CHAPTER VII

Brackenridge Field Lab Collaborative Planning

7.1. COLLABORATIVE PLANNING PROCESS

The design team was asked to undertake collaborative planning with U.T. Austin on the U.T. Austin facilities now on the Brackenridge Tract: the Field Laboratory and graduate student housing. This report about the Brackenridge Field Laboratory (BFL) includes mention of the Ladybird Johnson Wildflower Center and the Stengl Lost Pines Biological Station, which also provide research opportunities though they lie outside the Brackenridge Tract.

7.1.1. TEAM

The design team visited the Field Laboratory site several times, and had a presentation there of the Field Laboratory's work from several faculty, talked with Dr. Peter Raven and Dr. Nancy Moran, who have recently done evaluations of the laboratory, and had collaborative planning sessions with the College of Natural Sciences (CNS) representatives, always including:

- Dr. Mary Ann Rankin, Dean, College of Natural Sciences
- Kay Thomas, Associate Dean, College of Natural Sciences
- Dr. Larry Gilbert, Director of Brackenridge Field Laboratory
- Dr. Ed Theriot, Director of Texas Natural Science Center

There is agreement between Drs. Raven and Moran that a field laboratory is a critical component of a successful graduate program in Ecology/Evolution Biology.

7.1.2. EXISTING BRACKENRIDGE FIELD LABORATORY

7.1.2.1. Background and Role in the College of Natural Sciences:

Within the College of Natural Sciences' School of Biological Sciences is the Section of Integrative Biology, which involves study of such topics as global warming, invasive species, environmental toxicity, community and ecosystem health, and biodiversity. Its graduate program, Ecology, Evolution, and Behavior, is ranked among the top ten in the country by U. S. News and World Report and by the National Research Council in 1994; it is the major user of the Brackenridge Field Laboratory.

The University of Texas Fire Ant Research Project is located at the Brackenridge Field Laboratory. This research involves the use of flies from the genus *Pseudacteon* (generally referred to as "phorid flies" because they belong to the family Phoridae) to control ant species belonging to the genus *Solenopsis* (collectively, "red imported fire ant"). Phorid flies are parasitoids of the ants. On their website, the Brackenridge Field Laboratory states that "the first South American phorids were imported to North America and BFL in June 1994" and that "the first permitted release of those flies in North America was at BFL in November of 1995." "Many of the major names in phorid research across the country were trained at BFL and this laboratory is one of only two in the country where basic research is being done on new phorid species that may someday be useful in the fight against the Red Imported Fire Ant." The primary goal of the U.T. Austin Fire Ant Project is establishing "a comprehensive suite of phorid species for fire ant biological control in Central and South Texas."

In addition, within its greenhouses, Field Laboratory researchers in cooperation with the USDA are investigating biological control of the invasive species *Arundo donax* (giant cane), which in Texas has caused considerable displacement of native vegetation along the Rio Grande. Research on this species involves the mass rearing of wasps to study wasp interaction with Arundo donax; an established Arundo donax colony was observed on the Field Laboratory.

Eighteen faculty and five lecturers work at the Field Laboratory part-time. There are 24 U.T. Austin courses in which the Field Laboratory serves as the primary field laboratory for instruction. Approximately 562 students per year attend these classes. In addition classes from St. Edward's University, Concordia University, and Texas A&M also use the Field Laboratory. Outreach events involve approximately 10,000 people annually. The Field Laboratory is an Organized Research Unit and approximately 48 research projects are on-going. The team was told that up to $4 million in grant money is generated annually. (The 2008-9 FY grant money is $230,000.)

Research is also done at two other major locations over which the College of Natural Sciences has partial control, namely, Ladybird Johnson Wildflower Center and Stengl Lost Pines Biological Station.

There are also research projects underway at other host locations not controlled by the College of Natural Sciences.

Table 1. Course Offerings Utilizing BFL

Course #	Course Title	Semester taught	Most Current Enrollment
BLO 208L	Field Biology	Spring/Fall	18
B1O 321L/384.13	Aquatic Entomology	Fall	15
BIO 324/124L	Survey of the Plant Kingdom (with lab)	Spring	97
BIO 337	Research Methods (UTeach)	Spring/Fall	10
BIO 340L	Biology of Birds	Spring	43
BIO 453L	Entomology	Spring/Fall	30
BIO 359K	Principals of Animal Behavior	Spring/Fall	65
BIO 373L	Ecology Laboratory	Spring/Fall	15
BIO 406D	Native Plants	Spring/Fall	14
BIO 437	Plant Systematics and Texas Flora	Fall	14
BIO 438L	Animal Communication	Spring	30
BIO 448L	Invertebrate Biology	Spring	1 1
BIO 455L	Vertebrate Natural History	Fall	24-32
B1O 456L	Limnology and Oceanography	Fall	20
B1O 177, 277, 377	Undergraduate Research	Spring/Fall	2 (Abbott) 6 (Cummings) 24 (Juenger) 3 (Linder) 6 (Ryan)
BIO 478T	Natural Resource Management	Spring	14
GEO 376L/382C	Groundwater Field Methods	Spring	18
UGS 301	New Freshman Signature Course: The Evolving World: Evolution in Everyday Life (to be offered for the first time in fall 2008)	Fall	15-18*
BIO 301E	Plan II: Problems in Modern Biology (one class visit to BFL per semester)	Spring/Fall	60
BIO 471G	Museum Science (one class visit to BFL per semester)	Offered as needed	24
BIO 342L	Field Ornithology	Offered as needed	13
BIO 353F	Field Entomology	Offered as needed	15
BIO 354L	Icthyology	Offered as needed	18
BIO 369L	Herpetology	Offered as needed	24
BIO 352/387M	Reproductive Biology of Flowering Plants	Every other year	18
Graduate Workshop	QTL Methods	Not provided	20
Outreach Teaching	See Table 4		9,761

Source: Compiled from a Dean Mary Ann Rankin e-mail dated 11/6/07 in response to questions posted about the BFL.
** to be offered for the first time in fall 2008.*

Table 2. On-Site Outreach Activities 2001 to 2007
In addition to classroom use, BFL serves community outreach activities as follows:

Date	Host	Group	Age	Attendance
3/5/02	Abbott	Austin Butterfly Forum	Adult	40
6/1/03	Abbott	Austin Children's Museum Camp	Children	100
6/10/05	Abbott	Travis Audubon	Adult	20
7/23/05	Gilbert/Abbott	UT Honors Colloquium	High School	10
8/8/05	Gilbert/Abbott	Austin Children's Museum Camp	7-10 yrs old	40

Table 2 cont.

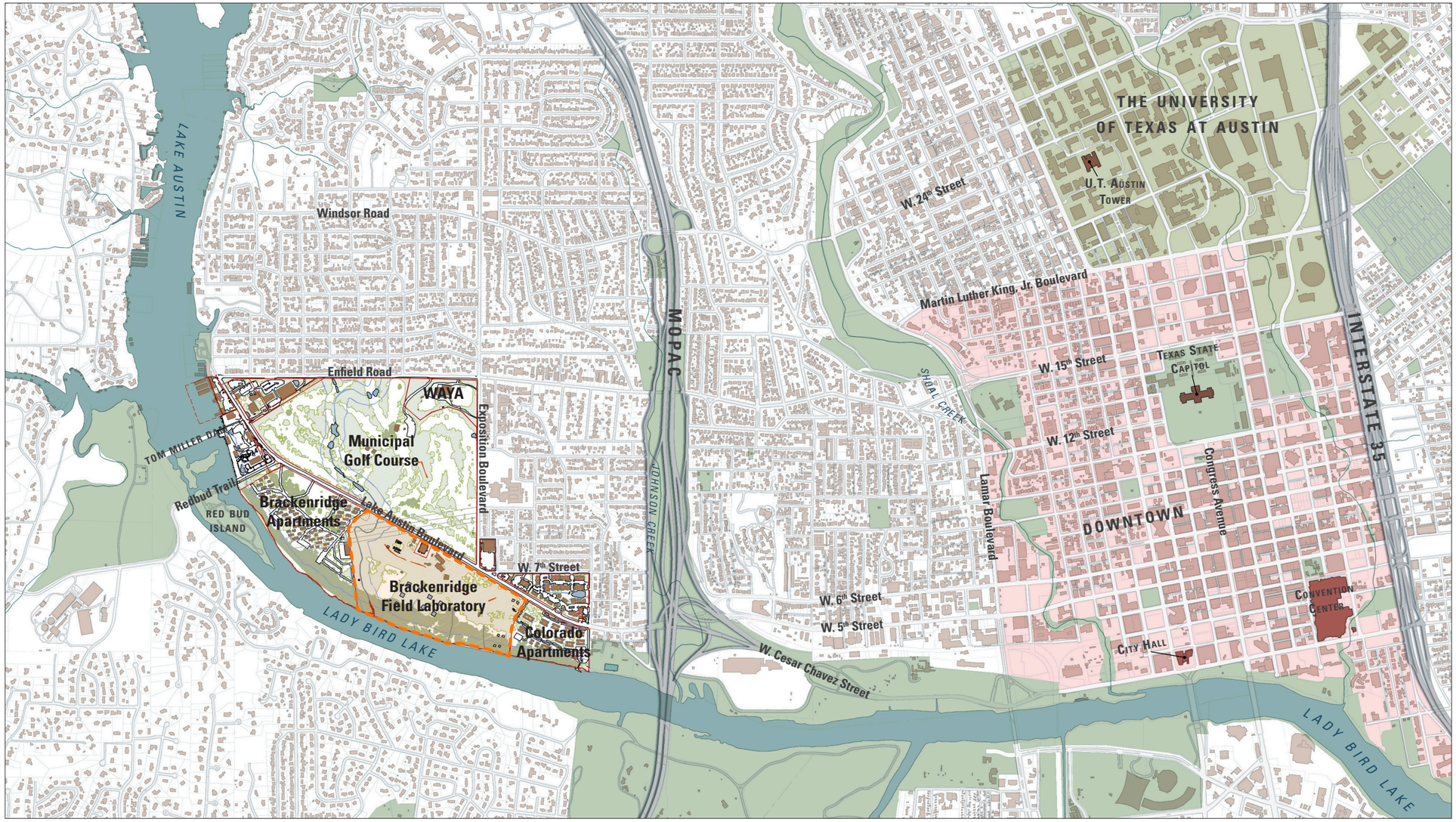
Date	Host	Group	Age	Attendance
11/1/05	Gilbert/Abbott	Plan II (Frank Bronson's class)	Univ.	3
11/1/05	Abbott	Macro photography Workshop	Adult	10
2/3/06	Gilbert/Abbott	Hyde Park Baptist Preschool	Pre-K	30
2/12/06	Gilbert/Abbott	Elaine Acker (Writer TX Wildlife Assn)	Adult	1
2/27/06	Gilbert/Abbott	SW Branch Entomological Society	Adult	11
3/1/06	Abbott	Sneed Collard (children's science writer)	Adult	1
3/1/06	Abbott	UT Sage Group	Seniors	20
3/1/06	Abbott	Travis Audubon	Adult	8
4/2/06	Gilbert/Abbott	Plan II (Dave Hall's class)	University	20
4/8/06	Gilbert/Abbott	Plan II (Dave Hall's class)	University	22
7/29/06	Gilbert/Abbott	UT Honors Colloquium	High School	20
8/1/06	Abbott	Boy Scouts	13-18 yrs old	15
9/1/06	Abbott	Travis Audubon	Adult	20
10/12/06	Gilbert/Abbott	Homeschool group	Elem. Mixed	10
10/21/06	Gilbert/Abbott	West Austin Neighborhood Group (J. Abbott)	Adult	25
10/28/06	Gilbert/Abbott	Plan II (Frank Bronson's class)	University	24
10/31/06	Gilbert/Abbott	Brack. Tract. Task Force Tour	Adult	12
11/1/06	Gilbert/Abbott	St. Stephens Episcopal School	11-12th gr.	13
11/1/06	Abbott	Travis Audubon	Adult	8
11/5/06	Gilbert/Abbott	Plan If (Frank Bronson's class)	University	27
12/1/06	Gilbert/Abbott	BASF Tour (for Bob Davis)	Adult	10
2/7/07	Gilbert/Abbott	Videographer from Statesman	Adult	1
2/22/07	Gilbert/Abbott	Austin High School	11-12th gr.	12
2/23/07	Gilbert/Abbott	Wildflower Center	Adult	6
2/24/07	Gilbert/Abbott	West Austin Neighborhood Group	Adult	15
2/27/07	Gilbert/Abbott	Austin High School	11-12th gr.	15
3/1/07	Abbott	Discover Nature Professional Development	Adults	20
3/14/07	Gilbert/Abbott	Austin Children's Museum Camp	6-10 yrs old	20
5/1/07	Abbott	Boy Scouts	13-18 yrs old	15
6/6/07	Gilbert/Abbott	Austin Children's Museum Camp	6-10 yrs old	41
6/8/07	Gilbert/Abbott	Teachers - UT summer program	Adult	10
8/1/07	Abbott	Brentwood School	Elem. Mixed	20
8/1/07	Abbott	Travis Audubon	Adult	20
9/7/07	Abbott	Plan II (Frank Bronson's class)	University	30
10/1/07	Abbott	Austin High School	High School	50
10/20/07	Abbott	Enzoology	Mixed	3
11/1/07	Abbott	Conference for the Advancement of Science Teaching	Teachers	47
3/6/08	Gilbert	Sneed Collard (children's science writer)	Adult	1
3/6/08	Gilbert	UT Sage Group	Seniors	20
5/7/08	Gilbert	Boy Scouts	13-18 yrs old	15
8/6/08	Gilbert	Boy Scouts	13-18 yrs old	15
8/7/08	Gilbert	Brentwood School	Elem. Mixed	20
9/7/08	Gilbert	Plan II (Frank Bronson's class)	University	30
10/7/08	Gilbert	Austin High School	---	50
11/7/08	Gilbert	Conference for the Advancement of Science Teaching	Teachers	47

Source: Compiled from a Dean Mary Ann Rankin e-mail dated 11/6/07 in response to questions posted about the BFL.

Table 3. Independent Research Activities at BFL
The following table was taken from the BFL website. It presents a listing of researchers and their activities at BFL. This illustrates the variety of studies currently taking place, as well as those which BFL has supported in the past.

Investigator	Research Organism	Research Topic	Primary Space Usage*
Abbottt, John	dragon and damselflies	dragon and damselfly species distributions and natural history; entomology collection curation and management	Fish tanks
Barth	titmice	interaction between morphology and song across a hybrid zone	Wooded land
Bertram	field crickets	effect of parasitoids on cricket mating systems	Field / laboratory
Bolnick, Daniel			
Cade, Bill	crickets	impact of fly parasitoids on cricket singing behavior	Field / laboratory
Cummings, Molly	Swordtails	Fish behavior and evolution; Sensory Ecology	Field / Fish tanks
Domjan, Michael	Japanese quail	sexually conditioned response	Aviary
Feener, Donald	Pheidole		
Eubanks, Mary	Maize	Origin and evolution of maize	Experimental garden
Fowler, Norma	grasses	effects of herbivory on plants	High fence exclosure / open field
Gilbert, Lawrence	imported fire ant	phorid flies as biocontrols	Field / laboratory
Gillaspy, James	moths	biodiversity	Field / laboratory
Hillis, David	fish	studies of gynogenetic mollies	Fish tanks / Town Lake
Hook, Allan	digger wasps	behavior, coevolution	Field / laboratory
Jansen, Robert	peppers	molecular phylogeny	Experimental garden / greenhouses
Juenger, Tom	Arabidopsis	Evolutionary genetics	Experimental garden
LeBrun, Edward	imported fire ant	phorid flies as biocontrols	Field / laboratory
Levin, Donald	phlox	population genetic studies of hybridization	Green houses
Linder, Randal	Sunflowers	Evolution of seed oil composition	Field /Experimental garden /green houses
Mueller, Ulrich	fungus-growing ants	Behavioral Evolution	laboratory
Neff, Jack	bees	nesting, foraging, and mating biology	Field / laboratory
Plowes, Rob	imported fire ant, swordtails	phorid flies as biocontrols	laboratory
Ryan, Michael	mollies, and frogs	evolution of sexual behavior	Tanks / laboratory
Schappert, Phil	plants/insects	chemical ecology of plant defenses	Field / greenhouses
Simpson, Beryl	plants/bees	plant systematics and biodiversity	Field / laboratory
Singer, Michael	butterflies	host relationships	field
Sword, Greg	grasshoppers	host specificity	field
Wuellner, Claire	imported fire ant	phorid flies as biocontrols	laboratory

Source: Base information for this table was compiled from http://www.utexas.edu/research/bfl/Research/Researchers%20at%20BFL.html. Additional information was obtained from a BFL handout provided by the College of Natural Sciences titled "Current Research: Brackenridge Field Laboratory."
**Primary Space Type column inferred from "Research Organism" and "Research Topic" descriptions.*



Context plan

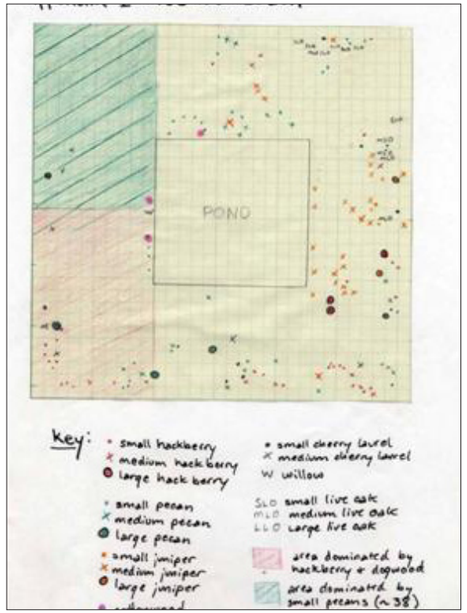
7.1.2.2. Existing Site Location:

The Brackenridge Field Laboratory (BFL) is an 81.97-acre facility located approximately 4 miles west of the U.T. Austin campus. It is situated between Lady Bird Lake and Lake Austin Boulevard on the Brackenridge Tract. It is an urban site evolving back to nature and recording the histories of the disturbances. Characteristics of the site include the following:

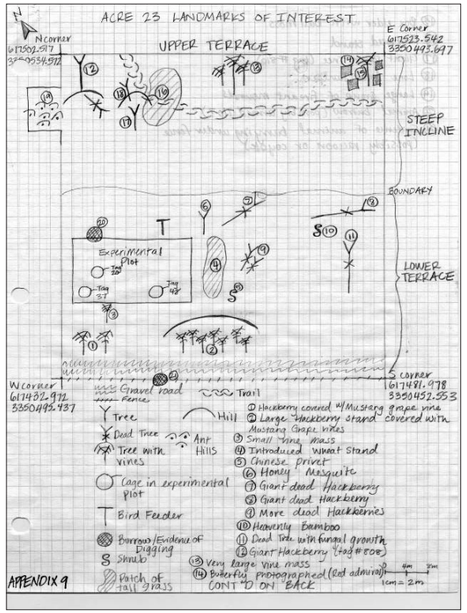
- It is located on the north-south Balcones fault divide between the Blacklands and Edward's Plateau, and on the northern edge of the range of some tropical biota.
- It combines the varied conditions of a freshwater lake, riparian forest and a stand of prairie.
- Therefore, it has a rich diversity of biota in a very small place: there have been 1200 varieties of butterflies and moths, 180 species of birds, 370 plant types, and 200 varieties of bees counted.
- Data on many of the species cover 40 years, and are used to review nature's responses to invasive species, urbanization, and climate change.
- It has man-made ponds, animal enclosures and "exclosures", fish tanks, laboratory buildings, and greenhouses.

