sup>, decreased strongly in the U.S. during 1990-2010, despite a U.S. population increase. However, ozone levels have decreased in the eastern U.S. more than in the western U.S. From the 1980's through 2007, mean ozone levels flowing into the western U.S. increased during winter, spring

<sup>1</sup> Ground level ozone is a pollutant created by chemical reactions between oxides of nitrogen and volatile organic compounds in the presence of sunlight. There's also good ozone in the ozone layer that blocks harmful ultraviolet rays from the sun. The rule of thumb for ozone is: good up high, bad nearby.

### In This Issue:

- 1 The Global Reach of Air Pollution
- 1 Coming to Your Park this Summer...
- 2 Looking at the Forest in 3-D: New Lidar Report
- 3 Brood II Cicadas
- 4 Calendar
- 4 Stream Physical Habitat
- 4 New Resources Available



Ozone concentration trends 1999-2008 (4th-highest, 8-hour levels). Blue arrows indicate significant and possible improving trends while red arrows indicate significant and possible degradation. Black boxes show no trend. (Credit: NPS Air Resources Division)

and summer (Parrish et al. 2009).

Ozone levels fluctuate throughout the year, typically with the highest levels during summer. From 1990-2010 during eastern U.S. summers, 83% of air monitoring sites in the Cooper study had decreases in the highest levels (Continued page 2)

### Coming to Your Park this Summer

	ANIT*	CATO	CHOH	GWMP	HAF	MANA	MONO	NACE	PRW	ROCR	WOTR
I&M Bird Monitoring	x	x	x	x	x	x	x	x	x	x	x
I&M Fish Monitoring	x				x			x			
Exotic Plant Management	x	x	x	x	x	x	x	x	x	x	x
I&M Forest Vegetation Monitoring	x	x	x	x	x	x	x	x	x	x	x
I&M Water Monitoring	x	x		x	x	x	x	x	x	x	x

\*Park acronyms on page 2

## Air Pollution con't

of ozone, 66% of sites had decreases in medium levels of ozone, and 20% had decreases in the lowest levels of ozone (the 95th, 50th, and 5th percentiles respectively).

However, during the same period of summers in the western U.S., only 17% of sites showed decreases in the highest levels of ozone (95th percentile) and 8% of sites showed decreases in medium levels of ozone (50th percentile). And during springtime, no western site had any significant decrease in ozone, while 50% had an increase.

This discrepancy in eastern and western ozone levels is a product of pollution from the other side of the Pacific, not nearby sources (Cooper et al. 2012). An eastward belt of air flowing in the northern hemisphere links continents and countries across the planet.

We are also learning how air pollutants and their transport affect the climate. Particulate components of air pollution alter the sun's radiation forces reaching the earth's surface and increasing the solar heating of the atmosphere. Particulate pollution may mask as much as 45% of warming by greenhouse gases (Rubino 2012). These changes are creating major con-

cerns about global climate change.

The globalization of air pollution suggests that efforts to reduce pollution levels at home are connected to what is happening to pollution levels throughout the hemisphere. With this in mind, we must look to the future and discuss the implications of pollution emissions and work toward strategies addressing air quality and climate change together.

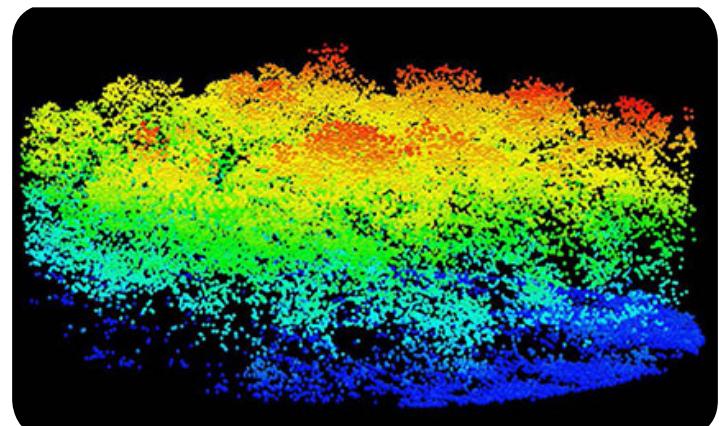
## References

- Cooper, O. R., R.-S. Gao, D. Tarasick, T. Leblanc, and C. Sweeney. 2012. Long-term ozone trends at rural ozone monitoring sites across the United States, 1990–2010. *J. Geophys. Res.*, 117, D22307, doi:10.1029/2012JD018261.
- Parrish, D. D., D. B. Millet, and A. H. Goldstein. 2009. Increasing ozone in marine boundary layer inflow at the west coasts of North America and Europe, *Atmos. Chem. Phys.*, 9, 1303–1323, doi:10.5194/acp-9-1303-009.
- Rubino, J. November, 2012. Boulder-led study: ‘Imported ozone’ from Asia could be hurting air quality in western U.S. Daily Camera.

