Gulf Coast Phenology Trail 2018 Annual Report

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USA National Phenology Network

U.S. Fish & Wildlife Service — National Wildlife Refuge System

USGS science for a changing world

Yaupon berries @GBishop

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Introduction

The Gulf Coast contains rich and varied ecosystems including pine savannas, forests, shorelines, and open marsh. Despite the importance of the area not much is known about the phenology of southeastern plants. Phenology, or the study of timing of recurring life cycle events in plants and animals and their relationship to the environment, is an indicator of species response to climate change.

The Gulf Coast Phenology Trail (hereafter refered to as the Trail) was established in 2016 as a citizen science-driven, long-term monitoring program with the goal to gain a better understanding of the effects of climate change on plants and animals at partner sites along the northern Gulf Coast from Louisiana to Alabama. Funding to establish the Trail and to monitor plants was provided by the U.S. Fish and Wildlife Service's Inventory and Monitoring Initiative. Support and coordination was provided by the staff at USA National Phenology Network located at the University of Arizona.

The Trail addresses both site-specific and larger-scale questions of interest. To address regional-scale questions, a set of core species, shared by most sites along the Trail, was selected. In addition, each of the ten partner sites selected a list of species to monitor to address local-scale questions of interest. The data collected by observers will be used by researchers and land managers who are interested in understanding the effects of climate change on plants and animals. To achieve educational and outreach objectives, we invited college students, school students, and local citizen scientists to participate in monitoring. Through their participation these groups gained field experience and knowledge of phenology data collection.

Project Description

The Gulf Coast Phenology Trail long-term monitoring program uses the USA National Phenology Network's *Nature's Notebook* as a tool for training, education, outreach, data collection, analysis and reporting.

The 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

Methods and Results

At all partner sites along the Gulf Coast Phenology Trail (GCPT) we followed the protocols outlined by *Nature's Notebook* (www. naturesnotebook.org). We set up partner sites in the *Nature's Notebook* interface for citizen scientists to use to collect phenology data along the trail. Individual training on how to use the *Nature's Notebook* mobile application was provided upon request by the partner site lead or the Gulf Coast Phenology Trail Coordinator. Where paper data collection was preferred, hard copies of data sheets were provided to citizen scientists for data collection. Data sheets were turned in to a designated location on site and the data were entered manually by the site lead as time permitted.

Locations of Gulf Coast Phenology Trail Partner sites active in 2018 are represented on the map below (Fig 1).

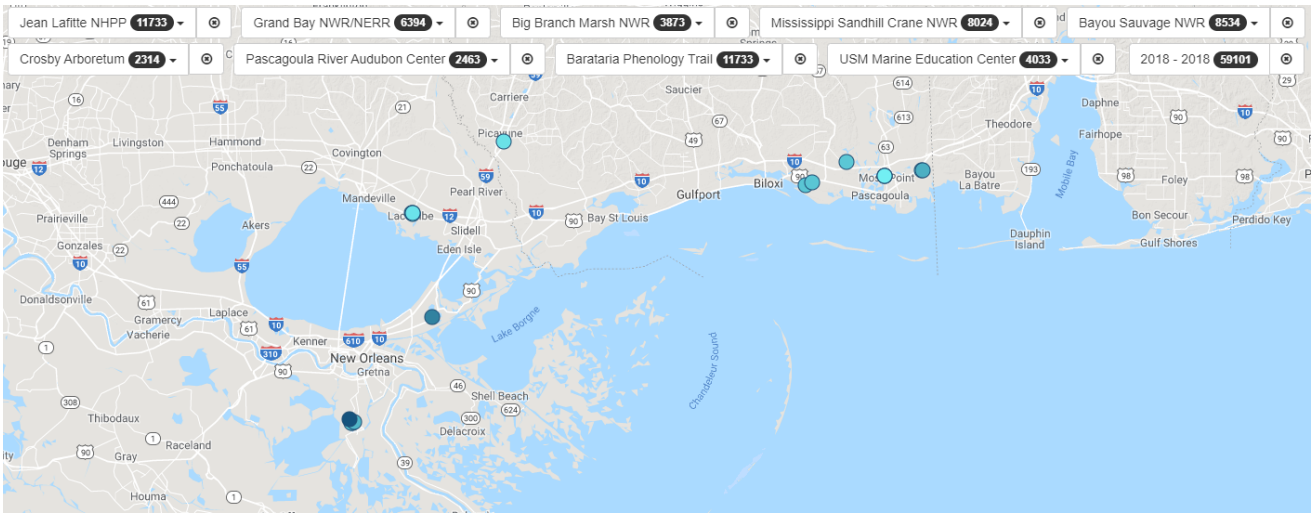

Figure 1. Observation locations monitored by one of the Gulf Coast Phenology Trail partners listed across the top of the map, in 2018. (Note: Mississippi Gulf Coast Community College Gautier, Miss. is a partner but is not located on map.)

Primary Questions

Box 1. 2018 by the Numbers
88,528 Observations
91 Citizen Scientists
10 Partners
20 Sites
51 Total Species Observed
30 Plant Species Observed
21 Animal Species Observed
85,601 Plant Observations
9,937 Animal Observations

We have four primary questions that drive the need for data collection on the Gulf Coast Phenology Trail:

1-1. Does phenology of native Gulf Coast plants change over time under a changing climate?

2018 was our second year of data collection on the Trail. As we collect more years of data, we can start to look at patterns in our data to see whether they reflect the impact of climate change.

In 2018, 91 volunteer observers collected 88,528 observations at 20 sites (Box 1). These observations represented 51 species including 30 plant species and 21 animal species.

We have a number of focal species that we encourage our Trail partners to observe so that we can have enough data to see whether phenology in these species is changing over time. Having focal species also allows us to make comparisons of the same species across Trail locations. Our focal species include red maple (*Acer rubrum*), red bay (*Persia borbonia*), wax myrtle (*Morella cerifera*), and yaupon holly (*Ilex vomitoria*).

Our ability to answer the question of how phenology is changing depends on having observations on the same individual plants over many years. In 2017, seven sites monitored Chinese tallow trees (*Sapium* sebiferum); seven sites monitored red maple (*Acer rubrum*), five sites monitored wax myrtle (*Morella cerifera*); four sites monitored red bay (*Persia borbonia*); and five sites monitored yaupon holly (*Ilex vomitoria*; Table 1). Additional sites were added in 2018: seven sites continued monitoring Chinese tallow; nine sites monitored red maple; seven sites monitored wax myrtle; six sites monitored red bay; and seven sites monitored yaupon holly.