Sample BFL photos

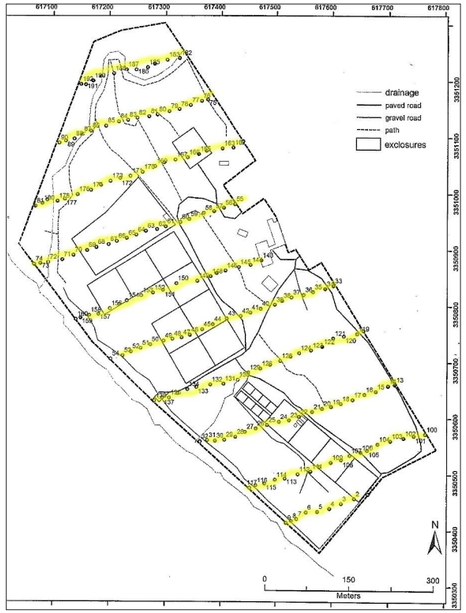
BFL site plan



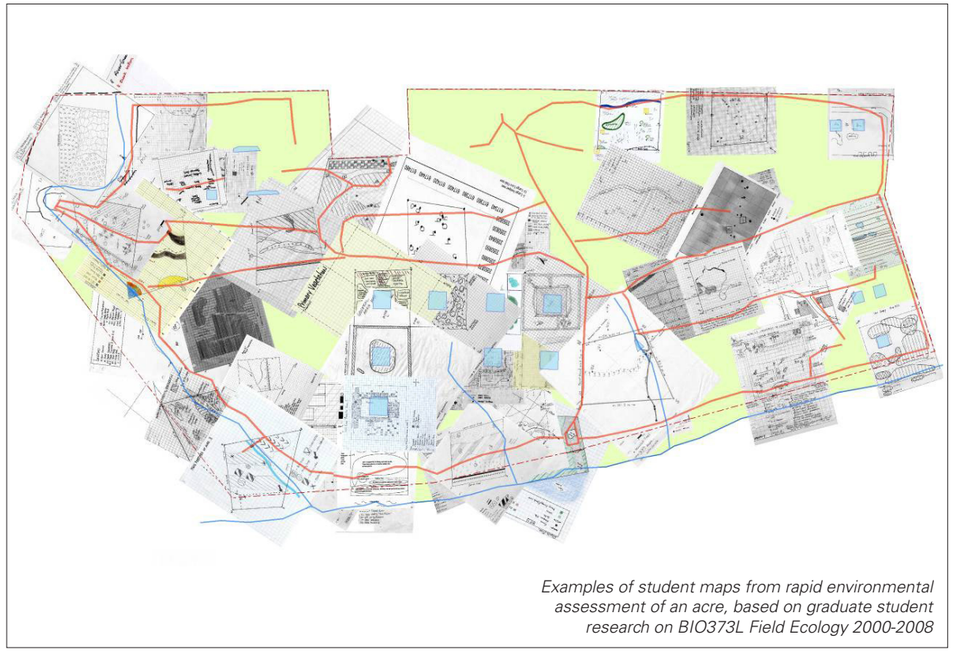
Example Student Acre Plot Assignment Sketch
Source: BFL Student Acre Plots 15



Example Student Acre Plot Assignment Sketch
Source: BFL Student Acre Plots 23



BFL Transects
Source: BFL 2008



Examples of student maps from rapid environmental assessment of an acre, based on graduate student research on BIO373L Field Ecology 2000-2008

Student Acre Plots Within BFL Property
Source: BFL 2008

View of typical transect

Acre plots

On a semester basis, students are assigned an acre plot for study. Some acre plots may be confined within man-made population enclosures, while others are not. Figure called "Student Acre Plots within BFL Property" depicts examples of student acre plots, which cover the majority of the field laboratory area.

As part of their individual assignment, students are tasked with taking an inventory of existing vegetation and general ecological conditions within their respective plot. Figures at the left depict two of the numerous sketches resulting from student plot assignments.

Transects

BFL is traversed by ten diagonally-oriented transects, spaced approximately 100 meters apart. Metal tags are generally located approximately 20 meters apart along each transect. In general, the transects serve as reference points for field research activities such as insect collections, teaching surveys, or any activities requiring a repeatable set of criteria.

The transects are currently used as part of a long-term plant succession experiment. Historically, BFL researchers have used these transects to identify individual plant species and characterize existing communities during different times of the year. The information gathered is used to study how plant communities change over time, as well as how they react to introduced species. These linear surveys assist in studying what BFL researchers refer to as *productivity dynamics* (i.e. changes in species abundance and biomass over time).

Transects are also useful in conducting fire ant surveys. Researchers use them to study how fire ant populations change in response to changes in vegetation composition over time.

Lady Bird Lake and Aquatic Rearing Facilities

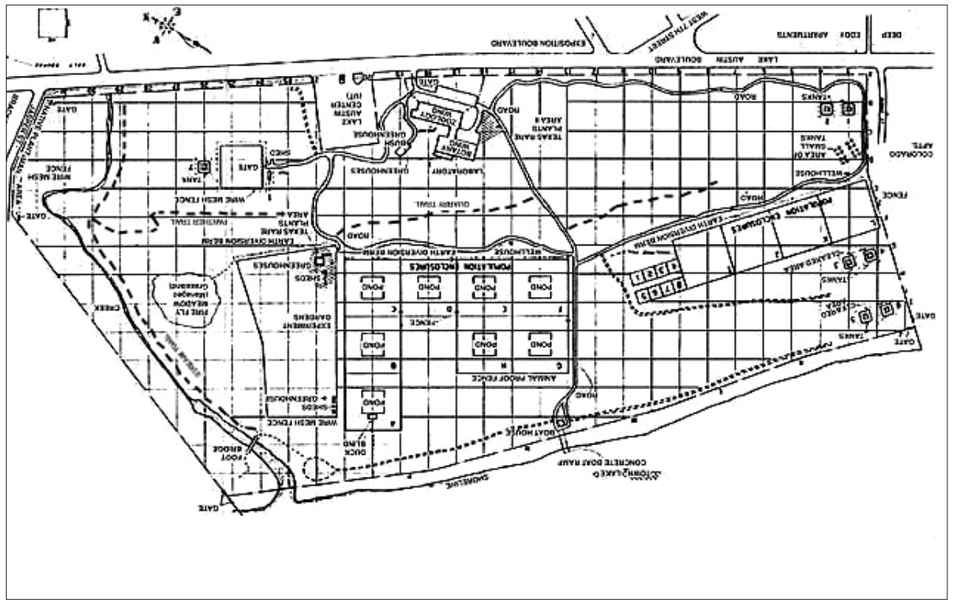
Aquatic research on BFL makes use of natural and man-made features. Data for the following map was provided by BFL personnel and depicts aquatic facilities currently in use and available for student and faculty research.

According to a synopsis of current research at BFL, Dr. David Hillis, Alfred W. Roark Centennial Professor, Section of Integrative Biology, and his students are using Lady Bird Lake to research the invasive Asian clam, which entered American waters in the 1920s. Dr. Hillis and his students utilize both the natural water environment along Lady Bird Lake, which is inhabited by two species of this clam, as well as man-made aquatic rearing facilities located on BFL. They are studying the genetic systems of these clams in hopes of understanding how these invasive clams displace native species.

Dr. Michael J. Ryan, Professor of integrative biology is using BFL to investigate the unique (cross-species) sexual selection between the Amazonian molly and the sailfin molly. Dr. Ryan is also conducting genetic research to better understand sexual selection among swordtail fish imported from streams in northeastern Mexico.

Molly Cummings, Assistant Professor, Section of Integrative Biology, is using BFL fish tanks to breed and study "how environmental changes have shaped visual sensitivity of small fish known as swordtails – how they have evolved to see their potential mates and predators and to respond to social stimuli."

BFL personnel prepared the following usage density map to illustrate comparative utilization of areas within the boundaries of the field laboratory.

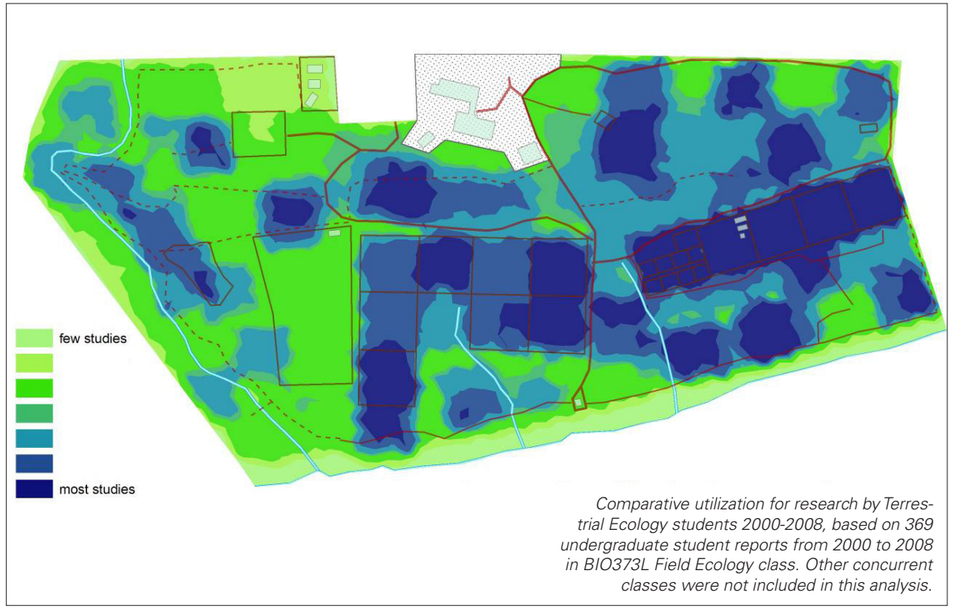


BFL site plan

Source: BFL website (accessed 10-14-08). http://www.utexas.edu/research/bfl/Facilities/Map.jpg

BFL Areas Used for Aquatic Studies

Source: Data for this map obtained from BFL personnel 2008



Comparative utilization for research by Terrestrial Ecology students 2000-2008, based on 369 undergraduate student reports from 2000 to 2008 in BIO373L Field Ecology class. Other concurrent classes were not included in this analysis.

BFL usage density map

Source: BFL 2008

7.1.2.3. Site History

1840-1860 Large cypress logged along Colorado for construction in early Austin.
1840-1900 Forest cleared for farms and pastures.
Ca. 1890's Quarrying of limestone through center of the area.
April 1900 Original dam washes out, depositing deep silt along lower terrace. Large pecans survive flood but are buried. Cottonwood colonizes open silt deposits left by flood (these are now senescing).
1900-25 Houses built on site.
1920s-1950s Ligustrum, melia, torillis , bromus, sorghum halepense, lonicera introduced in yards, invade and spread.

1929 Aerial photo

1951 Aerial photo

1958-1961 Pastures abandoned, houses cleared.

1966 BFL established and high fenced. Artificial ponds, paved roads, enclosure walls and lab buildings added.

1967-1975 Cedar elm and hackberry invade old fields especially near ponds & mesquite that had colonized pastures shaded out and killed.

1967 Deer excluded with high fence. Lacking deer, exotic plants thrive and spread.

1980 Gilbert assumes directorship from Blair.

1981 Large junipers cleared in firefly meadow.

1982 Campaign to remove Melia (china berry) begins.

1983 Population explosion of rabbits followed by sightings of mountain lions (August 1983). Rabbits have been rare since that time.

1981 Imported fire ants invade and spread over area by 1988. Native ants like Pogonomyrmex and S. geminata are dramatically reduced by S. invicta. Ironically, the rocky and densely wooded old quarry area provided a micro habitat that favors native ants over invicta.

1984 Professor Irwin Spear starts accidental fire in north end of experiment garden.

1986 Strip cleared west of boat house for native tall grass prairie species.

1987/88 First concrete fish tanks added. Overflow ponds create artificial wetlands nearby. Willows and cottonwood colonize.

1962 Aerial photo

1973 Aerial photo

1989 Restoration of grassland takes place in "Gill Ranch Glade". Several species are introduced (eg. Passiflora tenuiloba).

1990s Oak wilt, present since '60s begins to spread in the 1990s and by 2002, old trees are dead and dying along the central road North of enclosure E.

1990 Deer colonize in 1990 and peak at about 70 by 2002. Severe impact of herbivory on vegetation seen by 1996. Also rutting bucks, by rubbing antlers, girdle and kill small trees. May also be spreading oak wilt from spanish to live oak. By 1998 it is possible to see through the understory and browse lines are conspicuous.

1997 New greenhouse constructed East of laboratory.

1996-2000 Drought 1996-2000, stresses or kills many hackberry trees throughout area. Deer plus drought probably lead to extinction of orange tip butterfly.

2001 New underground electrical system installed throughout area.

2002 37 deer are removed.

June 2003 Introduced Phorid flies become abundant for the first time.

1994 Aerial photo

2008 Aerial photo

7.1.2.4. Existing Site Conditions and Characteristics

BIOTIC CHARACTERISTICS

Flora

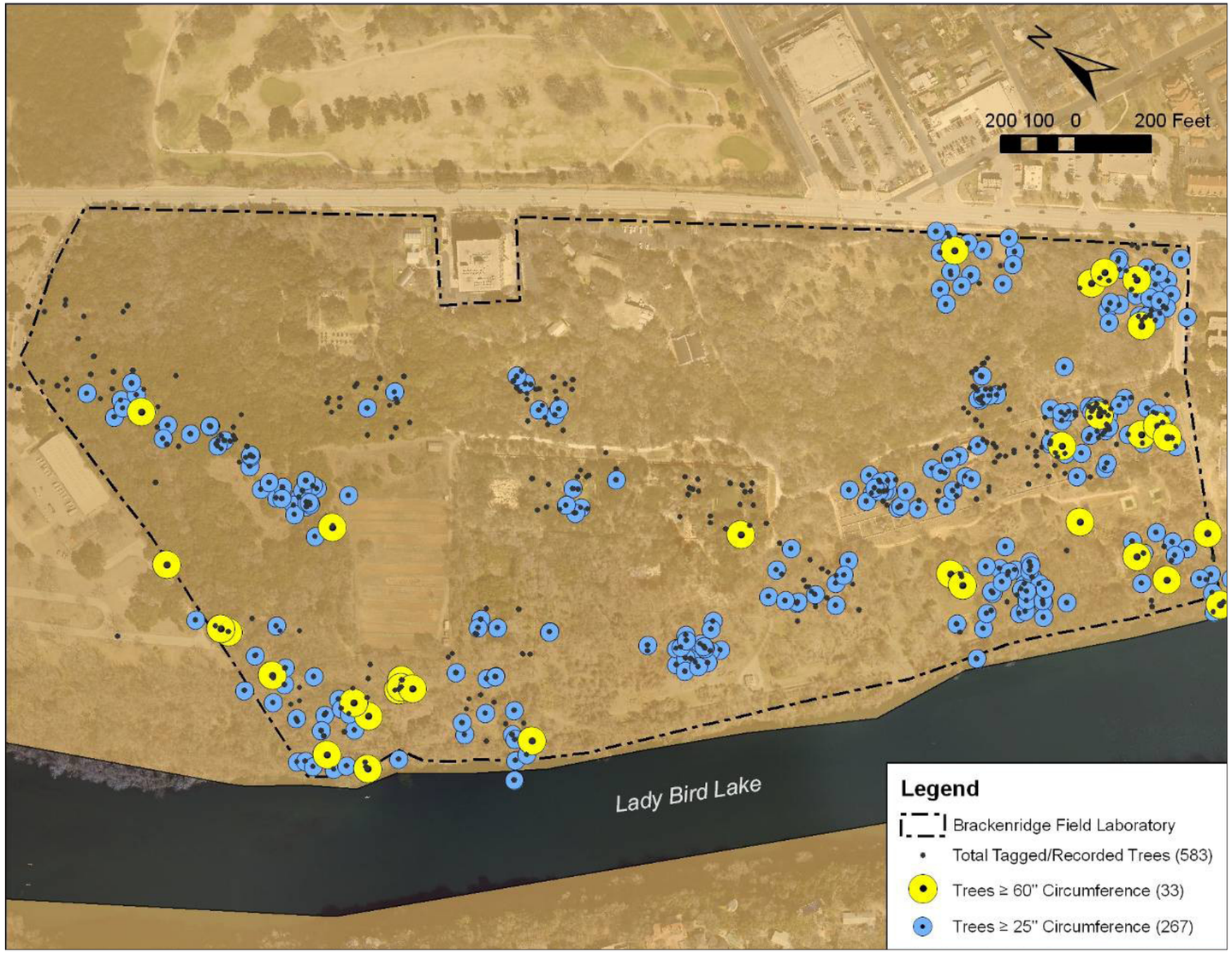
According to the Texas Parks and Wildlife Department's (TPWD) Vegetation Types of Texas, the BFL is located near the border of two vegetation communities described as "Live Oak - Ashe Juniper Woods" and "Urban" (TPWD 1984). Live Oak - Ashe Juniper Woods typically contain Texas oak, shin oak, cedar elm, evergreen sumac, escaprpment cherry, saw greenbriar, mescal bean, poison oak, twistleaf yucca, elbowbush, cedar sedge, little bluestem, Neally grama, Texas grama, meadow dropseed, Texas wintergrass, curly mesquite, pellitory, noseburn, spreading sida, woodsorrel, mat euphorbia. The project is consistent with the designation, with a moderate density of invasive plant species occurring within and around the property.