## Looking at the Forest in 3-D: New Lidar Report

More than two-thirds of the land in National Capital Region national parks is covered by forest. So it's important to understand the role of forest structure. Forest structure is the vertical and horizontal arrangement of plants in a forest, both dead and alive. It includes the height, density, and “bumpiness” of the canopy and understory layers. This structure can effect things like the spread of invasive plants and disease, and available habitat for animals.

For that reason, in 2009 and 2010, NCRN I&M arranged for collection of lidar data at Catoctin (CATO), Harpers Ferry (HAFE) [with adjoining pieces of the C&O Canal (CHOH)], and Prince William Forest (PRWI). Using lidar (a special plane-mounted laser used in a sonar-type fashion) is a way to peek through the forest and see its structure from the ground surface



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A false-color view of a ~30m tall forest (red) created by lidar data points. The forest floor is shown in blue. Data is from Prince William Forest Park.

level, to the presence of shrubs and small trees in the understory, to the contours and height (Continued next page)

### Park Acronyms

- ANTI = Antietam National Battlefield  
CATO = Catoctin Mountain Park  
CHOH = Chesapeake & Ohio Canal National Historical Park  
GWMP = George Washington Memorial Parkway  
HAFE = Harpers Ferry National Historical Park  
MANA = Manassas National Battlefield Park

- MONO = Monocacy National Battlefield  
NACE = National Capital Parks - East  
NAMA = National Mall and Memorial Parks  
PRWI = Prince William Forest Park  
ROCR = Rock Creek Park  
WOTR = Wolf Trap National Park for the Performing Arts

# Brood II Cicadas

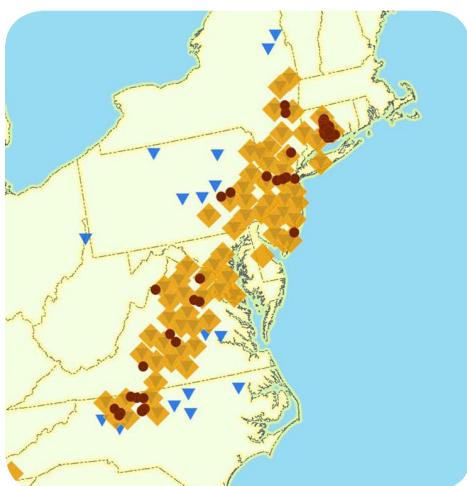
By the time this newsletter is in your hand, you may well be surrounded by members of Brood II of the periodical cicada, genus *Magicicada*. These small red-eyed creatures have been sleeping just below our feet, sucking on tree roots for the last seventeen years, and will emerge, mate, and vanish just as quickly as they appeared. The most likely time for them to emerge is late May and June. According to the Washington Post's Kevin Ambrose, "when the ground temperature at nymph level [6-12 inches down] warms to 64 degrees, the nymphs dig up to the surface."

Brood II, also known as the "East Coast Brood," is one of the biggest 17-year cicada broods of the Mid-Atlantic. It is expected to emerge in an area stretching from Connecticut to

Virginia though not all areas will be lucky. A big cicada brood is a special thing, and we likely won't see one again after this year until 17-year cicada Brood X, expected to emerge in 2021 (New York to North Carolina).

Cicadas fill an important ecological role, even though their sap-sucking is a minor drain on trees. They tunnel deep into the ground, helping to aerate and loosen the soil around tree roots. Their waste products return nutrients to the soil, which benefits their tree hosts. And they provide an unexpected food bonanza for mice, squirrels, turkeys, and many other species.

Maryland cicada sightings (and non-sightings) are being tracked by Entomologist Gaye Williams of the Maryland Department of Agriculture at [www.cicadas.info](http://www.cicadas.info).



Left: This Brood II map shows verified records from the Cicada Central Database in brown, records based on Marlatt (1923) in blue, and records based on Simon (1988) in gold.

Center: Periodic cicadas have red eyes and are smaller than the larger and greener annual dog day cicada (Right).

## Lidar con't

of the top of the forest canopy. The forest structure revealed is a product of many things including the plants present, available light, animal browse, storms, gradual climate change, historic land-use, and soil nutrients.

A new report and a forthcoming resource brief on forest structure and lidar at CATO, HAFE, and PRWI are available at: <http://science.nature.nps.gov/im/units/nrcn/monitor/forest/index.cfm>. The report is also available on the IRMA database at: [https://irma.nps.gov/App/Reference/DownloadDigitalFile?code=468470&file=Elmore\\_2013\\_NCRN\\_forest\\_vegetation\\_structure\\_using\\_LiDAR.pdf](https://irma.nps.gov/App/Reference/DownloadDigitalFile?code=468470&file=Elmore_2013_NCRN_forest_vegetation_structure_using_LiDAR.pdf)

We created a good image of our forests from the lidar data, but the real pay-off may be yet to come in combining lidar with other studies on bugs, bats, climate, or other topics.