Table 1. Number of individual plants and sites for each focal species in 2017 and 2018.

Plants	Plants in 2017	Sites in 2017	Plants in 2018	Sites in 2018
Chinese tallow	5	7	11	7
Red maple	36	7	29	10
Wax myrtle	29	5	26	8
Red bay	18	4	17	7
Yaupon holly	13	5	22	7

In 2017 the observed Chinese tallow trees flowered starting in mid-March with a peak in May (Fig 2). In 2018, they also started flowering in mid-March but peaked starting in April. Perhaps they bloomed earlier in 2018 because of warmer winter in 2018 than in 2017.

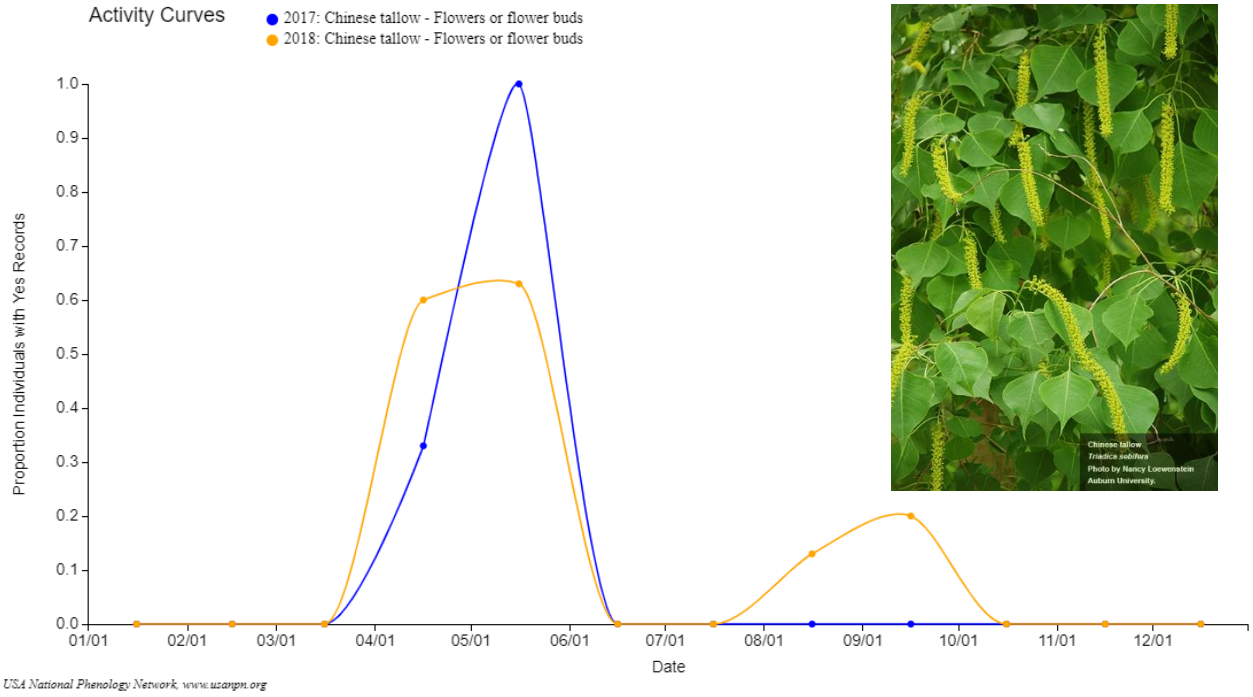

Figure 2. Activity curve showing the proportion of individual Chinese tallow trees with "yes" records reported for flowers or flower buds in 2017 and 2018. Photo of Chinese tallow flowers (Credit: Nancy Loewenstein, Auburn University).

In 2017, red maples already had flowers or flower buds starting in early January. In both 2017 and 2018, the peak in flowering occurred in mid- to late-February. This graph was created using biweekly reports of yes observations for Louisiana sites (Barataria, Big Branch, Bayou Sauvage) and some Mississippi sites (Grand Bay, Pascagoula River Audubon, and Mississippi Sandhill Crane).

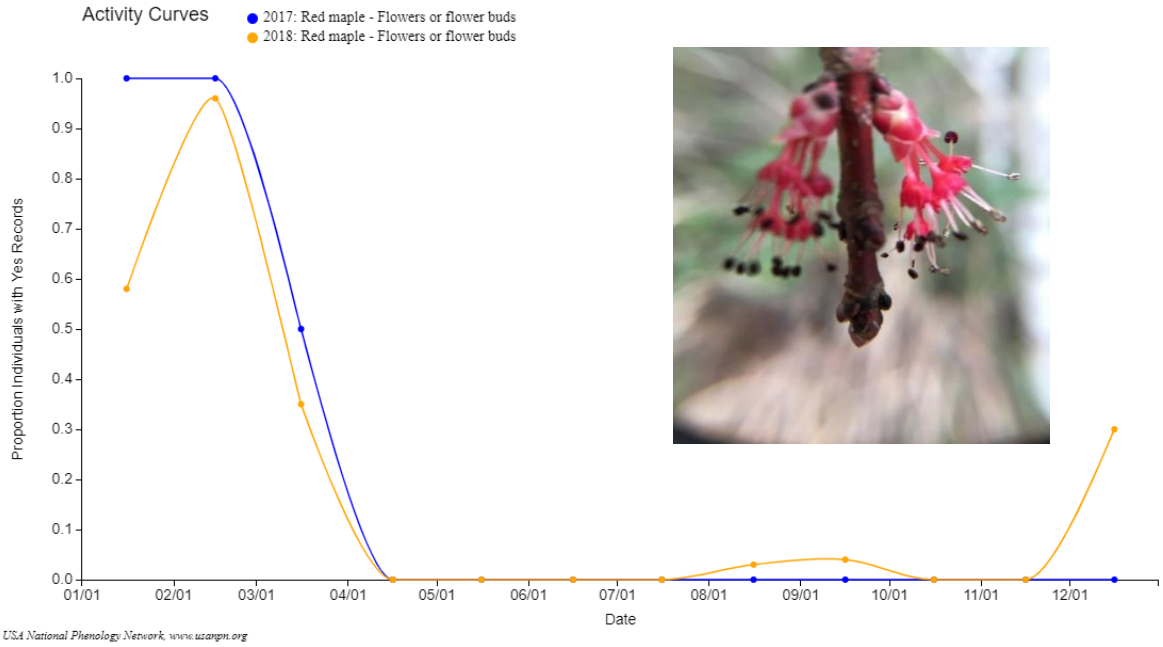

Figure 3. Activity curve showing the proportion of individual red maple trees with "yes" records reported for flowers or flower buds in 2017 and 2018. Photo of red maple flowers by G. Bishop.

