ST. EDWARD'S UNIVERSITY

Wild Basin Creative Research Center



Wild Basin Wilderness Preserve
2021 Annual Report

(October 1, 2020 – September 30, 2021)

Submitted by

Wild Basin Creative Research Center and St. Edward's University

to

Travis County Commissioners Court
and Transportation and Natural Resources

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Overview of Preserve Management and Operations

Wild Basin Wilderness Preserve is jointly owned and managed by St. Edward's University and Travis County (Appendix A). Wild Basin's mission is to protect and maintain its urban wilderness, and to promote the importance of environmental education, research, conservation and preservation.

Situated at the edge of the Texas Hill Country and surrounded by commercial and residential growth in west Austin (see Appendix B), Wild Basin is a unique conservation property for Travis County and the larger Balcones Canyonlands Preserve (BCP) system. As an urban and publicly accessible preserve, Wild Basin provides authentic environmental education and recreation experiences for the community. The preserve's location near a major urban area also brings challenges in the form of invasive species, water pollution, noise pollution, and litter. Wild Basin strives to incorporate these challenges into learning opportunities about our urban environments for students and the public.

Since its merger with St. Edward's University in 2009, Wild Basin remains an important resource to the local community and continues to build on its rich history of promoting conservation, research, and environmental awareness. Wild Basin aspires to become a model for urban preserves, a hub for stewardship, creative research, and environmental education, and a gateway to the BCP.

In addition to helping implement preserve management, St. Edward's University operates the Wild Basin Creative Research Center based at the preserve, which houses a Visitor Center with environmental exhibits, staff offices, an Artist in Residence space, a classroom, a lab, and meeting spaces. The Research Center is a key resource for educating university level as well as K-12 students and provides a platform for public outreach and engagement.

Wild Basin's education, art, research, and preserve management programs are designed to promote conservation and environmental awareness, while encouraging and demonstrating land stewardship practices. During the reporting period Wild Basin coordinated student internships and research activities, hosted undergraduate and graduate classes, maintained public trails, managed invasive species, performed restoration work, monitored and reported on water quality, hosted public and inter-agency meetings, workshops, and trainings, and hosted an Artist in Residence Program. During the FY21 period, the preserve was closed between October 1 – 17,

2020 and between December 9, 2020 and March 24, 2021, due to the Covid pandemic and to accommodate construction work on the Creative Research Center building, respectively (123 days closed in FY21). Several on-site activities were limited, cancelled or modified during this period due to the closure and Covid-19 protocols.

Wild Basin Vision

The vision of Wild Basin is to inspire conservation by connecting communities to a dynamic urban preserve. Together with our partners, we focus on the following goals for Wild Basin:

- Managing and restoring a mosaic of habitats indigenous to Wild Basin, including oak-juniper woodlands, riparian corridors, semi-open grasslands and cedar breaks;
- Protecting native biodiversity;
- Protecting habitat for the federally endangered Golden-cheeked warbler;
- Protecting habitats to support threatened and rare plant and animal species;
- Controlling non-native and invasive species;
- Protecting soil profiles and unique geologic features;
- Monitoring water quality relative to watershed inputs, runoff, and erosion;
- Protecting prehistoric and historic cultural sites;
- Managing a trail system that presents the regional flora and fauna, while minimizing impacts to the preserve's biotic community and inherent beauty; and
- Providing stewardship opportunities, research opportunities, and educational resources for students and the community.

Trail Maintenance, Restoration, and Construction

There are 2.5 miles of trails within Wild Basin that the preserve staff monitored, maintained, and improved throughout the year with assistance from trained stewardship interns and volunteers.

Trail Maintenance and Monitoring Activities:

- Weekly patrols of the trail system were conducted by staff and volunteers to monitor trail conditions and identify potential hazards that need attention. These patrols are documented in the land management quarterly reports submitted to Travis County.
- Weekly staff-led stewardship workdays with 1-5 trained volunteers took place on Thursdays and Saturdays to address safety hazards, erosion issues, brush

trimming along the trails, tread repair, removal of invasive non-natives, and minor restoration and construction projects. Work days were subject to cancellation due to weather, preserve closures, or other operational considerations.

- Throughout the trail system, erosion controls (water bars and berms) were cleaned out as needed and made ready for the next rains. Material was returned to the trails where appropriate.
- Arroyo Vista Trail continues to hold up well, even after some heavy rains at various times during the year. Several low berms were reworked on this trail to enhance the capacity to shed water off trail.
- During the second quarter (Jan-Mar) while the preserve was closed to the public, the Preserve experienced two winter storms, one of which was extraordinarily severe ("Uri") with several full days of below freezing temperatures, snow, and ice. These storms resulted in a lot of downed branches, rendering sections of the trails impassable until staff and volunteers were able to clear the storm debris off the trails. The extended hard freeze by Uri resulted in significant die-back in some trees, causing more branches to drop onto the trails over time as the branches/trees weakened. Staff and trail patrol volunteers were able to stay on top of all the clearing needed.
- Wild Basin visitation numbers are logged by two trail counters on Arroyo Vista Trail, one at each trailhead, as well as by manual counts from Wild Basin Security staff. The total estimated hiker count for this fiscal year was 8,906.
- For periods of time when the preserve was open during the first two quarters, directional signs directed visitors to use trails in a one-way fashion as a Covid-19 safe-distancing precaution. The signs were removed when the preserve fully reopened in the third quarter.

Trail Restoration and Construction Activities:

- Social trails off Arroyo Vista, Triknee, and the Overlook continue to self-restore due to absence of visitors during preserve closures and, once reopened, reduced access/hours with the new weekend and holiday reservation system. Thanks to reduced visitation, those that are hiking the trails experience less congestion on the trails and are therefore less likely to feel the need to step off-trail in order to enjoy nature without a crowd. Wild Basin staff and trail patrol volunteers continued to monitor the social trail recovery and disappearance, and reinforced existing barriers/signs to discourage off-trail activity.
- Restoration with locally native plants continued for the sensory garden along the south side of the Creative Research Center.

- Two of the old wooden trash/recycle container enclosures at the trailheads were dismantled and replaced with new critter-proof, metal, locking enclosures with much smaller footprints.
- The ELOO restroom construction project in the parking lot and near the two trailheads was initiated mid-January 2020 and then stopped by Travis County Natural Resources on January 27, 2020 due to permitting issues with the County. After Wild Basin/SEU hired an environmental engineer to help navigate the permitting process, and after multiple rounds of resubmitting the permit application and supplying Travis County permitting staff with additional requested information, the ELOO project continued to be on hold for the entirety of this fiscal year.
- During the first quarter (Oct-Dec 2020), repairs to the deck, ramp and exterior of the building were initiated, and the work was essentially completed by the end of the second quarter (Jan-Mar 2021). The building was unoccupied, most of the staff worked remotely the majority of the time, and the preserve was closed during this time (early Dec to late March) for visitor safety reasons. The Security Officer continued to be onsite full time to keep an eye on the preserve and ensure no unauthorized entry, and the Preserve Manager was onsite regularly to lend support to security, patrol the trails and attend to maintenance as needed.

Boundary Management

Every year, Wild Basin staff monitor the preserve's entire perimeter at least twice. The entire perimeter was patrolled three times this fiscal year, with more frequent visits to certain sections of concern.

Boundary Management Activities:

- Section A (northern boundary shared with City of Austin's Vireo Preserve) was found to be secure in each of the quarterly surveys conducted on this section.
- Section B (southeastern boundary including back gate, in-holding, and several neighboring properties):
    - Absence of adequate sediment controls on Wild Basin Ledge was a chronic problem this FY, with multiple reports to and responses by Travis County inspectors. Primary source of sediment was a new residence construction site with two steep and unstable caliche driveways. Downstream neighbors also noticed and documented increasing sediment in Bee Creek as a result of this construction site. At our suggestion, and in the last FY quarter, the owner contracted with Environmental Survey Consulting to stabilize and revegetate the denuded and eroding areas on either side of the two driveways. This

situation is much improved by their site work, though the driveways themselves are not entirely hardened yet.
    - Invasive non-native plant species found along this boundary section were thick with mostly Ligustrum, Nandina and a large Chinaberry. Travis County BCP staff and an American YouthWorks crew cut or girdled and treated a considerable amount of these non-natives.
    - Some evidence of feral hog activity (scat and light rooting) has been observed in various locations in this area, including on the City's Vireo Preserve. Wild Basin put a trap and wildlife camera out to monitor activity. After weeks of no signs of hogs, the trap was removed.
    - Several erosion issues across the boundary, including a broken Travis County pipe, were noted and mostly resolved. Monitoring continues.
- Section C (eastern portion of south-central boundary):
    - The fence is sagging in a few places along the shaded fuel break areas, possibly due to trespass but no other signs of trespass noted.
    - There are signs of possible new development with land clearing and survey tape. We'll monitor this section for changes over time.
- Section D (western half of the southern boundary):
    - Several neighbor activities at the fence line include "No Trespassing" and "Security Camera" signs added by neighbor, a fort built that abuts the fence, a new home construction with silt fence installed. No concern for impacts to the Preserve at this time, except a small pile of brush thrown onto the Preserve.
    - Other neighbor incidents in the third FY quarter, involved the cutting of trees on the Preserve and causing significant damage to trees and fencing. Travis County issued cease-and-desist letters to the neighbors and asked for reimbursement costs for damages.
    - A camera was placed near the boundary across from the back of the Sweeney residence to document any further trespass or tree cutting issues.
    - In the fourth FY quarter, a couple seeps coming from neighboring properties have had algae and bad odors, along with some trash. Details were provided in the July-Sept quarterly report.
    - At the southwestern portion of this boundary section, there's a large pocket of invasive non-natives, mainly Ligustrum and Nandina.
    - Red oak die-off seems to be increasing along this boundary, as reported with the first quarterly report.

- Section E (along Loop 360):
  - Staff and volunteers picked up trash in the eastern right-of-way of Loop 360 on multiple occasions to prevent it from traveling into the Preserve and Bee Creek.
  - Invasive non-natives removed by Travis County BCP staff and AYW. Austin Energy performed tree maintenance along this boundary but left tallow trees that then needed to be girdled/treated.
  - Due to signage Wild Basin and TXDOT installed along Loop 360, Christmas decorating of junipers and vendor issues were essentially non-existent this FY.
- The February deep freeze weakened many trees in Sections B, C, and D that have fallen onto the fences over a period of months. This was reported to Travis County BCP with a request for chainsaw support to clear the fences.
- "No Trespassing" signs were secured to the fences by Wild Basin staff in Sections C and D. In fenceless Section E, care was taken to post the signs out of view from Loop 360.
- Wild Basin Preserve has intermittent fencing or no fencing (Section E) along the boundary which leaves the Preserve vulnerable to trespass. In addition, there are some stretches of fence that are deteriorating and could use brush management, especially in Sections B and C.

Vegetation Management

Vegetation Management Activities:

- Vegetation Mapping. Wild Basin staff, volunteers, and researchers use the citizen science platform iNaturalist to map the distribution of plants within the Preserve. The smartphone app allows users to document locations, photos, and relevant notes about plant occurrences onsite. Currently, we have two projects established in iNaturalist: one project for the public to report their observations along the trails (Wild Basin Biodiversity Project), and a second project for staff, researchers, and trained volunteers to report observations of rare plants and invasive species in off-trail locations (WBCRCMappingProject). In the case of rare or endangered species, all coordinated are obscured from the public so as to not encourage iNaturalist users to venture off trail. The Wild Basin Biodiversity Project currently has 1291 Research Grade observations of 435 unique species (5 new species, 3 new plant species) made by 70 observers. Significantly 393 different iNaturalist members have contributed identifications to these observations.

