Camp Shelby Field Office
The Nature Conservancy
2012 Annual Report

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Acknowledgements

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We look forward to continuing with these projects and starting new projects in 2013.

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1.0 GOPHER TORTOISE RESEARCH AND MANAGEMENT

1.1 Head-starting Gopher Tortoise Hatchlings

Objectives

Most estimates of pre-adult gopher tortoise mortality rates have come from multi-year burrow survey comparisons and telemetry studies of hatchlings. Mortality rates of hatchlings have been documented as 90 - 100% within two years in both Mississippi and Florida, and predation has been reported as the most common cause of mortality. In the fall of 2006 we started a head-starting study on CSJFTC, using a modified predator-proof hatchling pen modeled after the juvenile desert tortoise hatchery at Edwards Air Force Base. The design of the pen was to prohibit any mammalian, fire ant, snake and avian predation. Each year, some of the yearlings/juveniles were released to their natal burrow and radio-tracked, in an effort to provide valuable information on: 1) growth; 2) home range; 3) burrow use and construction; 4) movement patterns; and 5) cause and extent of mortality. Since adult gopher tortoises are not considered prey for most of the hatchling predators, we hypothesized that there must be a size threshold in the younger age classes that, when reached, may reduce their susceptibility to these different types of predation.

Summary of 2006 activities

Once the predator-proof enclosure was completed in the fall of 2006, the 31 hatchlings obtained in the summer of 2006 were released into starter burrows. Prior to release, measurements were taken again on all hatchlings, and then they were each fitted with a 0.1g radio frequency identification (RFID) tag on the fifth vertebral scute using waterproof epoxy. Great care was taken to ensure that the seams between scutes were not bridged, which could potentially result in shell deformities. At release, the lightest hatchling weighed 24 grams, so at most, the RFID tags represented 0.4% of the total body weight of each animal. Hatchlings were then released into the starter burrows on October 4 & 5, 2006.

Summary of 2007 activities

For the purpose of categorization, tortoises that hatched in 2006 were termed H2006, those that hatched in 2007 were H2007, etc. Ten of the H2006 tortoises from the head-start pen were re-captured, re-measured, fitted with radio-transmitters, and released into T-44 on September 26 & 27, 2007. All ten survived through the end of 2007.

Summary of 2008 activities

Of the ten H2006 tortoises released in September 2007, two were tracked through 2008. Four were definitely predated, a fifth fell into a stump hole and could not get out, and the transmitters of the remaining three were found (tortoise status is unknown – presumed dead). In September 2008, an additional 10 H2006, 15 H2007, and 20 H2008 tortoises were fitted with radio-transmitters and released into the field (45 total). Nine of these were predated (2 H2006, 2 H2007, and 5 H2008 tortoises) in 2008. Still residing in the head-start pen were 10 H2006 tortoises, 50 H2007 tortoises, and 73 H2008 tortoises.

Summary of 2009 activities

Two of the original 10 head-started tortoises (released as yearlings in October 2007) were tracked through 2009. Of the 45 animals released in September 2008, 5 H2006, 2 H2007, and 2 H2008 tortoises were tracked through 2009. Reasons for not tracking include transmitters falling off or failing, stump holes, fire ant predation, mammal predation, snake predation, and unknown health issues (wasting). An additional 5 three-year-olds, 2 two-year-olds, 17 yearlings, and 19 hatchlings were released into the field with radio-transmitters. To the best of our knowledge, current residents of the head-start pen were: 5 three-year-olds, 36 two-year-olds, 52 yearlings, and 24 hatchlings (117 total).

Summary of 2010 activities & preliminary results

Through 2010, 132 hatchling and juvenile Gopher Tortoises have been head-started and released. As was seen in previous years, fire ants continued to be a major cause of mortality, almost exclusively on hatchlings. Out of the 17 hatchlings released, 9 (53%) of them were predated by fire ants; average lifespan of those 9 hatchlings was 8 days. To the best of our knowledge, current residents of the head-start pen were: 2 four-year-olds, 9 three-year-olds, 15 two-year olds, 9 yearlings, and 19 hatchlings (54 total).

Predation of hatchling and juvenile Gopher Tortoises has been documented by all four predator classes (mammal, snake, invertebrate [fire ants], and avian) originally thought to be potential predators. The majority of predation has been by mammals and fire ants; however, whereas mammals have been documented preying on all ages of juvenile tortoises, fire ants almost exclusively prey on hatchling tortoises (21 out of 23 predation events – 91%). Additionally, the only known predation by a snake (Eastern Coachwhip – *Coluber flagellum flagellum*) was on a hatchling tortoise.

Cause of death attributable to disease was also investigated, and from necropsy results two different diseases have been identified: metabolic bone disease (MDB) and septicemic cutaneous ulcerative disease (SCUD). MDB has been documented almost exclusively from tortoises that were initially put into the head-start pen after 2007, so we think that this phenomenon (caused by deficiencies and/or inability to process calcium and vitamin D) might be caused by a deteriorating man-made environmental condition in the pen (e.g. repeated dormant season burning). To address this, soil and vegetative analyses from samples inside and outside the pen are ongoing. SCUD has only been reported once from necropsy results, and is caused by the bacteria *Citrobacter freundii*. The bacterial infection is thought to be caused by abrasions, invertebrate predation, or some other form of injury (F. Ridgley, unpubl. report).

Summary of 2011 activities & preliminary results

Through 2011, 176 hatchling and juvenile Gopher Tortoises have been head-started and released. Because of the ongoing investigations of environmental conditions, no more hatchling tortoises were placed in the pen. All hatchlings acquired this year (50) were released into the field at their natal site (30 with transmitters and 20 without transmitters). Release methods varied this year to include: 1) hard release onto natal burrow apron; 2) release into starter burrows in an open area treated with fire ant bait; and 3) release into starter burrows in an enclosed pen treated with fire ant bait.

In addition to the 30 hatchlings released, 9 hatchlings incubated at USM were also released with transmitters. A collaborative study with Mississippi State University (Dr. Jeanne Jones & Nicole Hodges) will directly address the disease issue uncovered by the head-starting

study. Begun in the Fall of 2011, the study is investigating the levels of nutrients in the soil and vegetation inside the head-start pen, as well as sites across the MS range of the Gopher Tortoise that have various documented numbers of hatchling and juvenile burrows (i.e. recruitment) and various fire regimes (both frequency and seasonality).

Summary of 2012 activities & preliminary results

No Gopher Tortoises were head-started in 2012. However, we continued to track tortoises equipped with radio transmitters that were released into the field during the five previous years. The current status of head-started tortoises released over the span of the study can be found in Table 1. Of the 39 hatchlings released in 2011, only six were still alive at the end of 2012. The transmitters on these individuals have expired and were removed, and we do not intend to re-fit these individuals with new transmitters. However, we are continuing to monitor the status of the four other head-started tortoises released in previous years (i.e., 1 from each 2007, 2008, 2009, 2010; Table 1). Over the past year, more tortoises have displayed the clinical signs of MBD and have apparently died from the disease, in addition to more documented mammal and fire ant predation. A feral pig (*Sus scrofa*) may have predated one of the hatchling tortoises released in 2011. While it is impossible to know for certain whether or not a feral pig consumed this tortoise, feral pig disturbance was observed within the area of its burrow and the apron and burrow had been completely excavated.

Table 1. Mortality results (by release year and age) of head-started hatchling and juvenile Gopher Tortoises at Camp Shelby, through November 2012.

Release year	Age at release	# released	Still alive	Trans. issues	Stump holes	Rx burns	Disease	PREDATION			
								Mammal	Avian	Snake	Fire ants
2007	yearlings	10	1	3	1			5			
2008	hatchlings	20	1	9	2	1		2		1	4
2008	yearlings	15	0	3			9	1	1		1
2008	two-year-olds	10	0	6				4			
2009	hatchlings	19	0	2		1	4	2	2		8
2009	yearlings	17	1	2		1	12	1			
2009	two-year-olds	2	0	0	1		1				
2009	three-year-olds	5	0	1	1		1	2			
2010	hatchlings	17	0	4			1	3			9
2010	yearlings	7	0	1			2	3			1
2010	two-year-olds	3	0	1			1	1			
2010	three-year-olds	6	0	2			1	3			
2010	four-year-olds	1	1								
2011	yearlings	5	0	1			1	2			1
2011	hatchlings	39	6	18	1		2	8			4
	TOTAL	**176**	**10**	**53**	**6**	**3**	**35**	**37**	**3**	**1**	**28**

2.0 LOUISIANA QUILLWORT MONITORING

2.1 Monitoring South of the Multi-Purpose Range Complex-Heavy (MPRC-H)

Our program is responsible for monitoring Louisiana quillwort (LAQ), (*Isoetes louisianensis*), colonies in the Poplar Creek watershed south of the Multi-Purpose Range Complex – Heavy (MPRC-H) construction box. Colony monitoring methods were initiated in December 1999 after quillwort were discovered in Poplar Creek on Ranges 43 and 45. In addition to an annual census, seven permanent plots consisting of an upstream and a downstream quadrat (0.25m²; please note this correction as the 0.5m² reported in previous annual reports was an error) for counting and measuring growth of quillwort are monitored quarterly. These plots (sites 1-5 and Bridge) were established to document possible negative impacts from construction of the MPRC-H and training activities in upstream ranges (40-45) if such impacts began to occur. Site 6 is also monitored to provide data on LAQ outside the influence of the MPRC-H and Range 45 training and maintenance, but still within the Poplar Creek watershed. Photographs are taken; the number of visible LAQ and maximum leaf length for selected quillwort are recorded for each plot. Seventy-eight plants at site 5 were lost in 2000 due to persistent inundation caused by a beaver dam. Consequently, these data have been removed from all analyses for this site.

Permanent Plots

Total plants counted quarterly in permanent plots from 2000-2012 are summarized in Table 2.1-1. Quillwort plants have not been present in plot 1u for the past 9 years and 1d for the past 7 years due to prolonged leaf pack. Despite periodic scouring arising from heavy rain events, this site accumulates leaves and debris regularly. In plot 2u, plants have not been present for the past 4 years due to a developing beaver lake downstream from the plot. Plants in plot 2d have not been present for the past 2 years. Sporelings were observed in this plot during the April 2010 census and feral hog (*Sus scrofa*) disturbances were observed within close proximity of the plot during the October 2011 monitoring. Before April 2010, plants were not present in this plot for 3 years. There have been canopy changes that have allowed full sun plant species to occupy the plot. Leaves have a greater tendency to become trapped around the bases of these plants and create conditions where they accumulate regularly.