Multiple man-made structures (e.g. indoor laboratories/classroom space, greenhouses, maintenance buildings, and other small structures) are located on BFL. The property contains a high density of vegetation cover, including tree canopy and understory. Field visits revealed multiple vegetation communities located throughout the property. Existing vegetation communities observed throughout the BFL appear to be influenced by several factors including:

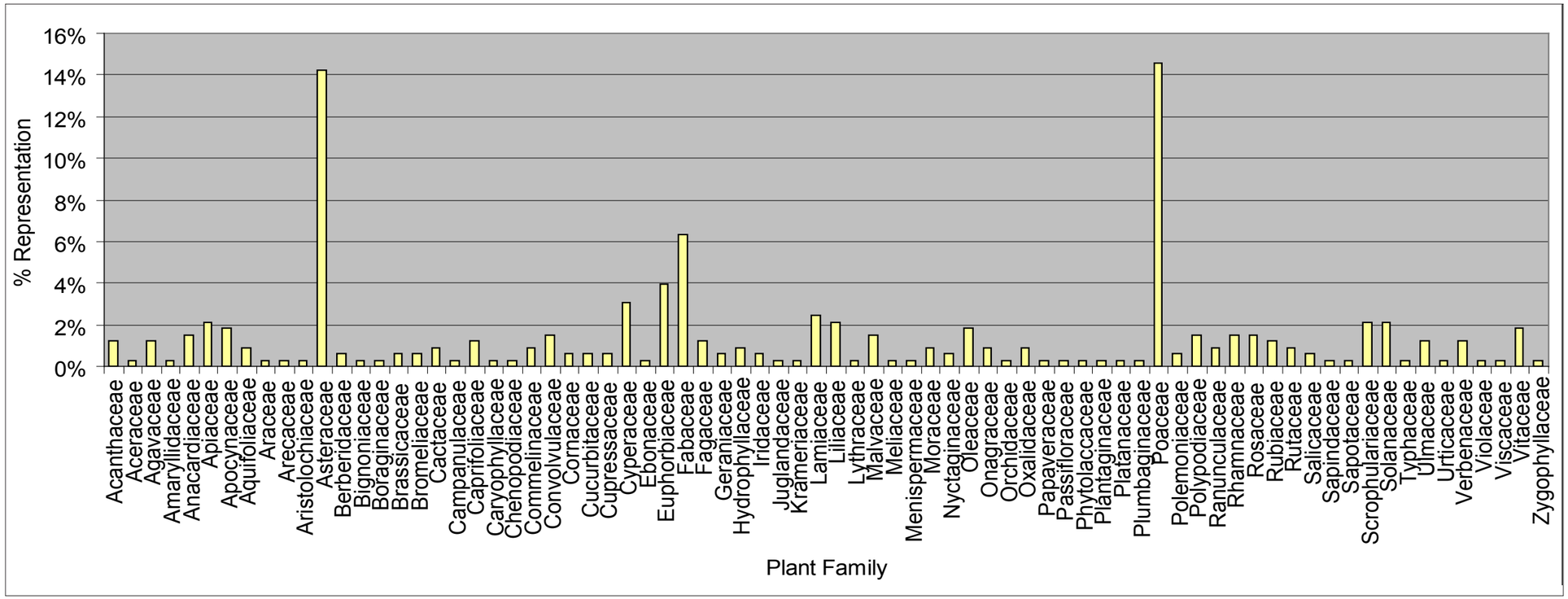
- Topography
- Town Lake floodplain and associated soils
- Historic disturbances on the site (e.g. historic quarrying, residential development, and pasture usage)
- Invasive species
- Schulle Branch, which traverses the western portion of the BFL
- Research activities at BFL

BFL Director Dr. Larry Gilbert provided a rough 170-year history of disturbances at BFL that have shaped the landscape within the site, which is used in ecology course instruction.

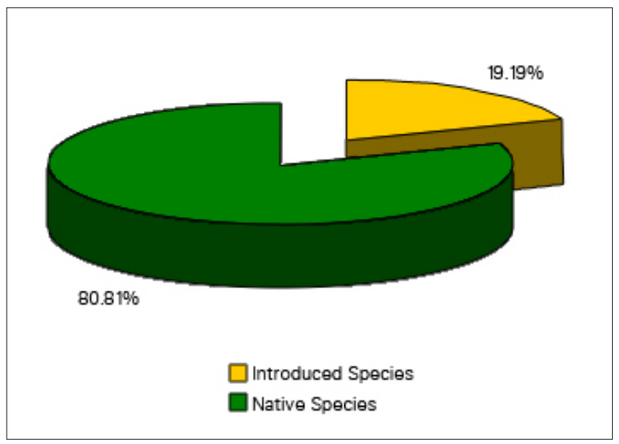
BFL personnel provided Geographic Information System (GIS) data from the results of tree tag surveys conducted within the BFL property. This data inventories tree species and corresponding trunk sizes for 583 trees previously tagged by the BFL. There are data gaps, or areas within the BFL where trees have not been surveyed. According to BFL personnel, recorded trees are limited to the student acre plots, which cover a large portion of the site.



Tagged trees within BFL student acre plots



Native versus introduced species (counted individuals)
Source: Results of positive counts based on limited plant surveys from 58 one-acre student plots. Provided by BFL personnel on 10/24/08.
Note: Based on student reports; therefore, results are variable depending in part on season, student identification skills, etc.



Plant species representation (number of species identified per plant family)
Source: Based on plant surveys from 58 acre plots. Provided by BFL personnel on 10/24/08.
Note: Based on student reports; therefore, results are variable depending in part on season, student identification skills, etc.

The chart on the left depicts plant family representation (based on the number of species identified within each plant family). The data was extracted from plant surveys conducted on 58 student acre plots, which cover the majority of the BFL. The data shows that the plant family with the highest representation is Poaceae (grass family of monocotyledonous flowering plants), followed by Asteraceae (aster, daisy, or sunflower family), and Fabaceae (legume family).

Included in this data was a denotation of native versus introduced plant species. The data shows that based on total individual plants counted during the various surveys (may include more than one individual from same species, and at different times), 433 introduced species (19.19 percent) and 1,823 native species (80.81 percent) were identified.

Numerous habitat types exist on the BFL. Some of the habitats were present prior to the field lab development and many have had successional development after the influence of man (e.g. clearing, addition of water sources, former homesteads, etc.). BFL staff provided a map dated July 8, 2008 depicting the various habitat types as delineated by BFL. This map was enhanced to include more descriptive plant associations based on a plant list provided by BFL and on field visits.

Balcones canyon woods: This habitat type is located on the western portion of the tract and generally follows the course of the Schulle Branch. This habitat is dominated by live oak, white shin oak, Texas ash, Mexican Buckeye, Texas sachuista, Texas yucca, grape, and rusty blackhaw.

Climax prairie: A climax prairie habitat consisting of little bluestem, kidneywood, evergreen sumac and cassia is located adjacent to an oak motte community on the western portion of the BFL. Typical vegetation consists of little bluestem, Opuntia Macracarpa, kidneywood, evergreen sumac, cassia, and silktassel.
Source: BFL

Prairie-fenced: The fenced prairie is similar in structure to the climax prairie and is located adjacent to the experimental garden. Typical vegetation consists of gay feather, common flax, flameleaf sumac, and little bluestem.
Source: BFL

Chaparral: A small chaparral habitat is located along an asphalt-paved path on the eastern side of the BFL. This habitat type is similar to that found in South Texas, and is comprised of prickly pear cactus, Brazilian blue wood, and pencil cactus.
Source: BFL

Experimental garden: Cultivated Plots
Source: BFL

Transitional flood deposited wooded terrace: This is located between the riparian edge along Lady Bird Lake, the live oak juniper woods, and population enclosure habitats. This community has a large and diverse vegetation composition that has been influenced by several factors including historic activities, the riparian edge to the south, and the oak community to the north. Included in this community are eastern cottonwood, hackberry, box elder, cedar elm, smallflower nemophila, wax mallow, palmetto, mustang grape, bernardia, mulberry, rough-leaf dogwood, Carolina cherry laurel, and woolly bucket bemelia.

Forest edge: This community consists of pricklyash, kidneywood, evergreen sumac, fragrant sumac, lantana, forestiera, agarita, colubrina, green condalia, and bernardia.

North terrace woodland: Typical vegetation includes ashe juniper, live oak, and ligustrum.

Oak motte: Typical vegetation includes live oak, white crownbeard (*verbesina virginica*).

Managed meadow: Typical vegetation includes prickly pear cactus, bromus, switchgrass, and silver bluestem.

Live oak woodland (former pasture): Typical vegetation includes ashe juniper, live oak, and Texas red oak.

Oak savanna: This community gernally consists of live oak, post oak, bumelia, ashe juniper, cedar elm, and ligustrum.

Live oak / ashe juniper / ligustrum woods: ashe juniper, live oak, cedar elm, yopuon holly, silktassel, Texas ash, red oak
Source: BFL

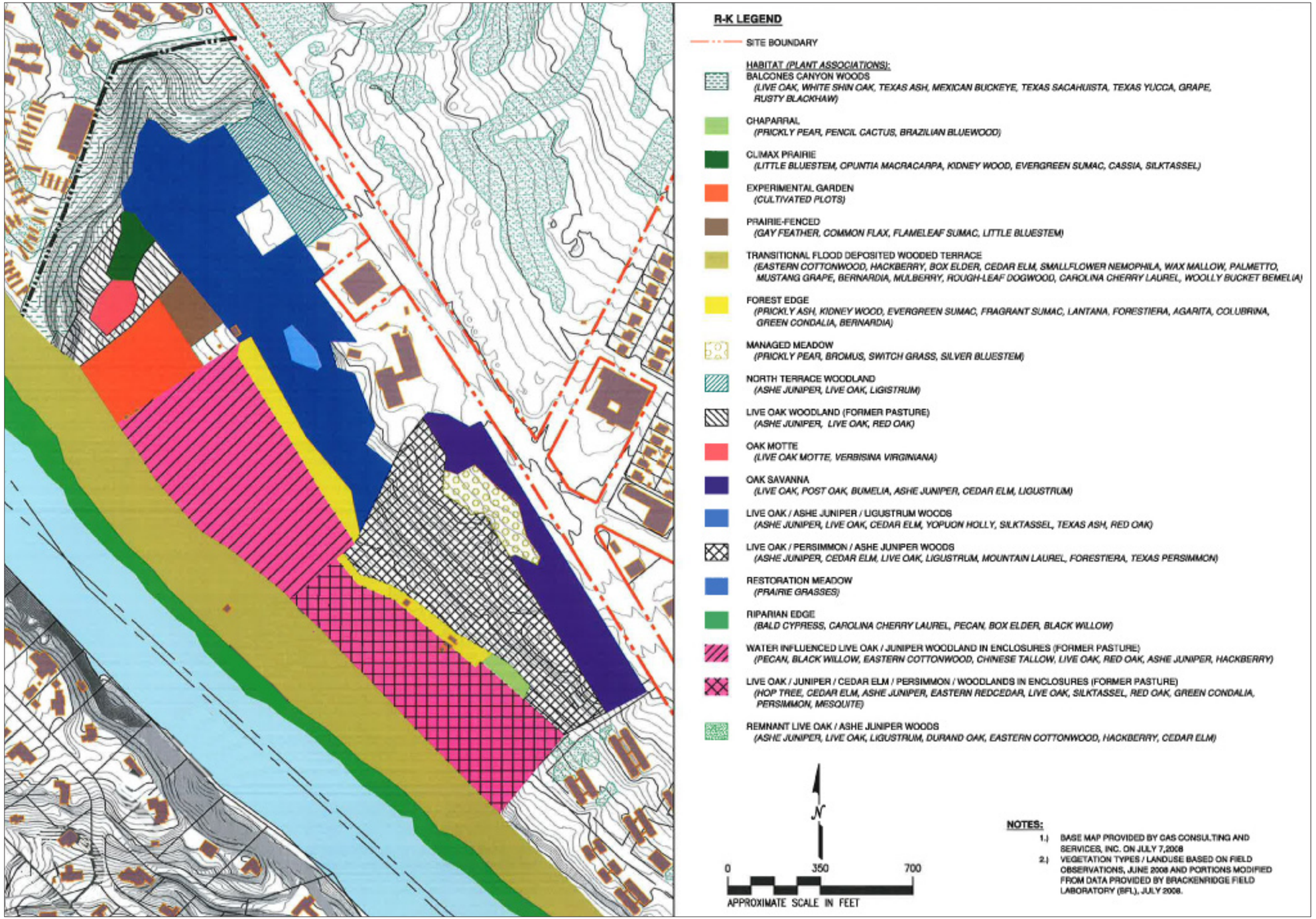
Restoration meadow: Prairie Grasses

Water-influenced live oak / juniper woodland in enclosures (former pasture): Pecan, black willow, eastern cottonwood, Chinese tallow, live oak, red oak, ashe juniper, and hackberry.

Live oak / persimmon / ashe juniper woods: Comprised of ashe juniper, cedar elm, live oak, ligustrum, mountain laurel, forestiera, and Texas persimmon.

Riparian edge: Generally comprised of bald cypress, Carolina cherrylaurel, pecan, box elder, and black willow.

Live oak / juniper / cedar elm / persimmon / woodlands in enclosures (former pasture): Consists of hop tree, cedar elm, ashe juniper, eastern redcedar, live oak, silktassel, red oak, green condalia, persimmon, and mesquite.



BFL vegetation map

HABITAT ANALYSIS

HABITAT or LAND USE	ACREAGE
Aviaries	0.12
Balcones Canyon Woods	7.81
Boathouse	0.21
Buildings	3.49
Central Old Pasture	9.32
Chaparral	0.27
Climax Prairie	0.60
Expt Garden	2.49
Fenced Prairie	0.76
Fish Tanks (2)	0.70
Flood Deposited Terrace North	3.61
Flood Deposited Terrace South	4.57
Forest Edge Central	1.39
Forest Edge South	0.75
Green House (2)	0.90
Gully North	0.30
Gully South	0.30
Managed Meadow	1.23
North Old Pasture	1.88
North Terrace	2.40
Oak Motte	0.55
Oak Savanna	4.06
Old Quarry North	11.42
Old Quarry South	8.94
Pecan Terrace North	3.08
Pecan Terrace South	2.12
Restoration Meadow	0.30
Riparian Edge	3.55
South Old Pasture	7.09
Stream	0.90
Total Area	85.11
Subtotal Developed	7.91
Subtotal Undeveloped	77.2

Habitat analysis map

Habitat analysis map

Habitat Analysis - Old Quary Habitat

North old quarry

Terrapin - north old quarry

Chaparral habitat at the edge of the south old quarry

Spanish mulberry (callicarpa americana common) - north old quarry

Texas Coral Snake (Micrurus fulvius) - north old quarry

Habitat Analysis - Old Pasture and Pecan Terrace Habitat

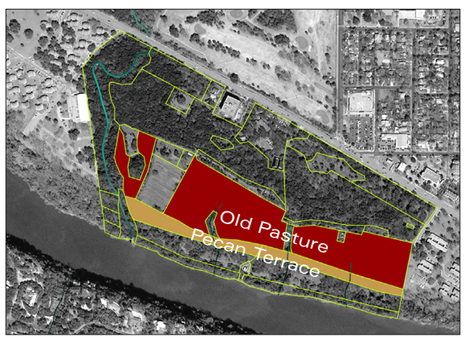
Central old pasture

Sabal palmetto trees- north pecan terrace

Lupines - south old pasture

Hyla green tree frog - central old pasture

North pecan terrace



Habitat Analysis - Expt Garden Habitat

Botany plotted

Liatris fenced prairie - October

Liatris fenced prairie - September

Solidago fenced prairie

Habitat Analysis - Flood Deposited Terrace and Riparian Edge Habitat

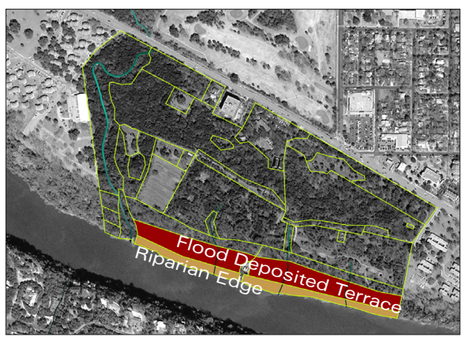
Hackberry Elymus below flood deposited terrace

Riparian edge cleared

Canadia wild rye Elymus under old cottonwood - flood deposited terrace

Managed clearing riparian edge

Large willow riparian edge west of the stream



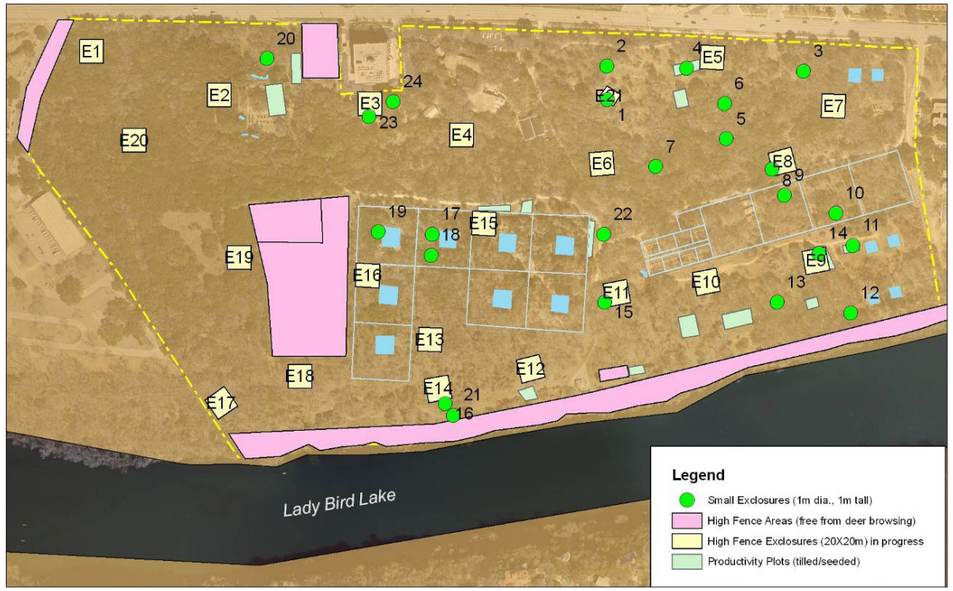
Fauna

On their website, the BFL states that a number of species have been identified within the BFL including 163 birds, 19 mammals, 60 ants, and 1,200 moths and butterflies. Many species encountered on BFL may be transient in nature (e.g. migratory birds stopping for water), while other species with smaller home ranges may be encountered on BFL year-round (e.g. Eastern Hognose Snake and other smaller reptiles). Occasional use of the BFL is illustrated in a map titled *Facilities and Sites Used for Aquatic Biology Research and Teaching*, provided by BFL on July 16, 2008, which depicts a turtle nesting area along the BFL perimeter at Lady Bird Lake.