- Rare Plant Species. All rare plant locations are documented in the iNaturalist WBCRCMappingProject or, if done through Coordinates, are obscured from the

public when sightings are off-trail. A report from volunteer Master Naturalists monitoring rare plant species in Wild Basin can be found in the scientific research section (Project 12) of this report and in Appendix E. The following rare plant species are on our monitoring list:

Primary Species of Interest

- naked broom-rape *(Orobanche uniflora)*
- shooting-star *(Primula meadia)*
- Texas madrone *(Arbutus xalapensis)*

Secondary Species of Interest

- canyon mock-orange *(Philadelphus ernestii)*

Tertiary Species of Interest

- glass mountain coral-root *(Hexalectris nitida)*
- crested coral-root *(Hexalectris spicata)*
- Heller's marbleseed *(Onosmodium helleri)*
- Buckley tridens *(Tridens buckleyanus)*
- Louisiana broom-rape *(Aphyllon ludovicianum, Orobanche ludoviciana)*
- ladies tresses *(Spiranthes magnicamporum)*
- sticky liatris *(Liatris glandulosa)*
- Virginia snakeroot *(Endodeca serpentaria)*

- Invasive Species Management.
  - Preserve and Travis County TNR staff, student interns, volunteers, and American YouthWorks (AYW, contracted by Travis County) continued to map, monitor for and remove invasive non-native species, such as Japanese honeysuckle *(Lonicera japonica)*, Japanese privet *(Ligustrum japonicum)*, Chinese privet *(Ligustrum sinense)*, nandina *(Nandina domestica)*, Johnson grass *(Sorghum halapense)* and giant cane *(Arundo donax)*, among others.
  - Invasive species control measures at Wild Basin involve manual removal of plants by hand pulling or use of a weed wrench. In addition, in collaboration with Travis County TNR staff, we use either a "cut and paint" method or "girdle and treat" method with Garlon 3A herbicide. These treatments are used on plants too large to be removed manually. Chemical treatments are performed under supervision of Julie Murray, Travis County BCP Natural Resource Specialist, a licensed applicator through Texas Department of Agriculture.

- Invasive species are primarily mapped and monitored using the GIS "Collector" app in cooperation with Travis County TNR.
- During this fiscal year, Wild Basin staff, interns and volunteers, and Travis County staff and contracted crew (AYW) removed 13,973 stems of invasive plants. The previous year, the combined effort resulted in removal of 5,650 stem (see Appendix C).
- As in the previous year, the Covid-19 pandemic impacted intern and volunteer availability and readiness to join invasive species removals this year. The three-and-a-half-month construction closure December-March also saw little attention to invasive removal by staff due to other pressing tasks related to construction oversight and post winter storm cleanups.

- Fuel reduction. Travis County TNR coordinated with the City of Westlake Hills to cut fuel breaks along the southern border of Wild Basin in areas adjacent to residential areas. In FY2017 and FY 2018, a total of 2.2 acres were treated. No treatments were needed in these areas during FY2019, FY2020, or FY2021. Firewise guidelines of clearing debris and trimming back branches and woody brush continue to be followed in the area immediately surrounding the visitor center.

Wildlife Management

- Golden-cheeked Warbler. A total of 44 surveys were conducted at Wild Basin and Vireo Preserve between 10 March and 8 June by Darrell Hutchinson, Lisa O'Donnell, and Jim O'Donnell for a total of 152.5 survey hours.
  Between the two preserves, ten separate males were detected during the breeding season. Seven males paired (including one probable but unconfirmed), and three nesting pairs reproduced successfully. Two of the three successful nesting pairs attempted to double brood and one succeeded for a plot total of four broods. Compared to recent years, plot density was considerably higher with increased density found on the upper Vireo Preserve. For a full report see Appendix D.

- Feral Hogs (*Sus scrofa*). Signs of feral hog activity, including scat and light rooting, were evident near the back entrance to the Preserve (Wild Basin Ledge) and were also reported on the neighboring City of Austin's Vireo Preserve. After setting up a trap with wildlife camera and seeing no additional activity for several weeks, the trap was removed.

- Wildlife Activity. Wild Basin continued to monitor the Preserve boundaries using motion-triggered cameras along the boundary and trails. Additionally, we continue to monitor human hiker activity alongside wildlife activity using images from the trail cameras. Cameras are regularly maintained and data are collected and analyzed (ongoing) by Wild Basin staff, interns, research students, and volunteers. A report of the findings is included in the scientific research section of this report (Project 15).

Water Quality

- Monthly water quality monitoring of Bee Creek at the waterfall continued for this fiscal year. Wild Basin staff (with some assistance from student interns) used the LCRA's Colorado River Watch Network (CRWN) test kits and monitoring protocols to measure various parameters including: pH, nitrates, turbidity, dissolved oxygen, specific conductance, *E.coli* bacteria counts, and field observations. Water quality testing data from the Wild Basin site can be found on the CRWN website at https://crwn.lcra.org/events.aspx?qrySite=72.
- Throughout this FY, sediment loads and algal blooms in Bee Creek and North Hollow from upstream developments west of the Preserve were of great concern to Wild Basin staff and downstream neighbors. The established Hotel Granduca on Bee Creek had a failed leach field that we continued to see impacts from. The Addie Development on North Hollow has been in process this entire FY with site clearing, earth-moving, and construction of roads, retention ponds, etc. Travis County inspectors were called out repeatedly to monitor compliance with erosion control measures and take action when controls were inadequate.
- In the second quarter, Wild Basin staff called a site meeting with LCRA and Travis County staff to discuss creek monitoring equipment that LCRA spec'd out for installation at Bee Creek and North Hollow at the Loop 360 culverts on Wild Basin's boundary. The real-time monitoring and notification features would provide LCRA, Travis County and Wild Basin staff a better understanding of the upstream development issues impacting the Preserve's waterways. Wild Basin staff are still working with Travis County to provide funding from the Hotel Granduca settlement to purchase the equipment.
- During the fourth quarter, a significant sediment spill occurred from the Addie Development on North Hollow, across Loop 360 and upstream from Wild Basin. Travis County required the developer to remove the sediment manually and with a vacuum truck. The crew spent three days on the Wild Basin side of 360, and more than a week on the Addie side of 360 with a second truck, dealing with

sediment removal. Much of the sediment managed to make its way down the creek to downstream neighbors' properties, much to their aggravation. The sediment was very slick/slimy, and may have had some additives that remain unknown at this time. Quick response by Travis County Environmental Quality staff was very much appreciated. It was recommended that Travis County EQ staff work with Wild Basin staff and Travis County BCP staff to determine best practices when removing sediment from the creeks. It was noted that during removal, the creek was still flowing through the area, carrying sediment downstream.

- See also notes in the Boundary Management section of this report about residential properties along our east and southern properties that have had water quality impacts to the Preserve, including sedimentation, gray water discharge, and foul odors.

Outreach, Education, and Volunteer Coordination

Wild Basin actively provides environmental educational opportunities and volunteer stewardship opportunities for the community. A total of 1342 education, stewardship and volunteer hours were logged at Wild Basin on a number of outreach-related activities, including trail maintenance and stewardship (described above), environmental education, and research. The events and programs held at Wild Basin from October 1, 2020 to September 30, 2021 are summarized below.

Educational Permits

Eight permits for educational activities were issued during the reporting period. The description and progress of each project is provided below.

(1) Ackermann, C. REI Star Walks

Project Description This event involves an introduction to the night sky through a hike and a guided exploration of the constellations. Permittee will lead up to 10 attendees on a 2-hour hike staying on public trails. Permittee is responsible for assuring all participants leave Wild Basin and gate is locked after the hike.

Progress

Star Walk: Over the course of the last fiscal year, REI guides hosted 30 Star Walks for the public, leading 234 visitors on nighttime Star Walks at Wild Basin. The walks occurred several times a month (weather permitting) and began 30 minutes before dusk and concluded after 2 hours. We followed the loop trail (Triknee to Possum to Creek Trail and back), providing interpretive content during the low light time of the tour and pausing for Star Viewing once the skies were sufficiently dark.

Hill Country Hikes: Over the course of the last fiscal year, REI guides hosted 2 Hiking Tour for the public, leading a total of 11 visitors on interpretive walks through the Preserve. We follow the outer loop of the property – Triknee – Possum – Yaupon – Warbler, while discussing trail etiquette, land history as well as flora and fauna.

(2) O'Keefe, K. Environmental Conservation and Climate Change Lab – Fall 2021

Project Description The proposed project is to develop a new laboratory course for the Environmental Science and Climate Change program at Saint Edward's University. This course (BIOL 2423) will utilize a Course-based Undergraduate Research Experience (CURE) format, in which students will conduct an original research project together as a class. The overall research objectives of this project are to: (1) Determine differences in vegetation structure and composition between urban and natural habitats and (2) Link vegetation differences with anthropogenic drivers (e.g., changes in microclimate, habitat fragmentation, disturbance, etc.). Students will collect vegetation and environmental data together as a class at two field sites: (1) Blunn Creek (a more disturbed "urban" site) and (2) Wild Basin (a less disturbed, more "natural" habitat). The data collected using this larger framework will then be used by small student groups to investigate individual research questions that more specifically address Obj. #2.

Progress Students developed independent projects within the larger framework of comparing Wild Basin with Blunn Creek. Specifically, they were interested in comparing soil characteristics (soil moisture, pH, and texture) across the two sites. We conducted field work over two days at Wild Basin, collecting vegetation and soil data at three different sites. Students collected tree species composition, ground cover, canopy cover, tree basal area, and soil characteristics. They are currently processing soil samples and are beginning to analyze their vegetation data. Preliminary analyses indicate that tree species diversity is higher at Blunn Creek

compared to Wild Basin, although we think this may be due to an increased number of invasive species at Blunn Creek.

(3) Lake, N. Video about Ashe Juniper: The Tree, the Myth, the Legend (and the truth).

Project Description Permittee and sub-permittee will film a short video about the Juniper tree to fulfill requirements for Tree Campus USA designation at St. Edwards University. Content will involve filming of Juniper trees in and out of Wild Basin, short interviews with people regarding their thoughts on Ashe junipers, as well as facts about the value of and natural history of Ashe junipers, and their place on the Balcones escarpment. Permittee and sub-permittee may go off trail at Wild Basin to film the video.

Progress This video was put on hold and did not come to fruition.

(4) Lake, N. Naturalist Neighbors Webinar Series

Project Description Naturalist Neighbors is an initiative to engage neighbors in the protection of the Bee Creek watershed. It will consist of a series of webinars focused on the natural history of the area, how the resources of Wild Basin are managed, and how neighbors can participate through thinking of their own yards as habitat or habitat "influencers". Permittee and sub- permittee may travel off-trail at Wild Basin to film video for the webinars. Some samples of non-native and native plant parts may be collected for use in the webinars. Native plants will not be permanently harmed. The role of Wild Basin in the BCP and preserve/outdoor ethics will be covered in each webinar. Upon attending two webinars, neighbors (within Bee Creek watershed) will be offered a free, one-hour consultation (remote or in person) on their landscaping to provide recommendations based on presence/absence of invasive plants and their goals for their property. Wild Basin's invasive species volunteer group and interested Naturalist neighbors may also perform chemical-free removal of invasive plants on these properties at the request of the landowner and guidance of Wild Basin's Preserve Manager. If landowners request further consultations or work beyond these opportunities, fees may be charged.

Progress Three webinars covering invasive species, dark skies, and sediment/runoff issues and best practices on resolving these issues were conducted and attended by

several neighbors. These webinars were recorded for future viewings/participation and materials were developed to be used as outreach over these topics. No consultations were conducted with neighbors.

(5) Proppe, D., Folkerth, D. Science Live! at Wild Basin

Project Description Wild Basin is creating TEKS-aligned live science webcasts for 4th-8th grades, called Science Live! at Wild Basin. Each webcast will include a live interviews and question and answer sessions with education staff and field scientists, as well as three pre-recorded video segments of scientists in the field discussing and demonstrating field research at Wild Basin and by extension, the larger Balcones Canyonlands Preserve. For the purpose of this permit, Wild Basin seeks permission to film one short demonstration drone flight over Ledge trail as part of the larger education project. Permittee will be the sole operator of the drone and will have a spotter present to help monitor the drone. The drone will be flown over Wild Basin Preserve only and will not be flown within view of any neighboring houses. The flight will occur on October 9, 2020, but an alternative rain date may be chosen in October if the flight doesn't occur on the 9th.

Progress Drone flights were conducted and filmed in accordance with the permitted activity on October 9th, 2020 at Wild Basin. As proposed, the recording of these flights was used to develop a Science Live webinar for 4th-8th grade students.