Plants in plot 3u have not been present for the past 3 years and these plants were sporelings that developed in the plot after fire moved through the plot in 2007. Although this plot is heavily shaded by woody vegetation (Swamp titi) and hardly any herbaceous vegetation occupies the plot, leaves and debris regularly accumulate among the stems of Swamp titi. Plants in plot 3d are consistently present and have increased in number over the past year. This plot is heavily shaded and periodically has other plant species that grow in shady environments. The difference is that the plot is located in the middle of the channel and is frequently scoured because there are no shrub stems within the plot for leaves and debris to become trapped. Historically, older plants persisted in this plot, while newer plants came and went with changing conditions. In July 2011, however, the plot was disturbed by feral hogs. The increase in plant numbers, consisting of a mixture of adults and sporelings, suggest that the timing of disturbance may have played a role in the increase in plants within this plot since the initial disturbance occurred when quillwort leaves wither and release spores (late spring-summer months).

Quillwort sporelings were observed in plot 4u during the April census last year, but have not been present since. Before these sporelings were observed, the plot had no plants present for 9 years. This plot, although located in the middle of the channel, is surrounded by a beaver impoundment where water remains pooled and leaves and debris persistently accumulates. Plants in plot 4d have not been present for the past 4 years. Between 2001 and 2005, herbaceous vegetation covered the plot allowing leaves to accumulate. Herbaceous vegetation gradually decreased by 2009 and the plot has been consistently scoured leaving bare soil. However, no plants have been present in this plot recently. This site received line of sight cutting in April 2003 and it appears as though there was a temporary change in canopy that allowed full sun herbaceous plants to develop which decreased as the canopy cover increased.

Plants have not been present in the bridge plot since before the October 2011 monitoring. Several subsequent feral hog disturbances were observed thereafter (between January and April 2012). There have been no further disturbances at this site. Since quillwort fertilization is thought to occur during the wet season (winter months) and sporelings are visible when 2-3 leaves that are 1-2 cm long are present the following spring, it appears these disturbances occurred when quillwort sporelings were developing. The majority of larger ("adult") plants within the colony were limited to the areas that are persistently covered in water at the bridge site where feral hog disturbance did not occur. In comparison to the one feral hog disturbance that occurred at plot 3d with the multiple disturbances at the bridge plot, it appears as though timing and frequency of disturbance is a threat to quillwort.

In examining the control plots at site 6, quillwort plants have not been present in plot 6u for the past 2 years. There are several felled trees in the area that occurred during Hurricane Katrina (August 29, 2005). These canopy changes have allowed herbaceous plants which thrive in moderate sunlight conditions to persistently cover the plot. In addition, the plot is located near the edge of the floodplain where scouring is limited to periodic flooding events. Plants in plot 6d have not been present for 8 years. This plot is located at the edge of a small braid in the main channel where scouring is frequent. The canopy is intact and very few herbaceous plants grow within the plot. The reason for which plants disappeared from the plot (after April 2004) is unknown. It could be related to natural, localized changes in hydrology where the water movement has increased at this site allowing too much energy for quillwort and other plants to develop as water movement is very rapid following heavy rain events. There are several quillwort plants in close proximity of the plot (in adjacent braids and on the floodplain).

Colony Counts

The annual census was performed 9-10 April 2012. Colony counts are shown in Table 2.1-2 and graphs depicting Raw Counts, Change in Baseline Data and Annual Change in Colony Counts are in Figures 2.1-1, 2 and 3. As compared to the 2011 census, colonies have increased in number at sites 2-4 and decreased at site 6 and the bridge. There has been no change in colony numbers at site 1 this year. The decrease in colony counts at the Bridge and site 6 is largely due to multiple disturbances caused by feral hogs. Feral hog rooting was observed on the west side of the channel where the bulk of the Bridge colony is located. Rather than one disturbance, at least three have been observed (evidence observed during the October 2011, January and April 2012 plot monitoring). This year, feral hog rooting was observed at several locations along the census stream segment of site 6 (Poplar Creek tributary between Ranges 46 and 47A). A combination of old and new disturbances were observed and are outside of the upstream and downstream plot locations.

While colony numbers increased at sites 2-4 this year, the majority of quillwort plants observed were either fully mature or in a younger developmental stage. Where sporelings were observed, they were in localized areas within the stream census segment at sites 2 and 3. These localized areas are in the stream channel where the probability of frequent scour events is higher. As noted over the past 5 years, the bulk of the site 2 colony (271 plants this year) is below the tree line and developing beaver lake within this census site on Range 45. The remainder of the colony (57 plants) above the tree line is limited to the tributary to the west of the main channel around the downstream plot. As compared to other colonies this year, colony 3 had the most sporelings. Colony numbers increased by 86 plants this year despite the feral hog disturbance observed in July 2011. Curiously, the majority of sporelings were observed in and around the downstream plot where feral hog disturbance was observed. Whether or not disturbances such as this stress plants to the point of reproduction (as known for other plant species) or the rooting simply spreads megaspores in the vicinity (if it occurs during megaspore production) has not been determined. It does appear, however, that fewer feral hog disturbances do not negatively impact quillwort plants as compared to the many disturbances observed within the Bridge site (where disturbances reoccurred within a crucial period of the quillwort life cycle). Site 4, where beaver activities have occurred upstream and within the census segment and no feral hog rooting has been observed, increased by 221 plants this year. The majority of the colony is below the pooled segment within the census area as described in the above plot status section. The same observations as described for sites 2 and 3, in terms of sporeling abundance, were made within this area. Overall census numbers were up this year in sites 2-4 as compared to previous years. This is probably largely attributed to the above average amount of rainfall received in this quarter which allowed for regrowth of established plants and sporeling development (Figures 2.1-4 and 5).

There was no change in total quillwort numbers within the site 1 census segment. The canopy trees that remained after Hurricane Katrina have been killed by ordinance being fired from Range 43 leaving dense thickets of Swamp titi lining the stream segment that very recently resprouted. Large pieces of rotting debris have become lodged within the trunk bases of Swamp titi where smaller pieces of debris and leaves accumulate in several areas which thereby limit quillwort recruitment. The same 4 adult plants counted last year remained this year, but were challenging to locate as they were under loosely packed leaves and small pieces of woody debris. It appears as though there is a long history of debris and leaf accumulation within this channel segment since the majority of plants were lost due to prolonged leaf pack. This could be attributed to the natural hydrology of the stream as this segment is located within a tributary east of the main channel where the baseline colony census was low.

Precipitation Data

In 2011, we deployed a Solnist Levelogger Gold^{TM} in Poplar Creek on Range 45. This levelogger was programmed to record hourly water level data so that the daily change in average daily water level can be used to estimate rainfall entering Poplar Creek. This method provides more accurate data since the terrestrial rain gauge has level limits which can cause rain data to be lost during prolonged rain events. Repeated visits are required so that the water level is manually recorded and dumped off to acquire new measurements. While there is a difference between the terrestrial rain gauge and levelogger readings, the difference is due to a combination of 1) the amount of water entering the stream from the surrounding uplands during heavier rain events (we measured minimal differences between the terrestrial rain gauge and levelogger

during lighter rain events) and 2) increased efficiency in capturing data (as described above). This became more clear as we had a wetter than usual October quarter this year (partly due to storms created by Tropical Storm Isaac). In addition, better inferences can be made as they relate to channel scouring and amount of water deposited in the channel during heavier rain events. Furthermore, relating rain event dates to what is known about the life cycle of quillwort may help us better understand the fluctuations in growth of individual plants as well as colony size.

Precipitation reported previously does not correspond with what is known about the life history of Louisiana quillwort. Quillwort data collection occurs quarterly within a single point in time where we are measuring factors that occurred between the current and previous monitoring. Therefore, precipitation data should correspond with events that occurred before monitoring. For example, quarterly monitoring is performed in January, April, July and October. Therefore precipitation data should be summarized by rain events that occurred three months before the monitoring (January=October-December, April=January-March, July=April-June, October=July-September). In addition, annual precipitation should correspond with rain events that occurred from April of the previous year through March of the current year (e.g. April 2012 census should correspond with precipitation data from April 2011-March 2012). Data have been re-evaluated to correspond with the life cycle of Louisiana quillwort and are depicted in Figures 2.1-4 and 5.

MPRC-H Construction

The rain event which caused erosion issues during construction was discovered in Poplar Creek on Range 45 during August 2001 and the MPRC-H officially opened in December 2005. Colony 2 and the bridge colony are located within the stream where silt was carried and thereby had the greatest probability of potential impact. In examining census data from April 2002 through 2006 for these two sites and comparing them with colony 6, changes in colony numbers have similar patterns in colonies 2 and 6 (Table 2.1-2, Figures 2.1-1, 2 and 3). The bridge colony shows an overall decrease, but this was due to channel cutting that occurred within the colony during 2003. It is difficult to compare patterns from 2006 to present because there have been several unrelated events that have caused changes in colony size over time. The bridge colony decreased in 2009 because a large pile of debris that became lodged at the bridge pilings covered the colony for approximately 9 months following the 2008 line of sight cutting and more recently due to repeated feral hog disturbances. Colony 2 decreased in 2008 and 2009 because of developing beaver pond downstream and colony 6 decreased this year because of feral hog disturbances. However, the overall increase following 2002 shows that the stream siltation did not have long term impacts on downstream quillwort colonies. This is likely because the issue was corrected immediately and there have been no further erosion issues in Poplar Creek. With the MPRC-H officially opening in 2005, soils are stable and should remain so as long as future activities do not lead to erosion issues.

Range 45 Line of Site Maintenance

Trees were pruned within the drainages of Sites 2, 3 and 4 on Range 45 for line of sight clearing in April 2003 and within drainages of Sites 2, 3 and bridge in August 2008. Overstory pruning for line of sight maintenance along colonies 2-4 that occurred in 2003 did not appear to have a negative impact on colony size. Colony size during certain years following line of sight clearing decreased, but was followed by an increase in colonies 2 and 3. Colony 4 decreased after line of sight pruning, but this is not necessarily related to range maintenance since this

colony was and is currently being influenced by hydrological changes created by beaver activities within the channel. After the August 2008 line of sight maintenance activity, colony 3 exhibited a dramatic increase similar to what was observed in colony 2 after the April 2003 pruning (Figure 2.1-3). Colony size patterns between these two colonies two years following these pruning activities are similar; however, the same cannot be said for patterns during year 5. As explained in the above sections, colony 2 decreased due to beaver activities discovered in 2008 and feral hog disturbances have recently impacted all three colonies. Although line of sight pruning appears not to have a major impact on colony size, localized influences have been observed (see above permanent plot section).