The lidar data collected allows us to create a detailed picture of some expected characteristics, and will hopefully reveal

new surprises. As expected, the canopy is far from flat with gaps created by streams, tree falls, forest fires, and other forces. And the canopy surface tends to be more level than the ground beneath—taller trees are growing in low areas, and shorter trees on high spots. The most common canopy height for all parks ranged from 25-30 meters (equivalent to a 7- to 8-story building). The tallest trees ranged from 45-47 meters (13 stories!).

It's possible that reading the surface of the forest may also tell us about the history of the land beneath it by showing characteristic signatures from farming or logging.

Already, Andrew Elmore from the University of Maryland is using lidar surface elevation data in an ongoing study of tree growth rings and climate change at CATO, HAFE, and PRWI. We hope more studies taking advantage of this new data set are to come.

## Calendar

### JUNE

**6. EPMT-Sponsored Invasive Plant Training.** National Conservation Training Center, Shepherdstown, WV. 8:30 am- 3 pm. Contact Mark Frey for details: 202-339-8317.

**27. EPMT-Sponsored Invasive Plant Training.** Fort Dupont 8:30 am- 3 pm. Contact Mark Frey for details: 202-339-8317.

### JULY

**18. NAT (Natural Resources Advisory Team) Meeting.** NAMA.

**31- August 1.** Mid-Atlantic Invasive Plant Council 2013 Conference "Ensuring Restoration Successes" National Conservation Training Center in Shepherdstown, WV. [www.maipc.org/](http://www.maipc.org/)

## Stream Physical Habitat

There are many ways of looking at the health of a stream and its watershed. One is to study stream physical habitat, and the NCRN I&M program does just that in 10 NCR parks.

Stream physical habitat includes the physical structure of a stream channel and vegetative features around it. Condition is judged by criteria including the extent of bank erosion, amount of woody debris in the stream, habitat for fish, shading, suitability of stream bed surface materials for macroinvertebrates, and the quality of riffles.

Stream physical habitat monitoring at thirty-seven park sites throughout the NCRN began in 2008 and follows a set, six-year rotation. In 2013 NCRN will monitor: Sharpsburg Creek (ANTI); Flowing Springs Run (HAFE); and Henson Creek, Accokeek Creek, Still Creek, and Oxon Run (NACE).

A new series of resource briefs describes the outcomes of stream physical habitat monitoring so far. They can be found at: [http://science.nature.nps.gov/im/units/ncrn/monitor/stream\\_survey/index.cfm](http://science.nature.nps.gov/im/units/ncrn/monitor/stream_survey/index.cfm).



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GWMP Biologist Erik Oberg with an early migrating shad on the Potomac River, April 8.

Shad prefer stream flow of larger rivers for spawning while fish like trout prefer a silt free gravel stream bed.

## New Resources Available

**IPM and Hantavirus video:** <http://www.youtube.com/watch?v=T2hKOanAUow>. A related demonstration video on mixing bleach and treating a cabin is available at: <http://www.youtube.com/watch?v=havQ6jg6Ku0>.

**George Wright Society (GWS) keynote speeches** by Michael Soulé and Emma Marrus are available at: [http://www.georgewright.org/gws2013\\_plenaries](http://www.georgewright.org/gws2013_plenaries).

### National Capital Region Network Inventory & Monitoring (NCRN I&M) Staff:

Program Manager: Patrick Campbell  
Botanist: Elizabeth Matthews  
Data Manager: Geoff Sanders  
GIS Specialist: Mark Lehman  
Hydrologic Technician: Jim Pieper  
Hydrologic Technician: Tonya Watts  
Quantitative Ecologist: John Paul Schmit  
Science Communicator: Megan Nortrup

### Visit NCRN I&M online at:

Website: <http://science.nature.nps.gov/im/units/ncrn/index.cfm>  
Sharepoint: <http://sharenrss/im/networks/NCRN/default.aspx>  
RSS: [http://science.nature.nps.gov/im/units/ncrn/rss/ncrn\\_rss.xml](http://science.nature.nps.gov/im/units/ncrn/rss/ncrn_rss.xml)  
Twitter: <https://twitter.com/#!/NPSNCRN>

*NCRN Natural Resource Quarterly* offers updates on the status of park natural resources and Inventory and Monitoring (I&M) "vital signs" for the NPS National Capital Region Network (NCRN).

Questions or comments? Contact Megan Nortrup by NPS email or at 202-339-8314