(6) Folkerth, D. Wild Basin Virtual Environmental Education Programs

Project Description Permittee and sub-permittees will create and produce a variety of free, on demand environmental educational videos covering topics from Life Science, Earth Science, and Environmental Science. Videos will be correlated to the Texas Essential Knowledge and Skills (TEKS) and highlight key science topics such as watersheds, scientific investigations, wildlife, native plants, geology, and field science. Most of the videos will be filmed on-trail but occasional off-trail filming of unique features, permitted research, and preserve management activities may occur. Efforts will be made to obscure the locations of off-trail sites. In a few instances, plant leaves may be collected but native plants will not be permanently harmed. Each video will educate about outdoor ethics on the preserve and emphasize the Leave No Trace seven principles along with the primary theme.

Progress: Media art student intern positions have been posted and applications have been received. However, no other progress has been made on this project due to the departure in August of the Wild Basin Environmental Education Coordinator.

(7) Quinn, B. Phenology and Vegetative Composition Studies for Botany and Ecology Courses

Project Description Permittee and up to 10 students enrolled in St. Edwards University Botany and Ecology courses may go off trail at Wild Basin on 4 occasions to collect phenology and vegetation composition information. This information may include photo-documentation and the collection of soil samples and leaves. Leaf collection will be limited and must not kill the plant.

Progress Due to Covid restrictions, this activity was unable to occur.

(8) DeWhatley, D. Course-based undergraduate research experience with an introductory biology course (BIOL 1107) at St. Edward's University

Project Description Permittee and students enrolled in BIOL 1107 will collect water samples from Bee Creek in Wild Basin and then conduct analyses in the St. Edward's labs to evaluate water quality parameters (nitrates and chlorophyll a). They will also determine dissolved oxygen concentrations and temperature of the water in the field with the use of a DO probe. The students will determine water velocity by timing a plastic object as it floats 1 m downstream. The plastic object will be retrieved immediately following this assessment.

Progress This permit was issued late in the reporting period and activity did not occur in the 2021 cycle. Progress will be reported in 2022.

Environmental Education and Interpretive Programs

- School Programs – Due to the pandemic, no on-site guided environmental education hikes or events were conducted for school or scout group. Rather, virtual programming, such as the two 45-minute *Science Live!* Webcasts broadcast to Austin and Manor area schools, and *Reading in the Wild* videos were created. Video segments from both of these programs remain hosted on the Wild Basin Creative Center website and can be streamed or downloaded for educational purposes. The fall webcast focused on using technology to study nature; the spring

webcast focused on biodiversity. Webcast topics and lessons are correlated to the TEKS standards and can be streamed or downloaded, free of charge, by anyone in the world. Interest and participation in the Live Science webcasts was strong. Registration for both events was limited to 1000 participants by the Zoom Webinar tool. Participation in Live Fall Webcast: Nine schools from Austin ISD, Round Rock ISD, Pflugerville ISD, and Lake Travis ISD participated in the live webcasts. 77% (7 out of 10 schools) were Title I classrooms. We estimate, based on Zoom participation numbers, that 171 students and teachers participated in the fall webcast. [Note: in the fall webcast, teachers and students joined together as one single participant. To better track participation numbers, for the spring webcast we have asked teachers and students to individually sign up and participate.] Participation in the Live Spring Webcast included 559 students and 31 teachers. Participants include students and teachers from Austin ISD, Pflugerville ISD, Prairie Lea ISD, private schools, and homeschools. 67% (10 out of 15) of the participants signed up for the spring webcast were from Title 1 schools.

- Wild Basin also created two online curriculum guides as an extension to the individual environmental education modules developed in 2019. The two new curriculum guides provide broad, foundational science-based background information about environmental education concepts tied to natural science themes and concepts covered in Wild Basin's guided and self-guided activities for K-5 youth. The guides also offer inquiry-based questions and general activity suggestions and have been developed to serve teachers as resources for stand-alone lessons or for pre- or post-visit field trip classroom activities.
- Public Programs – With the exception of the programs and events sponsored by REI (above), no on-site public programming occurred due to restrictions imposed by the Covid-19 pandemic.
- Artist in Residence – Wild Basin welcomed the sixth Artist in Residence in Fall 2021, Danika Ostrowski. Ms. Ostrowski was originally selected as the spring 2020 AIR, but her residency period was postponed due the Covid-19 pandemic. Ostrowski is based in Austin and is a dedicated advocate for the preservation of public lands. She paints both en-plein-air and creates in-studio work based on photographs, sketches and memories. Ostrowski began painting on the porch at Wild Basin every Friday morning until Wild Basin closed due to COVID-19 in March 2020 and restarted her residency in Fall 2021. Ms. Ostrowski has also created the artwork and conducted the graphic design layout of a series of new interpretive signs that will be installed along the Arroyo Vista Trail in spring 2022.

- memories. Ostrowski began painting on the porch at Wild Basin every Friday morning until Wild Basin closed due to Covid-19 in mid-March.

Environmental Education Resources for the Public

- Interpretive Visitor Gallery. During most years, visiting groups and the general public have access to the Wild Basin Visitor Center on Monday-Friday, 9am-4pm year-round except major holidays. Due to continuing Covid-19 pandemic protocols, Wild Basin has kept the Visitor Center closed to the public for the entire FY2021 for safety and to prevent the spread of Covid-19 in the community.
- Public Visitation. FY21 Wild Basin public visitation estimate: 8,906. This is significantly lower than our pre-pandemic visitation levels, but a few important points to keep in mind here:
  - Preserve was Closed: 03/24/20 – 10/17/20 (17 days closed in FY21)
  - Preserve was Closed: 12/9/20 – 3/24/21 (106 days closed in FY21)
  - Eventbrite reservation system was operational: 9/17/20 – 12/2/20 (Wednesdays through Sundays; Mon/Tue closed) [donation-based]
  - FareHarbor reservation system operational 7/31/21 to present (weekends & holidays); visitation capped at 63 cars (3 hiking sessions w/21 parking spaces each - until 5:30pm). After 5:30pm, reservations are not required.
  - Preserve was closed for 142 days in FY21 (42% of the year closed).
  - Reservation systems capped visitation numbers on many days of FY21.

Volunteer Stewardship

Volunteer Stewardship Workdays provide opportunities for the public to volunteer and assist with land management activities, as well as learn about the BCP and conservation practices and issues. Altogether, stewardship volunteers contributed 567 hours, including dedicated weekday and weekend individual volunteers, and group stewardship events. All volunteer workdays were on hold during the Covid-19 and construction closures October 1-17, 2020, and December 9 – March 24, 2021, for a total of 123 days. Specific stewardship workdays held in FY21:

- Thursday Workdays – Five regular volunteers showed up nearly every Thursday the Preserve was open to help with trail construction/maintenance, signs, trash/recycle receptacle installations, small repair projects, trail inspections, creek sediment monitoring, litter pickup along Loop 360, etc.
- Saturday Workdays – Two to four regular volunteers focused primarily on removal of invasive non-native plants in off-trail areas, with some trail maintenance.

- Saturday Invasive Plant Control Workdays – Group events were on hold until the last quarter of the FY when two stewardship events provided training in invasive plant identification and control techniques, and then the groups pulled up young Ligustrum. The groups were: Austin Community College Phi Theta Kappa Honor Society and Texas State University Chapter of the Wildlife Society.

Public events, meetings, workshops, and conferences
*If not reported above under educational permits

- Dr. Darren Proppe, Wild Basin Research Director, led a hike and work day (invasive species removal) for 19 students from the Texas State University Chapter of The Wildlife Society on September 18th (6 hours).
- Dr. Darren Proppe gave an invited talk at the Texas State University Chapter of The Wildlife Society in San Marcos on September 15th. The talk addressed the history and ongoing work at Wild Basin.
- Dr. Darren Proppe gave an invited lecture via Zoom to the Conservation Biology class at King's University in Edmonton, Alberta, Canada. The talk addressed roles at Wild Basin, and conservation in our exurban context.
- Dr. Barbara Dugelby gave eight guided hikes to neighbors and supporters of the Wild Basin Creative Research Center.

St. Edward's University Events

- Dr. Barbara Dugelby, Wild Basin Director, gave an invited presentation about Wild Basin to a St. Edward's University freshman class about Wild Basin research and internship opportunities.
- Dr. Darren Proppe, Wild Basin Research Director, gave a guided hike to the Animal Behavior class from St. Edward's University on March 23, 2021. Participants included the faculty instructor (Katy Goldey) and six students.
- Dr. Darren Proppe provided guest lectures on Wild Basin for three courses
    - Animal Behavior (Goldey) – November 2, 2020 and April 29, 2021
    - Environmental Science (Beck) – February 10, 2021
    - Entrepreneurship (Alvarado) – September 29, 2021
- Dr. Kim O'Keefe conducted a 2-hour lab at Wild Basin on September 29, 2021. Students surveyed vegetation as part of her Environmental Conservation and Climate Change course.
- Dr. Darren Proppe taught an NSF funded workshop under the direction of Dr. Richard Kopec at St. Edwards University. The 6-hour workshop focused on

animal behavior and interactions at Wild Basin, although it was held on the main college campus.

- The Environmental Science Department at St. Edward's University held a 5-hour brainstorming colloquium on courses and majors at the Wild Basin CRC. Five faculty and the Wild Basin Research Director were in attendance.
- Student researchers presented their work on Wild Basin-related research projects at the Lucian symposium at St. Edward's University on September 24, 2021:
    - Sanchez, M., Stark, K., Gold, D.A. Comparing molecular markers of Gregarine life cycle stages in Neopterans obtained from Wild Basin to laboratory raised cockroaches.

- Staff Retreats and Meetings – No staff retreats or meetings were held at Wild Basin during the past fiscal year due to the Covid-19 pandemic and closure of the Visitor Center
- St. Edward's University events – Wild Basin staff participated in the SEU fall 2021 and involvement fairs in September 2021.
- Wild Basin Internship Program – Wild Basin provided internships for 14 undergraduate students. This includes internships in Land Management, Biological Research, Invasive Species, Environmental Education, Media Arts, and Outreach/Public Relations. Projects included water quality testing, invasive species removal, trail maintenance, sediment monitoring, monitoring animal behavior with camera systems, acoustic monitoring, butterfly garden maintenance, tabling events, trail patrol, photography, and virtual programming.
- Courses – A list of undergraduate and graduate courses that incorporated Wild Basin into their curricula in Fall 2021 and Spring 2020 is included in Table 1.

Table 1. Undergraduate and graduate classes taught at Wild Basin FY21

Course #	Title	# Students	Semester
BIOL 2423	Environmental Conservation and Climate Change	5	Fall 2021
PSYC 4349	Animal Behavior	6	Spring 2020
	TOTAL	**11 students**	**2 classes**

Publications

- VanTol S., Koehn C., Keith, R., Keith B. & **Proppe D.S.** 2021. Avian migrants encounter higher temperatures but continue to add mass at an inland stopover site in the Great Lakes region. *Journal of Avian Biology*. 52: https://doi.org/10.1111/jav.02626
- Wild Basin staff and interns reported on Wild Basin news, events, and volunteers in three email newsletters, as well as updates in regular blog posts and social media outlets.
- Bivens, Gracen. 2021. Mesopredator Temporal Activity Patterns and Landscape Utilization within an Urban Nature Preserve. UT-Austin Senior Capstone Research Project Report.

Scientific Research

During the 2020-21 reporting period, 16 permitted research projects were carried out at the Wild Basin Wilderness Preserve. Project participants included three Wild Basin CRC staff, five faculty from St. Edwards University, three faculty from Texas A&M University Kingsville, 21 undergraduate students from St. Edward's University, two graduate students from Texas A&M University Kingsville, and five community volunteers. Excluding Wild Basin CRC staff and contractors, over 3,125 hours were expended on research at Wild Basin during the reporting period.