In 2018, wax myrtle flowers bloomed at approximately the same time as in 2017 (Fig 4). The proportion of trees with flowers was less in 2018 than in 2017.

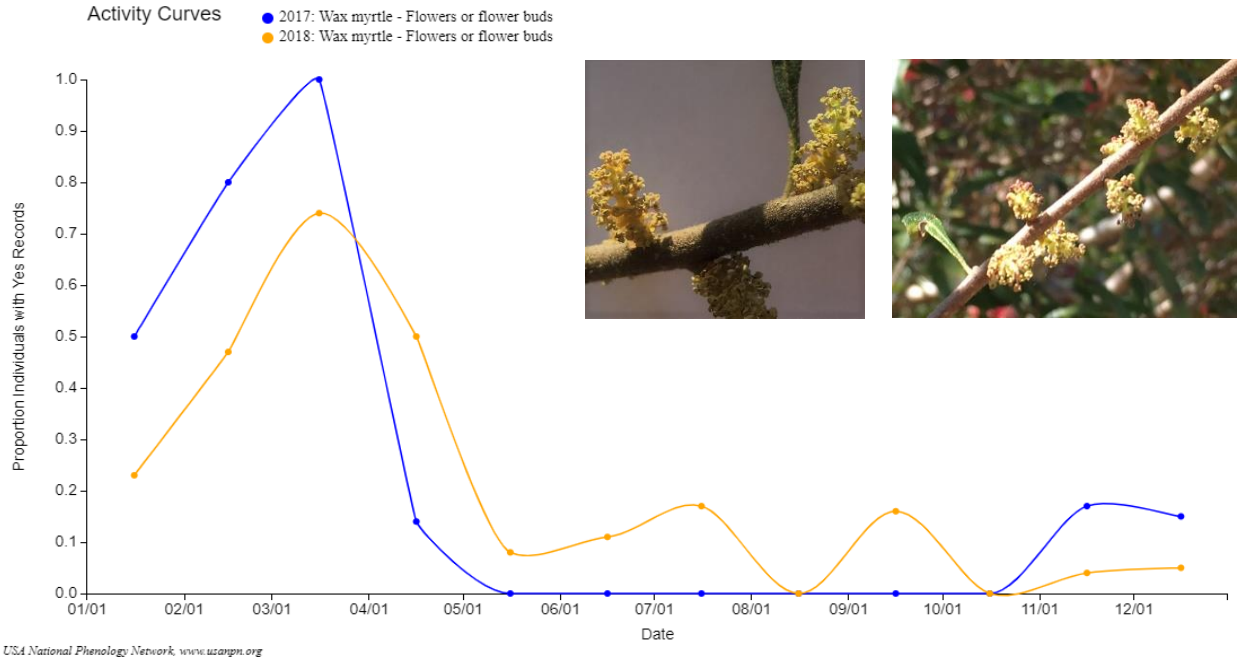

Figure 4. Activity curve showing the proportion of individual wax myrtle with "yes" records reported for flowers or flower buds in 2017 and 2018. Wax myrtle photos of female (left) by G. Bishop and male (right) by S. Wilder.

For redbay, we had our first full year of data collection on this species in 2018 (Fig 5). The start of flowering occurred in mid-February, with the peak in late May.

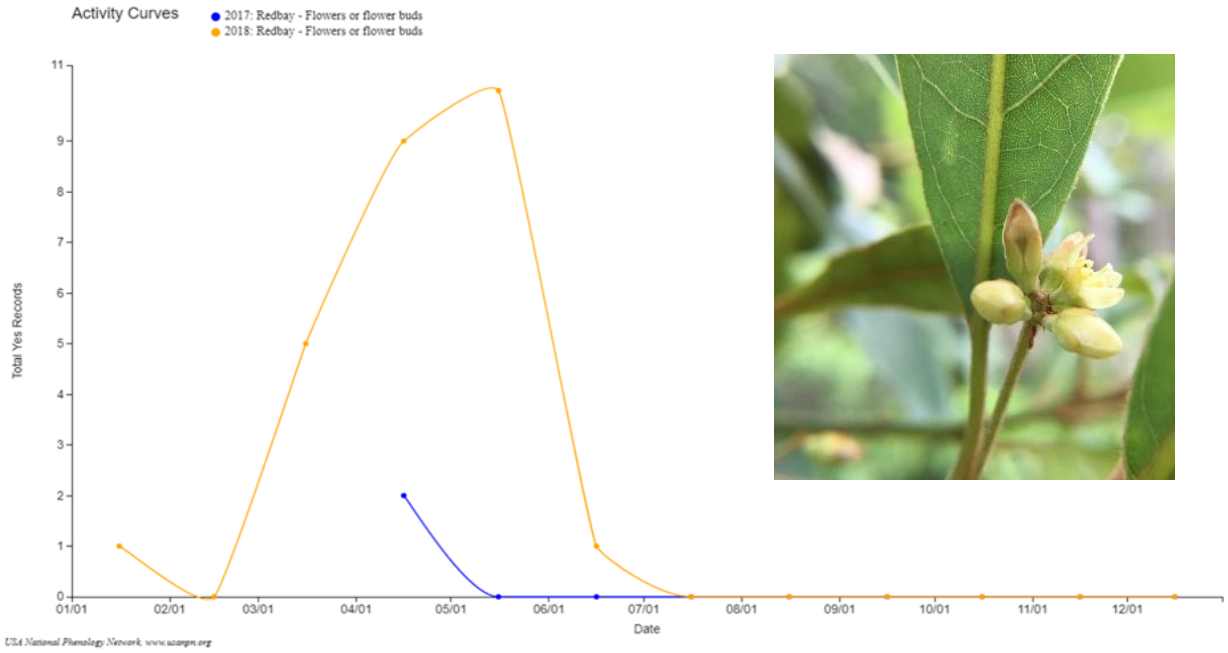

Figure 5. Activity curve showing the proportion of individual red bays trees with "yes" records reported for flowers or flower buds in 2017 and 2018. Red bay flowers by G. Bishop.