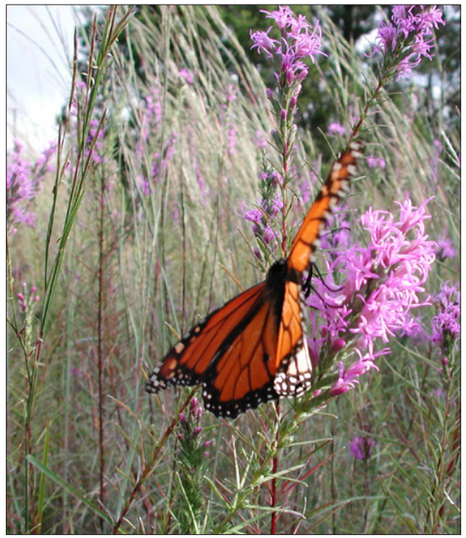
The following table is taken from the BFL website, and is a list of vertebrate species (birds omitted) that have been recorded on the BFL. This list was last revised in 1993.

Table 5. Provisional Checklist of Vertebrates of Brackenridge Field Laboratory

Pisces	**Reptilia**
Blacktail Shiner (*Notropis venustis*)	Common Snapping Turtle (*Chelydra serpentine*)
Channel Catfish (*Ictalurus punctatus*)*	Yellow Mud Turtle (*Kinosternon flavescens*)
Blackstripe Topminnow (*Zygonectus notatus*)	Eastern Mud Turtle (*Kinosternon subrubrum*)+
Mosquitofish (*Gambusia affinis*)	Stinkpot (*Sternotherus odoratus*)
*Gambusia spp.**	Texas Slider (*Chrysemys concinna*)
*Molleniesia spp.**	Red-eared Turtle (*Chrysemys scripta*)
Bluegill (*Lepomis macrochirus*)	Texas Tortoise (*Gopherus berlandieri*)*
Rio Grande "perch" (*Cichlasoma syanoguttatum*)*	Texas Map Turtle (*Graptemys versa*)*
Amphibia	Three-toed Box Turtle (*Terrapene carolina*)*
Cliff Frog (*Syrrophus marnocki*)	Ornate Box Turtle (*Terrapene ornata*)
Green Tree Frog (*Hyla cinerea*)	Spiny Softshell (*Trionyx spinifer*)
Blanchard's Cricket Frog (*Acris crepitans*)	Alligator (extinct in area) (*Alligator mississippinensis*)+
Gulf Coast Toad (*Bufo valliceps*)	Green Anole (*Anolis carolinensis*)
Red-spotted Toad (*Bufo punctatus*)	Texas Spiny Lizard (*Sceloporus olivaceus*)
Rio Grande Leopard Frog (*Rana berlandieri*)	Short-lined Skink (*Eumeces brevilineatus*)
Bullfrog (*Rana catesbiana*)	Ground Skink (*Lygosoma laterale*)
Slimy Salamander (*Plethodon glutinosus*)	Texas Spotted Whiptail (*Cnemidophorus gularis*)
Mammalia	Six-lined Racerunner (*Cnemidophorus sexlineatus*)
Opossum (*Didelphis virginiana*)	Slender Glass Lizard (*Ophisaurus attenuatus*)
Armadillo (*Dasypus novemcinctus*)	Texas Blind Snake (*Leptotyphlops dulcis*)
Eastern Woodrat (*Neotoma floridana*)	Yellow-bellied Racer (*Coluber constrictor*)
Hispid Cotton Rat (*Sigmodon hispidus*)	Texas Rat Snake (*Elaphe obsoleta*)
Fox Squirrel (*Sciurus niger*)	Sonora Kingsnake (*Lampropeltis getulus*)
Rock Squirrel (*Spermophilus variegatus*)	Rough Green Snake (*Opheodrys aestivus*)
Nutria (*Myocastor coypu*)*	Texas Patch-nosed Snake (*Salvadora grahamjae*)
Swamp Rabbit (*Sylvilagus aquaticus*)	Flat-headed Snake (*Tantilla gracilis*)
Eastern Cottontail (*Sylvilagus floridanus*)	Blotched Water Snake (*Natrix erythrogaster*)
Raccoon (*Procyon lotor*)	Texas Brown Snake (*Storeria dekayi*)
Mutt (*Canis familiaris*)*	Black-necked Garter Snake (*Thamnophis cyrtopsis*)
Grey Fox (*Urocyon cinereoargenteus*)	Western Ribbon Snake (*Thamnophis proximus*)
Feral Cat (*Felis domesticus*)*	Texas Coral Snake (*Micrurus fulvius*)
Mountain Lion (*Felis concolor*)**	Western Diamondback (*Crotalus atrox*)
Bobcat (Lynx rufus)	*Source: BFL Website. Compiled by Joe Ideker (1970-74). Additional Sightings 1983 (revised January 1993).*
Striped Skunk (*Mephitis mephitis*)	** Introduced*
Cave Myotis Bat (*Myotis velifer*)	*+ Known in Colorado River but not seen along shore of BFL*
Mexican Freetail Bat (*Tadarida brasiliensis*)	*** Sighted Aug-Sept. 1983 by C. Thompson, J. Longino, N. Nadkarni*
Whitetail Deer (*Odocoileus virginianus)*	



White-tailed deer study areas. This figure depicts sites used to study the impact of white-tailed deer on biodiversity and ecosystem.
Source: Data for this map obtained from BFL personnel 2008



Monarch butterfly (*danaus plexippus*): This butterfly's range is Southern Canada south through all of the United States, Central America, and most of South America (Big Sky Institute 2008).
Source: BFL

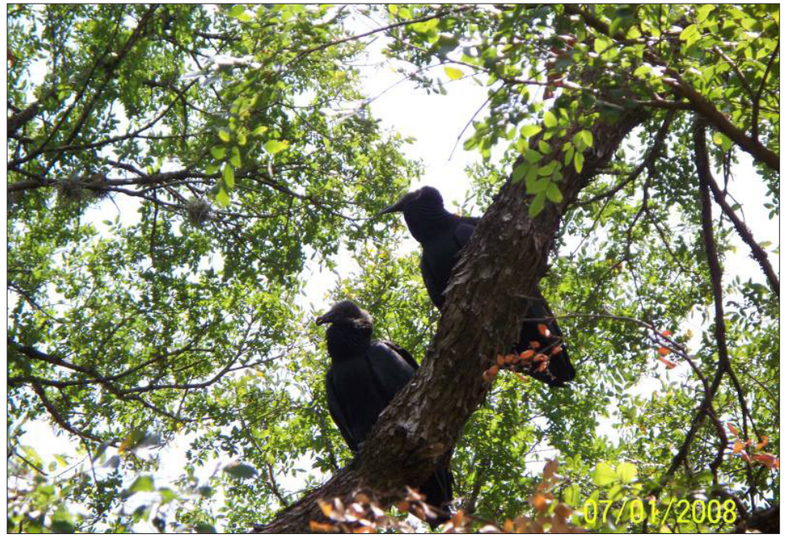
Zebra longwing (*heliconius charitonia*): This species originates in the neotropcs, occurring in extreme southern portions of the U.S. down through Mexico, Central America and the West Indies to South America" (University of Florida 2008).
Source: BFL

White-tailed deer (*odocoileus virginianus*): In Texas, the White-tailed deer is normally distributed in brushy or wooded lands (Schmidly 2004, 276). In contrast to the surrounding urban landscape, BFL provides forage and drinking water sources. The white-tailed deer colonized BFL in 1990 and peaked at about 70 by 2002. BFL researchers have observed impacts of the deer population to on-site vegetation and the possibility that their presence has influenced the spread of oak wilt on BFL.
Source: BFL

Northern raccoon (*procyon lotor*): This carnivore is scattered throughout the U.S. and all of Texas, but primarily found in areas near water sources. They inhabit dens located in trees or rock ledges and are primarily nocturnal. (Schmidly 2004, 165-166)
Source: http://www.nsrl.ttu.edu/tmot1/procloto.htm

Porcupine (*erethizon dorsatum*): The porcupine is adapted to a variety of habitats, primarily occupying forests. It prefers rocky areas, ridges, and slopes, as shown in this photo taken at BFL. Porcupines may be found in areas that appear completely unsuited to them. (Schmidly 2004, 451). According to Dr. Larry Gilbert, current BFL Director, the first sighting of this species north of the Colorado River occurred on BFL in recent history (Personal Communication 7/24/08).
Source: BFL

Nine-banded armadillo (*dasypus novemcinctus*): This species occurs throughout much of the state. They concentrate near streams and water holes. In the rocky terrain of the Edwards Plateau, this species tends to concentrate in the alluvial stream bottoms and den in the cracks and crevices of limestone outcroppings.



American black vulture (*coragyps atratus*): This species is common in Travis County. Black vultures spend much of the day searching for carcasses; however, due to a less developed sense of smell, they exploit the odor-detecting ability of turkey vultures to locate food and aggressively displace turkey vultures upon locating a carcass (Texas A&M University Dept. of Wildlife and Fisheries Sciences, Black Vulture). Black vultures nest in "dark recesses" in a variety of places (e.g., caves, hollow trees, brush piles, rock crevices, tangles of low vines or other low vegetation, protected under trees and logs (Texas A&M University Dept. of Wildlife and Fisheries Sciences, Black Vulture). During a BFL site visit, vultures appeared to be nesting in a crevice on a cliff face along Schulle Branch.

Yellow-crowned night-heron (*nyctanassa violacea*): Travis County is in the far western extent of this species' winter range. This specie is a locally common winter resident along the Texas coast, and rare to casual elsewhere (Lockwood and Freeman 2004, 36). This bird mainly feeds on crayfish in inland areas such as the BFL. They are secretive and nest in small scattered colonies beneath wooded/forested canopy (Texas A&M University Dept. of Wildlife and Fisheries Sciences, Yellow-Crowned Night Heron).
Source: BFL

Texas spiny lizard (sceloporus olivaceus): Also known as the "rusty lizard," this species inhabits trees such as mesquite, live oak, cottonwood, cedar, among other (Conant and Collins 1991, 106).
Source: BFL

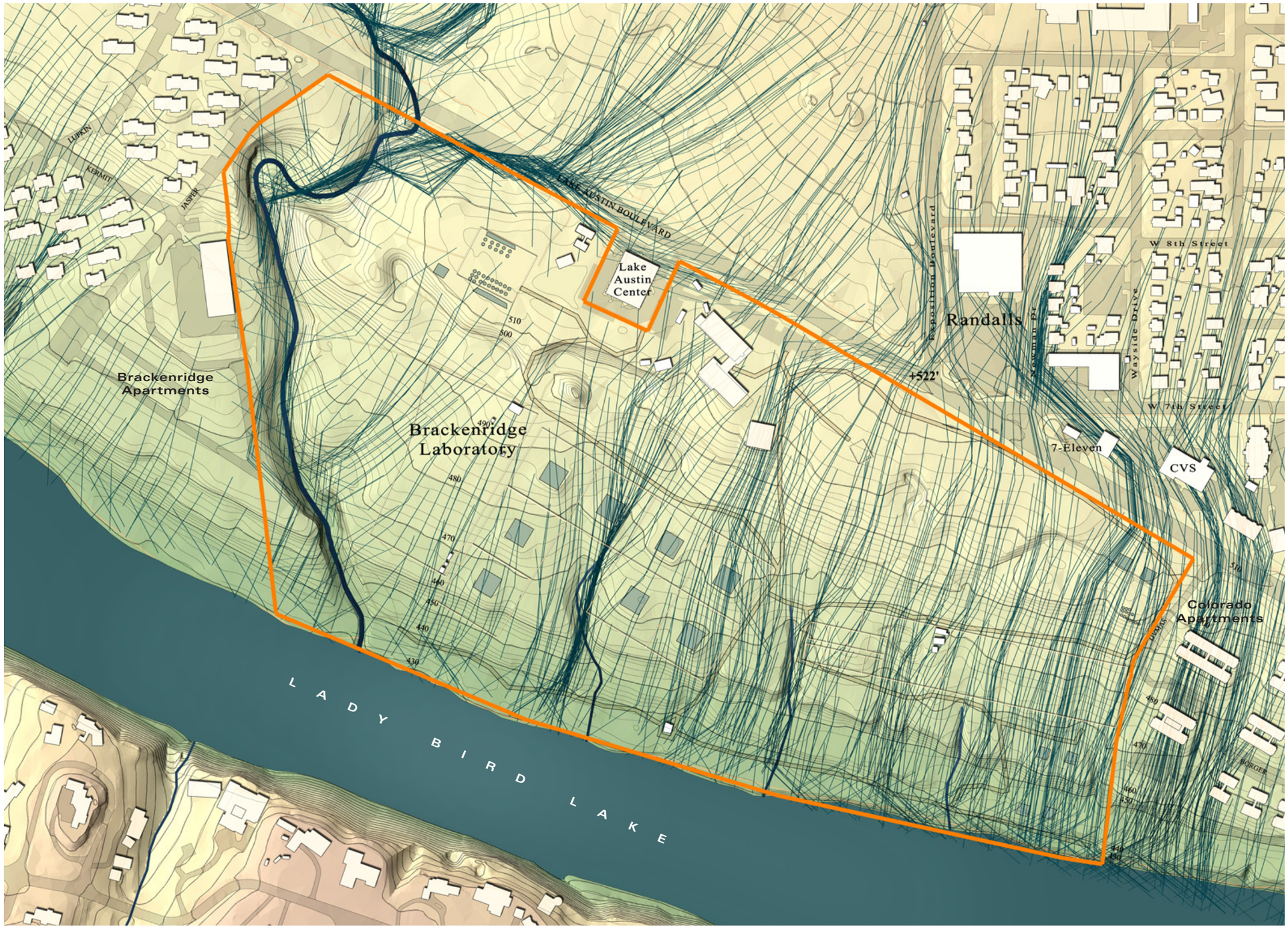
Eastern box turtle, (terrapene carolina carolina sp.): This is a land turtle with a high variation in color. Although ordinarily terrestrial in habit, they may soak in water periodically (Conant and Collins 1991, 52).
Source: BFL

Texas coral snake (micrurus fulvius): This snake inhabits lowland areas, as well as higher elevation areas such as the Edwards Plateau (Conant and Collins 1991, 225). They are highly venomous and can be found in cedar brakes and rocky canyons and hillsides (Conant and Collins 1991, 225).
Source: BFL

Eastern hognose snake (heterodon platirhinos): The Eastern hognose snake prefers sandy areas and feeds mainly on toads and frogs (Conant and Collins 1991, 175). According to BFL staff, this snake is quite common on BFL.

Green tree frog (hyla cinerea): This frog inhabits swamps, borders of lakes and streams, floating vegetation, or any place with well-supplied water or dampness (Conant and Collins 1991, 320).
Source: BFL

Snakefly (agulla sp.): Snakeflies are members of the Raphididae family. They have long, flat heads with very long antennae (eNature.com 2008). Generally found on trees, females lay eggs deep in the openings of tree bark. The larvae live under loose bark, feeding on other insects (Kendall Bioresearch Services 2008).
Source: BFL



Drainage analysis map

High Ground
Mid Ground
Low Ground

Terrain model

Slope analysis map

7.1.2.5. Existing Buildings and Facilities
In addition to the natural biological features of BFL, multiple man-made structures and facilities comprise the field laboratory. These are briefly described below.

Classroom/Laboratory Building
The main 18,279 square foot laboratory building provides indoor research facilities, classroom and computer lab space, and houses The University of Texas at Austin's entomology collection as well as a Fire Ant Lab, Insect Biodiversity and Systematics lab, and Chemical Ecology Lab. Indoor facilities also include an animal rearing room, wet lab, plant dryer, natural temperature laboratory, indoor greenhouse and living cycad collection with attached fumigation room, library, darkroom, workshop, and two constant temperature rooms. The building is designed with separate Botany and Zoology Wings. The Resident Manager's office and living quarters are also housed in the laboratory building.

Population Enclosures
Historically the population enclosures were constructed for small mammal and reptile experiments. These enclosures are used intermittently for comparative ecological studies of habitats for different enclosures. The enclosures are also used for undergraduate ecological course work.

Man-Made Ponds
There are 15 shallow, concrete-lined ponds located within acre enclosures and several outside population enclosures. These ponds were built in the late 1960s and have matured and integrated into the ecology of BFL, providing water for area wildlife and vegetation. These ponds are fed by well water, and overflow has caused many of these ponds to exhibit fringe wetland characteristics. They provide a wooded pond environment for research and the study of interactions of wildlife and water-influenced vegetation.

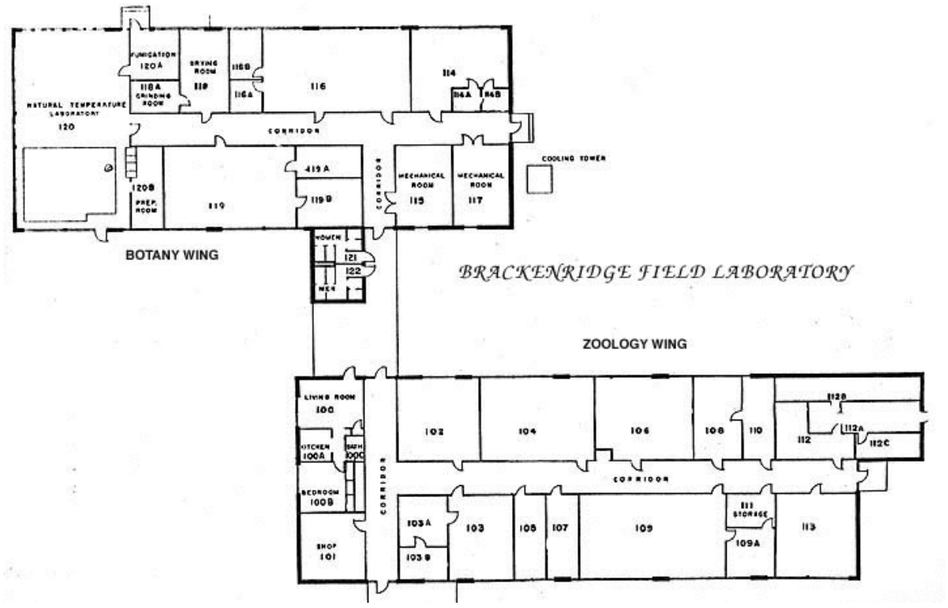
Aquatic Rearing Facilities (Fish Tanks)
BFL contains forty four (44) 500-gallon concrete above-ground fish tanks. Fish tanks at the western portion of BFL have overflow ponds that have developed wetland characteristics (hydrophytic vegetation). These tanks serve as aquatic habitats for student and/or faculty research. In addition, sixteen (16) 4-foot deep small concrete tanks are located on the east portion of BFL. The water source to the tanks and ponds originate from two on-site wells. These tanks are available for various aquatic research, particularly for genetic research on swordtail fish populations. Water from the water wells on-site mimic the water composition and parameters in which the studies species are found in their native Mexico.