(1) Concilio, A., Targa, A., and Qualls, A. Impacts of shaded fuel breaks on plant diversity and invasive species spread

Project description Our objectives with this project are to determine whether and how shaded fuel break treatments conducted in the Balcones Canyonlands Preserve affect plant diversity and abundance, with a specific focus on invasive plants. This is an extension of a project started in 2018 to document plant species composition before and after a shaded fuel break that was conducted at the Wild Basin Wilderness Preserve. Pre-treatment data were collected at 8 sites (4 treated with the shaded fuel break and 4 untreated) in Fall of 2018 and post-treatment at the same locations a month later. We wanted to extend this research in Fall 2020 to determine whether any changes occurred over time. We hypothesized that we would find an increase in invasive plant species dominance in the mitigated sites due to the disturbance that the treatments caused.

Summary of results In Fall 2020, we surveyed the same 8 sites for plant diversity using fixed-area plots and documenting all trees (in the full 15 X 15 m2 plot), and shrubs (in three circular subplots). We categorized all plants as native or introduced and compared mitigated sites to unmitigated sites. Although we hypothesized that invasive species would spread with the disturbance in the mitigated sites, our results were encouraging – we found no difference in invasive species cover in the control vs. mitigated sites either in 2018 or in 2020 (Figure 1). I submitted a permit application to continue this work in 2021 on other parcels within the BCP, but I did not have time myself (or any interested research students) to work on it. There has been no further activity on this project since December 2020. I hope to extend this project in the future at other parcels within the BCP to determine whether our results are generalizable.

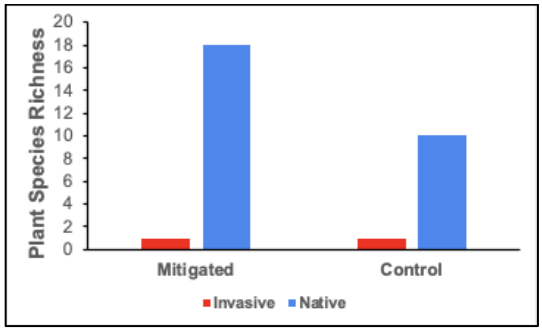


Fig 1. Species richness of invasive and native species at control and

(2) Concilio, A., Sigel, L., Turner, N. Carbon storage in native and invasive-dominated forests of the Texas Hill Country

Project Description There is little research that has been conducted on carbon sequestration potential for Ashe juniper - live oak forests in the Texas Hill Country, and no published studies that we know of. As the City of Austin plans for climate change mitigation to meet its ambitious 2050 goals, having a better idea of what our forests are sequestering is essential. Our objectives with this study were to quantify carbon storage in trees and soils of native Ashe juniper-oak forests and invasive privet forest patches in the Texas Hill Country. Because carbon stored in biomass differs by canopy and root structure, age of tree, and species, and soil carbon is affected by plant species composition, we hypothesize that the two forest types will be different in their total carbon storage.

Summary of results This study was initiated in Fall 2020 and over the following ~5 months we collected data at 20 sites on public and private land, which included Wild

Basin: 10 privet-dominated sites and 10 Ashe juniper dominated sites. We collected data in nested fixed area plots on tree diameter and species, shrub cover, the depth of the litter layer. We also collected soils at each site (3 samples per plot at varying depths to bedrock) and brought it back the lab for analysis. We used the loss on ignition method to measure soil organic matter. Total carbon stored in trees at the sites was calculated using the iTree model (model inputs = DBH and species). Our preliminary data showed little difference in soil carbon storage between the forest types, and although the average carbon stored in tree biomass was slightly higher in native forests, the difference was only marginally significant (alpha = 0.10). My students have graduated but I am still working on collecting more data and analyzing the samples for bulk density so we can calculate the grams of C stored per hectare. There has been little field work done on this project since May 2021.

(3) Concilio, A., Cuellar, N., Troiani, D., Luhrs, M., Pacheco, I. Kudrick, J. Edge effects in the Balcones Canyonlands Preserve on plant and bird diversity

Project description Edge effects are common in fragmented habitat like the BCP but little data have been collected on this topic in the region that we know of. Our objectives with this research were to determine whether and how plant and bird species composition varies from the boundary of BCP parcels into the interior, and how adjacent lands might influence these effects. We hypothesized that invasive species abundance would be higher in areas adjacent to housing developments due to the planting of invasive ornamental trees in home gardens. We were also interested in quantifying edge effects on bird species, particularly those that may have negative impacts on native songbirds such as cowbirds and blue jays.

Summary of results In Fall 2020, Natalie Cuellar and I measured plant species composition, focusing on invasive species, from the Wild Basin Wilderness Preserve border into the interior, and compared sites bordering housing developments to those bordering the Vireo Preserve. We surveyed 10 total transects from 0 to 50 m into the interior of the park for tree species abundance and diversity (and noted whether they were native or invasive). We did find that invasive species abundance was higher in transects bordering housing developments, particularly those woody species sold in the horticultural industry as ornamental plants (Figure 2). In Fall 2021, we expanded this project to include other BCP parcels so we could determine whether our results were generalizable. Again, we focused on plants and surveyed Emma Long Park.

These results have not yet been analyzed. No bird data have been collected on this project thus far.

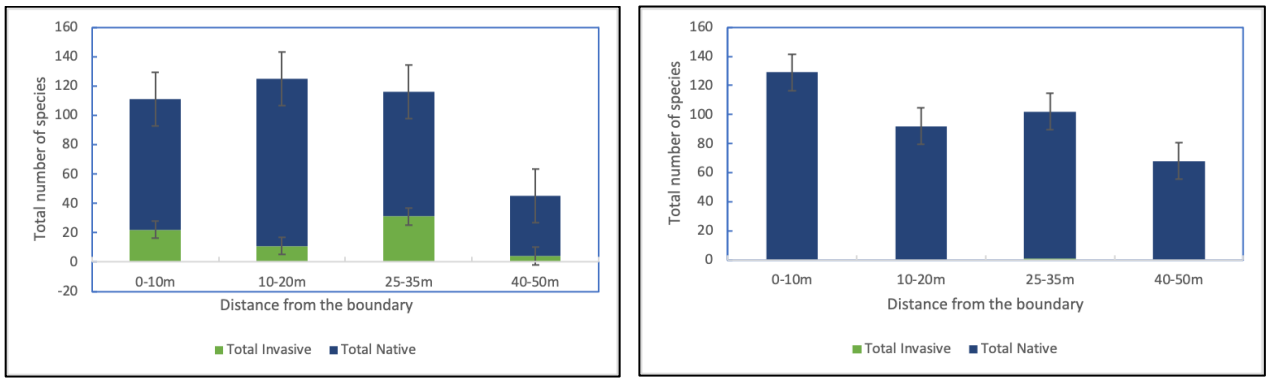


Fig 2. Total native and invasive plant abundance along suburban and control boundaries.

(4) Mitchell, C. Concilio, A. The effects of *Ligustrum sinense* and *L. japonicum* on bird abundance and diversity within Travis County, TX

Project Description The presence of invasive plant species is known to affect the abundance and diversity of various animal species. Researchers from across the world have measured negative effects of invasive plant species on wildlife, due to the displacement of native plant species that provide superior habitat. Chinese privet (*Ligustrum sinense*) and Japanese privet (*Ligustrum japonicum*) are two of the most common invasive plant species in Central Texas, yet little research has been done on their impacts on animals and no research could be found on the impacts these species presented to bird species. It is well known that invasive privet trees displace native plants and we therefore predicted that it likely affects native birds, which rely on these habitats for food and shelter.

Summary of results We assessed 16 sites across four watersheds (Bee Creek, Blunn Creek, Boggy Creek, and Bull Creek) throughout Travis County, TX with varying levels of privet abundance using point counts to measure bird presence from Sept to Nov 2020. We found a negative relationship between privet abundance and both bird abundance and diversity, confirming our hypothesis and suggesting privet removal may lead to increased presence of bird species (Figure 3). Overall, this study is able to provide valuable knowledge regarding the impacts of privet on Central Texas birds. No work has been done on this study since December, 2020.

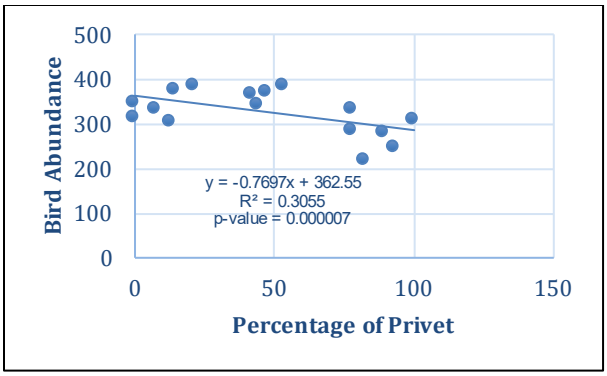


Fig 3. Relationship of bird abundance and privet.

(5) Dedeaux, C., Elawad, M., Concilio, A. The effects of invasive *Bothriochloa ischaemum* on native grassland systems and their ability to sequester carbon in the Texas Hill Country

Project Description Vegetation cover is known to directly influence the content, quality, and depth distribution of soil carbon (C), as it is directly responsible for organic matter input into the soil below. As invasive species move into healthy prairie ecosystems, root structure and depth may change as well, impacting soil carbon storage. This would be detrimental because with climate change, we need to get more C stored in terrestrial ecosystems, and prairies are a promising place to do that. This project aims to quantify and compared soil carbon storage under one of the most prevalent invasive species of Central Texas prairies, King Ranch bluestem (*Bothriochloa ischaemum)*, to the co-occurring native grass, little bluestem (*Schizachyrium scoparium*) at five sites across Central Texas. Our study sites are located on private and public land throughout the Hill Country, and include two parcels that are part of the BCP: Wild Basin and Vireo Preserve.

Summary of results Data collection began on this project in May 2021 until now, and although most of the field work has been completed, we still have some remaining samples to collect. We located sites where KR bluestem was growing on the same soil type as little bluestem and collected 3-4 plots per vegetation cover type at each site. At each site, we collected 5-10 soil cores at the surface (0-10cm) for a composite sample, and then dug three deeper soil pits per site to characterize soils at set intervals down to the bedrock. We measured plant species composition a 1m2 point-intercept quadrat. We are now processing the soils in the lab.

(6) Quinn, B., Proppe, D., Ohwobete, E., Stone, S., White, A. Quantifying the daily, seasonal, and COVID-19 shut-down variation in the soundscapes of the Wild Basin Wilderness Preserve

Project Description Acoustic recordings will be made using passive acoustic recorders and hand-held acoustic recorders. Passive recorders will be moved weekly and each of 20-30 locations will be visited bi-weekly through the duration of the project. Hand-held recording will occur at 69 locations in each of 2 years from mid-May to mid-July. Visitation will generally be conducted by 2 individuals but may be up to 5 individuals.

Summary of results Placement of handheld and passive acoustic recorders have been used to address two research questions under this permit. 1) The primary project, mapping the soundscape of Wild Basin is ongoing. Fifteen passive acoustic recorders were placed on an LTER grid that is spread spatially across the preserve on June 13, 2020. With the exception of a small number of gaps due to temporary equipment failures, these recorders have collected acoustic data during 1 minute of every 10 on a continuous basis. They are scheduled to continue collecting data through the summer of 2022. During the summer of 2021, an undergraduate student from St. Edward's University (Sam Stone) collected 24 hours of acoustic data (same recording schedule) at 132 sub-sites across the preserve. Noise levels are currently being extracted from this dataset, and will provide the foundation for our spatially and temporally dynamic map. 2) Handheld recorders were used to record the soundscape at five trailside locations in Wild Basin during the 2020 shelter-in-place orders by essential personnel (Darren Proppe). These recordings were duplicated in 2021 by Edere Ohwobete, and analysis shows that a) the preserve was quieter during shutdown, and b) a greater variety of sounds could be heard (Figure 4). Project one is ongoing, while two has concluded.

