



## **Annual Report 2017**

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## Project Description

Following a USA National Phenology Network supported *Nature's Notebook* workshop in 2016, a core group of local environmental educators, ecologists, and conservationists became interested in developing a citizen science-driven, long-term monitoring program in order to gain a better understanding of the effects of climate change on plants and animals along the northern Gulf Coast. In collecting local phenology data from multiple locations along the Gulf Coast from Louisiana to Alabama the group chose the name, Gulf Coast Phenology Trail (see Map, Appendix 1).

The *Nature's Notebook* citizen and professional science program provides a national framework for the submission of *long-term phenology observation data*. Data collected by observers can be used at multiple scales:

- ❖ By researchers and land managers interested in better understanding the effects of climate change on plants and animals
- ❖ By people or groups of people interested in local or regional seasonal variation and change
- ❖ By individuals who are interested in learning more deeply about the rhythms of the natural world around them.

The Gulf Coast Phenology Trail long-term monitoring program includes:

- ❖ Making repeated observations on the same individual plants or animal species at a site over time
- ❖ Making repeat observations at least once per week during the growing season
- ❖ Making observations for a least one growing season
- ❖ Making observations for more than one calendar year
- ❖ Using *Nature's Notebook* and the USA National Phenology Network as a tool for training, education, outreach, data collection, analysis and reporting

Our long-term goals for the Gulf Coast Phenology Trail include:

- ❖ Promote the increased use of *Nature's Notebook* for collecting local phenology data along the Gulf Coast
- ❖ Create a sustained network of citizen scientists for 7-10 years
- ❖ Provide insights through the knowledge gained from the phenology data collected
- ❖ Develop local partnerships across the Gulf Coast to establish sites that address local climate change and conservation issues while strengthening the overall mission of the Gulf Coast Phenology Trail.

The Gulf Coast Phenology Trail addresses both site specific and larger scale questions of interest. To address regional scale questions, we monitor a set of core species shared by most sites along the Trail. In addition, each partner site selects its own list of species to monitor to address very local fine scale questions of interest.

## Trail Development

The Gulf Coast Phenology Trail officially emerged from idea to reality in 2016 thanks to a grant from the USA National Phenology Network (USA-NPN). The grant provided seed funds to hire a Gulf Coast Phenology Trail Coordinator for one-year to oversee the initial development of the trail. The goals for the first coordinator of the trail included:

- ❖ developing sites

- ❖ developing curriculum and materials for training
- ❖ cultivating phenology observers
- ❖ documenting events and promoting *Nature's Notebook*.

A Core Team was developed of local scientists and environmental educators who provided initial feedback and guidance to the coordinator as the trail developed and took shape during 2016. By the end of 2016, four potential partner sites were selected, objectives were developed for each partner site, species were selected, general plans were developed for data collection, local partnerships were developed with potential partner sites, Trail vision and goal development.

The Gulf Coast Phenology Trail really came to life in 2017 thanks to the efforts of the Core Team and the Trail Coordinator with the help and support of both the USA NPN and *Nature's Notebook* Support Team.

- ❖ We received requests for the Trail to expand to Barataria Preserve and Bayou Sauvage NWR in South Louisiana resulting in an increase in the trail by mid-2017 to 6 partners and the length of the trail extending to nearly 100 miles
- ❖ We hired a new Trail Coordinator in September of 2017 as a part-time position
- ❖ The fall kept us busy with growing interested by new and potential partners including: (1) The Crosby Arboretum in Picayune, MS; (2) Mississippi Gulf Coast Community College's Estuarine Education Center in Gautier, MS; (3) Coastal Education Research Facility in New Orleans, LA; (4) Infinity Science Center in Bay St. Louis, MS.; (5) Ocean Springs Middle School, Ocean Springs, MS; (6) Gulf Islands National Seashore in Gulf Breeze, FL and MS; (7) Thibodeaux Wetland Acadian Center in Thibodaux, LA.

## Building a Citizen Scientist Network

Much of 2017 was dedicated to building a citizen science network. To accomplish this goal, we relied on strong leadership and coordination from our Core Team and Trail Coordinator, developed local partnerships, provided education materials for Training workshops and created outreach materials to get the message out about the Trail. Through the training workshops we were able to recruit many citizen scientists interested in getting out in nature and collecting data in support of the Trail.

## Leadership

**Core Team** - The core team is made up of five members representing US Fish and Wildlife Service (2 members), Grand Bay NERR (1 member), USA-NPN (2 members). The role of the Core Team was to lay out the guidance for the early development of the trail, goals and objectives, also develop and hire a trail coordinator position, and support trail partner sites as needed.

**Trail Coordinator**-The Trail Coordinator serves as the lead coordinator for the development of training and outreach materials, recruitment of new partners and new partner sites, recruitment of volunteers through workshops and data collection coordination for sites.

**Science Advisor**- The role of the science advisor is to ensure quality data collection is occurring along the Trail including site set up and data collection protocols for each site. The science advisor verifies the data quality and provides analysis and interpretation.

## Funding

Funding for the Trail Coordinator position was provided by a grant from the USA National Phenology Network. The Trail Coordinator position initially was established as an SCA (Student Conservation Association) Intern position from January-June 2017 but was converted to a part-time (10 hours per week) positions through the University of Arizona from September 2017 through September 2018. We hired locally for the position. A travel grant was provided from the US Fish and Wildlife Service's (USFWS) Southeast Region Inventory and Monitoring Program to provide Travel funds for the coordinator for mileage reimbursement. The Southeast Region USFWS has committed travel funds through September 2018.

