



# *Nature's Notebook 2012:* State of the Data

April 2013

## STATE OF THE DATA, 2012

---

This report summarizes participation in *Nature's Notebook* and the data comprising the National Phenology Database (NPDb) as of December 31, 2012. The goal of the report is to inform users of the composition, complexity, and spatial and temporal extent of data since inception of the NPDb in 2009 for plants and 2010 for animals.

The USA National Phenology Network (USA-NPN; [www.usanpn.org](http://www.usanpn.org)) engages a diverse range of citizen scientist volunteers, federal, state, and non-governmental organizations, educators and professional research scientists to collect observations of plant and animal phenology using consistent standards and protocols and contribute them to a national data repository, the National Phenology Database.

Launched in 2009, *Nature's Notebook* is the USA-NPN's phenology monitoring program ([www.nn.usanpn.org](http://www.nn.usanpn.org)). Through *Nature's Notebook* participants can enter and track their observations, and use interactive tools for analyzing patterns and trends in plant and animal phenology.

Observations submitted via *Nature's Notebook* are archived in the NPDb and are available for download with accompanying metadata at [www.usanpn.org/results/data](http://www.usanpn.org/results/data).

**Phenology** is the timing of recurring life-cycle events or stages of organisms and their scientific study.

**Phenophases** are the observable life stages of annual life cycles in plants and animals such as flowering or migration.

## SUMMARY

---

In 2012, 2,045 observers contributed 1,592 sites to the NPDb, encompassing all 50 states, the U.S. Virgin Islands, and Puerto Rico. At the close of 2012 the NPDb contained a total of over 1.6 million phenophase status records. More than half of these records were submitted in 2012. Observers submitted records on 547 species in 2012, including 371 plant species (comprised of 5,584 individual plants) and 176 animal species. Red maple (*Acer rubrum*) and American Robin (*Turdus migratorius*) were the most observed plant and animal species in 2012. Plant phenophases related to fruiting and flowering had the most records in 2012 and in all years combined, whereas animal phenophases related to feeding had the most records.


Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted material contained within this report.

This report complies with the US Geological Survey Fundamental Science Practices Standards. It has undergone peer and policy review and approval.

Suggested citation: Kellermann, J.L., T.M. Crimmins, E.G. Denny, C.A.F. Enquist, K.L. Gerst, A.H. Rosemartin, and J.F. Weltzin. 2013. *Nature's Notebook: 2012 State of the Data*. USA-NPN Technical Series 2013-001. [www.usanpn.org](http://www.usanpn.org).

## OBSERVERS AND OBSERVATION RECORDS

 In 2012, the number of observers registered with *Nature's Notebook*, and the number of observers reporting data grew steadily (Table 1), which resulted in large increases in the total number of records housed in the NPDb (Figure 1).

**Table 1.** *Nature's Notebook* registered observers, observers reporting and the number of days they observed, and total observations and records from 2008-2012. Note that an 'observation' consists of multiple 'phenophase status records' for the suite of phenophases observed for an individual plant or an animal species on a given date or time.

	2008*	2009	2010	2011	2012	Total
Registered observers <sup>a</sup>	90	2,153	795	1,069	2,045	6,152
Observers reporting	40	558	439	548	932	1,897
% of registered observers reporting <sup>b</sup>	11%	25%	31%	30%	31%	31%
Days observed per observer (mean±1SE)	8±2	9±0.3	10±0.6	12±0.7	13±0.6	10±0.9 <sup>c</sup>
Total observations	2,761	17,822	30,499	53,517	104,587	209,186
Total records	12,814	135,795	217,831	421,333	856,766	1,644,539

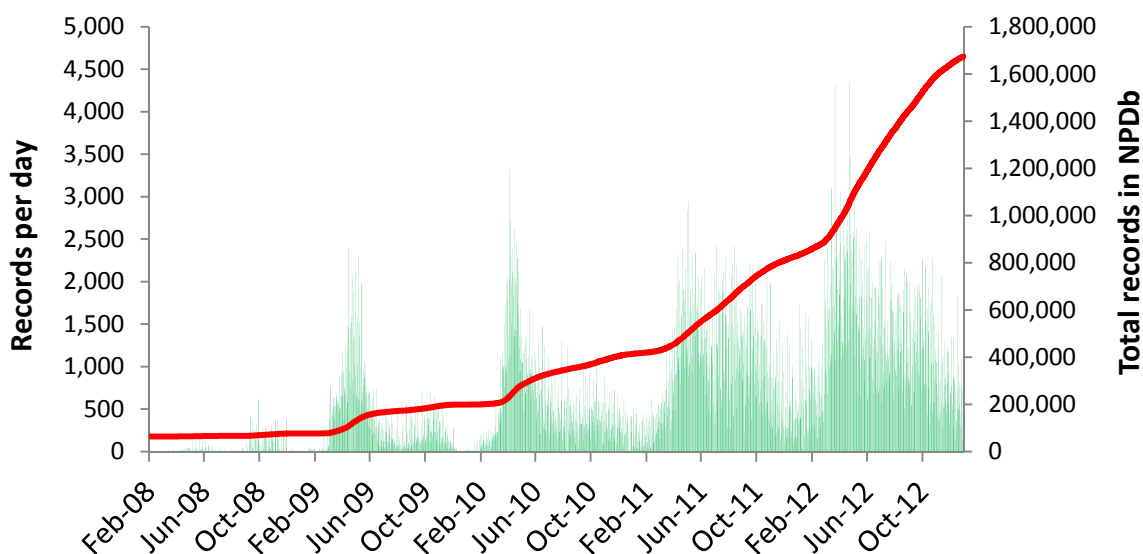
\* Data from 2008 represent a pilot year prior to the inception of *Nature's Notebook* in 2009