For yaupon, we also had our first year of data collection in 2018 (Fig 6). The start of flowering occurred in mid-January, with the peak in mid-March.

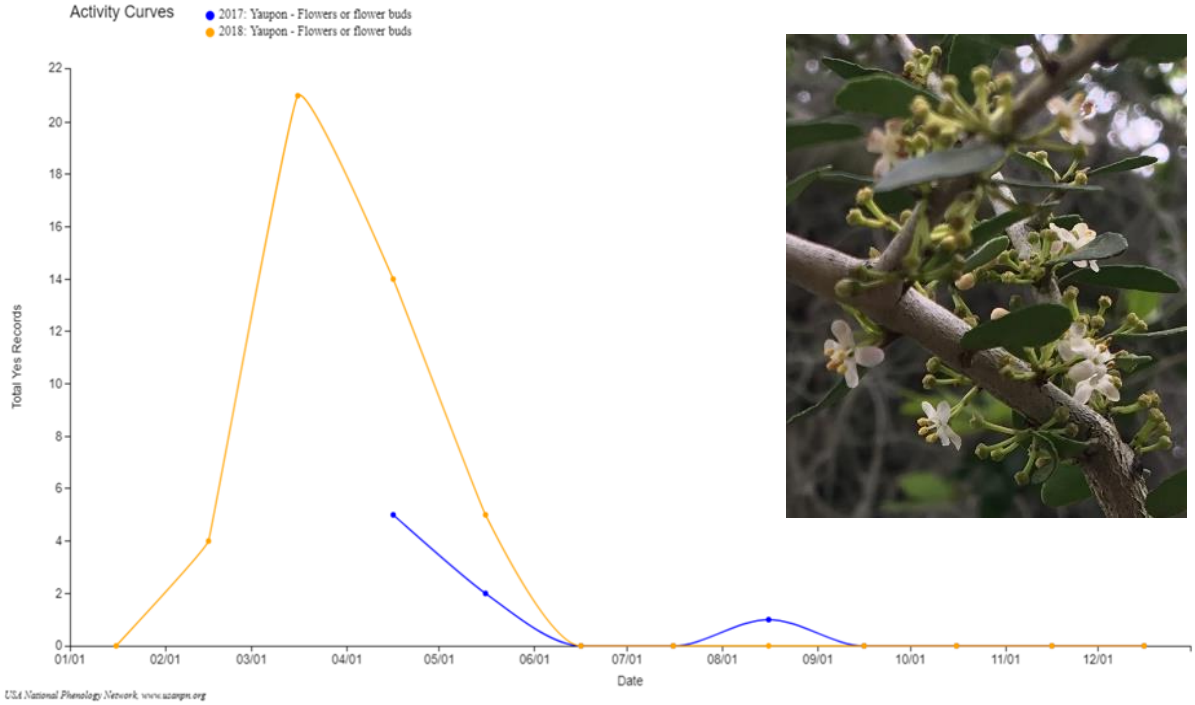

Figure 6. Activity curve showing the proportion of individual yaupon holly trees with "yes" records reported for flowers or flower buds in 2017 and 2018. Photo of yaupon holly flowers by G. Bishop.

1-2. Does phenology of Gulf Coast plants differ between native and non-native plants?

Invasive Chinese Tallow and native red maple had similar timing of breaking leaf buds in 201, though Chinese tallow had a larger second peak in breaking leaf buds in the summer that we did not observe in red maple (Fig 7).

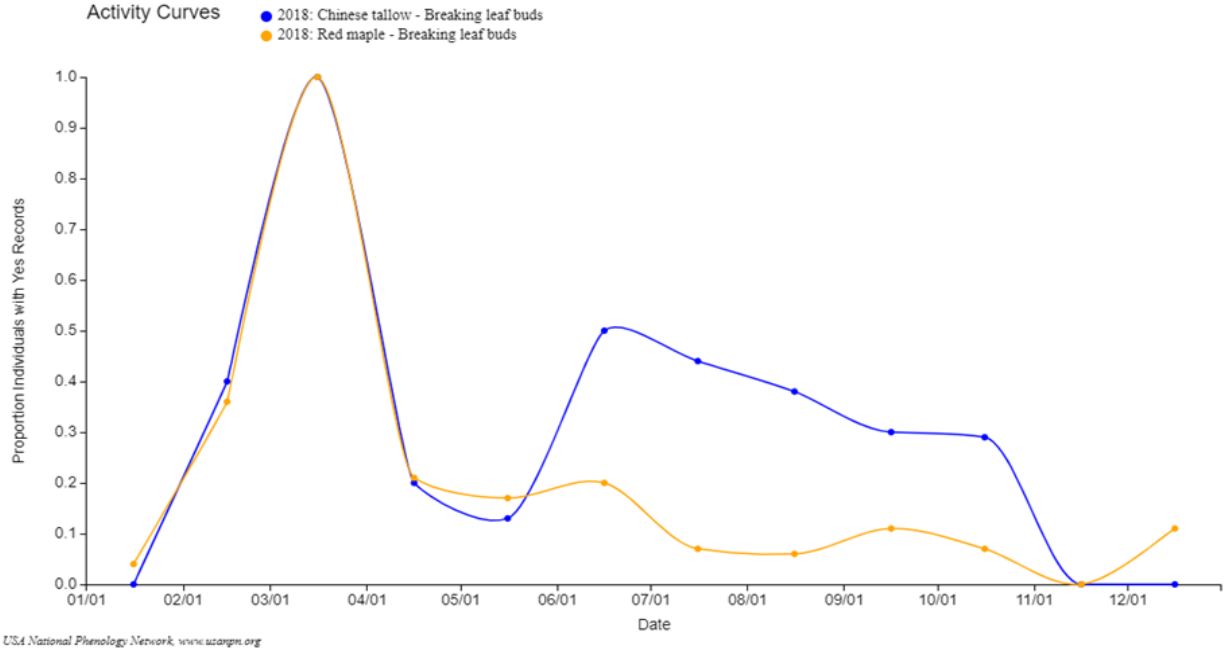

Figure 7. Activity curve showing the proportion of trees with a "yes" reported for breaking leaf buds for Chinese tallow and red maple in 2018.

The timing of flowers or flower buds was different between Chinese tallow and red maple, with the peak in red maple flowering occurring two months earlier than in Chinese tallow (Fig 8).