## Partnerships

Partners Sites established in 2017:

- Grand Bay NERR/NWR - Moss Point, MS (lead: Jonathan Pitchford, Patric Harper)
- Pascagoula River Audubon Center - Pascagoula, MS (lead: Mark LaSalle, Erin Parker)
- Mississippi Sandhill Crane NWR- Gautier, MS (lead: Melissa Perez, Gail Bishop)
- Big Branch Marsh NWR – Lacombe, LA (lead: Sue Wilder, Becky Larkins)
- Bayou Sauvage NWR – New Orleans, LA (lead: Sue Wilder, Becky Larkins)
- Barataria Preserve NHP – Lafitte, LA (lead: Lea Schram Von Haupt)

## Education and Outreach

- ❖ General education and outreach materials were developed by the Trail Coordinator including; 1) a Gulf Coast Phenology Trail logo, website, Facebook page as well as brochures, contact lists, summary of meeting notes, and set up of the Gulf Coast Phenology Trail Site in *Nature's Notebook* for data observation entry.
- ❖ We presented a poster to the Grand Bay NERR Research Symposium in September.
- ❖ We developed a traveling display for exhibits which was initially displayed for “Wild Things Celebration” at Southeast Louisiana NWRs in October 2017 and the Louisiana Master Naturalist of Greater New Orleans (LMNGNO) meeting in November 2017.

## Workshops

- ❖ Our first workshop for *Nature's Notebook* was held at the Mississippi Sandhill Crane NWR in March 2017.
- ❖ We held our second *Nature's Notebook* training at the Barataria Preserve, August 2017. Data collection began immediately thereafter.
- ❖ A third *Nature's Notebook* workshop was held at Grand Bay NERR/NWR in October 2017.
- ❖ We held an organizational meeting at The Crosby Arboretum in preparation for the *Nature's Notebook* workshop in February 2018.

## METHODS - *Nature's Notebook*

At all partner sites along the Gulf Coast Phenology Trail (GCPT) we followed the protocols outlined by *Nature's Notebook* ([www.naturesnotebook.org](http://www.naturesnotebook.org)). We set up six partner sites in the *Nature's Notebook* mobile application for use by citizen scientists along the trail. Individual training on the mobile application use was provided for scientists by request. In general, the partner site lead provided the one-on-one training for the mobile application. Where paper data collection was preferred, hard copies

of data sheets were provided to scientists for data collection. Data sheets are turned in to a designated location on site and the data are entered manually by the site lead as time permits. For the first year, all species selected on GCPT Trail sites were available in the *Nature Notebook* plant and animal database for ease of data entry and printing of data sheets.

## RESULTS

### Phenology Observations

- ❖ A total of 14,373 observations were completed by 50 citizen scientists along the Gulf Coast Phenology Trail in 2017.
- ❖ 31 species observed (24 plant species; 7 animal species)
- ❖ 13,023 plant observations; 1350 animal observations

### Partner Site Data

Data was collected on six partner sites along the Gulf Coast Phenology Trail in 2017. Within each partner site one to four phenology walks were installed for data collection. A description of each partner site and phenology walk is described below.

**Grand Bay NERR/NWR (GBNWR)** – Two phenology walks were installed in January 2017 with 15 species monitored (see Plant and Animal Species Tables below). Total observations made at this site were 3,107 observations in 2017.

Phenology Walk	Number of Observations
Boardwalk1	2,637
Front Lawn	470
Total	3,107

**Mississippi Sandhill Crane NWR (MSCNWR)** - One phenology walk was installed in March 2017 with 8 species monitored at this site (see Plant and Animal Species Tables below). Total observations made at this site were 3,528 observations in 2017.

Phenology Walk	Number of Observations
Visitor Center	3,528
Total	3,528

**Pascagoula River Audubon Center (PRAC)** - Three phenology walks were installed prior to 2017 and this partner joined the trail in 2017 in support of the Gulf Coast Phenology Trail. For this site, five species were monitored in 2017 (see Plant and Animal Species Tables below). Total observations made at this site were 743 observations in 2017.

Phenology Walk	Number of Observations
PRAC Boat Launch Trail	358
Front Lawn	213
Trail 2	172
Total	743

**Big Branch Marsh NWR (BBMNR)**– Three phenology walks were installed in January 2017 with three species monitored (see Plant and Animal Species Tables below). Total observations made at this site were 2,490 observations in 2017.

Phenology Walk	Number of Observations
Main Parking Lot	1, 912
Entrance Road	319
Azalea Trail	259
Total	2,490

**Bayou Sauvage NWR (BSNWR)** – One phenology walk was installed in March 2017 with five species monitored at this site (see Plant and Animal Species Tables below). Total observations made at this site were 3,528 observations in 2017.

Phenology Walk	Number of Observations
Boardwalk	1,646
Total	3,528

**Barataria Preserve (BPNS)** - Four phenology walks were installed in August 2017 with 17 species monitored (see Plant and Animal Species Tables below). Total observations made at this site were 2,490 observations in 2017.

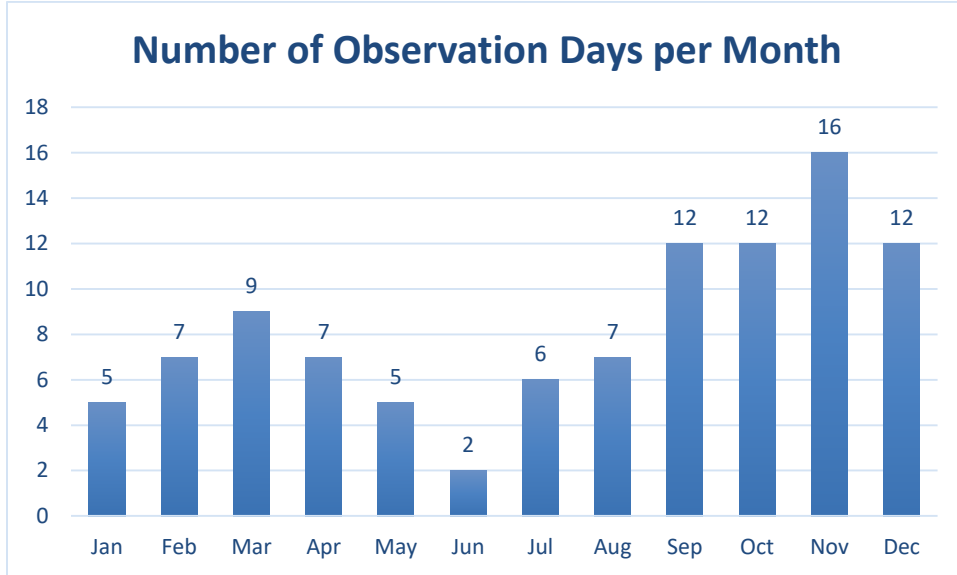
Phenology Walk	Number of Observations
Bayou Coquille Trail	1,144
Ring Levee Trail	608
Visitor Center Trail	612
Palmetto Trail	491
Total	2,855