Long term monitoring data examining the possible effects of line of sight maintenance activities within these colonies have become increasingly difficult to compare because of these other influences. Future line of sight cuttings should follow past protocols (hand removal to 4' around colonies), but this method should include trees and shrubs within the surrounding floodplain such that a buffer is created around the colony to limit the amount of sunlight reaching the colonies. In addition, cut debris should be moved further away from the floodplain such that it does not become lodged in tree stems and at the bridge pilings after heavy rain events. With what is known about the life history of Louisiana quillwort, it appears as though pruning during the drier periods has the least impact on quillwort since plants will likely be dormant. However, foot traffic within colonies during pruning should be kept at a minimum such that corms are not dislodged from the soil. This is least likely to occur during drier seasons.

Imminent Threats to Louisiana Quillwort and Management Considerations

Below is a summary of current threats to Louisiana quillwort and management considerations within this study area:

1. Beavers: While developing beaver lakes create new channels for quillwort to colonize; this is temporary as observed in the developing beaver lake within Site 2 since 2008. These new channels fill and eventually become part of the beaver lake. In addition, beavers create small ponds within stream channels that disrupt the channel flow needed for scouring new areas for quillwort to colonize. Early detection of beaver activity near quillwort colonies such that the beaver can be removed from the area and their dams breached before the area becomes a lake should be incorporated in management plans.
2. Feral Hogs: Frequent feral hog disturbances negatively impact quillwort colonies. Early detection and removal of these animals should also be incorporated in management plans.
3. Line of Sight Cutting: The most recent data show that while hand cutting trees to 4' around quillwort colonies does not have a negative impact, buffers should be included around the colonies to remove the potential for full sun herbaceous plant development in localized areas where leaves can accumulate over time. In addition, cut materials should be moved outside of the floodplain such that it does not wash into the stream after heavy rain events where they can become lodged between the stems of trees and shrubs and at bridge pilings. This creates an area for leaves and smaller debris to accumulate and limits quillwort growth.

Future Monitoring

Established monitoring procedures associated with the MPRC-H construction and line of sight cutting will continue throughout 2013 or until it is determined these monitoring procedures are no longer necessary. All sites will continue to be monitored quarterly.

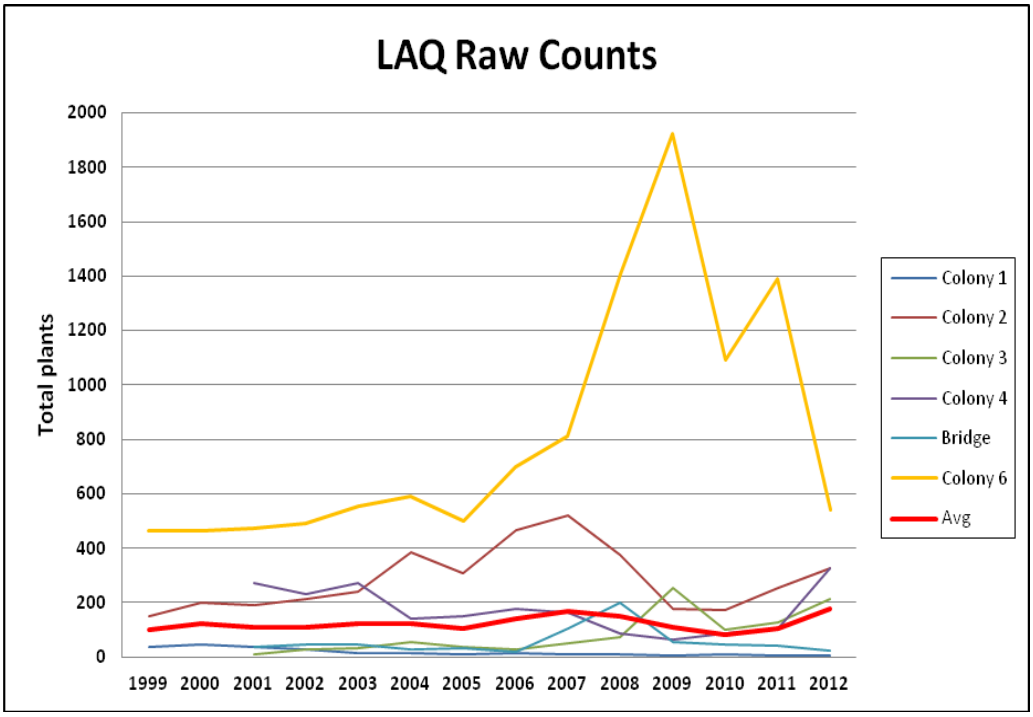


Figure 2.1-1. Total number of Louisiana quillwort counted among potential MPRC-H impact (Colonies 1-4, Bridge) versus non-impact (Colony 6) colonies located in the Poplar Creek watershed from 2000-2012.

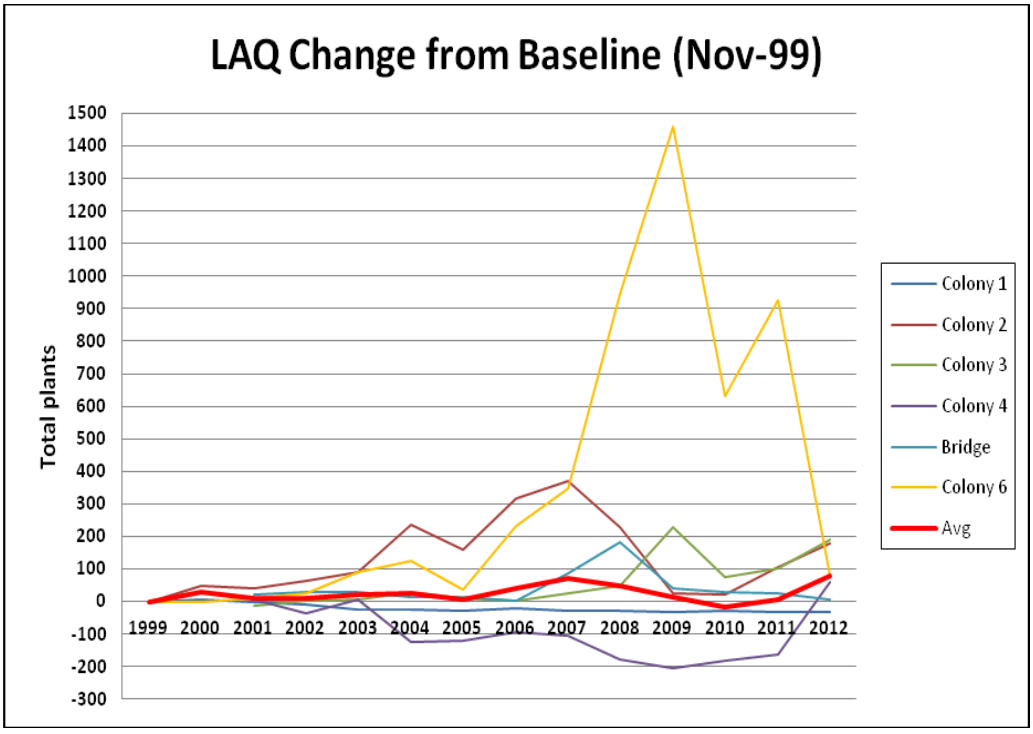


Figure 2.1-2. Change from November 1999 baseline counts of Louisiana quillwort counted among potential MPRC-H impact (Colonies 1-4, Bridge) versus non-impact (Colony 6) colonies located in the Poplar Creek watershed from 2000-2012.

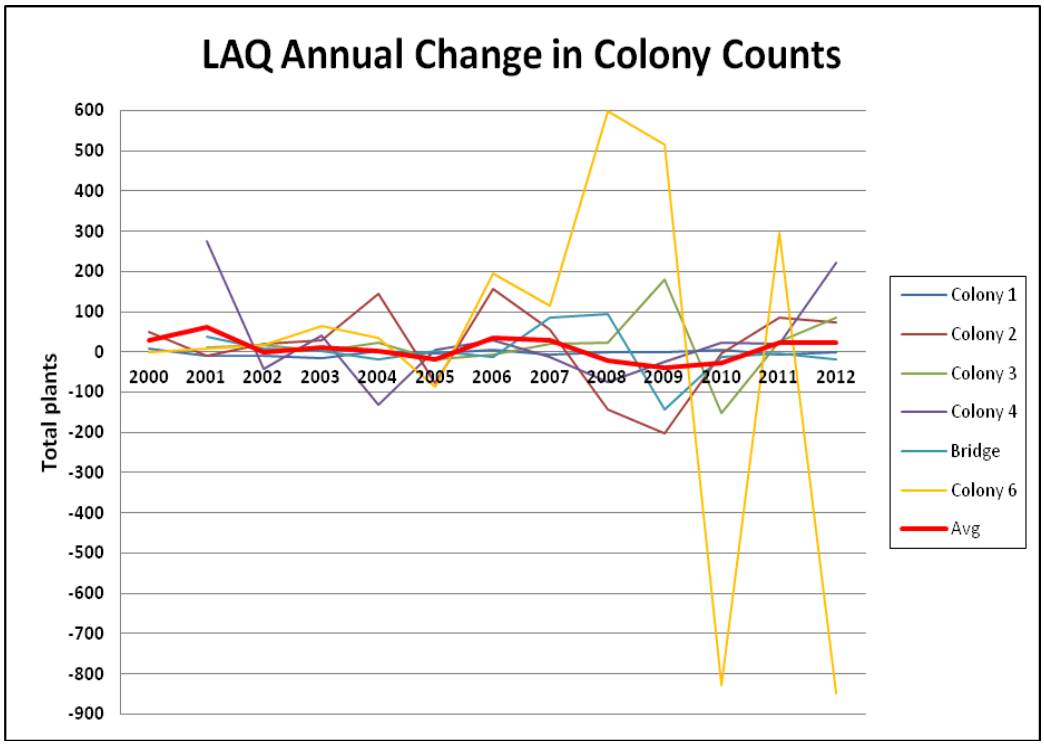


Figure 2.1-3. Annual change in Louisiana quillwort colony counts among potential MPRC-H impact (Colonies 1-4, Bridge) versus non-impact (Colony 6) colonies located in the Poplar Creek watershed from 2000-2012.