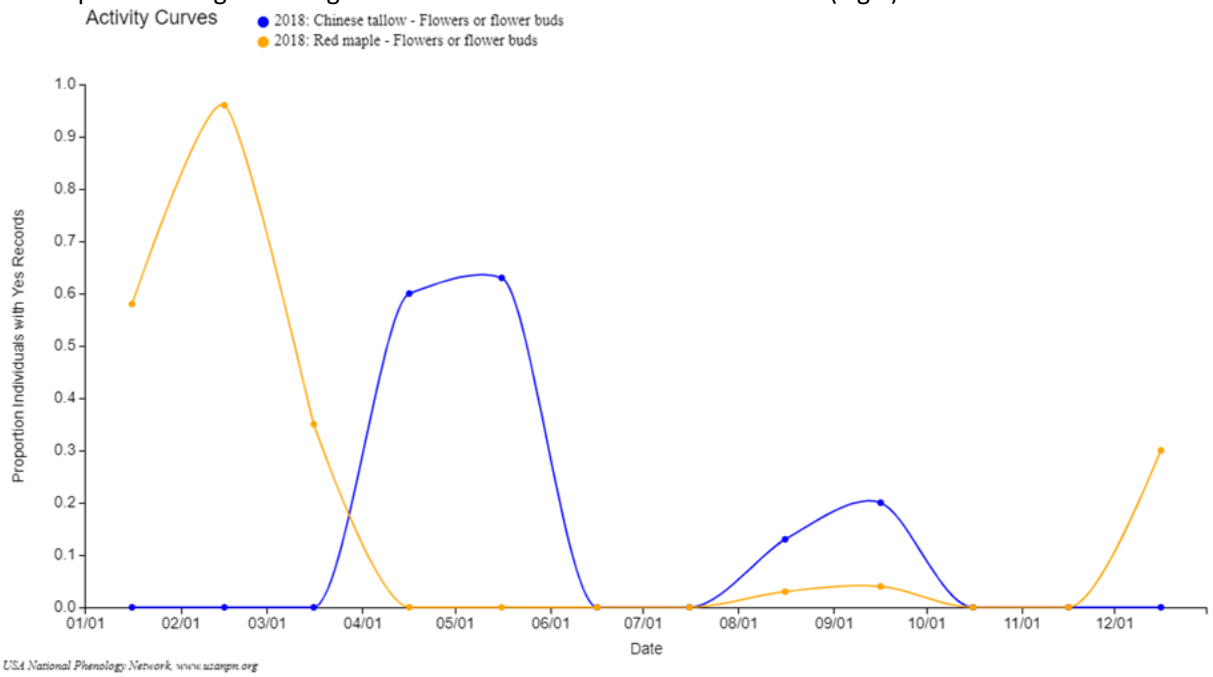

Figure 8. Activity curve showing the proportion of trees with a "yes" reported for flowers or flower buds for Chinese tallow and red maple in 2018.

1-3. Does the phenology of native plant pollinators match native plant phenology over time under a changing climate?

We will need many years of data before we can fully answer this question. In 2018, we recorded the flowering of eastern baccharis (*Baccharis hamlimifolia*) and the activity of monarch butterflies (*Danaus plexippus*) at Bayou Sauvage NWR and the Barataria National Preserve (Fig 9). The fall peak in flowering of eastern baccharis lines up with the activity of monarch butterflies (see photo from Grand Bay NERR/NWR, Fig 10), though we did not record flowers in the summer when monarchs were present. Monarchs may be relying on other nectar sources during the summer season.

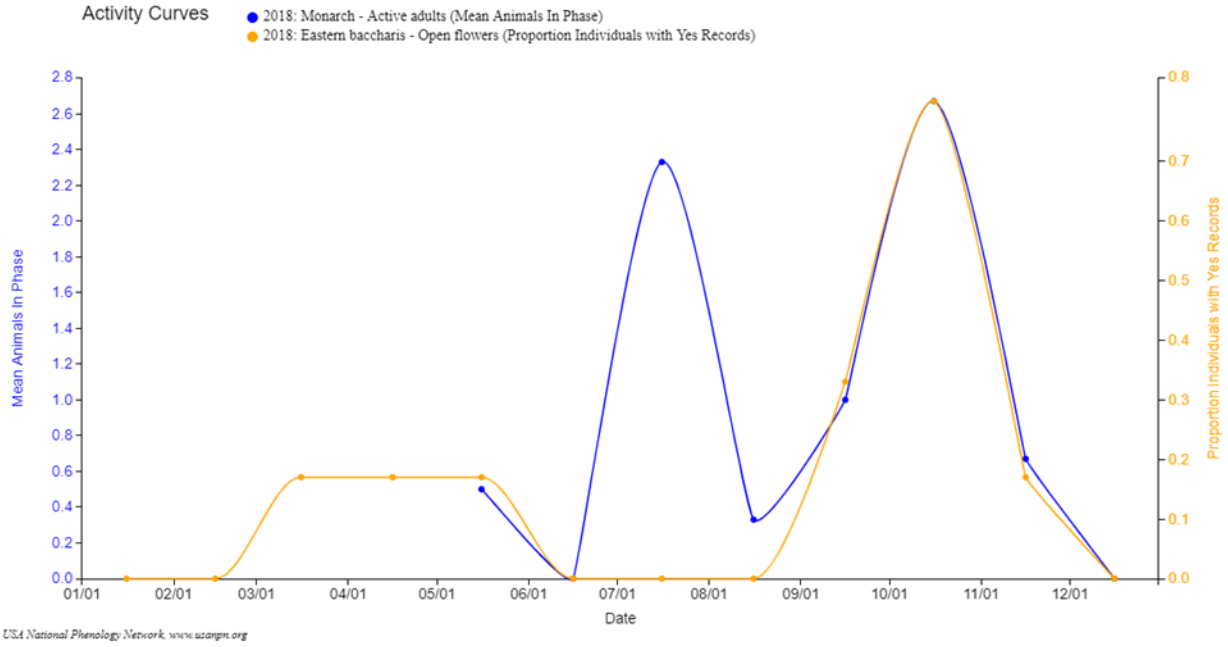

Figure 9. Activity curve showing the occurrence of monarch butterflies and occurrence of open eastern baccharis flowers in 2018.

We regularly report our sightings of monarchs and gulf fritillary butterflies to managers of the National Wildlife Refuges along the Trail. Our reports will inform them about the refuge's role in egg laying and caterpillar development of these important pollinators.

Figure 10. Monarch butterflies on eastern baccharis. Photo by Chris Feurt at Grand Bay NERR on November 3, 2019.