## Monitoring Effort

Partner	Site_ID	Site_Name	State	Latitude	Longitude	# Site Visits	# Observers
Grand Bay NERR/NWR	25081	Boardwalk 1	MS	30.42939	-88.4286	20	6
Grand Bay NERR/NWR	25174	Front Lawn	MS	30.4291	-88.4306	12	4
Mississippi Sandhill Crane NWR	26079	Visitor Center	MS	30.45158	-88.6555	32	4
Pascagoula River Audubon Center (PRAC)	28353	PRAC-Boat Launch Trail	MS	30.41477	-88.5425	6	2
Pascagoula River Audubon Center	28354	PRAC-Trail 2	MS	30.41479	-88.5426	4	2
Pascagoula River Audubon Center	28357	PRAC Front Lawn	MS	30.41472	-88.5418	6	2
Big Branch Marsh NWR	25151	Main Parking Lot	LA	30.32165	-89.9369	18	1
Big Branch Marsh NWR	25168	Entrance Road	LA	30.32005	-89.936	8	1
Big Branch Marsh NWR	25506	Azalea Trail	LA	30.31894	-89.9377	10	1
Bayou Sauvage NWR	25901	Boardwalk	LA	30.05377	-89.8805	18	1
Barataria Preserve	27474	Visitor Center Trail	LA	29.78447	-90.1148	11	7
Barataria Preserve	27475	Palmetto Trail	LA	29.78381	-90.1176	7	6
Barataria Preserve	27476	Ring Levee Trail	LA	29.78527	-90.1102	8	6
Barataria Preserve	27477	Bayou Coquille Trail	LA	29.79382	-90.1225	9	7
	TOTALS					169	50

Figure 1. Total Number of Observation Days per Month across GCPT. Note: multiple sites collected data on the same day and is not reflected in this graph.



## Plant Observations

Species	Grand Bay NERR/NWR	Pascagoula River Audubon Center	Mississippi Sandhill Crane NWR	Big Branch Marsh NWR	Bayou Sauvage NWR	Barataria Preserve	Total Observations
Red Maple	611	109	686	1912	350	228	3896
Wax Myrtle	449	181	649	259		163	1701
Yaupon	408	177	649				1234
Redbay	340	63	489				892
Chinese Tallow	356		157		289	78	880
Live Oak					362	214	576
Cypress	90				307	173	616
Eastern Baccharis					338	268	511
Sweetgum						361	361
Trumpet Creeper						258	258
Sweetbay		133	228				319
Poosumhaw						206	206
Box Elder						218	218
Buttonbush						202	202
Redbud				319			319
Poison Ivy						159	159
Buckeye		213					213
Water Tupelo						138	138
Sugarberry						86	86
Honey Locust						86	86
American Beautyberry						63	63
Longleaf Pine	30						30
White Crownbeard						35	35
Slash Pine	24						24
Totals	2308	876	2858	2490	1646	2936	13023

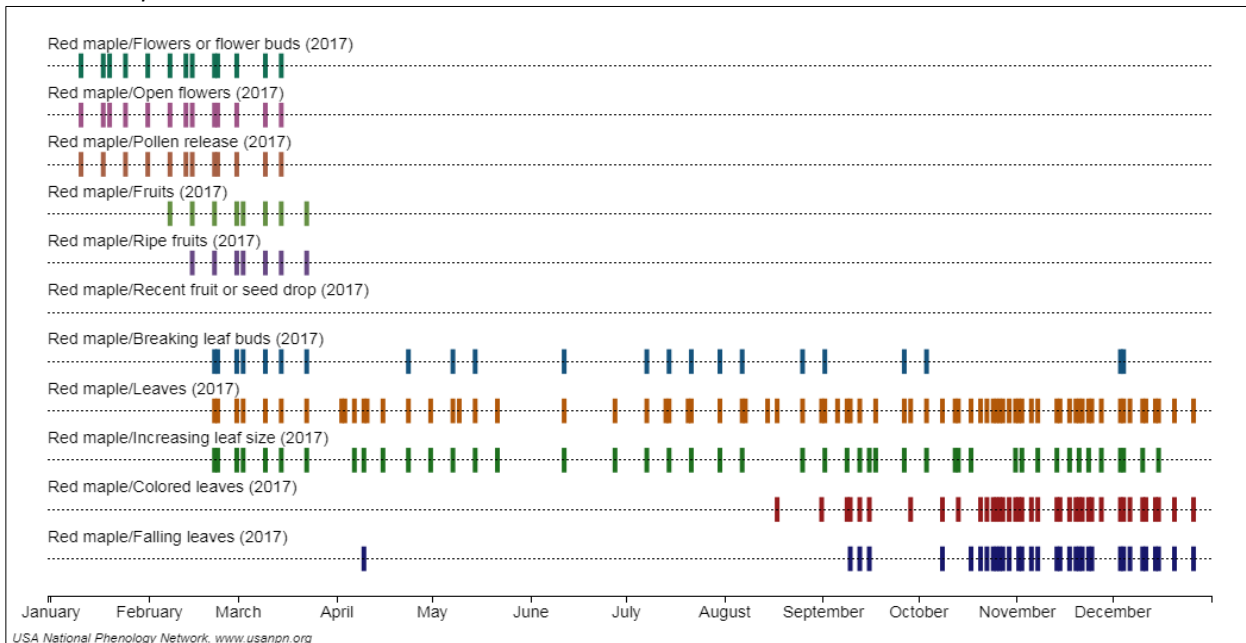
## Animal Observations

Species	Grand Bay NERR/NWR	Pascagoula River Audubon Center	Mississippi Sandhill Crane NWR	Big Branch Marsh NWR	Bayou Sauvage NWR	Barataria Preserve	Total Observations
American Robin			338				338
Northern Mockingbird			332				332
Osprey	212						212
Eastern Bluebird	160						160
Purple Martin	160						160
Bald Eagle	88						88
Fox Squirrel	60						60
<b>Total</b>	<b>680</b>	<b>0</b>	<b>670</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1350</b>