Experimental Garden
The experimental garden is used for undergraduate course work. Experiments related to plant productivity, plant competition, and growth rates occur within this location. The experimental garden is also used by graduate students to conduct independent research related to their discipline.

Greenhouses
According to a July 15, 2008 College of Natural Sciences bulletin, BFL researchers in coordination with the U.S. Department of Agriculture (USDA), Agricultural Research Service are investigating biological control of the invasive *Arundo Donax* (giant cane). This project will research the means of mass rearing of wasps and study the basics of the wasp interaction with the cane in the greenhouses at the BFL. Additional activities occurring in greenhouses include numerous student and faculty research projects.

Other noted activities involve the study of plants and butterfly species from Central America. These experiments study the evolution of plant and butterfly genetics, chemical and behavioral ecology, and their role in plant and butterfly interactions.

Aquatic entomology research occurring within the greenhouses includes the work of Dr. Abbot on dragonflies. The greenhouses are further used for fire ant research and teaching.



BFL building layout


View of typical perimeter of population enclosures


View of fish tanks at west portion of BFL


View of experimental garden


View of typical shallow, concrete-lined pond


View of fish tanks at east portion of BFL

View of large greenhouses near classroom buildings currently used for plant and butterfly studies

The Juenger Greenhouse is currently used to study the evolutionary changes of drought tolerant plant species. The Bush Greenhouse currently houses one of the most extensive collections of rare cacti and succulents within the United States. Some experimental work occurs at this facility.

Aviaries
The aviaries are used as a controlled environment to study behavior ecology and sexual selection of birds.

View of aviary

Aerial view of BFL grounds

View of greenhouses used for cacti research

View of greenhouses used for cacti research

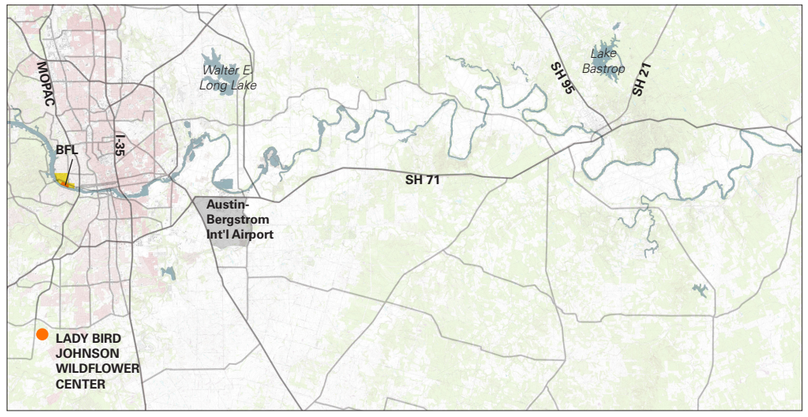
Greenhouse under construction within fenced Experimental Garden area. These greenhouses are currently used by the USDA for investigating biological control of the invasive Arundo Donax.

View of Juenger Greenhouse located near the Lake Austin Center
Source: BFL website (accessed 10-14-08)

7.1.2.6. Other Field Lab Locations

The Lady Bird Johnson Wildflower Center

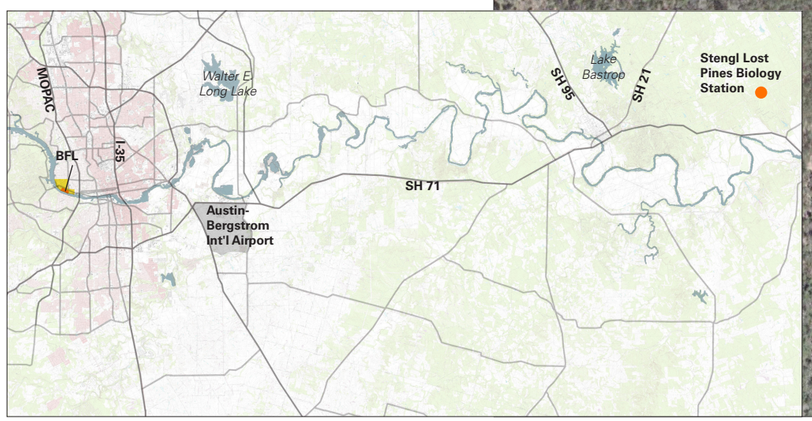
Ladybird Johnson Wildflower Center, south of Austin, has 163 acres of natural Texas savannah, comprising oaks and junipers interspersed with grasslands. The acreage is divided into plots for manipulative experimentation, including the effects of burn and mowing. It is adjacent to the City of Austin's undisturbed J-17 tract, which is also a research resource for U.T. Austin.




A Sea of Grass

The Stengl "Lost Pines" Biology Station

Stengl, in Smithville, is 208 acres of relict pine forest last connected to the East Texas piney woods over 5,000 years ago. It provides research opportunities as to how and why such distinct vegetation and its faunal elements can persist.




STENGL 'LOST PINES'
BIOLOGY STATION
UNIVERSITY OF TEXAS
401 OLD ANTIOCH RD
MANAGER'S RESIDENCE
GREENHOUSE

7.1.3. ISSUES AND CONSIDERATIONS

The following issues and considerations were heard by the design team from the various visits, meetings, and sessions with the College of Natural Sciences:

- **Network role:** The three research sites (Brackenridge Field Laboratory, Stengl Lost Pines, and Lady Bird Johnson Wildflower Center) are complementary (e.g. different soils and biota) but not interchangeable: importantly, only the Field Laboratory has water access of the three, and 40-year longitudinal records.
- **Proximity to main campus:** The Field Laboratory is close by U.T. Austin enabling its use not just for research but also for undergraduate classes, and allows faculty to productively divide their day between campus and the site.
- **Security:** The Field Laboratory is secured, enabling female students and staff to work alone in safety, and expensive instrumentation to be left in the field for continuous documentation.
- **Investment:** The ongoing level of new investment in the Field Laboratory has been modest, in part because of periodic uncertainties over BFL's future, and in part because other College of Natural Sciences programs needed resources that would bring them up to Integrative Biology's excellence. The College of Natural Sciences considers the Field Laboratory to be the investment/endowment for Integrative Biology.
- **40-year records:** The 40-year longitudinal records at the Field Laboratory would not be extended if BFL was moved.
- **Overnight accommodations:** Overnight accommodations for visiting faculty and scholars would be desirable.
- **Recruitment:** The Field Laboratory has been a major advantage for recruitment and retention of both faculty and students, in keeping with the University's priority of "getting the best students and the best faculty."

7.1.4. FUTURE STRATEGIES

7.1.4.1. Vision for the Brackenridge Field Laboratory at the Current Location:

The College of Natural Sciences and Brackenridge Field Laboratory personnel, and their Board of Advisors, have been considering current and future needs for the Field Laboratory, also in the context of U.T. Austin's recently-announced Capital Campaign. The following document, "A Vision for BFL", was provided by the College of Natural Science.

A VISION FOR BFL

Additions to enhance teaching, research, and outreach opportunities

Although BFL is intensively used for teaching and research, it could be even more useful if its facilities were improved. More classes could use the site if classrooms were available, and more research could be accommodated if there were significant additional and more modern research and greenhouse space. On site access to all of our research collections would be a great advantage for both teaching and research; additional field space would increase the kinds and number of projects that could be done at one time. Public outreach at BFL is perhaps the greatest opportunity for enhancement of activity if partners can be found who share our vision.

TEACHING

Indoor teaching space: We currently have no indoor space at BFL designed for teaching. Although many classes use BFL, and some meet there regularly, the space used for classes is converted research space. Almost any amount of additional space for teaching would be a welcome improvement, but ideally we would like to have a building with a large auditorium and classrooms and teaching labs of various sizes with a total of about 20,000 net assignable ft^2 (see below). Classrooms at BFL would free up an almost equivalent amount of space on the Austin campus. A classroom building/wing could also be used for public lectures and other outreach activities at times when the rooms were not being used for formal UT classes.

Integrative Biology (IB) is the area of biology that connects all levels of living organization from molecules to ecosystems. Faculty and student research encompasses major near-term and ultimate questions about natural phenomena including questions about global warming, invasive species, environmental toxicity, community and ecosystem health, and biodiversity, among many others. We propose to place UT Austin in a unique position in the world as a place for advanced undergraduate and graduate education in degree programs that are overseen by IB faculty. Brackenridge is already a magnet facility for attracting IB faculty and already is a key teaching resource, but its future potential, especially for teaching and outreach, is much greater. Our vision is to create an advanced teaching laboratory fully integrated with the outdoor facility and habitats already available at BFL. We see BFL as the future "Integrative Biology Campus" where all advanced courses would be taught on site, not on the main campus, and where faculty and graduate student research is seamlessly integrated with undergraduate teaching, research internships, and public outreach. We imagine the biodiversity resource collection of plants and animals now widely scattered between main campus, PRC, and BFL all centered within or near BFL and available for teaching, research and outreach in the living context of natural habitats, living greenhouse collections, and a "biotron".

In addition to a new building that would double as a teaching and outreach center we would like to have GIS, chemical, sensory and molecular ecology and genetic laboratories available to provide cutting edge education and research opportunities to undergraduate and graduate students. Ideally, additional field facilities would be added that would allow students and faculty to participate in long-term experiments on ecological change in this urban ecosystem. This would make UT Austin the premier site in the world for education in environmental biology, in ecological and evolutionary genetics, in landscape ecology, in chemical and molecular ecology, in biological impacts of climate change, in physiological ecology and other fields encompassed by Integrative Biology. All of these areas require hands-on field experience for students to really understand how to work in the discipline.

Inputs from a number of faculty in Integrative Biology have indicated great enthusiasm for these ideas and it is clear that as the main campus becomes more crowded, the concept of true integrative teaching at BFL becomes ever more appealing. Most faculty members would participate if the facilities and support were properly developed. The optimal scenario will be to cluster vertebrate, invertebrate, insect and plant collections into a Biodiversity Center on Brackenridge Tract adjacent to BFL, and then to develop the proposed new teaching facility in coordination with those resources.

Based on faculty input a new teaching complex and initiative at BFL would include:

1. Space for lecture/lab
    a. One lecture hall with 150 person capacity
    b. Two seminar rooms 75 person capacity
    c. Two seminar rooms 40 person capacity
    d. Four 25 person capacity lab/lecture rooms
2. Wet lab facilities, each with technical support to help students would cover:
    a. Molecular lab for ecology, genetic, physiology applications
    b. Chemical ecology*
    c. Sensory ecology, animal communications
    d. Soil, Geochemistry
3. Outdoor facilities
    a. Dock and aquatic lab on Lady Bird Lake
    b. Artificial spring and stream system*
    c. Biotron for controlled study of animal-plant interactions*
    d. Additional adjacent land particularly the riparian flood plain
4. Residence station** for visiting researchers, summer workshops and field courses

RESEARCH

Indoor laboratory space: There is such limited laboratory space currently at BFL that it will support little laboratory research on site, and most people only use it for the field or greenhouse portion of their research projects. If we had more research laboratory space with some basic core facilities, many faculty who have part of their laboratory facilities at BFL (greenhouses, ponds, etc) would move much of their laboratory activities there, freeing up considerable space in Patterson and the Biological Laboratory buildings. It would require renovation and considerable expansion of current space to make this feasible. Current space is about 12,000 ft^2, but only about half of that is now used for research, as much has been secondarily adapted for teaching. A research building on site or adjacent to the current BFL property would be extremely important in moving the center of gravity of IB from the main campus to BFL. A building of 30,000 net assignable ft^2 would provide laboratories for 12-15 faculty members and would allow us to develop a core of major BFL researchers on site.

Greenhouse space: Greenhouse space is very limited on the UT campus and needs to be greatly expanded at BFL. The current space in the useful greenhouses is about 9,000 ft^2. We need about three times that amount, configured so as to maximize efficiency and minimize necessary staff support.

Field space: If we had adjacent field space we could expand the types of research projects we do at BFL. Almost any amount of additional land would be useful, but an additional 60-80 acres including access to and control of the riparian flood plain would be ideal.

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* Prototypes already exist on site

** This need could be satisfied from commercial rental property elsewhere on the Brackenridge Tract if necessary.

Collections space: The college holds many valuable collections of fossils, and preserved and live specimens of flora and fauna. These large and virtually priceless collections are used in teaching, research, and outreach, but they are scattered across many buildings on the main campus, at BFL and at the Pickle Research Campus (PRC), and some are deteriorating because of the conditions in which they are being held. Some of the TNSC collections that are housed at the J.J. Pickle Research Center (located 12 miles NW of the main campus) are in rooms that lack temperature control and protection from pests. All would benefit tremendously by being consolidated in a modern collections facility. In doing so we would free up space on campus and at the Pickle Research Campus.

The current situation limits interaction between the faculty and staff who use these resources, it endangers the proper preservation of the collections, is inefficient for curation, and makes using the collections or facilities for educational or outreach functions very difficult. We badly need a modern building that will house all of the collections in modern, safe, space-efficient situations (in compactors where appropriate).

The building should include classrooms for biodiversity courses, and administrative/support space, and good network connections and IT support for maintaining the collections databases. We estimate that to house all the collections would require approximately 93,000 ft^2 of assignable space. This is about a 10% increase in total space, and with compacting and other efficiencies, would allow for significant growth of the collections.

If the building were located at BFL outside the current research area, it could take advantage of field sites for research, teaching, and outreach, and allow convenient access for students and faculty from the main campus. Such a facility would be transforming for the Texas Natural Science Center and for BFL. Collections space should be built so that an additional load-bearing floor could be added AND/OR so that building could be extended to accommodate collections growth.

Table 1: Space (net assignable) vacated by and required for Natural Science Collections:

Collection	Current Location	Approx space freed in current locations (ft^2)	Space Needed (ft^2)	Cost @ $500/ ft^2
Vertebrate Paleontology	PRC 6	16,000	18,000	$12,500,000
Invertebrate Paleontology	PRC 33	10,200	11,000	5,500,000
Herp & Fish	PRC 176	7,300	10,000	7,500,000
Plants	MAI	20,000	22,000	5,000,000
Algae	BIO	2,700	3,000	7,000.000
Insects	BFL & PRC 176	3,000	4,000	2,500,000
Support & Classrooms	MAI 127+, PRC 122, 18A, 6, 176	25,000	25,000	5,000,000
Total		**84,200**	**93,000**	**$46,500,000**

Academic benefits to housing the TNSC at BFL.

This move will indirectly provide significant benefits to the core academic mission of the University of Texas. Faculty, curators and staff associated with the TNSC and the BFL presently teach nearly all courses aimed at particular animal taxonomic groups (e.g., herpetology, ichthyology, and entomology) and also teach or have the potential to teach courses offering empirical understanding of the natural world such as marine biology and limnology. TNSC faculty or staff currently or recently teaching "–ology" classes that do or could take advantage of BFL, and the areas in which they teach, include: John Abbott, entomology; Ann Molineux, geology and marine biology; Pamela Owen, mammology; Dean Hendrickson, ichthyology; David Cannatella, herpetology; Ed Theriot, limnology and protistology; Chris Bell, paleontology; and, Tim Rowe, paleontology. Major research collections on-site where such "ology" courses are taught would greatly enhance the undergraduate training experience.

Moving the TNSC to BFL will help the Ecology, Evolution and Behavior program maintain its top 10 ranking in research as well. The TNSC research collections and library would become more immediately available for faculty and students in EEB. TNSC maintains the University's only curated frozen tissue collection, essential for DNA research in the EEB program. These collections include more than 1,000,000 whole animal specimens documenting world biodiversity, as well as local biodiversity. They were built by graduate research at the University of Texas. Placing the animal and frozen tissue collections at BFL would make them immediately available to faculty and graduate students.

This move would make IB faculty and TNSC staff more competitive for extramural funding. The National Science Foundation and other federal funding agencies, as well as many private sources of funding demand broader impact from research grants, beyond solving a scientific problem. Involving the public in the research agenda in some way, either through direct dissemination of results to the general public, by including K-12 teachers in the process, by using that research to develop novel exhibits and outreach programs are all considered to be appropriate avenues to create broader impact. Younger faculty are particularly eager to share their research with the public.

It will be a more efficient use of existing resources. Even with no increase in staffing, this move would regularly bring our education staff into closer contact with faculty in biology. New facilities could be designed to promote such interaction and existing BFL facilities could also be used to improve interaction between faculty and TNSC, a major recommendation of the recent external review of the TNSC. In short, moving the TNSC to BFL will benefit society, and will benefit the University of Texas by opening the "ivory tower" to a greater segment of society, and by increasing funding opportunities for its scientists.

Creation of New Public Outreach/Museum Facilities

We could also relocate the **public display** part of the TNSC, i.e. the Texas Memorial Museum, including exhibits and public education activities, to BFL. This would tremendously enhance the public outreach/education opportunities for both BFL and TNSC. The museum itself would be more available to the public than in its current location, could (provided funds are available) be expanded, and would provide a public venue to launch a major public outreach program for BFL. It would also, for the first time, put the collections, exhibits and research components of the museum, TNSC, and BFL together. This could only happen if the city of Austin were an active partner in creating a center for public education in science at BFL, and if private funding were available.

The mission of the Texas Natural Science Center is to encourage awareness and appreciation of the past, present and future of biological diversity on earth, especially that of the state of Texas.

The National Science Foundation says that the 21st Century will be the *Century of Biology*. The great potential and the great issues of the next 100 years will revolve around biology. The understanding of the genome promises to unlock the secrets of aging and disease. Global biodiversity, critical to agriculture, pharmaceutical exploration, fisheries, and general global health, are under severe threat. At the same time, biology and computer technology intersect through bioinformatics, enabling us to examine and understand biology at every scale from the molecules of our genes to global ecosystems.

The Texas Natural Science Center is well positioned to be a significant part of this explosion of biological knowledge. We have active collections of more than 5 million fossils and animals, which form the basis of world-class research in paleontology and the study of fish, reptiles, amphibians, insects and cave fauna. Our public education programs are rooted in these research programs and the broader UT research in biology and geology.

Our vision for the future includes a facility that will allow us to fully exploit our intellectual talent, unparalleled research collections, technological expertise and educational innovation to make Texas a leader of the Century of Biology.

This facility would be designed to unlock the potential that is in "our vaults" and in the BFL environment. The public entrance would be through exhibits that tell the story of Texas Through Time. It will include new mounts of the animals that dominated prehistoric Texas, from the Alamosaurus to the largest flying reptile that ever lived to the American Lion, the largest cat that ever lived. We would include the best of our present dioramas and build new ones, including one of BFL that show off the wonderful diversity that is modern Texas.