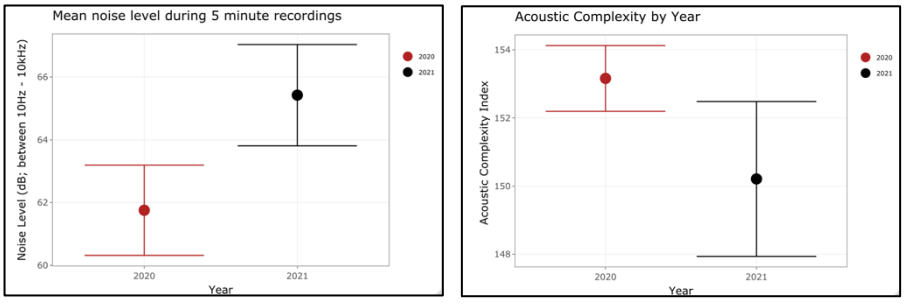


Fig 4. Mean noise and acoustic complexity between 2020/21

(7) Proppe, D., White, A., Ramirez, S., De Leon Castro, M., Dean, E., Berrios-Starbird, A. Wild Basin NOW: A long-term ecological research initiative at Wild Basin

Project Description The objective of the project will be to collect pertinent data on a range of organisms in 2021, with the intent to repeat survey efforts again in 5 and 10 years in order to document change and facilitate data-driven management recommendations. Vegetation, birds, small mammals, and arthropods will be surveyed at 16 sites on Wild Basin.

Summary of results Baseline surveys of 1) vegetation, 2) birds, 3) insects, and 4) mammals were conducted at 16 sites in the spring of 2021. Vegetation data was collected from March 3-22 at 9 LTER sites. Basal area, ground cover, canopy cover, and species identification were collected. Bird, insect, and mammal data were collected between March 29-April 30 at all 15 LTER stations and one additional survey location at the pond site to be excavated near the back gate of Wild Basin. We documented 327 birds from 31 unique species, 1479 arthropods from 39 species, and 8 mammal species from 119 images of wildlife. These data will be collected again in 5+ years to investigate the possibility that our native plant and animal communities are changing.

(8) Proppe, D. Assessing bird diversity and body condition at a pond restoration site in the Wild Basin Wilderness Preserve

Project Description Permittee will employ point counts and banding protocols to quantify diversity, abundance, productivity, and body condition of the bird community at the pond restoration site before and after the pond is dredged. Point count surveys using standard protocols (Bibby et al. 2000) will be conducted at the pond site every 10 days from May 11 – August 8 prior to the dredge operation (2021). Point counts will occur between sunrise and 900 hours on days without precipitation. During each survey all birds seen or heard within 100m of the point center will be mapped. Monitoring Avian Productivity and Survivorship (MAPS; DeSante et al. 2020) protocols will be used to band birds at the pond location from June 7 – August 8, 2021. Permittee will operate six 12-meter mist nets, separated by ~ 75m. Nets will be opened for one day out of every ten day period, operating for up to six consecutive hours after opening, which will begin at 30 minutes before sunrise on each banding day.

Summary of results Birds were surveyed at the pond site via standardized point count techniques on April 28 & 30th. Twenty-four individuals from 11 species were identified. Six mist nets were placed near the pond restoration sites and opened on June 21, July 2 and 23, and August 9 from 6-11:30am. Banders included Darren Proppe (WBRD), Laural Moulton (CoA), David Morgan (TC), Allison White (WB contractor), and Samuel Stone (SEU student). Capture rates were extremely low with a total of 6 captures from three species (white-eyed vireo, Carolina wren, and Northern cardinal). Although point count and capture numbers were low, these baseline numbers will facilitate a comparison of post-dredge bird communities in 2022.

(9) Proppe, D., Tanner, E., Tanner, A., Berrios-Starbird, A. Fine-scale thermal assessment of juniper and oak dominated habitats on the Edward's Plateau

Project Description Permittee and assistants will investigate thermal variation in ground and canopy environments at Wild Basin Preserve using Digital Thermal Sensing (DTS) technology. A 650-m DTS cable will be placed on the ground and then looped back along the same route at approximately 3-m height in the tree canopy. The power source will be an outlet at the Creative Research Center. The cable will cross underneath the Arroyo Vista trail under a bridge and/or by digging a tunnel and then covering it. The cable will be checked at least twice weekly and repaired as necessary.

Summary of results Drs. Evan and Ashleigh Tanner from the Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville visited Wild Basin to install the DTS cable on September 9-10. Nine volunteers also participated in the initial cable placement. The cable begins at the visitor's center and runs in a northerly direction into North Hollow and about ¾ of the way up the south facing slope (~450m). The cable was intentionally laid across at least 5 areas of open and closed tree cover so that a comparison of habitats could be made. As requested in the permit, the cable was buried below the trial where it crossed along Arroyo Vista. The Tanner's made two additional visits in order to make necessary repairs to line before it became operational on October 5th. Currently the cable is collecting temperature every minute at every ½ meter for 24 hours per day (Figure 5). In addition to comparing temperatures under different canopy types, the data will be compared to thermal data collected overhead via a drone and in relation to insect communities sampled along the line (see other permit reports for details).

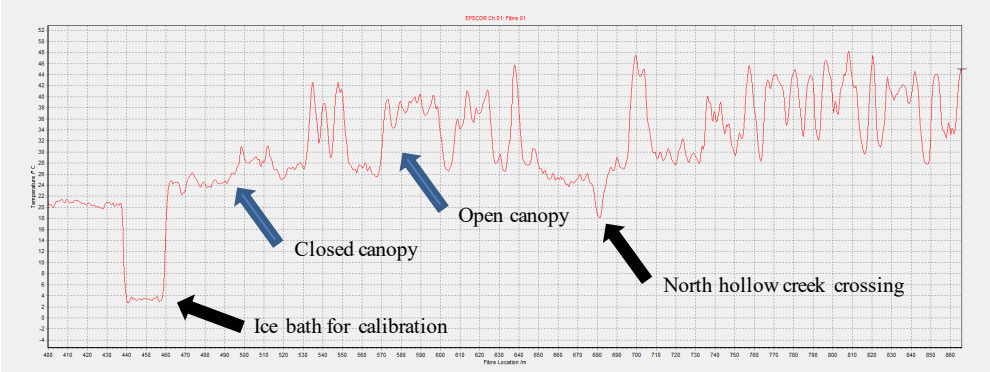


Fig 5. Sample data from the DTS cable at Wild Basin.

(10) Steffenson, M., Wostl, E., Proppe, D., Dean, E., Poulsen, M., Perotto, H. The impact of temperature on the distribution of ectotherms at the Wild Basin Wilderness Preserve

Project Description Permittee and assistants will conduct thermal mapping using a drone-housed radiometric sensor to quantify the skyward facing surface of the entire Wild Basin Wilderness Preserve. Drone flights will be conducted monthly (or less) along preset transects. To translate canopy temperature to ground temperature, two iButtons (temp/humidity loggers) will be placed at each of 6 ectotherm sampling locations to document temperatures for the entire project year. One iButton will record temperature and humidity in an open environment while the other will reside in an adjacent canopied environment. Permittee and assistants will also quantify ectotherm diversity and distribution for arthropods and herpetofauna. Arthropods will be surveyed weekly using malaise and pitfall traps. Arthropods will be collected for identification. Herpetofauna will be surveyed at these same sites using a drift fence array that is coupled with pitfall and/or funnel traps. Herpetofauna will be identified onsite and released. The data generated with this study will be used to generate high-resolution maps of both the thermal and physical environment of the entire Wild Basin Wilderness Preserve.

Summary of results Dr. Humberto Perotto from the Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville and two master's students have conducted drone flights collecting thermal and RBG imagery at Wild Basin twice (September 22 & October 6). The first visit served as a training session to assure proper drone technique and to assess the landscape. The second visit served to collect data along the DTS transect in order to compare ground and skyward facing temperatures (Figure 6). Further visits are planned to create thermal and RBG imagery of LTER sites where insect and herptile surveys are being conducted. Longer-term insect surveys were initiated at 6 LTER points on September 10th. Dr. Matt Steffenson of St. Edward's is mentoring two students in the collection of insects from Malaise and pitfall traps. Two iButtons have also been placed at each location (covered/open). A third St. Edward's student collected insects weekly along the DTS cable using pitfall traps. Dr. Elijah Wostl is installing drift arrays at the same 6 LTER sites in preparation for spring sampling of herptiles.

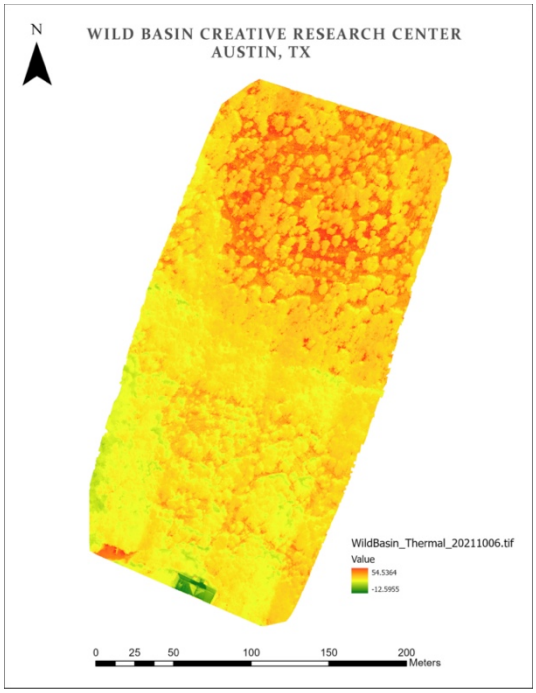


Fig 6. Thermal landscape of the North Hollow

(11) Todzia, C. Checklist of the Vascular Plants of Wild Basin Preserve, Travis County

Project Description Permittee will update the checklist of the flora which was compiled 24 years ago, vouchering uncommon species, putting information in database format which will be Web accessible.

Summary of results Wild Basin on March 23, 25, April 1, 4, 6, and 12, 2021. Nine additional plant species were verified as being on the checklist. These include: *Pellaea atropurpurea*, *Aristolochia serpentaria, Conoclinium coelestinum, Eleocharis montividensis, Phyllanthus polygonoides, Eriodium texanun, Allium drummondii,*

Passiflora affinis, and *Ulmus americana*. One species was added to the checklist: *Carex bulbostylis*.

(12) Barr, J., Fabre, C. Rare Plant Monitoring

Project Description Permittee and his assistants will conduct monthly monitoring to document the occurrence, location, conditions, and threats to the Plant Species of Special Interest listed in the attached proposal. Permittee and assistants may travel off trail and will not collect specimens.

Summary of results Several rare and unusual plant species have been noted at Wild Basin Creative Research Center (WB). In the past, the presence of these species has been documented in Wild Basin newsletters, periodic surveys, and personal communication. Bill Carr's 1996 Annotated Checklist of the vascular plants of Wild Basin compiled all the previous documentation into one resource. We continue to use iNaturalist as our favored method of documenting and tracking rare and unusual plant species. The exact location is included in iNaturalist, available to WB staff and approved volunteers, but obscured to the general public, which inhibits poaching while promoting scientific sharing. We have also created a Google Calendar of bloom periods to assist with focusing our efforts. Additional information is available in Appendix E.

(13) Sanchez, M.M., Stark, K., and Gold, D.A. Comparing Molecular markers of Gregarine Life Cycle Stages in Cockroaches Obtained from Wild Basin to Laboratory Raised Madagascar Hissing Cockroaches

Project Description This proposal will help to better understand host-pathogen mechanisms between gregarines and their host organisms at the Wild Basin Preserve. Gregarines are a type of Apicomplexan parasite that infect most invertebrate taxa. This will be done by collecting cockroaches at Wild Basin, and dissecting them to isolate intestinal stages of gregarine parasites. After isolating the internal stages, antibodies known to react to gregarines and other apicomplexans will be used to probe the interaction between the intestinal epithelial cells of the cockroach and their gregarine parasites. We will then compare these results to a laboratory-raised colony of Madagascar Hissing cockroaches to determine the similarity between the observed gregarines in the wild cockroaches and *Blabericola migrator* found in the Madagascar Hissing cockroaches. This research will help us better understand the adaptions of both the parasite and the cockroach that has led to this diverse relationship.

Summary of results Research was delayed due to both the Covid19 Pandemic and the extensive damage done to the John Brooks Williams North building by the Texas frost event in Spring 2021. At that point, Kaitlyn Stark graduated and the project was taken over by Mia M. Sanchez. Insects were kindly provided from pitfall traps set in Wild Basin by Dr. Elijah Wostl.