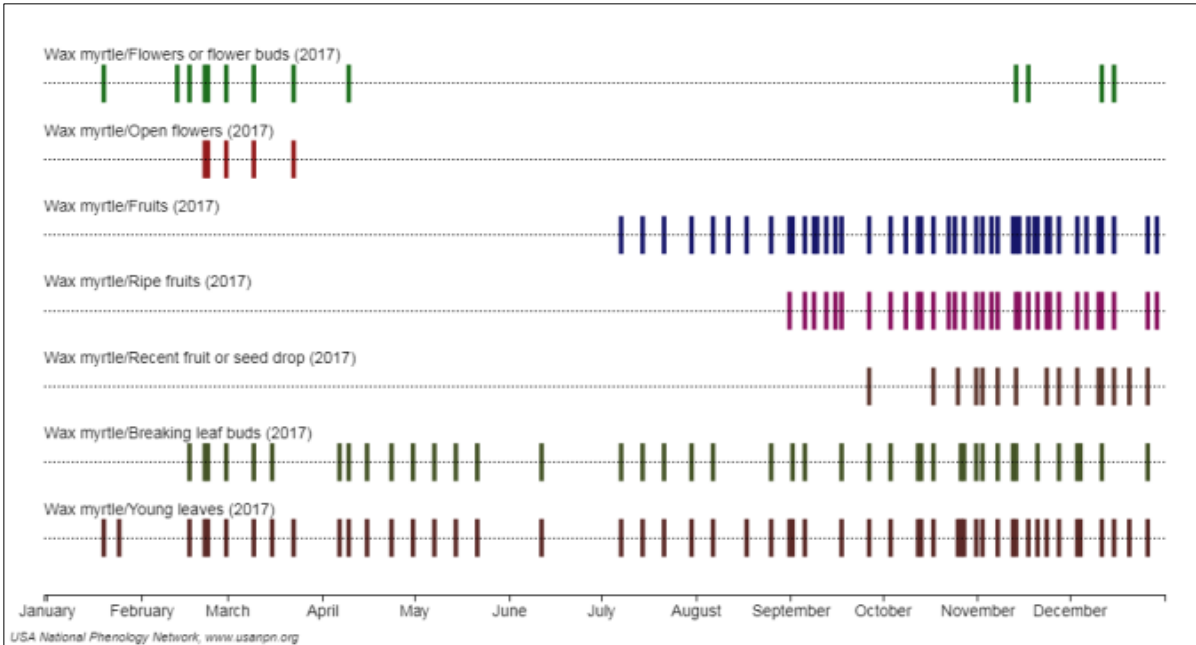
## Phenophase Data

Phenophase (flowering, fruiting and growth) calendar for top five most observed species: a) Red maple, b) Wax myrtle, c) Yaupon, d) Redbay, and e) Chinese Tallow. Colored lines indicate dates on which each life cycle stage was present in 2017.