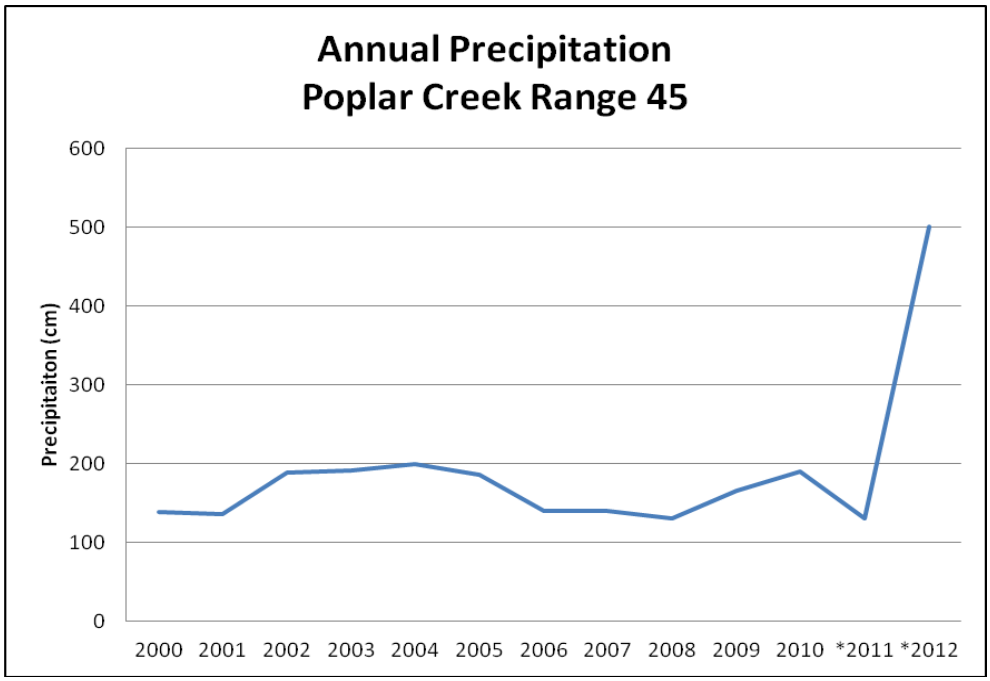


Figure 2.1-4. Annual precipitation from April of previous year's monitoring through March of the current year's monitoring. (*) Indicates year data started being collected using a water levelogger deployed in Poplar Creek on Range 45 (Oct-Dec 2012 data are not included).

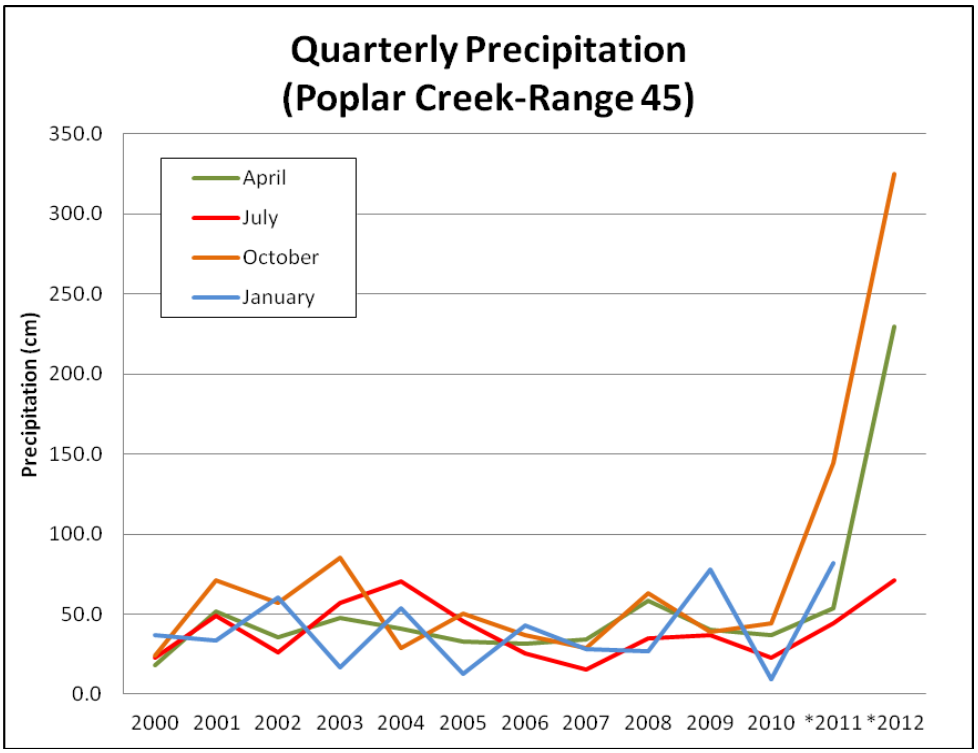


Figure 2.1-5. Quarterly precipitation (April=January-March, July=April-June, October=July-September, January=October-December of previous year). (*) Indicates year data started being collected using a water levelogger deployed in Poplar Creek on Range 45.

Table 2.1-1. Number of Louisiana quillwort plants counted quarterly in permanent plots from 2000-2012. Asterisk (*) indicated plots were not monitored due to military training activities. (b) indicates inundation by beaver activities, (d) indicates plot covered with debris, (i) indicates plots were flooded with >4' water.

January

Plot	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1u	13	12	*	0	0	0	0	*	0	*	*	0	0
1d	7	7	*	3	3	1	0	*	0	*	*	0	0
2u	5	6	*	6	6	4	4	*	1	*	*	0	0
2d	3	3	*	3	3	2	0	*	0	*	*	0	0
3u	2	0	*	1	1	1	0	*	0	3	*	0	0
3d	3	4	*	1	1	4	5	*	7	11	*	5	3
4u	7	0	*	0	0	0	0	*	0	*	*	0	0
4d	14	20	*	12	9	0	5	*	1	*	*	0	0
Bridge	7	8	*	6	4	0	0	*	8	d	*	3	0
6u	9	7	*	7	6	6	6	*	1	6	*	0	0
6d	7	4	*	4	1	0	0	*	0	0	*	0	0

April

Plot	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1u	14	13	4	1	0	0	0	0	0	0	0	0	0
1d	8	7	3	3	3	1	0	0	0	0	0	0	0
2u	5	6	6	6	5	4	4	4	1	0	0	0	0
2d	3	3	3	3	3	2	0	0	0	1	2	0	0
3u	2	2	1	d	1	1	0	0	0	3	0	0	0
3d	4	4	4	d	1	3	5	8	7	17	19	8	21
4u	7	1	0	0	0	0	0	0	0	0	0	4	0
4d	16	23	14	12	11	5	8	3	1	0	0	0	0
Bridge	9	12	8	5	5	0	3	9	10	4	1	0	?
6u	9	7	7	7	6	7	6	6	6	6	3	0	0
6d	5	3	3	4	1	0	0	0	0	0	0	0	0

Table 2.1-1. Continued													
July													
Plot	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
1u	15	10	3	1	0	0	0	0	0	0	0	0	0
1d	6	4	3	3	3	0	0	0	0	0	0	0	0
2u	6	6	5	6	2	4	4	2	0	b	0	0	0
2d	2	3	3	3	3	0	0	0	0	0	0	0	0
3u	2	2	1	1	1	1	0	0	8	0	0	0	0
3d	1	4	4	1	1	4	6	8	12	0	5	0	4
4u	2	0	0	0	0	0	0	0	0	0	0	0	0
4d	0	14	12	10	6	6	3	0	0	0	0	0	0
Bridge	3	10	9	2	0	0	3	9	6	1	i	0	0
6u	1	5	7	6	5	0	7	0	3	1	0	0	0
6d	3	4	4	4	0	0	0	0	0	0	0	0	0
October													
Plot	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
1u	8	8	1	0	0	0	0	0	*	*i	*	0	0
1d	6	3	3	3	2	0	0	0	*	*i	*	0	0
2u	4	6	7	6	6	4	4	1	*	*i	*	0	0
2d	0	3	3	3	2	0	0	0	*	*i	*	0	0
3u	0	2	1	1	1	0	0	0	*	*i	*	0	0
3d	0	3	2	1	1	5	4	2	*	2	*	2	22
4u	0	0	0	0	0	0	0	0	*	*i	*	0	0
4d	0	11	12	6	6	5	2	0	*	*i	*	0	0
Bridge	4	8	6	4	0	0	6	9	*	*i	*	0	0
6u	0	7	6	6	6	7	7	1	*	0	*	0	0
6d	0	3	4	3	0	0	0	0	*	0	*	0	0

Table 2.1-2 Number of Louisiana quillwort counted in colonies within the Poplar Creek watershed, Ranges 43-46, CSJFTC, MS. (*) indicates no data available.

	Colony 1	Colony 2	Colony 3	Colony 4	Bridge	Colony 6
Nov-99	37	150	25	268	16	464
Apr-00	44	200	*	*	*	464
Apr-01	36	192	11	274	37	472
Apr-02	27	213	29	232	44	489
Apr-03	13	242	32	274	46	555
Apr-04	14	387	54	142	28	589
Apr-05	9	309	35	148	31	501
Apr-06	15	467	29	176	18	697
Apr-07	9	522	50	163	104	812
Apr-08	8	378	72	88	199	1409
Apr-09	6	176	253	64	57	1923
Apr-10	10	171	101	87	44	1094
Apr/May-11	4	255	128	107	41	1391
Apr-12	4	328	214	328	22	542

2.2 Louisiana quillwort sample area performance monitoring

In April 2011, selected sections of Davis, Chaney, Clear, Joe's and Poplar (Site 3-Range 45) Creeks were established to examine subpopulation performance by measuring site conditions (macro and micro habitat), number of adults and sporelings, sporeling longevity, seasonal competition and hydrological factors within sample areas of these subpopulations. The purpose of this project will, not only provide quantifiable data for the USFS to make management decisions and provide the USFWS information concerning status review of Louisiana quillwort, but also provide a proactive approach to the CSJFTC SUP ROD concerning EIS compliance of T&E species by establishing additional monitoring sites in other watersheds within active training lands and provide a basis of comparison for future line of sight maintenance activities on Range 45. The methodology and baseline data are summarized in the 2011 Annual Report.

Sample Area Annual Census

Annual census data for the five, $400m^2$ sample areas are shown in Figures 2.2-1 and 2. For all quillwort plants counted in the sample areas, Poplar Creek-Site 3 had the greatest increase in total plants this year. With the exception of Chaney Creek, total plants within the other sample areas were lower this year as compared to last year. There was a slight decrease in adult plants and a dramatic increase in sporelings within the Poplar Creek-Site 3 sample area this year. As explained in the above section, this is likely attributed to the July 2011 feral hog disturbance that occurred within this sample area. This dramatic increase in sporelings was not observed within the other sample areas where no feral hog disturbances have been observed (to date).