1-4. Is there an East-West gradient in the timing of certain focal species, from Louisiana to Alabama?

Based on observations in 2018, red maples had open flowers a couple weeks earlier in the western sites than in the eastern sites on the Trail (Fig 11). The graph was created using biweekly reports of "yes"observations for Louisiana sites (Barataria, Big Branch, Bayou Sauvage) and some Mississippi sites (Grand Bay, Pascagoula River Audubon, and Mississippi Sandhill Crane). The gradient may have to do with warmer winter temperatures at western locations, as reflected in the weather summary from the New Orleans National Weather Service compared with the Gulfport, Mississippi National Weather Service or Mobile, Alabama Weather Service.

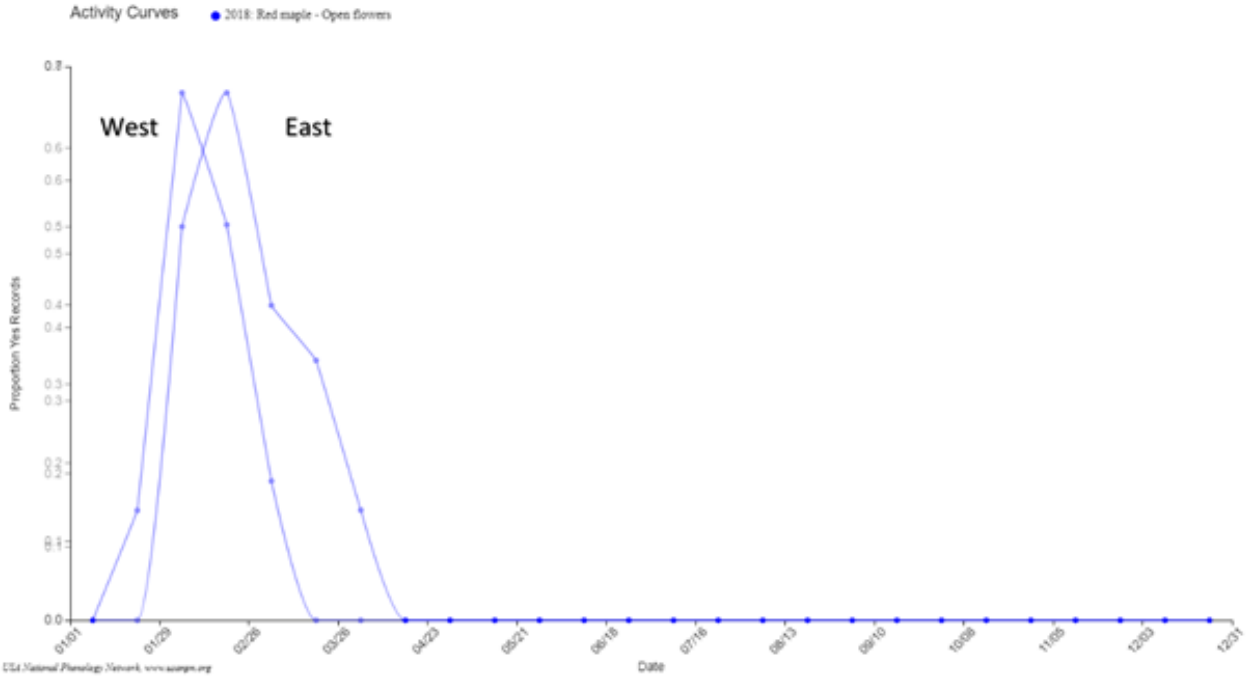

Figure 11. West-East comparison of "yes" records reported for red maple open flowers in 2018.

Secondary Questions

We also have a number of secondary questions that we are also trying to answer. Future years of data collection will allow us to start to answer these questions.

2-1. What is the variation in phenology in similar habitats across the Trail?

Once we have additional years of data collection, we can start to look at individual plants in different parts of the trail that occur in similar habitat. We are interested in the difference between the plants in terms of the start and end of breaking leaf buds, open flowers, etc.

2-2. Does phenology of focal species differ between areas that have been disturbed by fire, storm, etc. and those that have not?

Two of the sites, Grand Bay NERR and Mississippi Sandhill Crane Refuge have managed savannah areas which include prescribed fires and mechanical clearing. Several of the plants at the Grand Bay NERR were impacted by prescribed fires on the northside of the boardwalk that were burned on March 28, 2018 and on April 5, 2018 the southside of the same boardwalk. Primarily red maples were impacted and although a few grew basal sprouts, ultimately two died. At the Mississippi Sandhill Crane Refuge's Visitor Center Trail, mechanical clearing also impacted the selected plants and were cut to the ground. Trying to relocate them after the cutting was difficult, however most were found and re-sprouted from the roots. They were retagged and monitored again. After subsequent years of data collection, we will be able to compare the phenology of these plants before and after disturbance.

2-3. How is the arrival and departure of migrating animals, such as purple martin, shifting in response to a changing climate?

Currently our data is incomplete for answering this question about purple martins. We hope to record more data on this species in subsequent years.

Weather Data Summary

New Orleans, Louisiana

In 2018, ten months out of twelve were warmer in 2018 than the 30-year normal temperature range and seven out of twelve months were wetter than the 30-year normal rainfall average in the Gulfport, Mississippi recording location (Table 2 and 3).

Table 2. Temperature summary table for New Orleans, LA Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOA 2018).

Month	Average Temperature (F)	30yr Normal Temperature (Departure from 30yr Normal) (F). Red indicates warmer than 30Yr Normal.
January	48.8	53.4 (-4.6)
February	68.1	56.7 (+11.4)
March	65.3	62.6 (+2.7)
April	67.0	69.1 (-2.1)
May	80.0	76.1 (+3.9)
June	83.8	81.5 (+2.3)
July	84.9	83.3 (+1.6)
August	83.8	83.3 (0)
September	83.3	79.7 (+3.7)
October	76.7	71.3 (+5.4)
November	60.4	62.7 (-2.3)
December	58.5	55.6 (+2.9)

Table 3. Precipitation summary table for New Orleans, LA Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018).