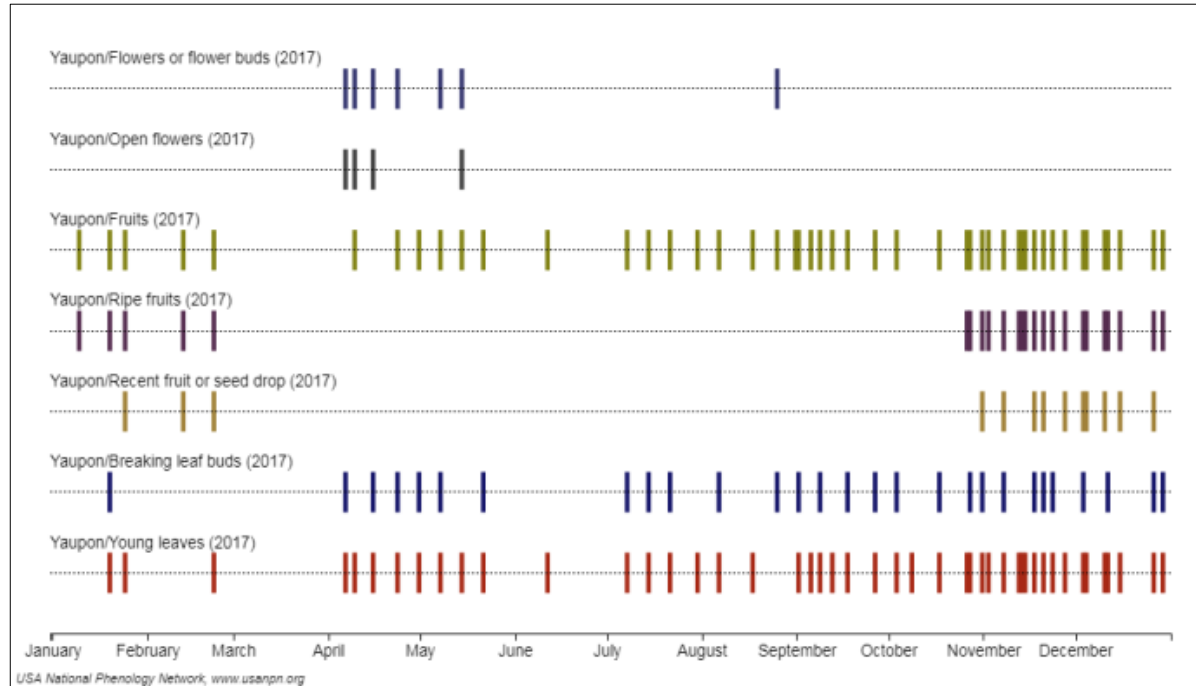
### A. Red Maple



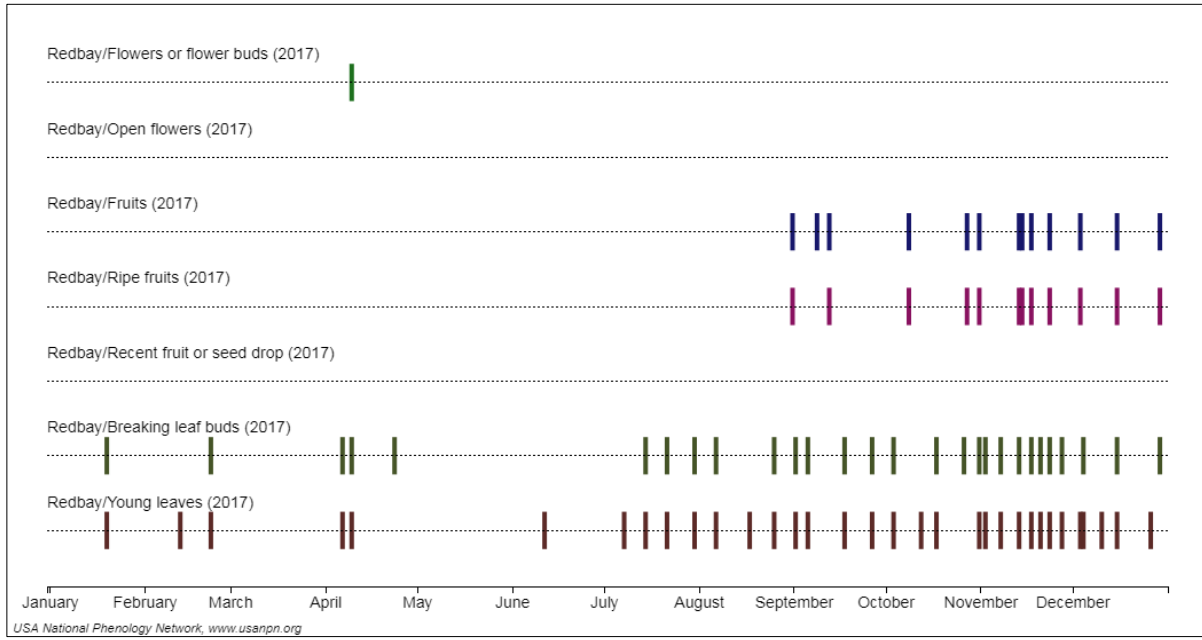
*B. Wax Myrtle*



*C. Yaupon*



### D. Redbay



### E. Chinese Tallow

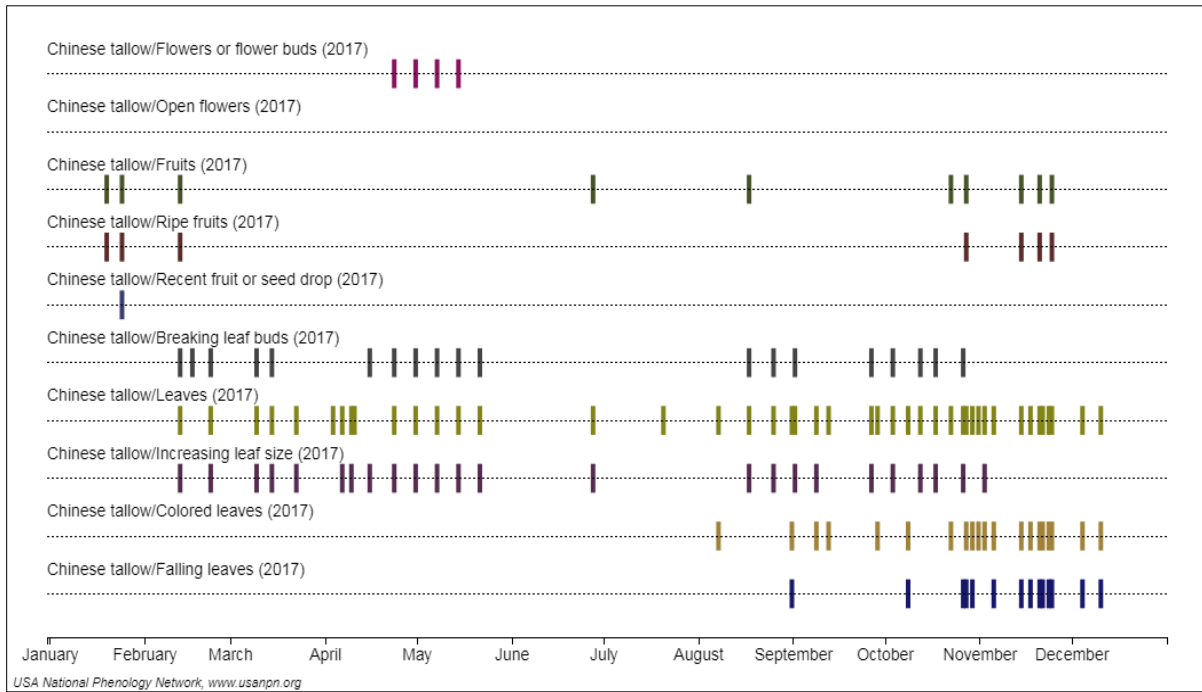
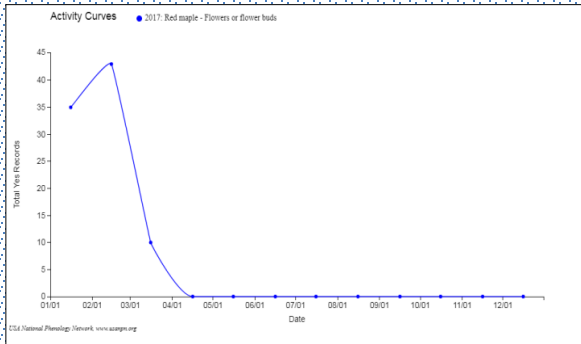
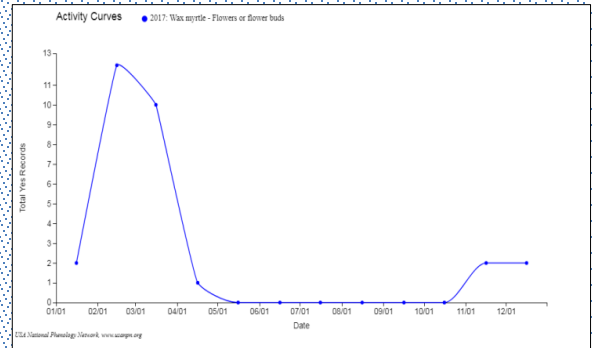