The Great Hall will lead to more specialized and interactive facilities. A new hall will be devoted to interactive learning facilities that are integrated with our research and teaching facilities at BFL. Part of our collections could be "active exhibits" with the public able to look on, and participate. For example, in the TMM now, there is a paleontology prep area where visitors can watch a preparator working on a fossil. The BFL center could have similar exhibit with different collections, but also areas where kids could screen cave deposits for microfossils, learn to pin and identify insects, dry flowers in a plant press, handle a snake, walk through a butterfly greenhouse, seine at the edge of Lady Bird Lake, etc., in addition to the more traditional exhibits.

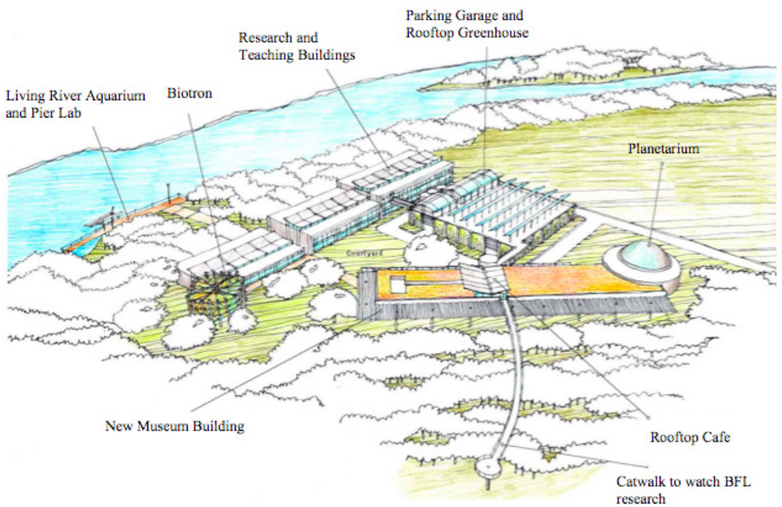
Visitors would follow designated corridors into the collections areas (perhaps as scheduled tours), where they view the "normal" daily life of research and collections activities. In the same way, they could be guided along designated trails (and perhaps elevated boardwalks) to view field research, with docents and/or signage providing information. A pier could extend onto the lake, with an aquarium exhibit, a pier lab, and a boathouse for research and teaching boats.

The Great Hall could also lead to a wing that recreates environments not found in Texas but that are relevant to global biological issues and are studied by UT scientists and students. External to the museum building we will have exhibits that illustrate the habitats and species of Aquatic Texas (aquarium and pier lab) and a biotron that will exhibit the Insects of Texas, among other things. These facilities could also be used to exhibit exotic, environmentally important habitats and species studied by our faculty.

Finally, the new building could include revenue-generating educational and other visitor services from an IMAX theater to a biodiversity-themed rooftop restaurant that promotes sustainable development. The aquarium and the biotron are other venues that could be attractive for affiliated restaurants or coffee houses.

Expansion of Current TNSC facilities	**na square feet needed**
Administrative suite/curatorial staff offices	6,000
Exhibit space	30,000
Exhibit fabrication	5,000
Auditorium/Planetarium	3,000
Museum total	**44,000**
Exterior facilities	
Insects of Texas: Environmental enclosure	5,000
Life in Texas Waters: Aquarium/Pier lab	5,000
Revenue-generating public entertainment/education facilities	
Gift shop & other retail	5,000
Rooftop Restaurant	5,000
IMAX Theater	5,000
Grand Total	**69,000**

Figure 1. One view of how the new TNSC/BFL collections, teaching, research and outreach facilities might look in the area north of current BFL.



Appendix 1: Public Programs of the TNSC at BFL

"Nature is in the country. People live in the city."

For the first time in history, the majority of humans will soon live in an urban environment. This will present new challenges to both society and the natural world. To help meet those challenges, we propose that the University of Texas at Austin consider moving the Texas Natural Science Center, and perhaps other collections, to the Brackenridge Field Laboratory. This will put the University in a unique leadership position to contribute to understanding of and solutions to the issues that will arise, and will take further advantage of the Brackenridge Field Laboratory as an urban biological diversity research center.

The challenges are both scientific and societal. Cities have a massive effect on biological diversity. Contrary to the belief that urbanization destroys biological diversity, cities are actually hotspots of biodiversity. This is partly true because cities offer new habitats in which new species evolve, and otherwise very rare species adapt and flourish. But cities also increase biological diversity because the fabric of native biological diversity is torn. Cities retain, fragment and alter remnants of the natural habitat, which has both negative and positive effects on species diversity. Standardized landscaping reduces biodiversity. Top predators (particularly mammalian, but also reptilian and avian) are removed allowing prey species (often species noxious to humans) to thrive. In fact, increases in vector borne diseases such as Lyme disease and hantavirus can be directly related to explosion of vector populations due to elimination of top level predators. Cities are centers of importation, naturalization and spread of exotic species.

Urban biodiversity and human well-being are connected in many ways, with complex cause and effect patterns. Wealthier areas are more biodiverse than poorer areas. Human health problems as disparate as asthma, Lyme disease, skin cancer, and hantavirus are all attributable (at least in large measure, if not entirely) to unmoderated human alteration of the natural landscape, undertaken without knowledge of (or with willful disregard to) the potential long-term health impacts of such changes to our planet's natural systems of checks and balances. Lack of interaction with the natural environment may lead to what has been termed the "nature deficit disorder" and increases in aggression and attention deficit syndromes.

The last issue may be the most important over the long-term. Soon urban biodiversity will be the first and main nature experience had by the majority of the earth's population and this will forever affect human perception of the natural world. Understanding urban biodiversity will therefore be at the heart of both a scientific understanding of nature and of humanity in the 21st Century.

The Texas Natural Science Center has already begun a number of activities building to three related long-term programs that it calls **Visit to Planet Earth (VPE), a Century of Urban Biodiversity (CUB)** and **Helping Educate At-Risk Teens (HEART)**. These programs would all benefit from access to relevant resources of BFL and the Section of Integrative Biology should the TNSC move its operations to BFL.

Visit to Planet Earth is a concept we use to organize our goals, strategies and tactics in biological diversity research and education. The most exciting finding possible would be to discover and travel to a planet with life. The first activity one would engage in is that which is at the core of our mission, to document and describe that life and to understand how it came to be and how it organizes itself. Our goal is to bring that same excitement and understanding to the public about earth, whose biota is still largely unknown. Even within the city limits of Austin, there are fossils, bacteria, protists, insects, and maybe even plant species unknown to science. VPE is mainly an educational project, providing the "hook" to open the public's eyes to the world around them. The VPE concept will become part of the educational idiom of all new and existing programs, such as Museum Express.

A Century of Urban Biodiversity is both a program and a product of Visit to Planet Earth. One challenge facing the understanding and management of urban biota is that few cities have any long-term documentation of what actually lives there. The BFL insect collection, curated by the TNSC, represents a detailed 40 year record of insect diversity during a crucial period of Austin's transition from a college/state government town into a large, diverse metropolis. It is complemented by our statewide collections of fish, reptiles, amphibians and cave fauna. We are engaged right now with continuing and expanding those studies to provide a broad documented picture of urban biodiversity over the 21st Century.

CUB will include formal collaboration with environmentally oriented organizations. Strategic benefits to us will be that these projects will help build an "alumni" group for the TNSC, as generations of Austinites will revisit observations made and specimens collected by their parents, aunts and uncles. This will teach the community the value of collections as well as provide an emotional connection to the collections. In turn, this will help engender long-term public support for the TNSC.

A model of one VPE/CUB activity is our website, OdonataCentral.org. Odonates are dragonflies and damselflies, easily recognizable insects with popular appeal. Aside from providing a great deal of information about odonates, this website features a "citizen science" portal, which allows users (which can be individuals or K-12 class projects) to capture or photograph odonates, identify them, and add them to the larger database on odonates. Verified identifications are awarded with locality dots on interactive on-line maps, linked to the user who provided the specimen or photograph. We are expanding this approach to our Herps of Texas and Fishes of Texas projects, as well as ProtistCentral. These on-line databases will also be used in University of Texas classes such as The Natural History of Protists, and Limnology and Oceanography.

HEART is based on the Director's experience at the Academy of Natural Sciences of Philadelphia. We will bring at-risk teens directly into our collections, and involve them with every aspect of collection curation. The teenagers learn not only biology, but job and social skills, and gain exposure to an academic environment. They will learn to operate computers, use relational databases, and act appropriately in professional situations. Training and managing teenagers is not a job for our scientific staff. Rather, a unique aspect of this program is that we hire active or retired high school teachers and train them in collection curation. They, in turn, train and supervise the students. Besides several years of experience with this as an NSF funded program at his former employment, the Director introduced this idea to the TNSC several years ago and we have run a successful short pilot project.

These programs individually and collectively are unusual because they use our scientific and educational resources to generate community involvement in the core activities of a research museum. The community helps create a scientifically valuable database that will be used in both further public education and outreach and in research.

In summary, these three TNSC programs would tap core strengths of BFL and give the TNSC direct access to the natural environment. They are central to our mission of encouraging awareness and appreciation of biological diversity, and both will also use urban settings to examine some of the most important ecological questions of the 21st Century. The BFL and TNSC insect collections for example, curated by the TNSC, contain possibly the best long-term records of biological diversity changes in an increasingly urbanized Texas.

7.1.4.1. Alternative Futures:

The design team is required, by its charge from the Regents, also to identify possible reconfiguration and/or appropriate alternative sites for the Field Laboratory, in case the Regents decide to reuse some part or the entire current site.

Everyone heard from agrees that a field laboratory is a necessary part of a successful Integrative Biology program. There are three possible approaches regarding its future:

A. Leave at Brackenridge site location: This leaves in place a facility which – though not now used to full advantage – is part of a highly ranked academic program. It is nearer to the University than any replacement facility would be and close enough that some undergraduate classes can be, and are, taught there. There is not unanimous agreement as to the importance of the 40-year longitudinal research, but that record-keeping can continue if the Field Laboratory remains. Current physical and financial investment in buildings, greenhouses, and fencing would not need to be re-spent. And it is known and familiar to the faculty, staff, and students using it.

On the other hand, these 82 acres are more than half the acreage of – and are in the middle of and divide – the most valuable part of the Brackenridge Tract: the frontage on the lake south of Lake Austin Boulevard.

It is one-quarter of the overall available site area, and in an integrated development design can be expected to provide more (because of the water frontage) than that share, in the revenues that would accrue to the University. From a redevelopment point-of-view, then, the Field Laboratory site is the keystone of the Brackenridge Tract. A relocation and reconstruction elsewhere could be fully funded by the revenue from the Field Laboratory site, with substantial funds then left over for the enhanced betterment of The University of Texas at Austin generally.

B. Leave at Brackenridge site location, but reduce the footprint: If the laboratory site is not now used to its fullest, could there be a reduction in its size or a reconfiguration that would preserve the major values of the laboratory and also help serve public purposes as well as revenue–generation?

A community benefit or public purpose that has been raised is the extension of the Town Lake Trail along the waterfront through the Field Laboratory site. The College of Natural Sciences has opposed this with an expressed concern that the water-to-land, land-to-water access for biota would be compromised and that accidental human influence (e.g. trash) could intrude on the current and desired natural state of the Field Laboratory site. But it is possible to consider a walkway, elevated as needed, along part of the frontage, to allow the natural corridors to remain open, and designed to keep refuse and people out of the natural area.

The site could be reduced on its east and/or west sides and still maintain the vast majority of its different soil and natural conditions. If the site were to be reduced on the Lake Austin Boulevard frontage, i.e. compressed toward the water, the replacement costs for the buildings, including Lake Austin Center, might approach or outweigh the incremental revenue benefit, and would not yield valuable lakefront property for the development.

C. Relocate the Field Laboratory to another site: Part of the design team's assignment was to investigate where, in the event the Regents decided to relocate the Field Laboratory currently on the Brackenridge Tract, there would be another site(s) that would be appropriate for a Field Laboratory. Since every site is unique, consideration could create the possibility of having more than one replacement site, in order to broaden and enhance the research possibilities. Multiple locations that are inherently different in soils, biota and water access would expand the breadth of opportunities for College of Natural Sciences research and experiments. This concept is currently partially in use since the Field Laboratory has additional locations at the Lady Bird Johnson Wildflower Center and Stengl Lost Pines, both of which would remain as sites in the future even if the Brackenridge Field Laboratory were relocated.

7.2. FIELD LABORATORIES AT OTHER INSTITUTIONS

STANFORD UNIVERSITY
PALO ALTO, CA

Quick Facts:

- The number one ranked Biological Science program as defined by U.S. News and World Report for 2008 for the top graduate biology programs.
- Major research interests of the Department
  1. Molecular Biology, Cell Biology, Developmental Biology, and Genetics
  2. Plant Biology
  3. Population and Evolutionary Biology and Ecology
  4. Marine Biology
- Includes over 110 graduate students and 90 postdoctoral fellows
- Facilities include:
  On the main campus
  - 3 buildings: The Gilbert Building, Herrin Laboratories and Herrin Hall;
  - The Carnegie Institution, a private, non profit organization engaged in research and education in the fields of biology, astronomy and earth sciences;

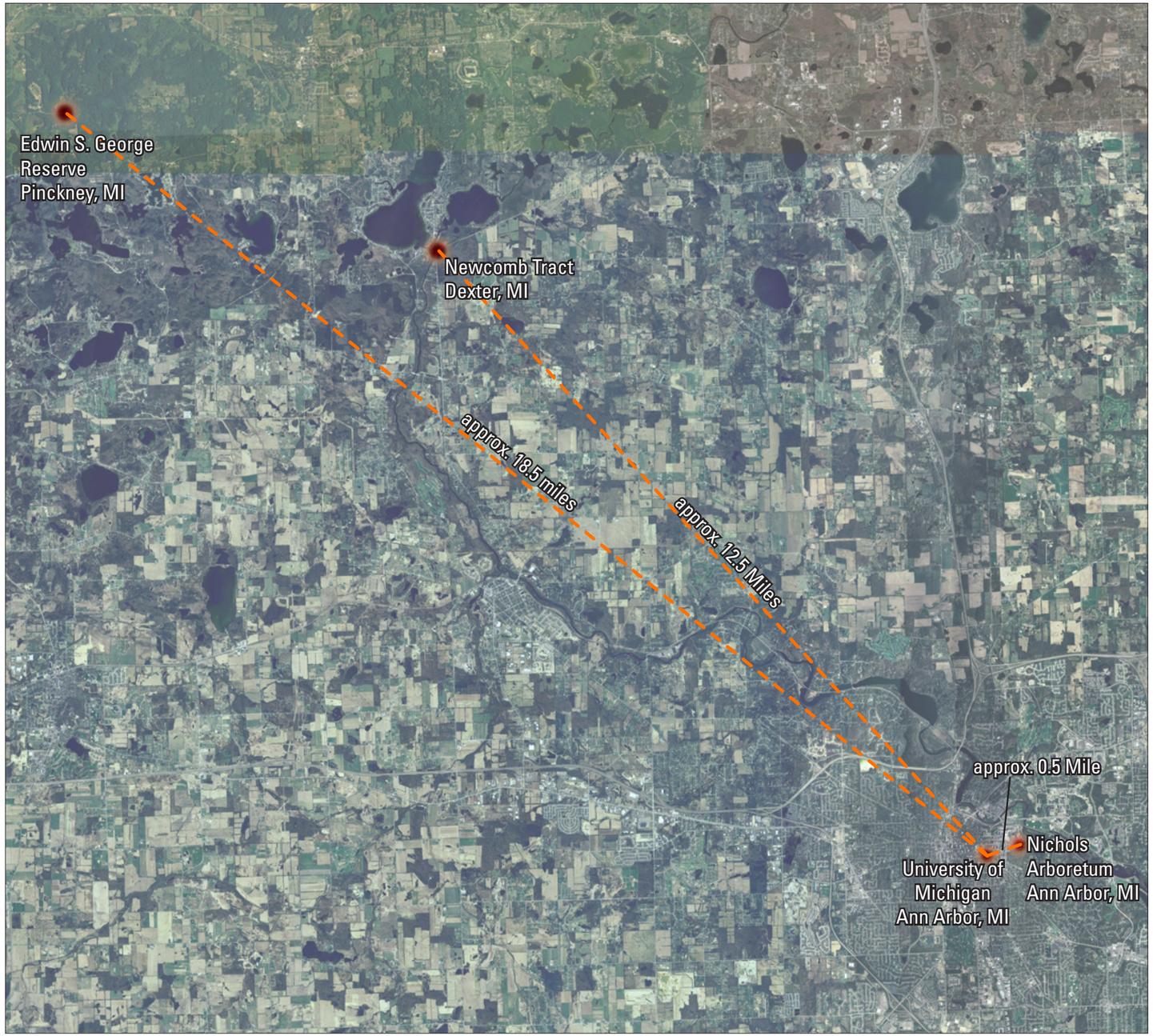
  Off campus
  - The Hopkins Marine Station;
  - The Jasper Ridge Biological Preserve.

The Hopkins Marine Station

- Location: 90 miles from the main campus in Pacific Grove on Cabrillo Point.
- Campus size: 11 acres.
- Houses 10 faculty members who teach both undergraduate and graduate level courses

Jasper Ridge Biological Preserve (JRBP)

- Location: in the eastern foothills of the Santa Cruz Mountains (5 miles from the main campus, approximately 25 minutes drive time).
- Size: 1,189 acres.
- Established: in the 1960's.
- Facilities include:
  Leslie Shao-ming Sun Field Station
  - Size: 9,800 square feet interior space and 13,200 square feet exterior footprint
  - A research laboratory, two classrooms, a reference library, a herbarium, and staff offices
  - Awarded first San Mateo County Green Building Award
- JRBP attracts 2,000 undergraduate visits, 100-300 non-Stanford university students and 1,500-2,000 K-6 grade level children.



UNIVERSITY OF MICHIGAN
ANN ARBOR, MI

Quick Facts:

The Biology program has two departments:

- Ecology and Evolutionary Biology Department (EEB)
- Molecular, Cellular, and Developmental Biology (MCDB).
- 78 full-time faculty
- 7 concentrations (or majors) and three minors:
  1. Biology
  2. Cellular and Molecular Biology (CMB)
  3. Ecology and Evolutionary Biology (EEB)
  4. General Biology
  5. Microbiology
  6. Neuroscience
  7. Plant Biology
- Facilities include the University of Michigan Biological Station (UMBS), the Edwin S. George Reserve (ESGR) and the Matthaei Botanical Gardens and Nicols Arboretum.