Similar patterns between the total adult plants counted last year and this year was observed within all sample areas in that there was a slight decrease in numbers this year. There were no sporelings counted within the Davis and Clear Creek sample areas this April. Total sporelings increased within the Chaney Creek sample area this year, although not as dramatic as observed within the Poplar Creek-Site 3 sample area, and there was a slight decrease in total sporelings counted within the Joe's Creek sample area.

At this point, quillwort census data within sample areas cannot be compared with rainfall data because sample areas were established in March 2011 and there are no complete quarterly rainfall data available for the April 2011 monitoring.

Quarterly Quadrat Monitoring

All adult and sporeling plants within $1m^2$ quadrats within each sample area were marked and measured quarterly by length of longest leaf present and total number of leaves of each plant. The total adult and sporeling plants present during each quarter are depicted in Figures 2.2-3 and 4. Like what was observed within the sample area census for Poplar Creek-Site 3, total adult plants within quadrats decreased and total sporelings increased from April 2011 to April 2012. More specifically, adult and sporeling plants decreased following the July 2011 feral hog disturbance. Some adult recovery was observed during the following monitoring periods; however, the total number of plants is not what was observed last April. While some of the remaining sporelings recovered from the disturbance, a dramatic increase in sporelings occurred between the January and April 2012 monitoring. This suggests that fertilized quillwort spores develop visible leaves sometime between February and April. Whether or not the amount of water entering the stream is related cannot be compared at this point because, as explained

above, these sample areas were established in March 2011 and we lack complete levelogger data for the period before the April 2011 monitoring.

Following the April 2011 monitoring, life history patterns can be evaluated. As observed in total plants present, leaf length and number, quillwort plants tend to go dormant during the drier months of the July quarter (Figures 2.2-3 through 6). Contrary to what was reported elsewhere, quillwort plants will regrow following rain events. Although growth, in general, occurs more rapidly during the cooler wetter season, regrowth was observed following the July quarter. This suggests that regrowth is related to moisture rather than shorter day length and temperature. Although soil moisture measurements were not part of this study, inferences can be made with rainfall and stream temperature data (Figures 2.2-7 and 8). With the exception of sporelings in Davis Creek, there was an overall increase in average leaf length and number among adult and sporelings as observed between the July and October 2011 quarters (rainfall and temperature data is from July-September 2011). A similar pattern is observed between the July and October 2012 quarters. A slight increase in stream temperature was also observed between these two quarters in both 2011 and 2012 (Figure 2.2-8). Plants being measured within the Chaney Creek sample area were checked two weeks after Tropical Storm Isaac occurred. All plants known to be dormant during the July quarter had regrowth.

There are no sporeling plants within the Clear Creek sample area and the one sporeling observed within the Davis Creek sample area has not been visible since the January 2012 monitoring. Average growth among adult plants is similar to other sample areas. The pattern of average stream temperature among all sites is the same. Clear Creek has a tendency to receive more water during rain events than the other sites, while Davis Creek appears to receive the least amount of water (pattern may be similar to Chaney Creek). However, it should be noted that the pattern observed in Davis Creek may be similar to Joe's Creek (data are inconclusive due to levelogger malfunction).

Quadrats with adult and sporeling quillwort plants were added in October 2012 in an effort to increase the total plants measured so that better inferences can be made. The preliminary inference at this point is that perhaps there is too much stream flow energy within the Clear Creek sample area for sporelings to become established and that there is too little stream flow energy within the Davis Creek sample area for sporelings to develop (i.e. greater probability of leaf pack persistence). However, due to the lack of levelogger data for Joe's and Chaney Creeks, more data need to be collected in order to make better inferences.

Summary

This year, it appears as though the colony within Poplar Creek-Site 3 sample area is the best performing as compared to the other sample areas where there have been no disturbances such as line of sight pruning as part of range management or feral hog disturbances. As explained in the above section, the timing and frequency of feral hog disturbance plays a role in quillwort recovery. Since we cannot control when and where feral hogs are going to root, it is imperative that feral hog control efforts are implemented at Camp Shelby. As explained above, long term monitoring within colonies on Range 45 as well as within the control site 6 (tributary between Ranges 46 and 47) have become increasingly difficult to compare the effects of line of sight maintenance activities because of other disturbances influencing theses colonies (e.g. beaver activities, frequent feral hog disturbances). Since this monitoring methodology began last year, the goal is to be able to make better inferences regarding these management activities such that we can make comparisons with colony performance outside of Range 45. There will

be a future need to prune the canopy around quillwort colonies again as it appears this occurs every five years (first was in April 2003 and second was in August 2008).

Age Class Determinations

If a component of what is considered a viable population is determined by the abundance and distribution of different age classes, Louisiana quillwort within colonies, subpopulations and even populations must be categorized by age class. In the above sections, the terms "adult" and "sporeling" are used loosely to measure growth of existing and new plants which fall within these categories. A quillwort plant is considered a sporeling when there are 1-6 visible leaves that are 1-6 cm long, while adults have >9 leaves that are >10 cm long. There exists a gap between 7-8 leaves that are 7-9 cm long. A judgment call must be made based on the thickness of leaves and coloration. Sporelings tend to have thinner leaves that are lighter green as compared to adults. Further measurements over time may help us understand the life history of Louisiana quillwort as it relates to growth and longevity. In addition, we may find a need to place plants in a "juvenile" category, but further measurements over time are needed. This may help us understand when a sporeling becomes reproductively viable and the factors associated with longevity. A better understanding of what happens within localized areas can reveal information regarding habitat management at larger scales.

2.4 Colony determination using ArcGIS

We began updating census data within other streams where Louisiana quillwort is known to occur as some of these records are dated. In addition to updating census records, new GPS points are being recorded for each cluster of plants encountered along the stream and the total number of plants within these clusters are recorded for each point. Preliminary analyses using the Euclidean distance measurements within the proximity analysis feature in ArcGIS v10.0 are being evaluated to determine if this method can be used to define a colony, however, we have limited data at this time to be conclusive. We plan to continue this work in an effort to update GIS records while potentially determining a method to define colonies.

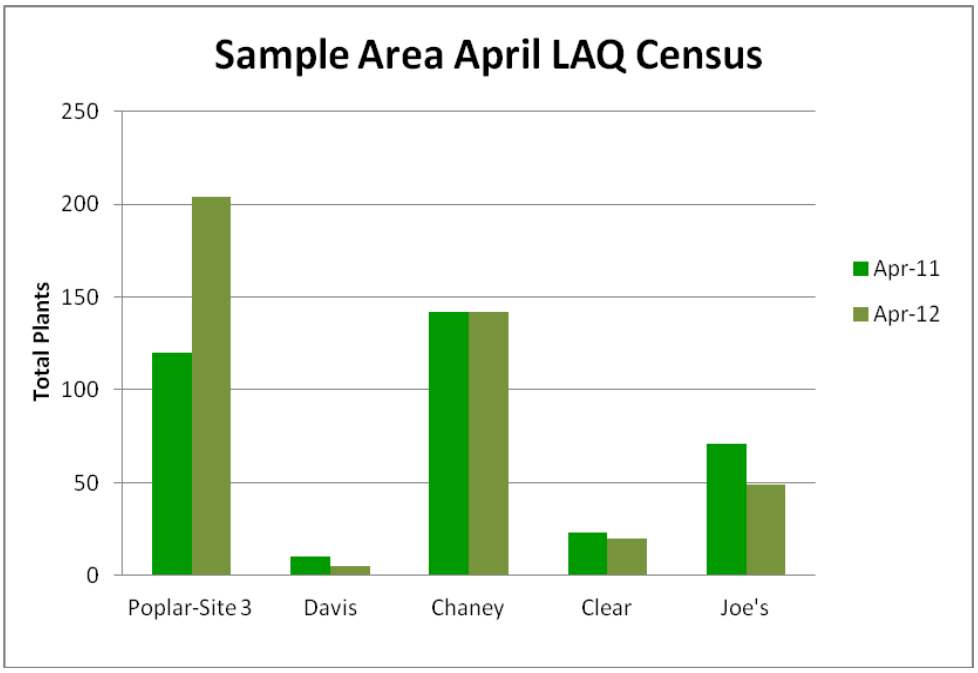


Figure 2.2-1. Total Louisiana quillwort counted with each sample area during the April 2011 and 2012 census.

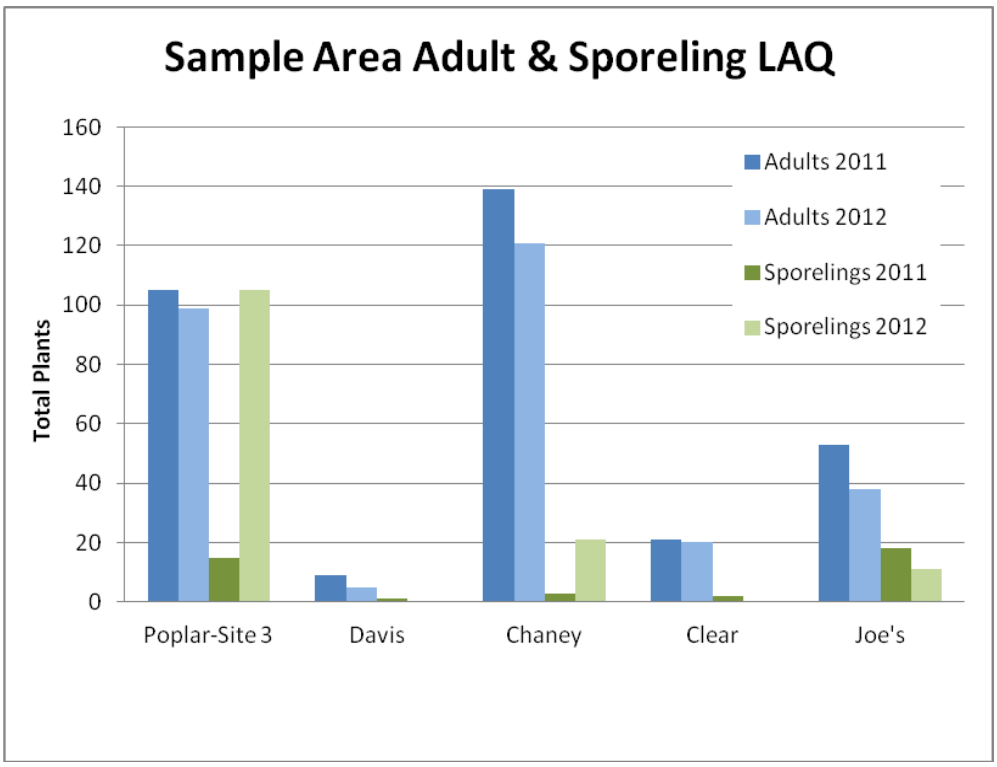


Figure 2.2-2. Total adult and sporeling Louisiana quillwort counted within each sample area during the April 2011 and 2012 census.