Figure 2. Flowering activity for top five most observed species: a) Red maple, b) Wax myrtle, c) Yaupon, d) Redbay, and e) Chinese Tallow. Lines indicate the number of total “yes” reports for each species over 2017.

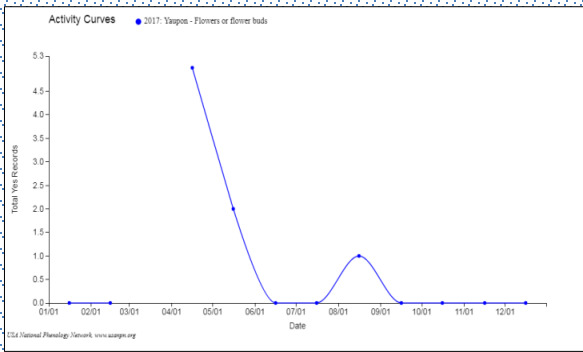
a. Red maple



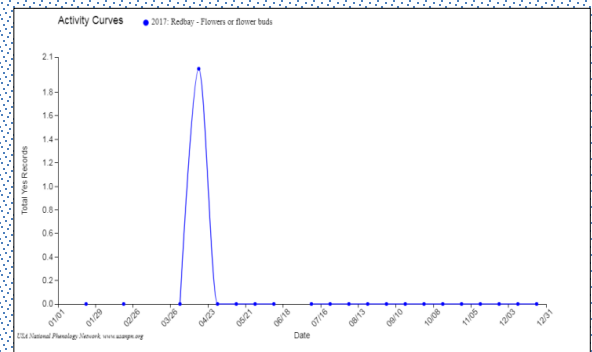
b. Wax myrtle



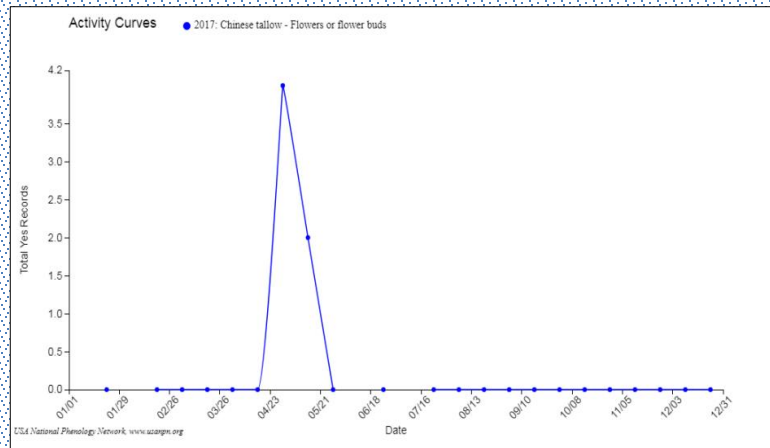
c. Yaupon



d. Redbay



e. Chinese Tallow



## Climate Data

Temperature summary table for Gulfport, MS Weather Station in 2017. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018, May 23).

Month	Average Temperature (F)	30yr Normal Temperature (Departure from 30yr Normal) (F)
January	58.5	50.8 (+7.7)
February	61.9	53.8 (+8.1)
March	56.2	50.1 (+5.7)
April	61.4	57.4 (+4.0)
May	73.4	74.3 (-0.9)
June	79.3	80.3 (-1.0)
July	82.9	82.4 (+0.5)
August	82.3	82.4 (-0.1)
September	78.7	78.2 (+0.5)
October	71.3	69.2 (+2.1)
November	61.9	60.3 (+1.6)
December	53.4	53.1 (+0.3)

Precipitation summary table for Gulfport, MS Weather Station in 2017. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018, May 23).

Month	Total Precipitation (in.)	30yr Total Precipitation (Departure from 30yr Normal) (in.)
January	8.89	5.19 (+3.70)
February	3.09	5.23 (-2.14)
March	2.60	5.99 (-3.39)
April	4.09	4.56 (-0.47)
May	8.25	5.11 (+3.14)
June	22.00	6.39 (+15.61)
July	4.94	7.21 (-2.27)
August	11.33	6.28 (+5.05)
September	0.74	5.63 (-4.89)
October	9.04	3.55 (+5.49)
November	0.59	4.64 (-4.05)
December	3.92	4.90 (-0.98)



## Data Summary

Although the long term phenology dataset for the Gulf Coast is in its infancy, a few summaries are noted below.

### Flowering, Fruiting, Growth of Core Species

**Red maple** - The earliest red maple flowering was reported for January 11 at Big Branch Marsh NWR. Flowers and flower buds were reported from January 11 through March 15. Fruits were observed from February 8 through March 23. Breaking leaf buds were reported as early as February 23. After February 23, red maple produced leaves and continued to grow through September 30. Leaf color change was first reported August 8 and was observed until December 21 with most leaves falling from September 8 through December 31.