A total of 5 neopteran insects were analyzed by dissection of the gut contents and subsequent fluorescent microscopy and PCR amplification of the 18S rDNA and Sanger sequencing for identification purposes of both eukaryotic microbes and host brain tissue. nBLAST of the host brain tissue-derived 18S rDNA sequences revealed that all 5 hosts were ground beetles infected with fungi in their mid-guts. The ground beetles were: *Pterostichus aterrimus, Dynastes granti, Calosoma scrutator*, and *Pterostichus pseudosinensis*. The gut microbes included: *Leptospora clematidis* (Ascomycetes), *Sporobolomyces beijingensis* (Basidiomycetes), and *Pleosporales spp*. (Ascomycetes). As none of the microbes were Gregarines, we were not able to carry out the proposed comparisons, however, confocal microscopy revealed specific staining of the surface of the fungi with the Vicia villosa Lectin-fluorescein conjugate, which stains N Acetylgalactosamines also found on Gregarine surfaces.

(14) Wostl, E. Assessment of Amphibian and Reptile Communities of Wild Basin Wilderness Preserve

Project Description The proposed study will evaluate the population dynamics of extant amphibians and reptiles at the Wild Basin Wilderness Preserve. There are two main objectives.

1. Establish an ongoing herpetological monitoring program that utilizes standardized, systematic methods that are not subject to observation bias and can be replicated at other sites. (pit-fall arrays). This effort will generate data that are comparable across successive sampling efforts. From these data we will be able to assess how species composition and relative abundance shift over time allowing for the detection of local declines and potentially the identification of causal factors.
2. Establish baseline data on herpetological species composition and relative abundance from a relatively intact habitat (Wild Basin).

Summary of results

Pit Fall Arrays

To date, I have installed four pit-fall arrays on the wild basing property. Each array consists of 4 pitfall traps separated by 25 feet of drift fence arranged in either a linear or "Y" configuration. There is a funnel trap located along each side of each section of fence (6 total). Not all pit-fall traps or funnel traps were open at all times due to local conditions (rising ground water kept some pitfall traps closed during portions of the surveys). The Arrays are located at monitoring stations 4, 7, 8, and 14. The arrays at stations 7, 8, and 14 were active in spring. In total there were 37.27 array-days (1 array day = 1 array open for 1 day), 109.7 pit-fall days, and 181.6 funnel trap days.

In all there were 19 amphibians and reptiles captured: 12 *Incilius nebulifer*, 4 *Scincella lateralis*, 1 *Lithobates berlandeiri*, 1 *Nerodia erythrogaster*, and 1 *Storeria dekayi.* The rate of capture at each site was 0/pit-fall day at site 07, 0.19 captures/per pit-fall day at site 14 and 0.21 captures per pit-fall day at site 08. Only a single animal, a leopard frog (*Lithobates berlandeiri*), was captured in a funnel trap.

Herpetological Surveys

Data from the pit-fall surveys is augmented by visual encounter surveys. I conducted 10 nocturnal herpetological surveys between 18 June 2021 and 09 September 2021. Total survey time was 21.92 hours. 137 individuals of 14 amphibian and reptile species were detected. Serval anurans were also audibly detected, these do not change the number of species detected and are not included in the count. Ten *Nerodia* and the single *Salvadora* were injected with a PIT tag for future identification. Species encountered are as follows:

Anurans	
Incilius nebulifer	42
Acris crepitans	8
Lithobates berlandeiri	46
Eleutherodactylus marnocki	11
Turtles	
Trachemys scripta	1
Chelydra serpentina	5
Lizards	
Anolis carolinensis	1

Scincella lateralis	1
Snakes	
Leptotyphlops dulcis	1
Thamnophis proximus	1
Opheodrys aestivus	1
Salvadora grahamiae	1
Nerodia erythrogaster	10

In addition to the species encountered during formal surveys, I Also encountered *Aspidoscelis gularis, Sceloporus olivaceous*, *Tantilla gracilis,* and a single *Micrurus tener* while on the property. Additional information is available in Appendix F.

(15) Dugelby, B. Documenting spatial and temporal patterns in wildlife distribution across Wild Basin

This permitted research continued in FY21 and has two components: (a) Documenting wildlife distribution and movement patterns along and through Wild Basin boundaries and (b) Study of the impact of human foot traffic on native mammal use of trails in an urban preserve.

(a) Documenting wildlife distribution and movement patterns along and through Wild Basin boundaries

Project Description: This study employs 15 motion-triggered wildlife cameras to document wildlife species and their activity patterns across the Wild Basin landscape. Cameras have been installed at a distance of at least 250m from each other or along Wild Basin boundaries.

Progress Report: Data from cameras continues to be collected and processed (wildlife identified and analyzed). Using several years' data from these perimeter cameras, Gracen Bivens, a UT environmental science undergraduate, completed an analysis of "Mesopredator Temporal Activity Patterns and Landscape Utilization within an Urban Nature Preserve". The abstract of this report is below.

Bivens, Gracen. 2021. Mesopredator Temporal Activity Patterns and Landscape Utilization within an Urban Nature Preserve

Abstract:

Recent ecological studies demonstrate that human alteration of landscapes and resulting habitat fragmentation have led to novel behavioral responses within

mesopredator communities, such as niche differentiation. In urban landscapes, resource scarcity associated with loss of habitat can result in behavioral adaptations among similarly-sized mesopredators that decrease the effects of interspecific competition, such as spatial and temporal habitat divisions (Schuette et al., 2013, Litvaitis & Harrison, 1989). This study investigated temporal and spatial patterns of three mesopredators in an urban preserve for evidence of behavioral adaptations resulting from habitat alteration and changes in resource availability. Data from 15 motion-triggered game cameras installed along the perimeter of Wild Basin Wilderness Preserve (WBWP) in Austin, Texas, were used to examine diel activity patterns of bobcat (*Lynx rufus*), coyote (*Canis latrans*), and grey fox (*Urocyon cinereoargenteus*). Specifically, we sought to investigate whether diel activity patterns in each species differed from patterns observed in wild settings, as well as look for overlap in diel activity patterns among these species. Kruskall-Wallis results showed a significant difference in the diel activity patterns of the three mesopredator species. In pairwise combinations among the three species, Kruskall-Wallis showed a significant difference in diel activity patterns of coyote and grey fox. Understanding spatial and temporal behavioral adaptations of mesopredators and their interactions in an urbanized landscape can enhance our understanding of the potential effects of urbanization on wildlife species. Resource partitioning and avoidance of agonistic interactions among mesopredators can facilitate the coexistence of species. With the expansion of coyote range and varying sensitivity among mesopredators to habitat fragmentation, this study may provide insight into fine-scale habitat divisions that help to sustain mesopredator communities within urban landscapes.

(b) Study of the impact of human foot traffic on native mammal use of trails in an urban preserve.

Project Description: This study examines the effect of human activity on wildlife use of preserve trails using 13 motion-triggered wildlife cameras. We aim to evaluate the impact of human relative activity (HRA) on wildlife relative activity (WRA) at different locations along the trail network at Wild Basin.

Progress Report: Data from cameras continues to be collected and processed (wildlife identified and analyzed). Analysis is currently prioritizing the period prior to the Covid-19 closure of the preserve and the 6-month closure period when trail activity was limited to the few staff working during the closure period.

(16) Ditto, S Environmental Monitoring Using LoRaWAN Wireless Network and Sensors – Pilot Project

Project Description Permittee will set up, deploy, and maintain wireless data networks and sensors at Wild Basin Preserve using long-range wide-area network (LoRaWAN) technology. Up to 4 wireless gateways may be stationed at Wild Basin, pending site location and design approval by Travis County and St. Edwards University. The network and sensors will collect environmental monitoring data, which the permittee will manage, store, and display in a password protected dashboard. The dashboard can be accessed for research and education purposes by Travis County, St. Edward's University, and other entities as mutually agreed upon by the Permittee, Travis County, and St. Edward's University. This is a pilot project with the possibility of becoming a long-term project.

Summary of results This permit was issued late in the 2021 reporting period and has no activity to report. Activity will be report in 2022.

Facilities and Signs

Facilities

- The building's security is monitored by ADT.
- Composting toilets are located in the Visitor Center and are maintained regularly by adding water and wood shavings, and turning weekly.
- The gate system with its remote-capable feature worked well the majority of the year though it malfunctioned at times. Customer support for the gate was generally very responsive and helpful at getting the gate back on line quickly.
- Additional surveillance cameras were installed in the parking lot. Currently there are five cameras around the parking lot/trailheads, two at the Visitor Center, and two surveillance video cameras on the Security shed. One security camera was at the back gate.
- The ELOO evaporative toilet units purchased through two grants awarded by REI during FY19 and FY20 remain a work in progress pending septic and development permits from Travis County. These toilet units will eventually replace the chemical toilet in the parking lot once a building to house the units is constructed.

Signs and Maps

- We provide digital maps on our website for visitors to access on their smartphones, including a Google Earth file for the trail system and a PDF copy of the trail map. We also have other information on the website including interpretive information and resources for specific age groups. A weather-resistant map of the trail system is mounted at each trailhead.
- Numerous informational, parking, and rules signs are around the parking lot and trailheads to welcome, direct and inform Preserve visitors.
- "No Decorations Please" signs were temporarily tied to trees along Loop 360 during the Christmas season.
- "No Trespassing" signs have been posted along much of the Preserve's eastern, southern and western boundaries. The northern boundary is shared with the City of Austin's Vireo Preserve and does not need these signs.

Security, Access, and Safety

Emergency Preparedness

Wild Basin staff continued to improve the Wild Basin Wilderness Preserve (Wild Basin) Emergency Response Plan (ERP) developed with St. Edward's University Campus Safety personnel. This plan describes how staff, student interns, and volunteers respond to emergencies, addresses various types of hazards and establishes policies, responsibilities and operations designed to effectively and efficiently address an incident. Wild Basin personnel developed this ERP in collaboration with the Director of Campus Resilience and is a dynamic document. This plan outlines the roles and responsibilities of identified parties and as well as the training and exercises that will be conducted on a regular basis. All staff and volunteers who work at Wild Basin have access to a copy of the ERP. It is located in the "Wild Basin Share" directory of the SEU online file hosting service "Box", filed under "***Safety Resources and Emergency Response Plan.***" Additionally, a hard copy of this ERP is stored in a labeled binder located under the hutch on the front desk of the Wild Basin Creative Research Center.

Security

- Wild Basin has a security officer on site five days a week. This officer is provided by Travis County in response to security and integrity issues such as vandalism, car break-ins, and visitors bringing dogs into the Preserve.
- The security guard and additional gate attendants on weekends and holidays have been extremely helpful when they are on duty, but Wild Basin continues to face many of the same issues when the officer and attendants are off duty during

the evenings. Surveillance cameras and incidental observations show dogs on trails when staff or security are offsite or off work.

- There is an automatic gate at the Preserve entrance timed to open at first light and close at sunset. The gate is equipped with a sensor that will open the gate arms when people leave the Preserve after hours.

Fire Safety and Preparedness

- Koetter Fire Protection in coordination with St. Edward's university staff completed their annual inspection of the Visitor Center.
- Wild Basin trimmed brush back from building as per fire-wise recommendations. Wild Basin continued to work to implement Westlake Fire Department fire management recommendations.
- Wild Basin held one fire extinguisher review session during this reporting year.