Month	Total Precipitation (in.)	30yr Total Precipitation (Departure from 30yr Normal) (in.). Red indicates higher than Normal.
January	4.55	5.15 (-0.60)
February	3.09	5.30 (-2.21)
March	3.00	4.55 (-1.55)
April	5.82	4.61 (+1.21)
May	1.72	4.63 (+2.91)
June	6.78	8.01 (-1.23)
July	5.17	5.93 (-0.76)
August	9.88	5.98 (+3.90)
September	3.54	4.97 (-1.43)
October	5.13	3.54 (+1.54)
November	7.58	4.49 (+3.09)
December	5.33	5.24 (+0.09)

Gulfport, Mississippi

In 2018, ten months out of twelve were warmer in 2018 than the 30-year normal temperature range and seven out of twelve months were wetter than the 30-year normal rainfall average in the Gulfport, Mississippi recording location (Table 4 and 5).

Table 4. Temperature summary table for Gulfport, MS Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018).

Month	Average Temperature F	30yr Normal Temperature (Departure from 30yr Normal) (F). Red indicates warmer than 30Yr Normal.
January	47.5	50.8 (-3.3)
February	65.4	53.8 (+11.6)
March	62.3	50.1 (+12.2)
April	65.0	57.4 (+7.6)
May	78.3	74.3 (+4.0)
June	83.4	80.3 (+3.1)
July	84.1	82.4 (+1.7)
August	82.9	82.4 (+0.5)
September	83.0	78.2 (+4.8)
October	75.0	69.2 (+5.8)
November	57.7	60.3 (-2.6)
December	56.0	53.1 (+2.9)

Table 5. Precipitation summary table for Gulfport, MS Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018).

Month	Total Precipitation (in.)	30yr Total Precipitation (Departure from 30yr Normal) (in.). Red indicates higher than Normal
January	3.96	5.19 (-1.23)
February	7.57	5.23 (+2.34)
March	4.56	5.99 (-1.43)
April	6.09	4.56 (+1.53)
May	3.82	5.11 (-1.29)
June	5.20	6.39 (-1.19)
July	10.85	7.21 (+3.64)
August	9.25	6.28 (+2.97)
September	7.94	5.63 (+2.31)
October	2.15	3.55 (-1.40)
November	6.70	4.64 (+2.06)
December	7.19	4.90 (+2.29)

Mobile, Alabama

Nine months out of twelve were warmer in Mobile than the 30-year normal. In addition six months out of twelve had greater percepitation rates in 2018 than the average 30-year perceptition rate (Table 6 and 7).

Table 6. Temperature summary table for Mobile, AL Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018).

Month	Average Temperature (F)	30yr Normal Temperature (Departure from 30yr Normal) (F). Red indicates warmer than 30Yr Normal.
January	46.6	50.4 (-3.8)
February	65.1	53.8 (+11.3)
March	61.4	60.2 (+1.2)
April	64.3	66.4 (-2.1)
May	77.3	74.1 (+3.2)
June	81.8	79.8 (+2.0)
July	83.1	81.8 (+1.3)
August	81.8	81.6 (+0.2)
September	82.2	77.5 (+4.7)
October	73.6	68.4 (+5.2)
November	57.0	59.6 (-2.6)
December	55.4	52.4 (+3.0)

Table 7. Precipitation summary table for Mobile, AL Weather Station in 2018. Departure from 30-year normal is based on years 1981-2010 (NOAA 2018).

Month	Total Precipitation (in.)	30yr Total Precipitation (Departure from 30yr Normal) (in.). Red indicates higher than Normal
January	3.56	5.65 (-2.09)
February	6.02	5.12 (+0.9)
March	3.71	6.14 (-2.43)
April	3.07	4.79 (-1.72)
May	5.87	5.14 (+0.73)
June	7.10	6.11 (+0.99)
July	6.96	7.25 (-0.29)
August	4.20	6.96 (-2.76)
September	5.24	5.11 (+0.13)
October	1.98	3.69 (-1.71)
November	6.29	5.13 (+1.16)
December	9.45	5.06 (+4.39)

Education and Outreach

To support the data collection on these species, we facilitated a number of workshops to recruit and train new participants. A February workshop was held at the Crosby Arboretum in Picayune, Mississippi for 24 people; the second one was held at the Southeast Louisiana National Wildlife Refuge Complex in LaCombe, Louisiana for 15 volunteers. Two teacher workshops, hosted by the Long Beach Campus of University of Southern Mississippi, were held offsite at the Crosby Arboretum for 40 teachers.

Students at the Gulf Coast Community College in Gautier, Mississippi were recruited under the direction of Dr. Christy Philopoff. Her college student accepted the challenge to observe and, in the process, became intrigued with the ambrosia beetle's impact on red bays. The honors classroom of 8th grade science students at Ocean Springs Middle School received classroom and field instructions. Retired high school and college teachers helped with student groups during weekly spring observations at the Fountainebleu Trail located in the satellite unit of the Mississippi Sandhill Crane Refuge. One student recounted later that being outdoors for the Nature's Notebook observations was the best activity of the school year.

Adults were recruited for a new site, the Marine Education Center in Ocean Springs and for existing sites including the Barataria Unit at Jean Lafitte National Park and Preserve in Louisiana, and the Mississippi Sandhill Crane National Wildlife Refuge. Two interns at the Grand Bay NERR were assigned to make observations and one was hired permanently in the fall and continued to make observations. Attrition occurred at the Pascagoula River Audubon Center and the Crosby Arboretum, but observations were made by the coordinator or the science advisor when possible. Contact with the Gulf Islands National Seashore was made to establish a trail site in the Davis Bayou Unit in Ocean Springs but because of lack of seashore staff it was decided by the supervisor not to participate.

Refuge Dashboard for the Mississippi Sandhill Crane Refuge was updated. GCPT Facebook pages were updated as well as the webpage. Eight observers participated in a late May boat trip into Grand Bay Estuary that was sponsored by the staff at the Grand Bay NEER. An August get-together for volunteers was held at the Barataria Unit to mingle, to discuss observations, and to ask questions. Photo guides for wax myrtle, yaupon holly, and red bay were drafted for observers. A color brochure on the Gulf Coast Phenology Trail was written and printed with funds from the Trail.

Lessons Learned

1. The addition of more sites, plants, and or animals provides more data and richness of species. However, producing analysis based on individual species is time consuming for an annual Gulf Coast Phenology Report. We suggest that the partner sites produce specific reports based on species that are not part of the Trail's annual report.
2. Workshops and/or field trips for current volunteer observers provide opportunities to network and ask individual questions concerning phenophases, for example.
3. Selected species for observation that are in savannah sites, managed with prescribed fires and/or mechanical clearing or brushing, are impacted. Tags and flagging are chopped or destroyed making finding the plants difficult for future observations. Most plants do experience basal sprouting and can be observed again. Accurate GPS coordinates can assist the observer when trying to relocate the plants.