**Wax myrtle** –Flowering of wax myrtle occurred from January 20 through March 23. Fruiting was observed July 8 through December 11 with fruit drop occurring in October 18. Breaking leaf buds were reported throughout the year beginning February 17. Emergent young leaves were reported as early as February 23. This species is an evergreen shrub and does not have typical late-season leaf color change or leaf drop. It was especially hard to differentiate new young spring leaves from annual growth thus young leaves were observed from March through December as observers documented new leaf growth throughout the year.

**Yaupon**- Flowering occurred from April 7 through May 15 with one site showing flowering as late as August 26. Fruiting was reported throughout the year from January 1 to December 31. The ripe fruits of yaupon may hold on for quite some time and remain on the plants throughout the year. Breaking leaf buds were reported throughout the year with most new leaf buds emerging after April 16. It was difficult to distinguish spring leaf out versus annual growth for this evergreen species, as noted by many observers. The burst of new spring growth primarily occurred around mid-April.

**Redbay**- Flowering was reported on April 10 and may reflect the limited sample size for this species during 2017. Fruiting was reported from September 1 to November 1. Breaking leaf buds were observed in the spring beginning February 23 through April 24. Young leaves were observed to leaf out as early as January 20. The primary purpose for including redbay as a core species on the Trail is to observe impacts caused by the Laurel Wilt Disease and to document its spread across the Gulf Coast. This year was limited by sample size to say anything significant about the disease and its impact. However, all plants observed were noted as showing signs of the fungus present on leaves at Mississippi Sandhill Crane NWR. Additional sites and individuals will be added in 2018 to more fully address this issue.

### Climate Summary

In general, 2017 showed higher than normal average temperatures in spring and fall with the greatest deviation from normal in February (+8 degrees). Summer was met with a high amount of precipitation with over 15 inches of above average rainfall in June. August was met with another heavy rainfall due to hurricanes passing through with over 5 inches of above average rainfall. In October, a normally dry month for the Gulf Coast, observed over 5 inches of above average rainfall as well. Overall 2017 was a

wetter year than the 30-year average. Hurricane Nate made U.S. landfall near the mouth of the Mississippi River in Louisiana as a Category 1 Hurricane, October 7, 2017. It made a second and final landfall near Biloxi, MS on October 8, 2017 and was later downgraded to a tropical depression as it moved inland.

## **Interesting Discoveries**

One of the most interesting findings for the year was the discovery of the linkage between the timing of the flowering of eastern baccharis and the fall migration of butterflies, especially the monarch butterfly and the gulf fritillary. The Gulf Coast is one of the last migratory stops along the fall southward migration of butterflies as they cross over the Gulf of Mexico to reach their wintering grounds. The interesting item of note here was the observance of a multitude of butterflies on the baccharis shrubs at Bayou Sauvage NWR in the fall. Numerous butterflies were observed flitting from shrub to shrub when this shrub flowered this fall. This could be a very important species for the fall migrating butterflies as the timing of flowering is highly correlated to the migration of butterflies. Additional detailed data will be collected for this butterfly-shrub phenology linkage. Similar patterns have been observed in the Southwest with western Baccharis species and monarch butterflies. Very little is known about the importance of the southeastern Baccharis species to monarch butterfly migration.

## **Restoration**

Hurricane Katrina heavily impacted the natural hardwood forests that made up the Ridge Trail Boardwalk area of Bayou Sauvage NWR where the phenology observations are made. Much of the area has been replanted with native species of trees. A combination of natural remaining trees and planted trees are monitored on this site. We hope that the long term phenology data will help us compare planted vs. naturally occurring trees in the future.

## **Fire**

The Mississippi Sandhill Crane NWR performed a prescribed (controlled) burn across our phenology site on the refuge in 2017. As a result of the fire, many of our monitored plants appeared to be killed but then immediately showed signs of new life shortly after the fire. We continued to monitor the phenology of the new stems of each plant as it put on new growth. We hope to study more detailed observations of the phenological response to fire in the near future.

## **Lessons Learned**

We learned a tremendous amount during this first year of development of the GCPT. Here are a few of the items we would like to pass along from our lessons learned.

The success of the GCPT is owed to the dedication and commitment of the initial GCPT Core Team that provided guidance and critical decisions in the initial Trail planning and development. A solid vision of the objectives and goals of the Trail was necessary for successful implementation of the Trail. The support, experience and guidance from the USA-NPN staff was invaluable in providing insight and recommendations for Trail development. Funding for a Trail coordinator helped to provide a central person responsible for the coordination of all aspects of the initial development of the trail. We hope to

find funding in the future through additional grants to continue to support the GCPT coordinator position. A part-time position is ideal for this work.

A heavy investment of work hours is needed initially to develop education and outreach materials. These materials provided a uniform message about the trail through workshops and presentations. Workshops were important to engage and recruit volunteers. A three-hour workshop on a Saturday morning seemed to be a good opportunity for all. The workshop should not delve too much into details but be a broad sweep of the concepts and importance of phenology data. Mixing in activities within the workshop is beneficial to keep the students engaged. Participating in an outdoor activity as demonstration for phenology data collection is important. Both the mobile application and the hard copy data sheets should be included in the demonstration. A phenophase guide for species in the demonstration is recommended.

Working with partners is also a key to the success of the GCPT. Efforts were made to set up meetings to discuss the site objectives and target groups for data collection. Each partner has a unique set of volunteer groups that they work with. It is important to work with each partner and meet their needs. Along the GCPT volunteers include a diversity of volunteer groups such as middle school children, master gardeners and master naturalists, college and university students, federal and state employees, bird observers, and outdoor enthusiasts. It is important to tailor the sites to each unique situation while meeting the overall goals of the GCPT.