Appendices

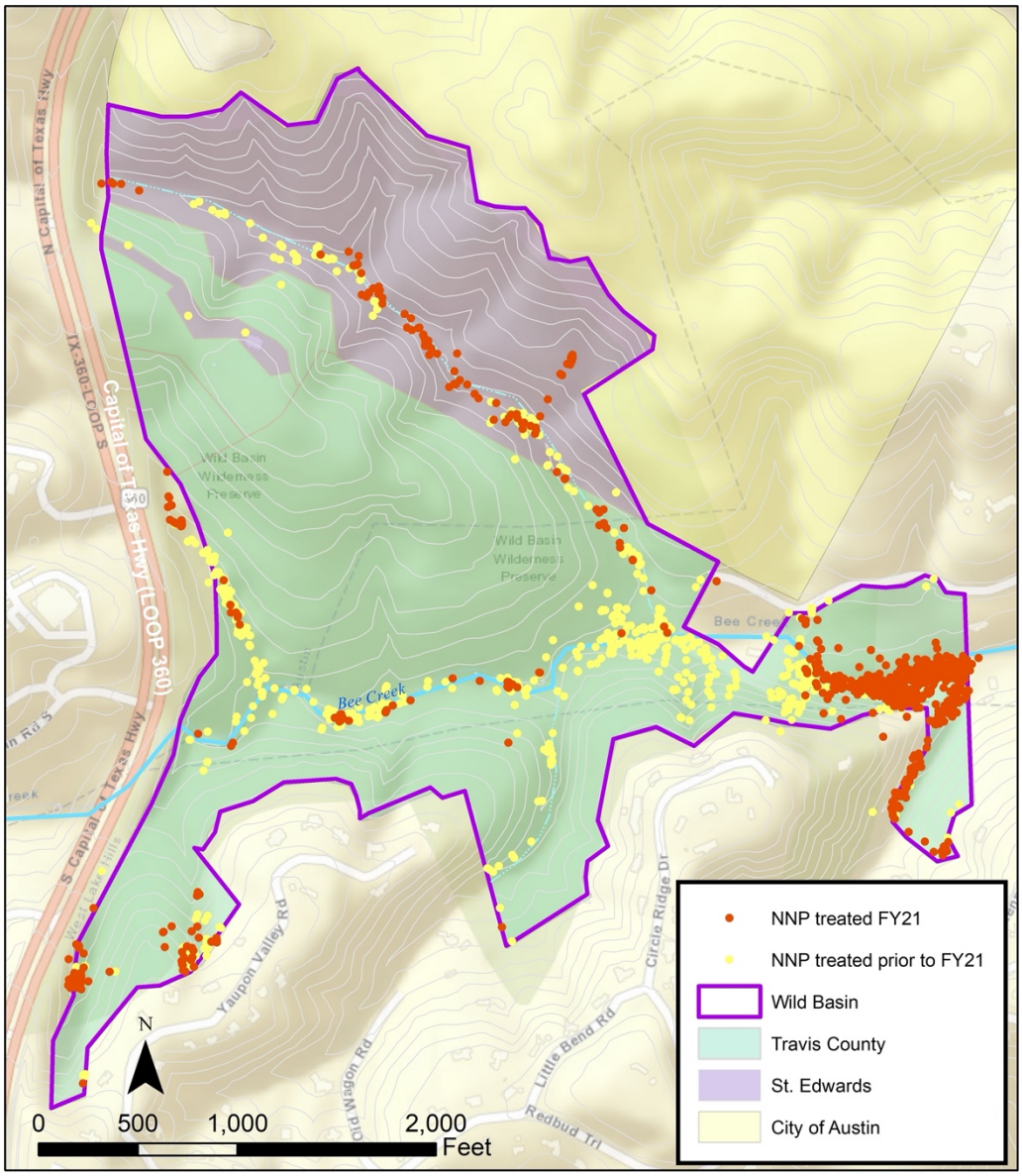
Appendix A: Map of Wild Basin Wilderness Preserve Trail System



Appendix B: Aerial Map of Wild Basin and Residential Neighbors



Appendix C: Annual Invasive species removal at Wild Basin



Appendix D: Golden-cheeked Warbler Surveys at Wild Basin
Darrell Hutchinson, City of Austin Field Biologist

A total of 44 surveys were conducted at Wild Basin and Vireo Preserve between 10 March and 8 June by Darrell Hutchinson, Lisa O'Donnell, and Jim O'Donnell for a total of 152.5 survey hours.

Between the two preserves, ten separate males were detected during the breeding season. Seven males paired (including one probable but unconfirmed), and three nesting pairs reproduced successfully. Two of the three successful nesting pairs attempted to double brood and one succeeded for a plot total of four broods. Compared to recent years, plot density was considerably higher with increased density found on the upper Vireo Preserve.

Eight out of ten males were color-banded. All were banded as second-year (SY) birds. We detected no banded returns from previous years (see 2021 VPWB Territory Polygons). Banding was accomplished by Jim O'Donnell and Laurel Moulton.

YE/SI:MV/PI was banded SY at Vireo Preserve on 7 April. He paired and their first nest fledged 4 on approximately 2 May. They attempted to double brood, but their second attempt failed in early June. Both nests were located south of the Wild Basin Creative Research Center along Arroyo Vista Loop, but neither nest was found. YE/SI:MV/PI are notable for having one of the largest territories ever recorded. The pair were consistently observed from the Wild Basin Creative Research Center all the way across North Hollow to the second knoll at Vireo Preserve. The male's territory measures over 100 ac. and nearly 45 ha. Also noteworthy is that this is the second year in a row that a pair of Golden-cheeked Warblers established a territory at the top of the hill near the Wild Basin Creative Research Center. This year's male is confirmed SY and the female appeared to be, so neither is a return from last year's pair.

DB/SI:DB/MV was banded SY at Wild Basin on 14 April. He paired and their first nesting attempt failed. On 19 April, the male was observed possibly provisioning a nest north of the back gate in the southeast corner of Vireo Preserve, but the nest was not found. Fledglings were never detected and the male was last observed on 4 May.

MV/SI:DG/BL was banded SY at Wild Basin on 14 April. He was paired and their first nesting attempt failed. On 30 April, the male was observed provisioning a nest located

southwest of upper Possum Trail, but the nest was not found. Fledglings were never detected and the male was last observed on 18 May.

OR/DG:BK/SI was banded SY at Wild Basin on 14 April. He was paired and their first nesting attempt failed. On 27 April, the male was observed provisioning a nest located in the South Hollow near Warbler Trail, but the nest was not found. On 4 May, the pair were observed copulating, and then never detected again. We presume the female did not renest and the pair abandoned the plot.

WH/WH:PI/SI was banded SY at Vireo Preserve on 30 March. He failed to pair, however, he was detected throughout the breeding season from 27 March – 2 June adjacent to UBVPWB1. Regular detections inside and around UBVPWB1's territory suggest he may have had reproductive investment in one or both of UBVPWB1's nests.

UBVPWB1 successfully paired and fledged two nests. Their first nest fledged 4 on approximately 3 May. Second nest was the only one found this year on the plot and fledged minimum 1 on 4 June. UBVPWB1 pair were the most productive on the plot.

Surveys were funded by City of Austin Wildlands Conservation Division and conducted according to City of Austin's Balcones Canyonlands Preserve GCWA Demographic Study protocols.

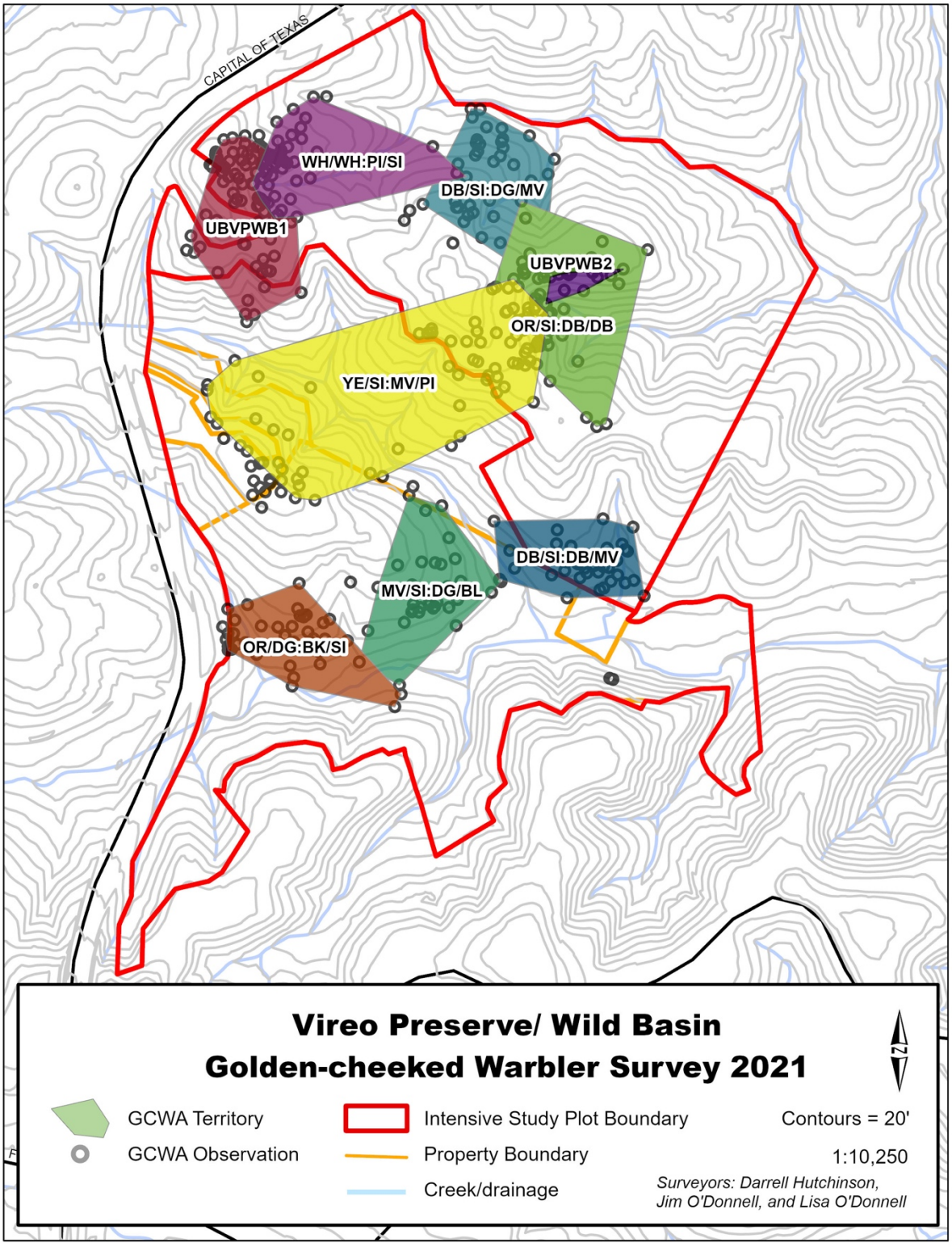


Figure D1. 2021 Golden-cheeked Warbler territories

Appendix E: Detailed Report of Rare Plant Monitoring

Significant events: Covid-19 shut-downs and surges continued for the second year to limit access to the preserve for monitoring. Winter storm Uri brought days long freezing temperatures and snow in Feb of 2021.

Wild Basin's unique geographical location: Wild Basin is the extreme range limit of two plant species: Ours are the southern most individuals of shooting star (*Primula meadia*) and the easternmost individuals of Texas Madrone (*Arbutus xalapensis*). As global and local climate changes, our plants could be harbingers of the future. Continued monitoring is very necessary.

Primary Species of Interest

One-flowered Cancer-Root aka Naked Broomrape (*Aphyllon uniflorum,* formerly *Orobanche uniflorum*)

One outing 4/18 during bloom period failed to find any plants.

Shooting-star (*Primula meadia*, formerly *Dodecatheon meadia*)

One outing 4/18 at the peak of the bloom period found 27 plants (24 in the North Hollow population and 3 in the south population). 5 plants in North Hollow had bloom spikes two of which had been eaten. Each intact bloom spike had two buds. One was open and the rest were days away from opening. I was unable to revisit to monitor seed set. One plant in the south population had a dried seed capsule from 2020.

Texas Madrone (*Arbutus xalapensis*)

Two observations made: 3/6 the eastern-most Madrones were checked for damage from winter storm Uri. Both trees appeared to be in excellent health with no ill effects and flower buds were forming. 4/18 three Madrones in the south population were observed and seemed to have no damage from the storm.

Secondary Species of Interest

Canyon mock-orange (*Philadelphus ernestii*)

4/18 the single plant that was given to the center and planted about 10 years ago on the hill south of the visitor's center was observed to be in excellent health.

Tertiary Species of Interest

Glass Mountain coral-root (*Hexalectris) nitida*)

No monitoring. No observations posted to iNaturalist by anyone else.

Crested coral-root (*Hexalectris) spicata*)

No monitoring. No observations posted to iNaturalist by anyone else.

Heller's marbleseed (*Lithospermum helleri,* formerly *Onosmodium helleri*)

4/18 North Hollow, could not find the single Hellers down slope from the shooting stars. Two observations of healthy plants posted to iNaturalist.