<sup>a</sup> Cumulative total is less than the sum of 2008-2012 due to some observers reporting in multiple years

<sup>b</sup> Percentage of registered observers that reported data in their registration year

<sup>c</sup> Mean number of days observed per observer from 2008-2012

 In March 2012, the NPDb reached **1 million** total records, and by December 31, 2012 the NPDb contained over **1.6 million records** (Figure 1).



**Figure 1.** The number of phenophase status records made per day (bars) and the cumulative number of records contributed (line) to the National Phenology Database as of December 31, 2012.

## SITES

A site is a georeferenced location where observers can record the phenology of one or more individual plants and one or more animal species. Note that some registered sites may not have observations made at them.



The number of registered sites in *Nature's Notebook* continued to grow, with **1,592 new sites registered in 2012** (Table 2) throughout all 50 states and Puerto Rico (Figure 2). Of these sites, **49% reported observations** for 2012. Since 2008, the mean annual number of observations per site has also increased (Table 2).

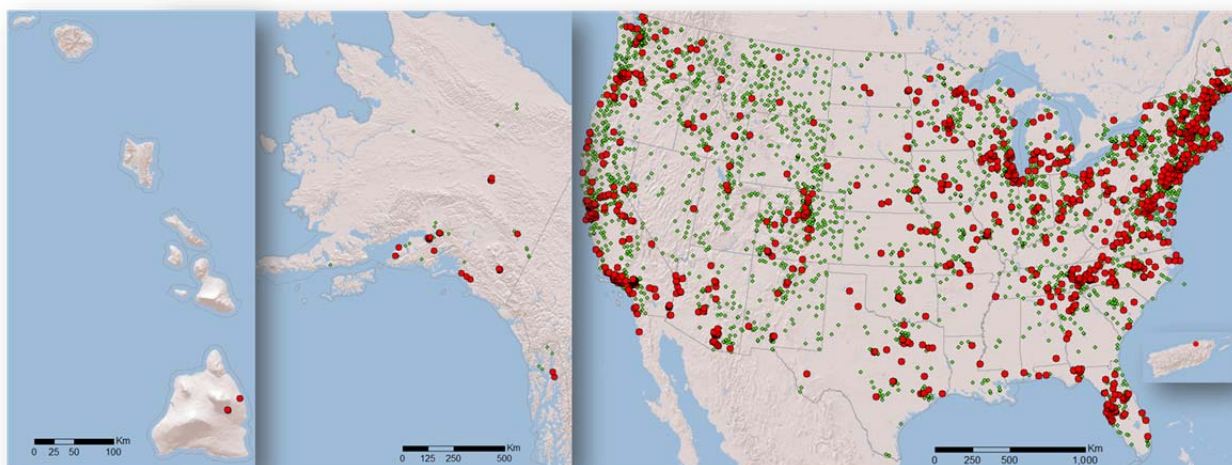
**Table 2.** Registration and activity of sites in *Nature's Notebook*, 2008-2012.

	2008	2009	2010	2011	2012	Cumulative
<b>Registered sites<sup>a</sup></b>	-	-	-	1,190	1,592	<b>7,512</b>
<b>Mean observations per site</b>	4.6	9.0	9.9	11.4	13.1	<b>9.6</b>

<sup>a</sup> Prior to 2011 the date a site was registered was not recorded in the NPDb. Total includes historic lilac sites.



States with the **most new sites** registered in 2012 were California (261 sites), Arizona (96), and Oregon (76). Our largest geographical gaps are in the central Great Basin, Great Plains, and the south Atlantic and Gulf coastal plains (Figure 2).



**Figure 2.** Sites registered with *Nature's Notebook* in 2012 (red ) and in previous years (green).

## SPECIES

The 871 species available for observation through *Nature's Notebook* in 2012 included 633 plant and 238 animal species. Complete species summaries for every species observed in 2012 and for 2008-2012 combined are available as supplemental material on the USA-NPN website.