UMBS

- Location: 266 miles north of the main campus in Ann Arbor (approximately a 4 hour drive time) near the division between Lake Huron and Lake Michigan in northern Michigan. On the shores of Lake Douglas.
- Established: in 1909.
- Size: 10,000 acres.
- Includes:
  - 150 buildings for housing, dining, teaching, research, maintenance, and recreation;
  - 70 one-room cabins;
  - 30 larger two- to six-room cabins;
  - A 14-room dormitory;
  - A dining hall/kitchen that seats over 275 people;
  - A rich diversity of natural habitats includes pine forests, northern hardwoods, conifer swamps, aspen forests, meadows, wetlands, rivers and streams.
- The facilities located at the UMBS include:
  - Alfred H. Stockard Lakeside Laboratory, a 24,000 SF, 50-room research building;
  - Elevated Carbon Dioxide Facility;
  - The Greenhouse of 3,200 SF, 5 rooms;
  - The UMBS Stream Research Facility (SRF);
  - Soil Biotron;
  - PROPHET (Program for Research on Oxidants: Photochemistry, Emissions and Transport) Lab;
  - Ameriflux Tower, which collects data for the Forest Carbon Cycle Research Program;
  - FASET (Forest Accelerated Succession Experiment) Site;
  - Study collections building;
  - George R. LaRue Library.
- The Station also manages the Chase Osborne Preserve:
  - Location: On Sugar Island in the St. Mary river between Lake Superior and Lake Huron.
  - Size: 3,200 acres

ESGR

- Location: 25 miles northwest of Ann Arbor (approximately a 38-minute drive).
- Size:1,300 acres.
- Established: in 1930.
- Includes: a wide variety of natural habitats, an extensive experimental pond facility, living quarters, laboratory and storage space, and a weather station.
- Fenced to permit the safe conduct of experimental programs that otherwise would be sensitive to public intrusion.
- Home to a number of long-term studies of plant succession and population and community dynamics of white-tailed deer, amphibians, turtles, and insects.

The Matthaei Botanical Gardens and The Nichols Arboretum

- Size:
  - 350 acres on Dixboro Road near the Ann Arbor campus;
  - A 123-acre site adjacent to central campus (6.3 miles, approximately a 15 minutes drive time);
  - 250 acres in Mud Lake Bog and Horner-McLaughlin Woods: two other research and teaching areas.
- Matthaei Botanical Gardens includes:
  - Four large greenhouses for research and teaching;
  - A laboratory-classroom building; service and utilities buildings;
  - Protected common garden areas
  - A rich diversity of habitats for field research;
- The Nichols Arboretum includes:
  - A visitor center;
  - A classroom;
  - An administrative building;
  - A mosaic of gardens,woody plant collections, managed woodlands and prairie.

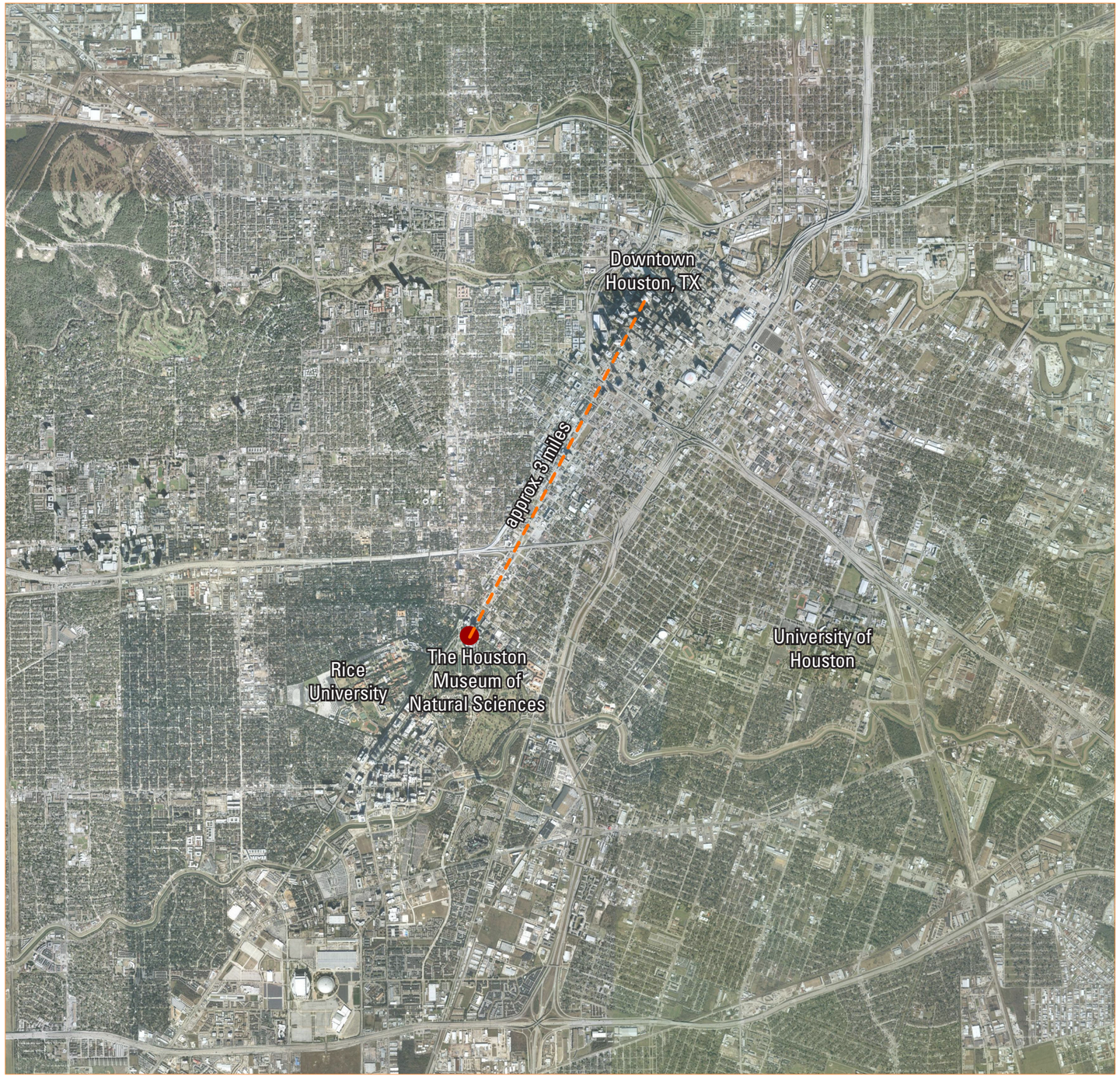
The Newcomb Tract

- Former farm
- Location: On the southwest side of Washtenaw County (approximately 19 miles from Ann Arbor).
- Size: 206 acres

Peony Gardens at The Nichols Arboretum
http://www.flickr.com/photos/cseeman/3590124141/

Pond at Matthaei Botonical Gardens
http://www.flickr.com/photos/a2gemma/263182477/in/set-72157594225172274/

Panoramic View in front of the Visitor Center
http://www.flickr.com/photos/a2gemma/1454431969/in/set-721575942251722 74/



THE HOUSTON MUSEUM OF NATURAL SCIENCES, HOUSTON, TX

Quick Facts:

- Located in Herman Park, about 3 miles south of Houston
- Founded in 1909 by the Houston Museum and Scientific Society.
- Belongs to the company of the Smithsonian Institute
- One of the most popular in the United States and is ranked after American Museum of Natural History in New York City.
- Includes:
  - 4 floors of natural science halls and exhibits
  - Burker Baker Planetarium
  - Cockrell Buttery Center
  - The Wortham IMAX Theater
- It has a second Challenger Learning Center at its George Observatory, which is located 55 miles south of Houston.

Dome of the Planetarium
http://www.flickr.com/photos/bravesirrobin/3498776089/

THE TEXAS NATURAL SCIENCE CENTER (U.T. AUSTIN) AND THE AUSTIN NATURE AND SCIENCE CENTER (ZILKER PARK), AUSTIN, TX

The Texas Natural Science Center

- Located at The University of Texas at Austin.
- Includes:
  - Texas Memorial Museum, which holds the exhibits and educational program
  - Vertebrate Paleontology Laboratory which is ranked ninth in the nation.
  - Non-vertebrate Paleontology Laboratory, which has the sixth largest collections in the United States
  - Texas Natural History Collections
- Produced 5.7 million specimens in the disciplines of paleontology, geology, biology, herpetology, ichthyology and entomology.
- More than 75,000 visitors annually

The Austin Nature and Science Center

- Located on the western edge of Zilker Park
- Founded in 1960
- Promotes awareness and appreciation of the Central Texas natural environment
- Includes a variety of public exhibits as well as educational programs, such as:
  - Animal Exhibits, which feature more than 90 native Texas animals
  - Dino Pit Exhibit
  - Naturalist Workshop
  - Beverly S. Sheffield Education Center
  - Splash! Into the Edwards Aquifer Exhibits

The Texas Natural Science Center

The Austin Nature and Science Center

7.3. ALTERNATIVE SITE ANALYSIS

7.3.1. Site Selection Criteria

Working from discussions with the College of Natural Sciences group on the Brackenridge Field Laboratory, criteria for evaluating possible alternate locations has been identified, including:

- **Size:** The Brackenridge Field Laboratory is 82 acres. While not all of it is used, a size at least more than half that would be needed to provide the necessary diversity and range of research opportunities. The College of Natural Sciences has asked for additional acreage at Brackenridge for academic and research enhancement and a Science Center, the feasibility of which would depend on the location.

- **Availability:** A site must be able to be purchased or leased, in the near term.

- **Duration:** Investment will be required, for fencing and buildings, and it is desired to have the potential for long-term experimentation and observation, so the term of the site's availability is a consideration.

- **Distance from Campus (time):** There are no other sites as close to campus, and, therefore, it is unlikely that undergraduate classes could be held at the more distant site, though a dedicated shuttle bus and the typically long class periods may make such a use feasible. Generally, the closer the better it is. However, Stanford's field laboratory is 25 minutes from campus.

- **Securability:** Female students need to be able to work alone in off hours in safety, and valuable instruments need to be able to be kept in the field over long periods of time.

- **Buildable Areas:** Certain buildings and greenhouses will be required, so there need to be relatively level areas accessible to roads.

- **Water Access:** The Brackenridge Field Laboratory fronts on Lady Bird Lake, allowing interplay between water and land biota. At least one replacement site should have similar water access.

- **Native or disturbed vegetation, and types:** A variety of vegetation types will permit a broader range of research.

- **Variety of habitat:** This will also permit a broader range of research.

- **Topography:** Topographical changes are beneficial, but pedestrian access in and through the site must be possible.

- **Flood plain:** The Brackenridge Field Laboratory has both flood plain and non-flood plain areas, as should a replacement site(s).

- **Parking:** There needs to be accessible parking for staff and researchers.

- **Cost to build:** The necessary facilities and fencing must be able to be built economically. It is estimated that the current facilities and necessary fencing for a similar size area could be constructed for a sum in the range of $8MM.

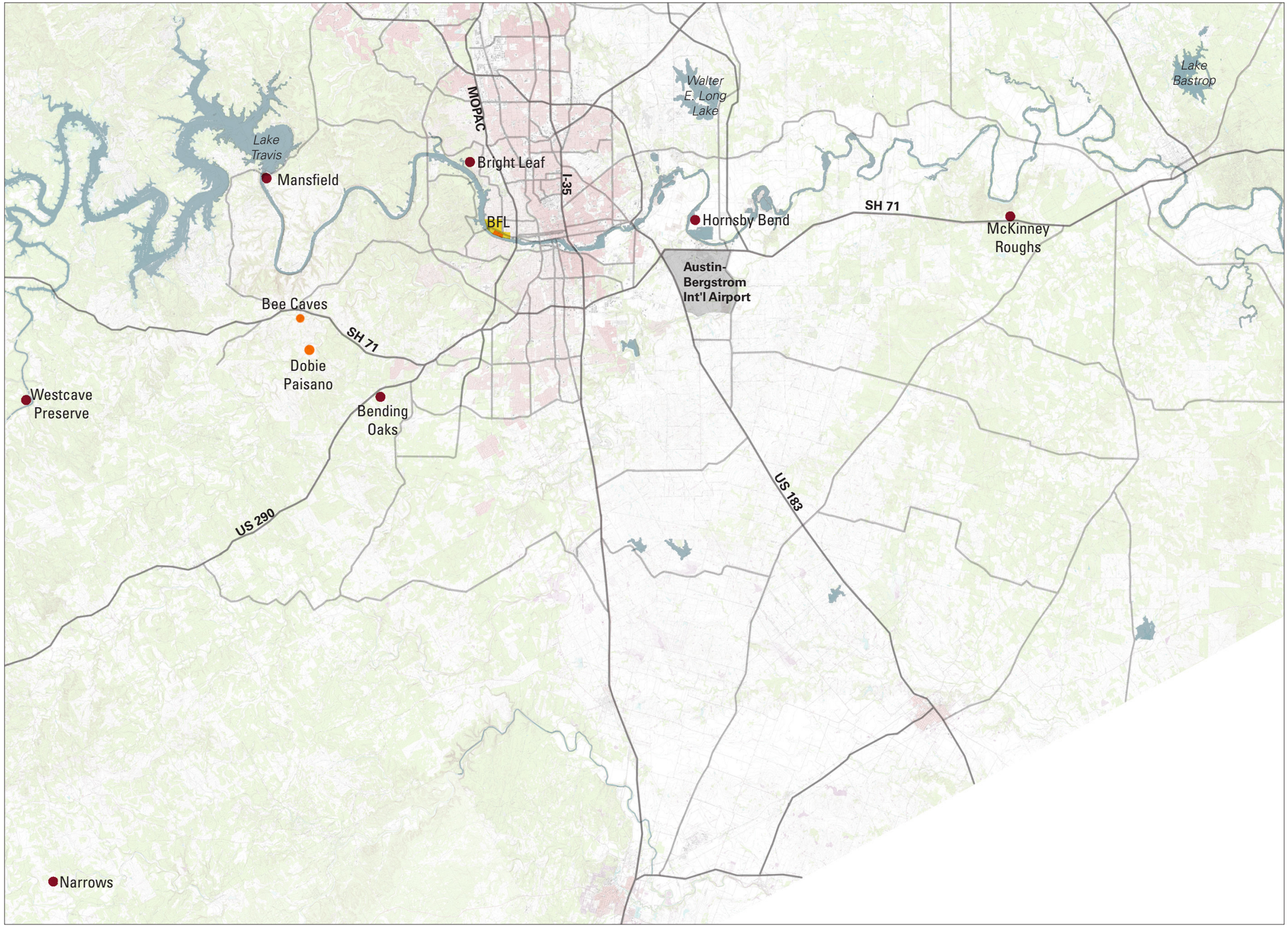
- **Maintenance cost:** The cost of maintenance must be supportable.

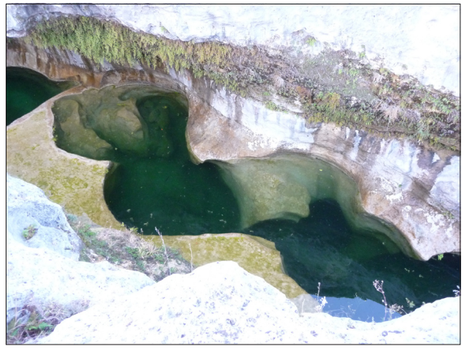
- **Consideration to the Landowner:** The cost of acquisition or lease must be affordable.

- **Implementation plan and schedule:** There must be an Implementation Plan and Schedule, especially regarding current research underway at the Field Laboratory.

7.3.2. Potential Sites

After repeated visits to the Brackenridge Field Laboratory, and trips to the Lady Bird Johnson Wildflower Center and Stengl Lost Pines, nine sites were visited and considered.





7.3.2.1. The Narrows

Located west of Austin, the privately-owned and offered-for-donation site has 70 available acres, is not water accessed, and is adjacent to 250 more acres, jointly owned by the offer or and several other parties, that include a deep-running gorge within cavern walls. The latter is a spectacular and unique natural resource, but the offered 70 acres is difficult to secure, and the larger site is difficult to subdivide in a way that would provide both a research site and continued access to the owners. On these bases, consideration was discontinued.

7.3.2.2. Mansfield Dam

Located 25 minutes west of Austin, the site is a 21-acre parcel owned by LCRA just below the Mansfield Dam. It has gentle topography, good water access, is predominantly tree-covered. It is divided by a small public-road, and could be fenced for security. Not sized for the prime replacement site, but could be a useful ancillary site.

7.3.2.3. McKinney Roughs:
Located 30 minutes east of Austin, it is a 1,100 acre site owned by LCRA, whose staff has indicated up to 120 acres as a potential site. It has full waterfront access, level areas adjacent to road access for buildings and parking, and can be secured. Vigorous topography exists on some of the site. LCRA staff is willing to discuss a 100-year lease, and the desired overnight facilities are on-site. It is a prime possibility as a relocation site.