Buckley tridens (*Tridens buckleyanus*)

No Monitoring. No observations to iNaturalist.

Louisiana broomrape (*Aphyllon ludovicianum* formerly *Orobanche ludoviciana*)

No monitoring. No Observations posted to iNaturalist.

<u>Suggested additions</u>

Ladies Tresses orchids (*Spiranthes magnicamporum*)

We found 5 of the 7 plants that were relocated prior to the paving of the driveway and one had apparently bloomed in the fall of 2020 as a dried bloom stalk was observed. No monitoring of the creek population.

Sticky Liatris (*Liatris glandulosa*)

No monitoring of the late summer blooming species. No observations posted to iNaturalist.

Virginia Snakeroot (*Endodeca serpentaria*)

This plant was observed 4/18 along the creek, but no flowers were seen.

Conclusions: Winter storm Uri appeared to have minimal effect on any of the species we are monitoring. This is likely because we are at the southern and western range limit for most of these species. Since we are at the northern limit of the ground orchids in the *Hexalectris* genus, it is possible there was some impact. Unfortunately, these orchids have an unpredictable bloom cycle and regular monitoring throughout the year was not possible, so we are unable to assess any impact from Uri.

Primula meadia did better than in any year prior with more bloom stalks (5) than ever observed in the past (only one bloom stalk observed before), and the plants looked generally healthy and robust. This probably should not be unexpected since shooting-stars range north to Manitoba and our plants are the furthest south individuals on record. Herbivory is an ongoing concern. Two of the five stalks were eaten. I caged the primary southern population in 2018 following the recommendation of David Mahler.

It has long been hypothesized that the old fencing over part of the North Hollow population provided herbivory protection, but I have observed no difference in herbivory on plants under or outside the fencing.

Additional information: The iNaturalist Wild Basin Biodiversity Project currently has 1291 Research Grade observations of 435 unique species (5 new species, 3 new plant species) made by 70 observers. Significantly 393 different iNaturalist members have contributed identifications to these observations.

Appendix F: Herpetological activity at pitfall arrays

Table F1. Pit-Fall Array Activity

Drift Fence Survey	Drift Array Configuration	Drift Fence Length	Functional Pits	Functional Funnels	Start Date/Time	Finish Date/Time	Total Time (h)	Days	Pitfall Hours	Pit Fall Days	Funnel Hours
WB07-001	Linear	75	4	0	5/26/2021 12:30	5/27/2021 13:55	25.42	1.06	101.67	4.24	0.00
WB07-001	Linear	75	4	0	5/27/2021 14:00	5/28/2021 13:20	23.33	0.97	93.33	3.89	0.00
WB07-002	Linear	50	3	0	6/14/2021 7:50	6/15/2021 7:40	23.83	0.99	71.50	2.98	0.00
WB07-002	Linear	50	3	0	6/15/2021 8:23	6/16/2021 8:18	23.92	1.00	71.75	2.99	0.00
WB07-002	Linear	50	3	0	6/16/2021 8:20	6/17/2021 7:30	23.17	0.97	69.50	2.90	0.00
WB07-002	Linear	50	3	0	6/17/2021 7:20	6/18/2021 8:05	24.75	1.03	74.25	3.09	0.00
WB08-001	Y	75	4	6	4/27/2021 16:11	4/28/2021 7:45	15.57	0.65	62.27	2.59	93.40
WB08-001	Y	75	4	6	4/28/2021 8:00	4/28/2021 16:45	8.75	0.36	35.00	1.46	52.50
WB08-001	Y	75	4	6	4/28/2021 16:55	4/29/2021 7:12	14.28	0.60	57.13	2.38	85.70
WB08-001	Y	75	4	6	4/29/2021 7:34	4/29/2021 15:36	8.03	0.33	32.13	1.34	48.20
WB08-001	Y	75	4	6	4/29/2021 15:45	4/30/2021 9:30	17.75	0.74	71.00	2.96	106.50
WB08-002	Y	75	2	6	5/3/2021 14:10	5/4/2021 9:28	19.30	0.80	38.60	1.61	115.80
WB08-002	Y	75	2	6	5/4/2021 9:45	5/4/2021 16:40	6.92	0.29	13.83	0.58	41.50
WB08-002	Y	75	2	6	5/4/2021 17:00	5/5/2021 7:12	14.20	0.59	28.40	1.18	85.20
WB08-002	Y	75	2	6	5/5/2021 7:25	5/5/2021 16:17	8.87	0.37	17.73	0.74	53.20
WB08-002	Y	75	2	6	5/5/2021 16:20	5/6/2021 10:04	17.73	0.74	35.47	1.48	106.40
WB08-002	Y	75	2	6	5/6/2021 10:15	5/6/2021 15:49	5.57	0.23	11.13	0.46	33.40
WB08-002	Y	75	2	6	5/6/2021 15:52	5/7/2021 8:33	16.68	0.70	33.37	1.39	100.10
WB08-002	Y	75	2	6	5/7/2021 8:40	5/7/2021 15:55	7.25	0.30	14.50	0.60	43.50
WB08-003	Y	75	2	3	5/17/2021 8:30	5/17/2021 15:30	7.00	0.29	14.00	0.58	21.00
WB08-003	Y	75	2	3	5/17/2021 15:45	5/18/2021 8:20	16.58	0.69	33.17	1.38	49.75
WB08-004	Y	75	0	6	5/24/2021 14:05	5/25/2021 14:30	24.42	1.02	0.00	0.00	146.50
WB08-004	Y	75	0	6	5/25/2021 14:35	5/26/2021 13:39	23.07	0.96	0.00	0.00	138.40
WB08-004	Y	75	0	6	5/26/2021 13:45	5/27/2021 14:20	24.58	1.02	0.00	0.00	147.50
WB08-004	Y	75	0	6	5/27/2021 14:30	5/28/2021 13:42	23.20	0.97	0.00	0.00	139.20

WB08-005	Y	75	2	6	6/14/2021 8:16	6/15/2021 8:40	24.40	1.02	48.80	2.03	146.40
WB08-005	Y	75	2	6	6/15/2021 8:48	6/16/2021 8:40	23.87	0.99	47.73	1.99	143.20
WB08-005	Y	75	2	6	6/16/2021 8:40	6/17/2021 7:50	23.17	0.97	46.33	1.93	139.00
WB08-005	Y	75	2	6	6/17/2021 7:53	6/18/2021 8:30	24.62	1.03	49.23	2.05	147.70
WB14-001	Y	75	4	6	4/27/2021 17:25	4/28/2021 8:15	14.83	0.62	59.33	2.47	89.00
WB14-001	Y	75	4	6	4/28/2021 8:30	4/28/2021 17:30	9.00	0.38	36.00	1.50	54.00
WB14-001	Y	75	4	6	4/28/2021 17:30	4/29/2021 7:48	14.30	0.60	57.20	2.38	85.80
WB14-001	Y	75	4	6	4/29/2021 8:04	4/29/2021 15:55	7.85	0.33	31.40	1.31	47.10
WB14-001	Y	75	4	6	4/29/2021 16:00	4/30/2021 10:00	18.00	0.75	72.00	3.00	108.00
WB14-002	Y	75	3	6	5/3/2021 14:50	5/4/2021 9:53	19.05	0.79	57.15	2.38	114.30
WB14-002	Y	75	2	6	5/4/2021 10:00	5/4/2021 17:26	7.43	0.31	14.87	0.62	44.60
WB14-002	Y	75	4	6	5/4/2021 18:00	5/5/2021 7:35	13.58	0.57	54.33	2.26	81.50
WB14-002	Y	75	4	6	5/5/2021 7:45	5/5/2021 16:38	8.88	0.37	35.53	1.48	53.30
WB14-002	Y	75	4	6	5/5/2021 16:45	5/6/2021 10:24	17.65	0.74	70.60	2.94	105.90
WB14-002	Y	75	4	6	5/6/2021 10:30	5/6/2021 16:06	5.60	0.23	22.40	0.93	33.60
WB14-002	Y	75	4	6	5/6/2021 16:12	5/7/2021 8:50	16.63	0.69	66.53	2.77	99.80
WB14-002	Y	75	4	6	5/7/2021 8:55	5/7/2021 16:17	7.37	0.31	29.47	1.23	44.20
WB14-003	Y	75	4	3	5/17/2021 9:00	5/17/2021 15:53	6.88	0.29	27.53	1.15	20.65
WB14-003	Y	75	4	3	5/17/2021 16:05	5/18/2021 8:40	16.58	0.69	66.33	2.76	49.75
WB14-004	Y	75	4	6	5/24/2021 14:30	5/25/2021 14:47	24.28	1.01	97.13	4.05	145.70
WB14-004	Y	75	4	6	5/25/2021 15:02	5/26/2021 14:00	22.97	0.96	91.87	3.83	137.80
WB14-004	Y	75	4	6	5/26/2021 14:20	5/27/2021 14:40	24.33	1.01	97.33	4.06	146.00
WB14-004	Y	75	4	6	5/27/2021 14:45	5/28/2021 13:58	23.22	0.97	92.87	3.87	139.30
WB14-005	Y	75	4	6	6/14/2021 8:35	6/15/2021 9:00	24.42	1.02	97.67	4.07	146.50
WB14-005	Y	75	4	6	6/15/2021 9:27	6/16/2021 9:00	23.55	0.98	94.20	3.92	141.30
WB14-005	Y	75	4	6	6/16/2021 9:15	6/17/2021 8:09	22.90	0.95	91.60	3.82	137.40
WB14-005	Y	75	4	6	6/17/2021 8:11	6/18/2021 9:02	24.85	1.04	99.40	4.14	149.10

Table F2. Pit Fall Array Captures

Drift Fence Survey	Start Date/Time	Finish Date/Time	Species	Type	Trap Type
WB08-001	4/28/2021 16:55	4/29/2021 7:12	*Incilius nebulifer*	Anuran	pitfall
WB08-001	4/29/2021 15:45	4/30/2021 9:30	*Incilius nebulifer*	Anuran	pitfall
WB08-002	5/3/2021 14:10	5/4/2021 9:28	*Incilius nebulifer*	Anuran	pitfall
WB08-002	5/4/2021 17:00	5/5/2021 7:12	*Incilius nebulifer*	Anuran	pitfall
WB08-003	5/17/2021 8:30	5/17/2021 15:30	*Incilius nebulifer*	Anuran	Pit Fall
WB08-005	6/17/2021 7:53	6/18/2021 8:30	*Storeria dekayi texanum*	Snake	pitfall
WB14-001	4/27/2021 17:25	4/28/2021 8:15	*Incilius nebulifer*	Anuran	pitfall
WB14-001	4/27/2021 17:25	4/28/2021 8:15	*Incilius nebulifer*	Anuran	pitfall
WB14-001	4/28/2021 8:30	4/28/2021 17:30	*Scincella lateralis*	Lizard	pitfall
WB14-001	4/28/2021 8:30	4/28/2021 17:30	*Scincella lateralis*	Lizard	pitfall
WB14-004	5/25/2021 15:02	5/26/2021 14:00	*Incilius nebulifer*	Anuran	Pit Fall
WB14-004	5/25/2021 15:02	5/26/2021 14:00	*Incilius nebulifer*	Anuran	Pit Fall
WB14-004	5/25/2021 15:02	5/26/2021 14:00	*Incilius nebulifer*	Anuran	Pit Fall
WB14-004	5/24/2021 14:30	5/25/2021 14:47	*Nerodia erythrogaster*	Snake	pit fall
WB14-005	6/15/2021 9:27	6/16/2021 9:00	*Incilius nebulifer*	Anuran	Pitfall
WB14-005	6/15/2021 9:27	6/16/2021 9:00	*Incilius nebulifer*	Anuran	Pitfall
WB14-005	6/14/2021 8:35	6/15/2021 9:00	*Lithobates berlandeiri*	Anuran	Funnel
WB14-005	6/14/2021 8:35	6/15/2021 9:00	*Scincella lateralis*	Lizard	pitfall
WB14-005	6/15/2021 9:27	6/16/2021 9:00	*Scincella lateralis*	Lizard	Pitfall