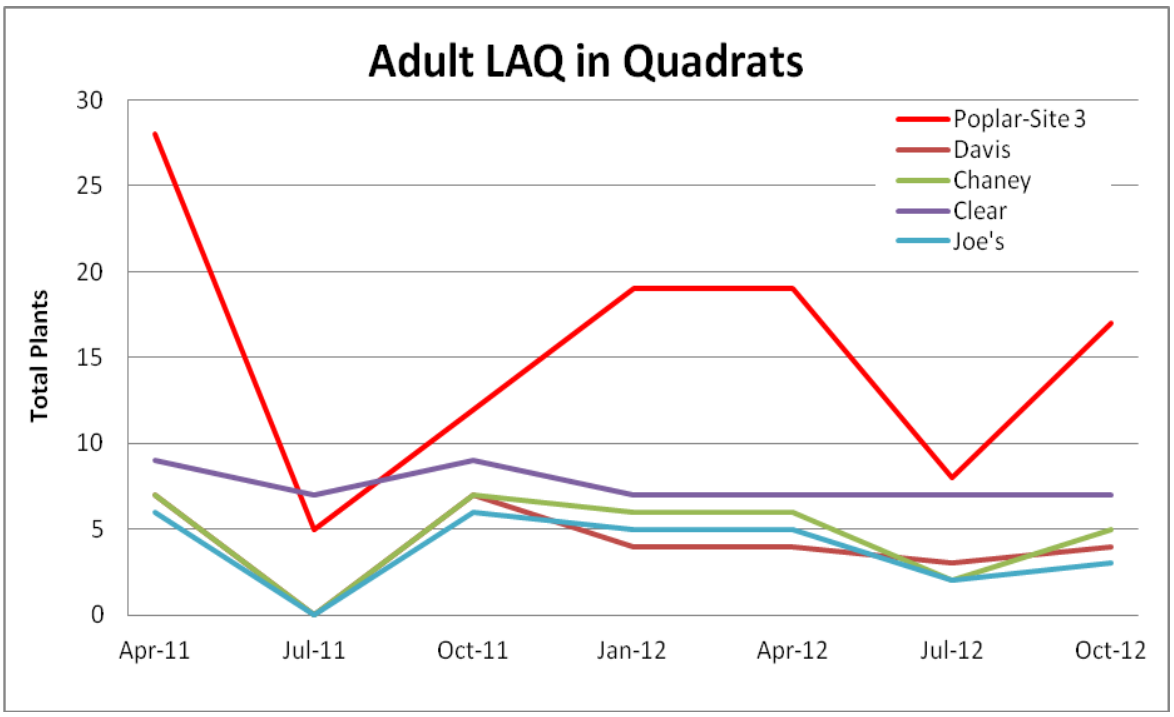


Figure 2.2-3. Total adult Louisiana quillwort plants counted quarterly within 1 m^2 quadrats.

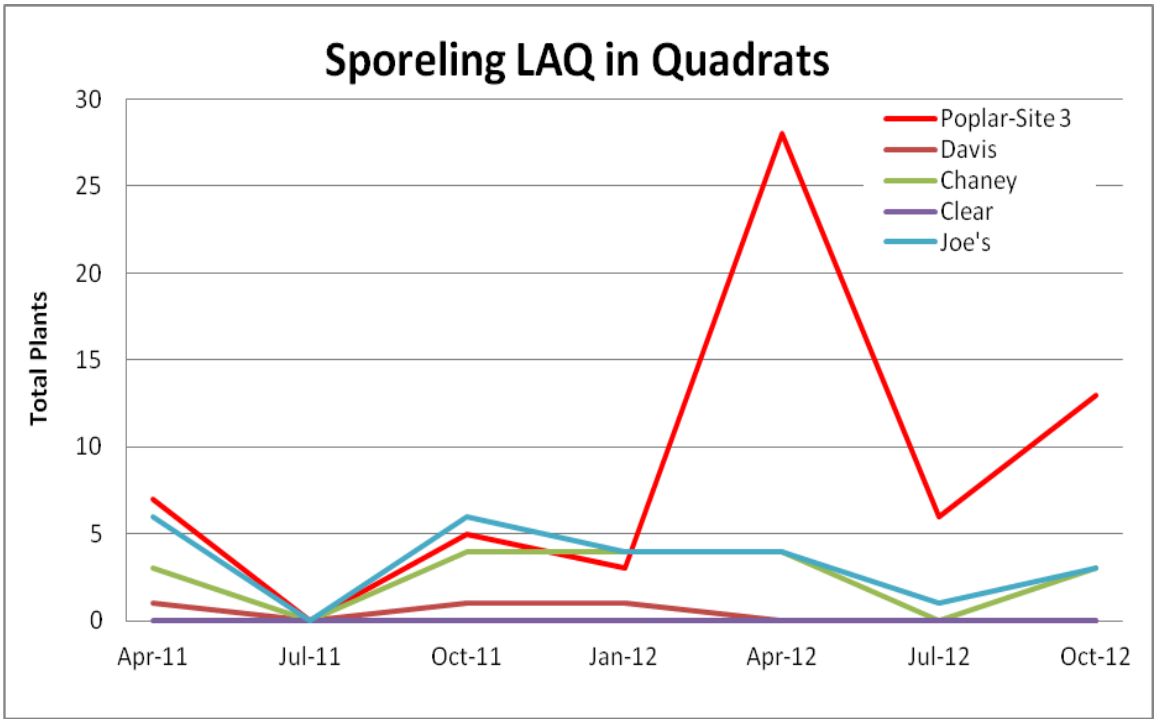
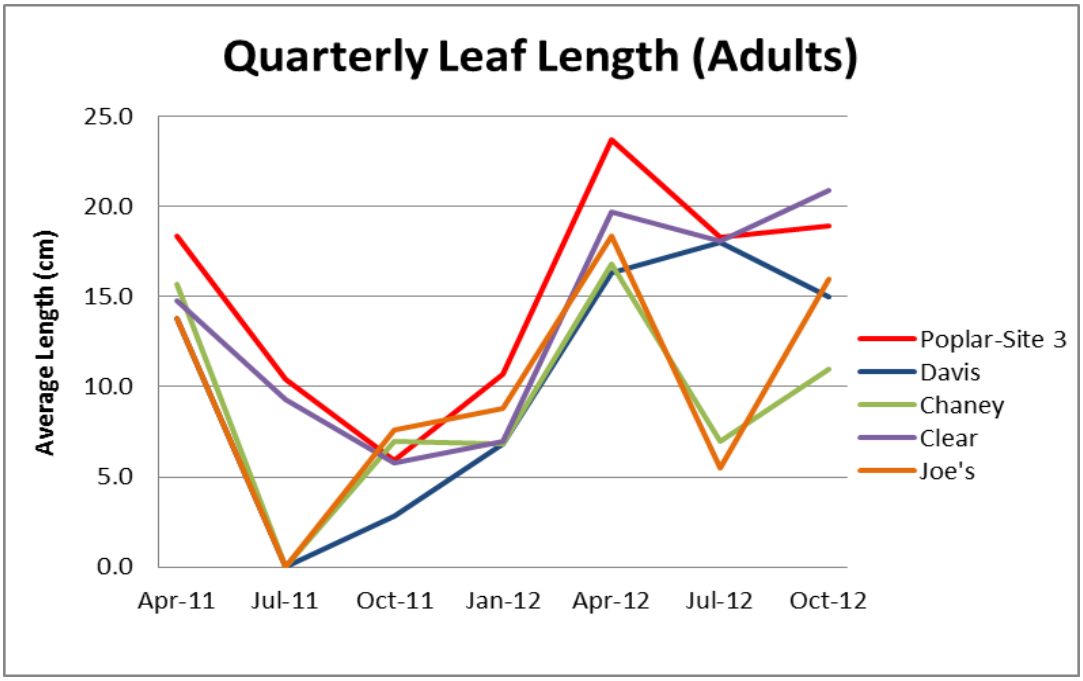


Figure 2.2-4. Total sporeling Louisiana quillwort plants counted quarterly within 1 m^2 quadrats.



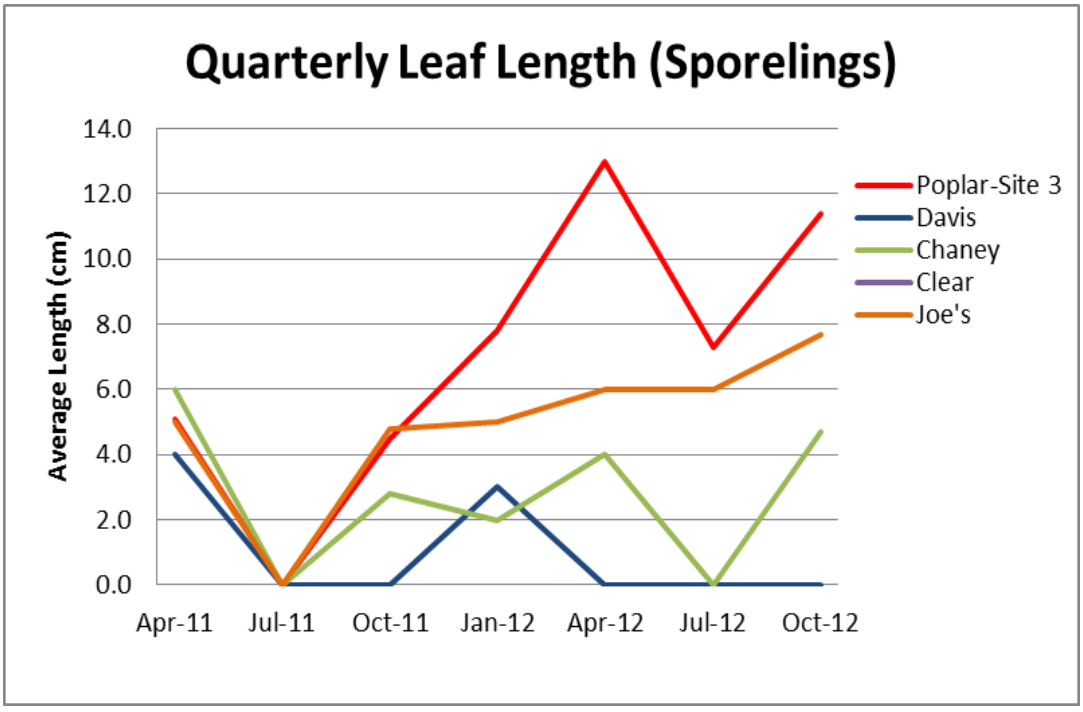


Figure 2.2-5. Average leaf length of adult and sporeling quillwort plants measured quarterly within $1m^2$ quadrats within each sample area.