4. Ideally, making observations early in the morning will make it easier for observers to view animal activity.
5. Retaining volunteers is an issue regardless of the volunteer activity. Making the volunteer activity relevant to individuals is one key. Explaining the natural health benefits of being outdoors definitely one example.
6. We have observed a monarch butterfly-eastern baccharis mismatch in the past two years of observations and this information has led to additional questions about other species that migrate and are dependent on specific plants for nourishment.

Summary and Next Steps

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 beginning in 2017
- 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.

We will continue to strive to meet our long-term goals and make needed adjustments when necessary. We realize that annual reports are based on observations made by citizen scientists and not based on laboratory conditions. Using the Nature's Notebook protocol provides standards that are used evaluate the reactions of species to changing climatic conditions.

Location of Project Components

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. Project documentation and resources for plant and animal identification are available at. Additionally, Trail fliers for public distribution, NPN Botany Primers, Trail supplies, and displays are housed locally at the coordinator's office.

Appendix A. Partner and Observation Sites. Includes locations, number of site records and number of observers in 2018.

Partner	Site_ID	Site_Name	State	Latitude	Longitude	# Records	# Observers
Grand Bay NERR/NWR	25081	Boardwalk 1	MS	30.42939	-88.4286	11104	6
Grand Bay NERR/NWR	25174	Front Lawn	MS	30.4291	-88.4306	1684	4
Mississippi Sandhill Crane NWR	26079	Visitor Center	MS	30.45158	-88.6555	6972	3
Mississippi Sandhill Crane NWR	28590	Fontainbleau Unit Nature Trail	MS	30.39778	-88.7572	7542	6
Pascagoula River Audubon Center (PRAC)	28353	PRAC-Boat Launch Trail	MS	30.41477	-88.5425	1361	4
Pascagoula River Audubon Center	28354	PRAC-Trail 2	MS	30.41479	-88.5426	584	4
Pascagoula River Audubon Center	28357	PRAC Front Lawn	MS	30.41472	-88.5418	498	4
Mississippi Gulf Coast Community College -Gautier	39287	Pine Forest Trail	MS	30.400648	-88.64506	2927	7
Big Branch Marsh NWR	25151	Main Parking Lot	LA	30.32165	-89.9369	3754	3
Big Branch Marsh NWR	25168	Entrance Road	LA	30.32005	-89.936	988	3
Big Branch Marsh NWR	25506	Azalea Trail	LA	30.31894	-89.9377	1104	4
Big Branch Marsh NWR	30648	Bog Trail	LA	30.3217	-89.9382	454	1
Bayou Sauvage NWR	25901	Boardwalk	LA	30.05377	-89.8805	14246	3
Jean LaFitte NHP&P Barataria Preserve	27474	Visitor Center Trail	LA	29.78447	-90.1148	2748	7
Jean LaFitte NHP&P Barataria Preserve	27475	Palmetto Trail	LA	29.78381	-90.1176	4046	4
Jean LaFitte NHP&P Barataria Preserve	27476	Ring Levee Trail	LA	29.78527	-90.1102	4440	5
Jean LaFitte NHP&P Barataria Preserve	27477	Bayou Coquille Trail	LA	29.79382	-90.1225	11294	9
Crosby Arboretum	28830	Phenology Journey	MS	30.50215	-89.6668	4420	6
Jean LaFitte NHP&P Wetlands Acadian Cultural Center	28969	Bayou Lafourche Phenology Trail	LA	29.79622	-90.825	1848	4
USM Marine Research Center	30971	Osprey Point Nature Trail	MS	30.39134	-88.776	6514	4
	TOTALS					88,528	91

Appendix B. 2018 Plant and Animal Inventory.

BARP- Barataria Preserve (Jean LaFitte NPP)
BYL- Bayou Lafourche
BS-Bayou Savage NWR
BBM Big Branch Marsh NWR
CR-Crosby Arboretum
GB-Grand Bay NEER and NWR
MSC Mississippi Sandhill Crane NWR
PRAC-Pascagoula River Audubon Center
USM-University of Southern Mississippi Marine Education Center
EC -Mississippi Gulf Coast Community College Estuarine Center

Plant Species	BARP	BYL	BS	BBM	CR	EC	GB	MSC	PRAC	USM	Total Obs
American beautyberry	330			300				80	80	992	1702
American elm			1100								1100
American sycamore		130									130
bald cypress	1364	238	1182								2785
black cherry				300							300
black willow		142	1604								1746
boxelder	1452										1452
Chinese tallow	568	58	1056	180		700	1572	220		220	4354
common buttonbush	944										944
common hackberry			1052								1052
eastern baccharis	1416		1796								3212
eastern poison ivy	1342										1342
flowering dogwood								356		356	356
honeylocust	368										368
live oak	1436	286	1412								3134
longleaf pine					256			810		810	1066
possumhaw	1510										1510
red buckeye									498		498
red maple	1914	272	2860	3754	1452	569	3170	2212	347	1616	18166
redbay				336	822	724	1534	1636	237	1402	6691
sassafras		136									136
Siberian elm		120									120
southern magnolia				688							688
sugarberry	544	248									792
sweetbay								578			578
sweetgum	1936		976								2912
trumpet creeper	1658	120									1778
water tupelo	910										910
wax myrtle	920			348	1054	451	2110	2566	462	1078	8989
white crownbeard	280										280
yaupon		98		334	776	483	2070	2334	459	1426	7980
Total	18892	1848	13038	6240	4360	2927	10456	10792	2003	6514	77070

ANIMALS											
Species	BARP	BYL	BS	BBM	Cr	EC	GB	MSC	PRAC	USM	Total Obs
American robin			420				384	678			1482
bald eagle	338						286				624
barred owl	392										392
blue jay								520			520
Carolina wren	572										572
chimney swift									65		65
eastern bluebird							412		80		492
fox squirrel							120				120
gulf fritillary			40								40
hooded warbler	392										392
monarch			300	60	60						420
northern cardinal								464			464
northern mockingbird								704			704
northern parula	510										510
osprey							672	442			1114
painted bunting	416										416
prothonotary warbler	506										506
purple martin							458		56		514
red-bellied woodpecker	510										510
ruby-crowned kinglet									80		80
TOTALS	3,636	0	760	60	60	0	2,332	2,808	281		9,937