With regard to site installation and set up a few common themes emerged across sites. One lesson learned is to start with a small manageable number of species and individuals to monitor. This will ensure that data is not too time consuming to collect and repeated measures are easily obtained if volunteer efforts are limited to one or two people per site. Completing the data (after the initial first introductory visits) within 30 to 60 minutes is ideal per person per walk. If it takes a significant time commitment interest may be lost quickly for repeated measures. Accessibility is also very important. Along the GCPT we can have many walking hazards (roots, stumps, uneven ground), low and inundated trails, bugs, snakes, wasps and other outdoor hazards. To reduce the potential for some of these hazards, plants and animals are selected along boardwalks and well maintained trails with adequate parking facilities to encourage phenology activities and mitigate the hazards. All walks have easy access and are framed to provide the citizen scientist with a pleasant walk and outdoor experience while collecting data. Good signage and maps are also important pieces of information to provide to the volunteers about plant ID, especially when they are introduced to a new site. Examples of signage across the trail includes metal tags, flagging, picture signs, or specific number markers (i.e., "sweetgum #1"). Each site is unique.

Understanding on-site management activities proved to be important when considering individual plant selections. Several individuals monitored were removed or significantly impacted by on-site management activities including herbicide treatments, mechanical removal, and prescribed burning throughout the year across many sites. In most cases, when an individual was removed it was generally replaced with a nearby individual and numbered in sequence from the last individual numbered. In addition, when an individual was damaged from herbicide treatment or prescribed fire the individual continued to be monitored over time as long as it lived. Any plants that died were so noted in the "observation details" comment section. This was also noted if the individual died of natural causes or natural disasters. The lesson learned here is that individuals selected at the start of a year may or may not be the same individuals that finish the year. This is acceptable along the GCPT with the understanding that the number of individuals per species observed should be consistent from year to

year and as possible, every effort made to monitor the same individual over time from one year to the next.

## Looking Forward – 2018 and Beyond

Short and long term goals for the GCPT:

**Short Term Goal:** *Train and schedule current and new volunteers to monitor plants and animals for 2018 and inform public of GCPT 2018-2019*

### Possible New Partnerships in 2018:

- ❖ The Crosby Arboretum - Picayune, MS
- ❖ Ocean Springs Middle School – Ocean Springs, MS
- ❖ Estuarine Education Center, Mississippi Gulf Coast Community College - Gautier, MS
- ❖ Gulf Islands National Seashore - Ocean Springs, MS and G, FL
- ❖ Thibodaux Education Center - Thibodaux, LA
- ❖ Coastal Education Research Facility – New Orleans, LA

### Next steps (Short Term):

- ❖ Meet with Ocean Springs Middle School Teacher, Shawn Dunaway, to strategize over developing a Fontainebleau Unit of the Mississippi Sandhill Crane Refuge phenology walk for middle school students.
- ❖ Meet with educators at the Infinity Science Center in Hancock County to develop a plan to train leaders of home schooled students on phenology and *Nature's Notebook*.
- ❖ Plan and lead phenology and *Nature's Notebook* training at the Crosby Arboretum in Picayune, Mississippi in February 2018.
- ❖ Schedule times for current and new volunteers and teachers to participate in monthly observations; develop additional education programs to keep volunteers engaged.
- ❖ Contact media outlets about GCPT citizen scientists.
- ❖ Interview local scientists affiliated with agencies that are included in the GCPT.
- ❖ Meet with representatives of the Mississippi Gulf Coast Community College and Gulf Islands National Seashore to discuss feasibility of adding walks located Davis Bayou and campus sites to GCPT.
- ❖ Continue to communicate along the entire GCPT through brochures, newsletters or by other social means.

**Long Term Goal:** *Promote and Evaluate GCPT 2019-2020*

### Metrics:

- ❖ Plan and lead phenology and *Nature's Notebook* training classes as needed.
- ❖ Provide additional workshops and educational programs to keep volunteers engaged.
- ❖ Provide public forums such as Science Café at the University of Southern Mississippi to inform the public of the GCPT and include preliminary analysis of data.
- ❖ Continue to make observations.
- ❖ Provide information for the media about the GCPT.
- ❖ Choose an instrument to determine the successes of the GCPT to date.
- ❖ Analyze data to use for decision making at Refuges and other locations.

## Conclusions

In its first year, the Gulf Coast Phenology Trail has blossomed from a simple desire to more fully understand the phenology of our Gulf Coast plants and animals to a successful citizen science driven network of sites that provide the foundation of a long term data that can be used to tell nature's story of the impacts of climate change over time. The first year began with the initial establishment of a few sites, a handful of interested partners, a small amount of data collection, and a vision. Throughout the year, we formalized goals and objectives, developed education and outreach materials, increased our partner sites, offered workshops for training and engaged people in the understanding of phenology. We have a broad network of citizen scientists who help gather data and increased interest for expansion to new partners along the Gulf Coast in the future. We will seek to continue this great work in 2018 and beyond and look forward to receiving support for our continued efforts for the long term.

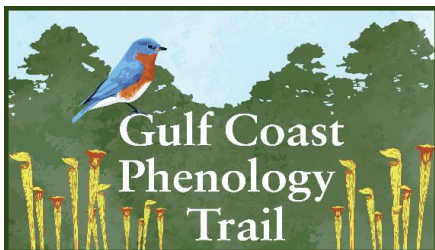
All data is entered online via *Nature's Notebook* and is stored in the USA-NPN National Phenology Database, available for download at [www.usanpn.org/results/data](http://www.usanpn.org/results/data).

## References

Schwartz, Mark D. 2017 Phenology Report for Environmental Sentinel of The 606 in Chicago, IL. University of Wisconsin-Milwaukee, Milwaukee, WI. 17pp.

NOAA. 2018. <https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data>. Accessed 5/23/2018.

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# Appendix 1. Map of Gulf Coast Phenology Trail partner sites, 2017.