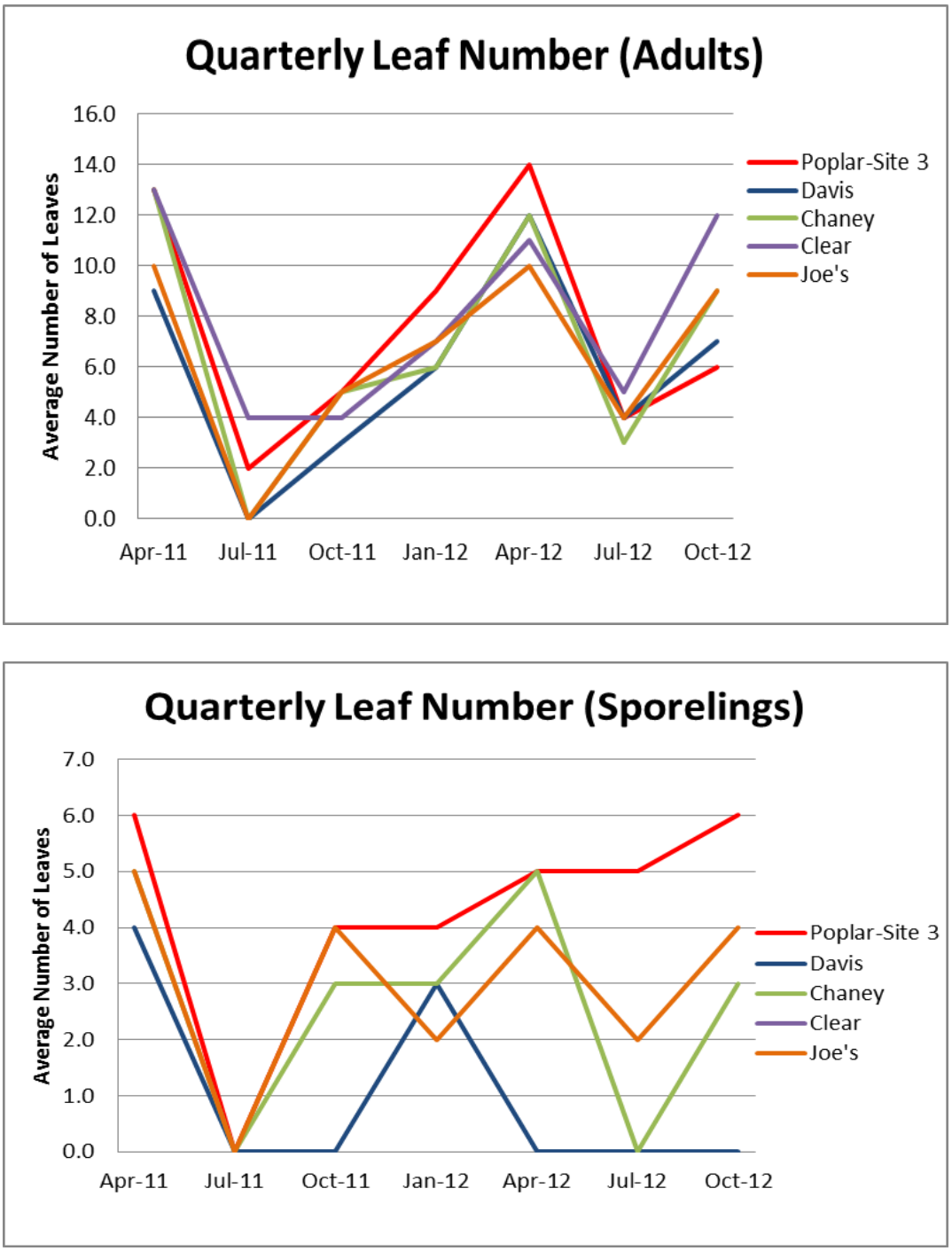


Figure 2.2-6. Average leaf number of adult and sporeling quillwort plants measured quarterly within 1 m^2 quadrats within each sample area.

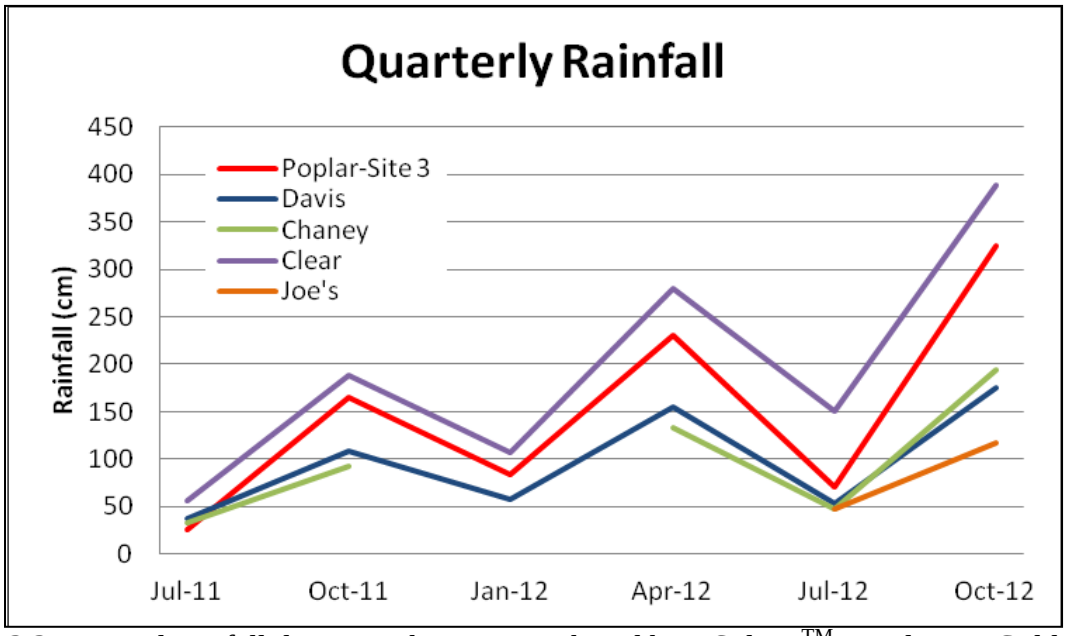


Figure 2.2-7. Total rainfall during each quarter gathered by a Solnist™ Levelogger Gold deployed 1m north of each sample area (Jan-April 2012 data are missing for Chaney Creek and October-April data are missing for Joe's Creek due to levelogger malfunction). (April=January-March, July=April-June, October=July-September, January=October-December of previous year).

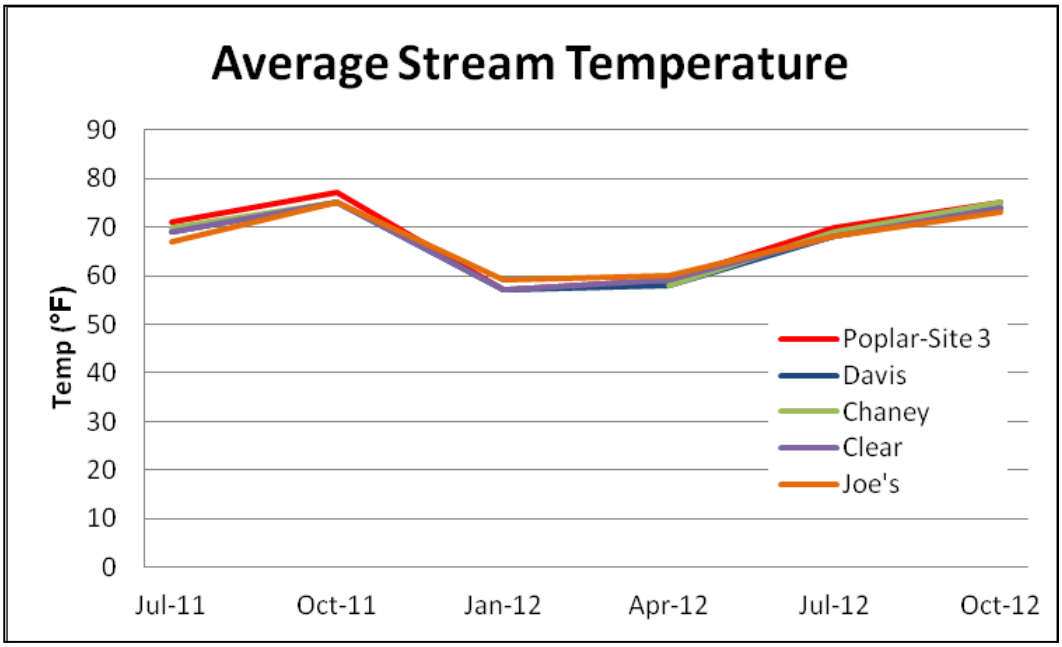


Figure 2.2-8. Average stream temperature gathered by a Solnist™ Levelogger Gold deployed 1m north of each sample area during each quarter (April=January-March, July=April-June, October=July-September, January=October-December of previous year).