7.3.2.4. Hornsby Bend

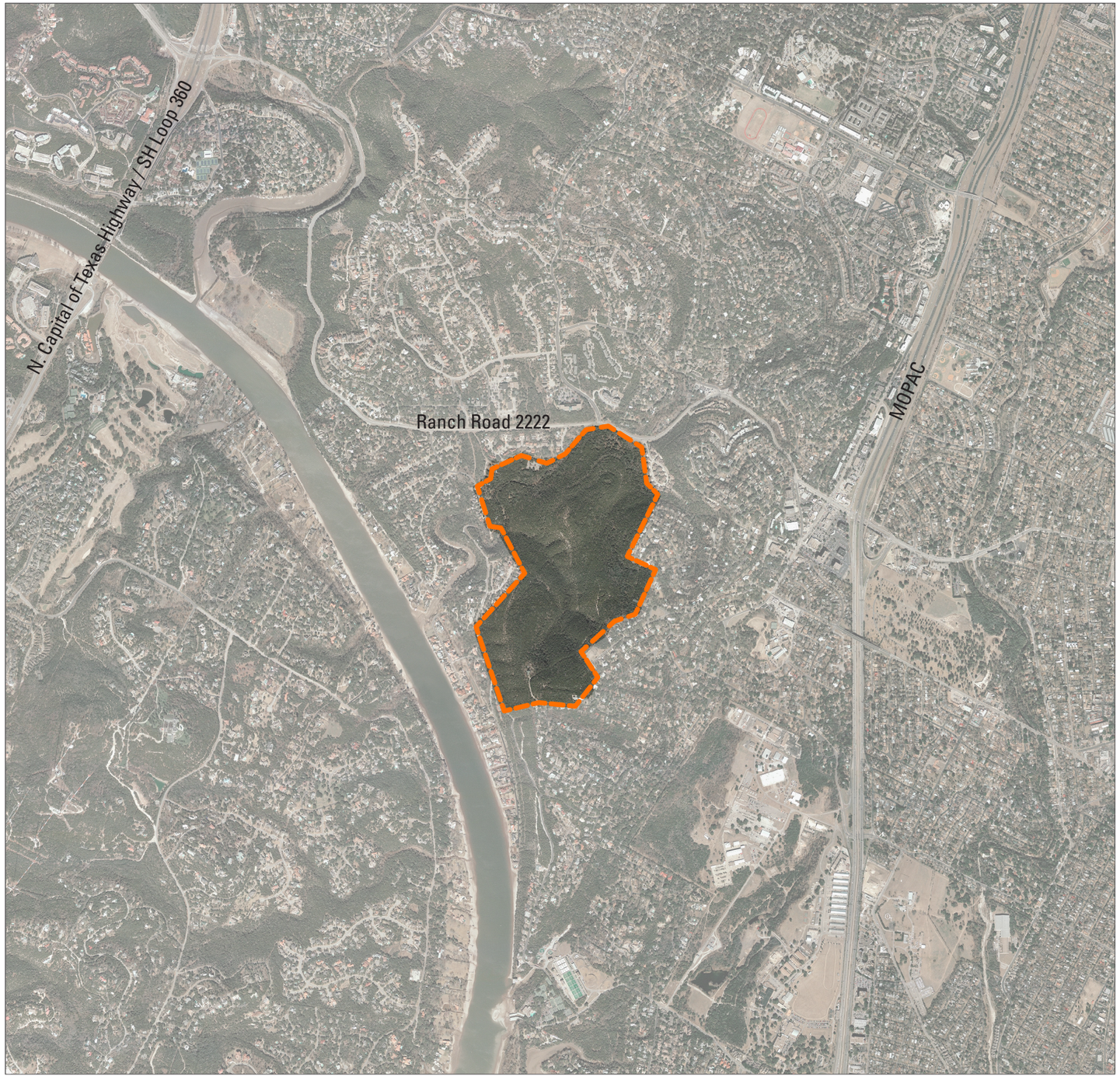
1,269 acres owned by the City of Austin, it is 15 minutes east of the University, and includes the City's Dillo Dirt plant and sewage treatment center. An unused 196-acre parcel in the northwest corner has full water access, partial flood plain, open fields, and forest cover. Deer and armadillos, as well as substantial bird populations, abound. This is also a possible candidate for a relocation site.

7.3.2.5. Westcave

A 38-acre LCRA holding 45 minutes west of Austin. The site includes several public exhibits and a deep grotto. It seems inappropriate given its already public use, and was dropped from consideration.

7.3.2.6. Bee Caves

Also a U.T. Austin parcel, west of Austin, but too small (32 acres) to be of use even on an ancillary basis.

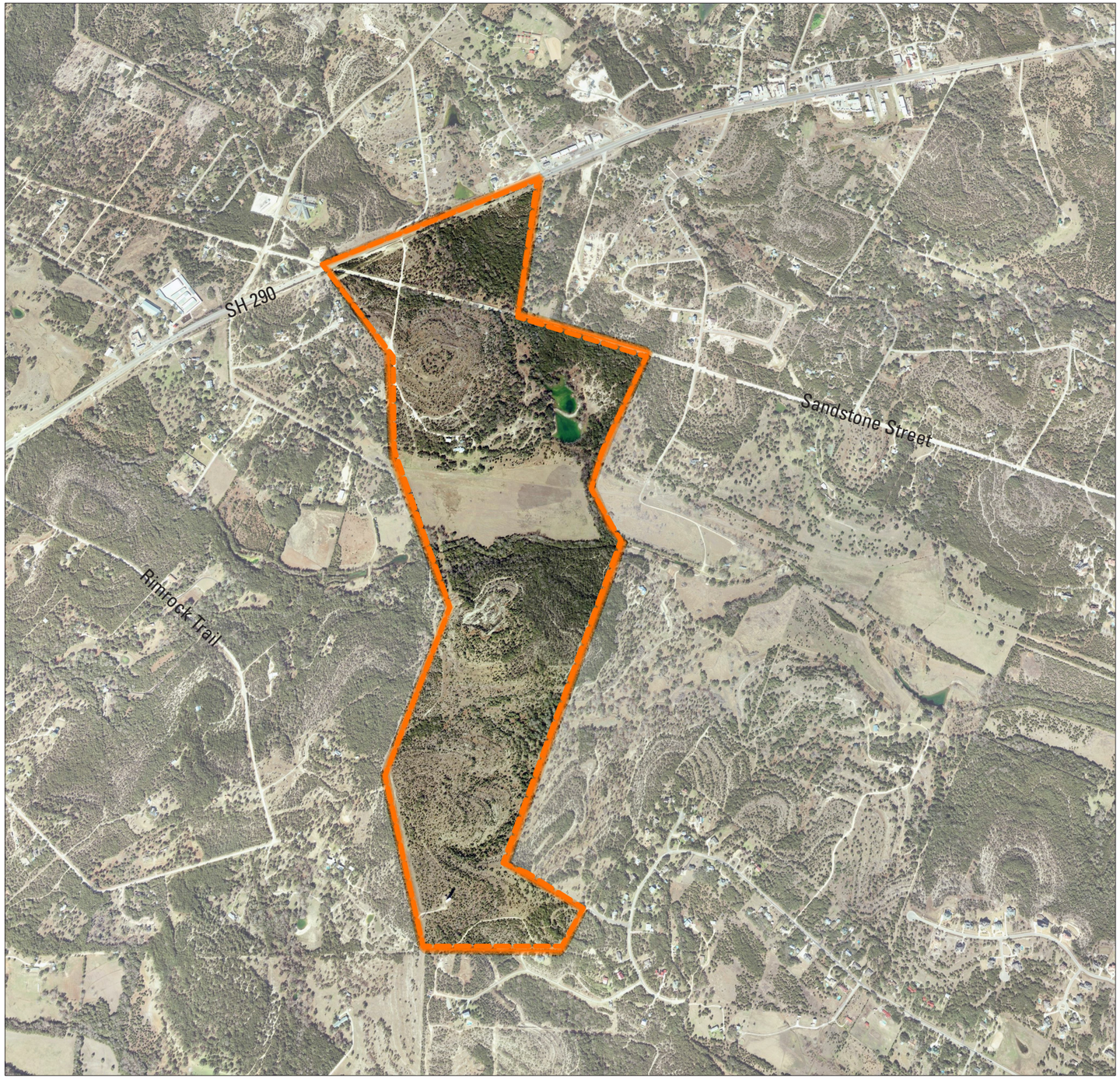


7.3.2.7. Bright Leaf

A 211-acre parcel in northwest Austin, owned by the Austin Community Foundation, from and under terms of the will of Ms. Georgia Lucas. Those who are familiar with the will believe that a research site on the northern portion (which includes a year-round stream) would be appropriate to the terms of the will, which stresses public access and education. Because there is no Colorado River access, this would be an ancillary site.

7.3.2.8. Bending Oaks Ranch

A 361-acre parcel offered-for-donation in the Oak Hill area and fronting on 290 West. The conservation terms on the parcel limit impervious cover to circa 100,000 square feet of site area, which is sufficient for replication of current facilities and buildings with room for more. There is no waterfront access on the Colorado, but there are streams and floodplain onsite. The site is 25 minutes from U.T. Austin. It could provide an important ancillary site, with extensive acreage for additional research, but should not be considered to be the relocation site, because it has no river access.



7.3.2.9. Dobie Paisano Ranch

The site is owned by U.T. Austin and currently used as a writer's retreat in a U.T. Austin fellowship program. It is 269 acres, 30 minutes west of Austin, and is a monoculture hill country setting without diversity; there are wet weather creeks only – inappropriate for the main relocation site.

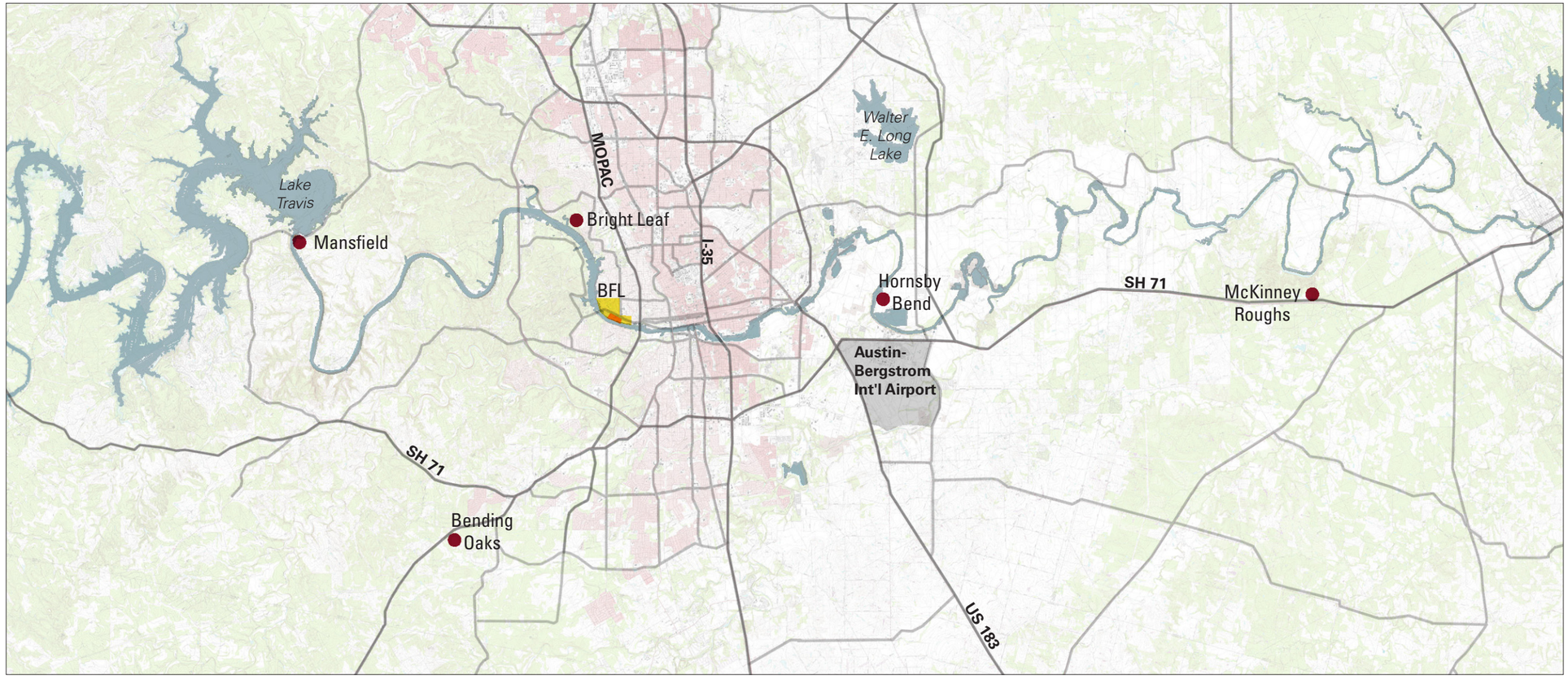
7.3.3. Summary Evaluation of Potential Sites

There are two candidate sites on the Colorado River: McKinney Roughs and Hornsby Bend and three ancillary candidate sites: Bright Leaf, Bending Oaks, and Mansfield.

It is useful to include one or more ancillaries, to provide more research opportunities. Bright Leaf is a different physical condition from Brackenridge Field Laboratory or the prime alternates (higher elevation, no river water); also it is the closest-in of the sites. Mansfield is available. Bending Oaks is the largest site, is offered, and a bit closer in than Mansfield.

Of the river sites, Hornsby is closer, larger, better topographically. But It is adjacent to the sewage treatment area, and 111 acres is flood plain (85 not). It is owned by the City.

McKinney Roughs is close enough, large enough, perhaps not ideal topographically, and available (in the view of LCRA staff) and securable.



Potential Sites Map

7.4. CONCLUSIONS

The Design Team has concluded that it is possible to relocate the Brackenridge Field Laboratory to another site(s) both in terms of availability of sites and the role of the Brackenridge Field Laboratory in the U.T. Austin Field Laboratory network. It is recommended that the McKinney Roughs site be considered as the relocation site for the Field Laboratory. In order to determine the impact of keeping the Field Laboratory on the Brackenridge site versus relocating it, and assist the Board of Regents in determining whether or not to relocate it, one of the Concept Plans relocates the field laboratory, the other maintains a reduced field laboratory on the site.

7.4.1. Considerations

Utilization:
The current field laboratory site is not currently fully utilized. Though the College of Natural Sciences analogized the site to a library in which not all books are in circulation at one time, it is clear from data provided by the Field Laboratory, that a fair portion of the site lies fallow. Although requesting more acreage at Brackenridge, the Field Laboratory leaders dismissed the McKinney Roughs site that offered up to 120 acres. A reduced Field Laboratory that trims mostly areas of low usage is assumed for the Concept Plan in which a Field Laboratory remains for some period of time.

Investment:
There is a pattern of non-investment in the Field Laboratory. The Field Laboratory leaders attribute this to uncertainty of permanence, yet rejected the McKinney Roughs site that offered a 100-year lease. A more persuasive explanation given was the need for investment in other College of Natural Sciences programs, to bring them up to Ecology's rankings - as a reason for not using more U.T. Austin money. But it is likely that grant and donor monies could have been obtained and used. The Design Team was told of grant totals as high as $4 million annually; the current fixed year level is $230,000.

Program Value:
It is difficult to describe the actual (vs. stated) value of this specific field laboratory. At other front-ranked institutions where the design team has recently worked (Caltech, Harvard, MIT, Yale, Duke), in order to get to know the programs we are working with, we have requested a "Top 10 recent scientific achievements" list. The list that we received from the College of Natural Sciences, covering the four-decade life of the field laboratory, is included in the appendix to this report. While individuals may come to different conclusions as to the significance of the list of results over 42 years, it is clear is that perhaps the most notable work, Dr. Gilbert's fire ant / phorid fly studies and findings, has (necessarily) been primarily conducted in a building on-site and around the state rather than in the field here. The appropriate question to ask is: "what can only be done here, and in the field, and what is that value?" We have not been able to obtain a clear answer to this question.

Undergraduate Program:
College of Natural Sciences personnel speak of the importance of keeping undergraduate education at the Brackenridge location. The proposed relocation site would not be as proximate, but the actual described method of undergraduate education is full afternoons, which is plausible at the proposed relocation site if a shuttle system is included. Moreover, it should be noted that it is the graduate program that is ranked nationally.

40-Year Records:
Outside advisors in the Field Laboratory's discipline were not unanimous in their estimation of the value of the 40-year longitudinal records. (The laboratory was established in 1967.)

Community Impact:
The Field Laboratory is today, and has been for 40 years, fenced and unavailable for Austin residents. Together with the Golf Course and WAYA, which both require membership and payment, it is inaccessible to the citizens. Both Concept Plans indicate the extension of the Town Lake Trail along the water on the lakefront edge of the Field Laboratory, giving free access to all, and a major park system centered on the Schulle Branch, also giving free access to all, but now encased in the Field Laboratory's western edge. Under terms of the Brackenridge Development Agreement, these facilities could be made available immediately. Field Laboratory faculty members have opposed any extension of the Town Lake Trail on the waterfront, though it can be achieved by an elevated walkway or boardwalk without interruption of the biotic movements between land and water.

Overnight Stays:
Field Laboratory personnel have expressed an interest in overnight stay facilities for visiting scholars, but rejected the McKinney Roughs site where those facilities are already in place.

7.4.2. Relocation Site

Nine possible relocation sites were visited and considered. Criteria included size; land availability; acquisition cost or consideration; ownership duration; proximity; securability; buildability; riparian access; variety of habitat, vegetation, and species; capital and maintenance cost; flood plain and topography; and fit with the network of Field Laboratory sites which includes the Lady Bird Johnson Wildflower Center and Stengl "Lost Pines."

The recommended site is 80-120 acres at McKinney Roughs, on the Colorado River 30 minutes east of campus. Preliminary discussions with Lower Colorado River Authority (LCRA) executive staff indicate: a) willingness to collaborate, b) eagerness to continue to expand the scope of LCRA educational outreach to area schools by means of collaboration with the College of Natural Sciences, and c) reasonable approaches to consideration, duration, and land reconfiguration and manipulation as the setting for experiments. This site is further distant than the current Field Laboratory, although it is the same time frame of distance as Stanford's laboratory is to its main campus, but it meets the other criteria, though with more topography in some areas.

The Field Laboratory and other College of Natural Sciences faculty representatives who visited McKinney Roughs (Dean Rankin, Dr. Gilbert, and Dr. Hillis, accompanied by Provost Leslie) were opposed to the relocation, on stated grounds of proximity, topography, concern re: LCRA willingness to allow land manipulation or security, and loss of longitudinal studies' continuation. It is our understanding from the LCRA, however, that it will allow fencing and manipulation of the land.

7.4.3. Reconfiguration On-site

Should the Regents decide to maintain the field laboratory use on-site for a period of time, the design team recommends a reconfiguration from the current 82 acres to 56 acres in the central part of the site, to:

- comport the size to better match the percentage of site now fully used;
- leave an area that allows the main buildings to remain in place and perhaps provide for use of the Lake Austin Center by the Field Laboratory or, if grants can be obtained, for new classrooms and teaching facilities;
- provide a more public face to the Field Laboratory, including a civic site that might be a related use – so that the laboratory begins to address public outreach/education meaningfully;
- accommodate the lakeside extension of the Town Lake Trail, and the central part of Brackenridge Park; and
- minimize the lack of free public accessibility and the disruptive effects and financial disadvantage to the University of a centrally-located out-parcel in the early phases of the redevelopment.

Should the Field Laboratory remain for a time, it should be required to cooperate with the water management and quality control system being proposed for the entire Brackenridge Tract.

7.4.4. Economic Valuation

Because the field lab occupies the center of the site, from Lake Austin Boulevard to the Lake, its retention, even reconfigured, limits internal traffic dispersion, particularly in the east-west direction. This will have an impact on the density achievable on the site. It is estimated that the reduction due to traffic capacity is about three million square feet out of the 15 million square foot program for the site.

7.4.5. Implementation Plan and Schedule

If the field laboratory is to be relocated, there needs to be an understood schedule for completion of current research. According to the BDA, the field laboratory site cannot be used for non-University purposes until 2019, but the language allows the site to lie fallow until then or be used for public purposes. The main site for the replacement field laboratory could be built soon,

to get research underway there, and the current site left also available toward 2019, for current research to be concluded. Or, if there are other reasons to amend the BDA prior to 2019, renegotiation of the 2019 date could be part of the new overall agreement, and the current field laboratory could be closed sooner.