For plants: [https://www.usanpn.org/files/shared/files/SOD\\_2012-Appendix%20A\\_Plants.pdf](https://www.usanpn.org/files/shared/files/SOD_2012-Appendix%20A_Plants.pdf)

For animals: [https://www.usanpn.org/files/shared/files/SOD\\_2012-Appendix%20B\\_Animals.pdf](https://www.usanpn.org/files/shared/files/SOD_2012-Appendix%20B_Animals.pdf)



The number of plant and animal species and plant individuals being observed through *Nature's Notebook* continued to increase in 2012, as did the number of plant and animal species being monitored per observer (Table 3). In 2012, observers submitted 651,366 records of plant phenophases, and 211,019 records of animal phenophases.

**Table 3.** Plant and animal species registered and observed via *Nature's Notebook* by year.

	2008	2009	2010	2011	2012	Total
<b>Species with observations</b>	41	166	268	382	547	<b>600</b>
<b>Plant species with observations</b>	39	149	196	250	371	<b>415</b>
<b>Plant individuals with observations</b>	541	2,143	2,170	3,234	5,584	<b>10,989</b>
<b>Animal species with observations</b>	2	17	72	132	176	<b>199</b>
<b>Average plant species per observer</b>	1.9	2.8	2.9	3.5	3.6	<b>2.9</b>
<b>Average animal species per observer</b>	2	2.1	4	3.7	4.9	<b>3.3</b>



In 2012, plant species with the most observations were:

- Red maple (*Acer rubrum*)
- Coyotebrush (*Baccharus pilularis*)
- Valley oak (*Quercus lobata*)
- Black elderberry (*Sambucus nigra*)
- Quaking aspen (*Populus tremuloides*)



In 2012, animal species with the most observations were:

- American Robin (*Turdus migratorius*)
- Ruby-throated Hummingbird (*Archilochus colubris*)
- Black-capped Chickadee (*Poecile atricapillus*)
- Monarch (*Danaus plexippus*)
- American Goldfinch (*Spinus tristis*)


<b>Most observed plant species 2008-2012</b>	<b>Obs.</b>
Common lilac ( <i>Syringa vulgaris</i> ) *	6,940
Red Rothomagensis lilac ( <i>Syringa chinensis</i> ) *	5,128
Red maple ( <i>Acer rubrum</i> )	1,972
Forsythia ( <i>Forsythia</i> spp.)	1,586
Common dandelion ( <i>Taraxicum officinale</i> )	1,377
Quaking aspen ( <i>Populus tremuloides</i> )	1,355
Eastern redbud ( <i>Cercis canadensis</i> )	1,241


<b>Most observed animal species 2008-2012</b>	<b>Obs.</b>
American Robin ( <i>Turdus migratorius</i> )	1,952
Bumblebee ( <i>Bombus</i> spp.)	1,715
Black-capped Chickadee ( <i>Poecile atricapillus</i> )	1,419
American Goldfinch ( <i>Spinus tristis</i> )	1,352
Ruby-throated Hummingbird ( <i>Archilochus colubris</i> )	1,143

\* Historic lilac phenology observations beginning in 1956 were integrated into the NPDb in 2009.

## PHENOPHASES

---

 In 2012, standard protocols for 133 unique phenophases across all 871 plant and animal species – with 3-11 phenophases per species – were available for observers to record through *Nature's Notebook*. Of these, **124 unique phenophases** were observed across 547 species of plants and animals.

 Phenophases were categorized separately for plants and animals in an effort to further characterize their ecological diversity (Table 4). Plant phenophases related to fruiting and flowering had the most records, whereas animal phenophases related to feeding (e.g. fruit consumption) had the most.

**Table 4.** The number of phenophase status records for general phenophase categories of plants and animals in 2012, and the total number of records from 2008-2012. Reproductive structures of plants include flowers, pollen cones, and rockweed receptacles. Green-up includes the breaking of leaf buds, increasing leaf size, and initial plant growth.

Taxa	Phenophase category	Records	
		2012	Total
Plants	Fruits	217,262	367,505
	Reproductive structures	190,944	375,330
	Green-up	119,505	298,263
	Senescence	60,854	201,274
	Leaves/needles (mature)	52,821	78,272
Animals	Feeding	72,271	98,239
	Reproduction/territoriality	40,569	57,572
	Present/active (adults)	33,359	50,139
	Vocalizing	28,548	39,951
	Dead individuals	28,531	41,841
	Present/active (immature)	3,199	5,685

### Additional information

All data in the NPDb summarized herein are publicly and freely available; use our new download tool at [www.usanpn.org/results/data](http://www.usanpn.org/results/data) to specify and download a custom dataset with associated metadata, or visualize (and download) our data at [www.usanpn.org/data/visualizations](http://www.usanpn.org/data/visualizations).

### Contributions & Acknowledgments

The USA National Phenology Network gratefully acknowledges the participants in *Nature's Notebook* and the following sponsoring organizations: US Geological Survey, University of Arizona, University of Wisconsin-Milwaukee, The Wildlife Society, US National Park Service, US Fish & Wildlife Service, National Oceanic & Atmospheric Administration, National Aeronautics & Space Administration, National Science Foundation and Oak Ridge National Laboratory.