3.0 CAMP SHELBY BURROWING CRAYFISH

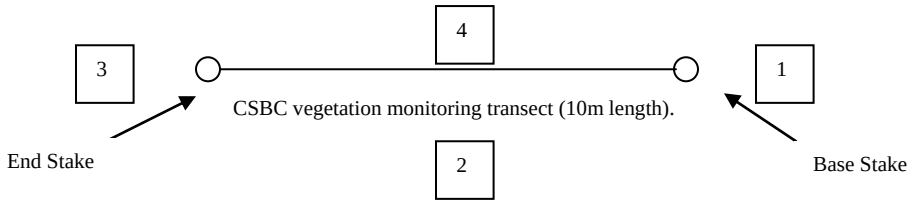
Based upon the Camp Shelby Burrowing Crayfish (CSBC), *Fallicambarus gordoni*, Candidate Conservation Agreement (CCA), the USFWS has removed CSBC from the federal list of candidates for listing as threatened or endangered. Under terms of this agreement, the MSARNG and USFS have agreed to monitor populations and manage habitat for CSBC. CSFO has assisted the MSARNG with this process by monitoring CSBC habitat and populations. CSBC are generally associated with current or historical pitcher plant wetlands. Therefore, decreases in herbaceous abundance and increases in woody abundance are indicators that habitat quality is declining. Abundance and condition of pitcher plants are also indicators of habitat quality. To determine effects of habitat change and management on CSBC, it is important to monitor the species itself. Therefore, in order to evaluate habitat conditions at known locations of CSBC and determine trends in CSBC populations in association with habitat change, we continued to collect habitat and burrow density data at 30 plots established in August 2004 or February 2005. In 2007, 1 plot (#43) was removed from the sampling due to dangers caused by post Katrina effects (i.e. large rotting trees to climb through) in navigating to the plot. A new plot (#111) was established to replace the lost plot. Sampling protocols are described below. Because directly sampling CSBC would likely be destructive to individuals and their habitat, changes in burrow densities are used as an index of changes in populations. Burrow densities were sampled in March 2012. Habitat data were collected in August 2012. Data are attached in an excel spreadsheet (Appendix 2a.): 2012 CSBC Habitat Monitoring & Restoration.

Habitat Monitoring Protocol

A 10m transect was oriented to cross wetland habitat at each location and ends are permanently marked with rebar. To estimate percent cover of groundcover, we record the presence of bare ground, litter, and vegetation functional groups every 0.5m along the transect. Vegetation functional group variables are: forbs, graminoids (grasses and grasslikes), vines, shrubs, and pitcher plants. Presence of pitcher plants in the area, regardless of whether or not they are encountered along the transect, are noted; and abundance and condition (evidence of shade effects such as compressed tubes, poorly developed hoods, light green color with no red streaks, etc.) are described. Midstory cover is estimated by recording length of intersection of shrubs/trees between 1 and 3.5m in height with transect. At the transect midpoint, basal area is estimated using a wedge prism (basal area factor 10) and canopy cover is estimated using a densiometer. Evidence of soil disturbance (ATV use, etc), sedimentation, fire, and water status of area is documented. Finally, the sample location at the plot is photographed.

Burrow Monitoring Protocol

Camp Shelby Burrowing Crayfish monitoring quadrats ($1m^2$) are located 2m from the CSBC vegetation monitoring transect base stake, end stake and either side of the transect midline (i.e. 5m). See diagram below. Quadrat corners are marked with pin flags. The number of chimneys and burrows are counted within each quadrat. A CSBC chimney is a mound, whereas a burrow is a mere hole (or what is observed when a chimney is removed). Because quantifying the number of mounds and burrows within the quadrats may be biased by the observer's interpretation, two people perform a count for each quadrat and the average is taken.



Burrow Densities & Habitat Condition

There was no evidence of sedimentation or soil disturbance from human activities in any of the plots. Three plots were burned this year (2 were dormant season and the other was the result of a wildfire during the growing season). In 2011, we placed plots into one of four general habitat categories: 1. Open condition plots (48, 60, 61 and 111) are considered the most favorable for the CSBC, 2. Moderate condition plots (32, 35, 63, 64, 101, 102, 103, 106, 108, and 110) are those that are similar to the most favorable conditions, but may have a denser stand of trees, 3. Shrub dominated plots (1, 13, 34, 40, 41, 42, 47, 68, 104, 105 and 109) are those dominated by shrubs such as Inkberry (*Ilex coriacea*), Buckwheat (*Cliftonia monophylla*) or a combination of both and are less favorable for CSBC populations, and 4. Bottomland hardwood condition plots (39, 44, 45, 46 and 107) are those with closed canopies dominated by hardwoods and are least favorable for CSBC populations. By categorizing plots based upon similarities in habitat condition, we hope to gain a better understanding of the relationship between habitat types and burrow densities. Considering the majority of plots are within either shrub dominated (37%) or moderate condition (33%) categories, management should be prioritized within these areas. Data are summarized by habitat condition below.

1. *Open Condition Plots*

On average, these plots have the highest burrow numbers as compared to the other habitat condition plots. Average burrow numbers this year increased and are the same as those observed in 2006 (Table 1). Herbaceous cover remains close to 100% and the shrub layer is consistently less than 30%. Percent canopy is also lower than those of other habitat conditions. The average pine SBA/acre among these plots is 14 and 3 for hardwoods. Pitcher plants in these plots are abundant and healthy.

Table 1. *Fallicambarus gordoni* burrow densities and habitat variables recorded within Open Condition plots on the CSJFTC. 2005-2012.

Averages	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
% Herbaceous	100	100	100	95	100	99	98	98
% Shrub	14	19	21	20	14	20	25	19
% Midstory	1	2	1	1	3	5	10	5
% Canopy	34	34	14	35	24	31	34	33
Burrows	20	26	16	21	36	27	20	26
% Plots Burned	0	0	100	25	0	0	0	0

Fire moved through plots 60 in 2007 and 2008 and 61 in 2008. None of the open condition plots have been burned for the past four years. Although there hasn't been a significant change in shrub and midstory cover, these plots should be burned to prevent them from exhibiting conditions like the shrub dominated or bottomland hardwood plots.

2. *Moderate Condition Plots*

These plots have burrow numbers that are slightly lower than the Open condition plots, but significantly higher than the Shrub dominated and Bottomland hardwood plots. Average burrow numbers this year did not significantly decrease as compared to the last two years, but are still in range of what was observed in 2007-2008 (Table 2). Herbaceous and shrub cover is similar to that of the Open condition plots, but the midstory layer, overall % canopy and average pine stand basal area (28/acre) is higher. Pitcher plants in these plots are sparse to abundant, but healthy.

Table 2. *Fallicambarus gordoni* burrow densities and habitat variables recorded within Moderate Condition plots on the CSJFTC. 2005-2012.

Averages	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
% Herbaceous	97	99	97	98	100	98	98	91
% Shrub	15	24	15	18	20	21	19	14
% Midstory	4	6	18	8	11	11	15	16
% Canopy	46	52	36	52	46	55	62	58
Burrows	18	22	14	16	20	20	15	14
% Plots Burned	0	0	0	0	20	10	0	20

Moderate thinning of pines in these plots such that the stand basal areas are similar to that of the Open condition plots would be beneficial. Two of the ten plots in this condition category were burned this year. One was a dormant season burn (Plot 35) and the other was an unintentional growing season burn caused by a wildfire (Plot 103). Based on pine stand basal area, we recommend pine thinning in the following order (Plots 103, and 110-Compartment 54; Plot 35-Compartment 81; Plots 63, 106-Compartment 56; Plot 101-Compartment 57). Regular prescribed fire intervals should follow to keep the shrub layer down.

3. *Shrub Dominated Plots*

Burrow numbers among these plots are significantly lower than those of the Open and Moderate condition plots, but slightly higher than the bottomland hardwood condition plots. Average burrow numbers did not significantly decrease this year and are the same as observed in 2007 (Table 3). Herbaceous cover is much lower while shrub and midstory cover is much higher as compared to the other above mentioned habitat conditions. The midstory is dominated by tall shrubs such as Inkberry (*Ilex coriacea*), Buckwheat (*Cliftonia monophylla*). The shift in shrub and midstory cover this year is likely due to shrub layer growth beyond 1m tall. Pine stand basal area (43/acre) and percent canopy are also higher among these plots. Pitcher plants in these plots are either not present or sparse. Sparse colonies have thin, elongated and often curled tubes in response to shade effects.

Table 3. *Fallicambarus gordoni* burrow densities and habitat variables recorded within Shrub Dominated plots on the CSJFTC. 2005-2012.								
Averages	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
% Herbaceous	63	69	71	71	68	65	62	53
% Shrub	54	60	49	55	59	58	67	56
% Midstory	21	21	21	14	25	34	45	57
% Canopy	62	61	46	68	50	60	68	67
Burrows	7	8	5	6	9	3	6	5
% Plots Burned	0	0	45	9	18	18	0	9

Although these plots are dominated by shrubs, they could also benefit from pine thinning. Only one of the eleven plots in this condition category was burned this year. Plot 40 received a growing season burn and Plot 109 was almost burned, but the fire did not reach the wetland in which this plot is located. Both plots are in the same compartment (Compartment 71). Water status in both plots was moist during the time of monitoring, but this was likely attributed to recent rains. It may be that plot 40 was drier than plot 109 during the time fire was introduced. Furthermore, plot 109 is closer to the main channel of Cypress Creek than plot 40. Soils would be expected to be consistently moister than those further away from the channel. In order to reduce the shrub layer, prescribed fire needs to be implemented during the growing season when shrub moisture content is lowest (April-June). Many of these plots have received periodic fires on the 2-3 year cycle, but these fires are only temporarily reducing the above ground biomass only to return to their previous states (and often more dense) within 2-3 years. If fire is absent at these sites, the shrub layer will continue to grow to midstory height and continue to limit the amount of light reaching the ground. In order to restore these sites to favorable conditions, prescribed fire is needed to reduce the fuel load followed by growing season maintenance burns to keep the shrub layer suppressed. Growing season maintenance burns under drier conditions would weaken the underground biomass and thereby further suppress the shrub layer. Suppression of the shrub layer at these plots could also be accomplished using a wetland friendly herbicide; however the effects of the herbicide upon CSBC populations are currently unknown, but may warrant further investigation.

Since pines are known to absorb soil moisture, increased fire return to these sites followed by pine thinning may be a more favorable management approach. We recommend thinning and burning these sites in the following order (Plots 34, 42, 104 and 105-Compartment 54; Plot41-Compartment 74; Plot 1 -Compartment 70; Plot 13-Compartment 61; Plot 62-Compartment 68). Plot 109 in Compartment 71 would benefit most from prescribed fire as pine density is lower as compared to the other plots.

4. *Bottomland Hardwood Conditions*

Burrow numbers among these plots are the lowest. Average burrow densities are similar to those of previous years (Table 4). Percent canopy, average hardwood stand basal area (58/acre) and Midstory (>1-3.5 m tall) area are highest in these plots which accounts for the low shrub and herbaceous cover. Average pine stand basal area (25/acre) is similar to that of Moderate and Shrub condition plots. Pitcher plants in these plots are either not present or sparse. Sparse pitcher plant colonies have thin, elongated and curled tubes in response to shade effects.

Table 4. *Fallicambarus gordoni* burrow densities and habitat variables recorded within Bottomland Hardwood plots on the CSJFTC. 2005-2012.								
Averages	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
% Herbaceous	38	38	40	45	49	33	30	25
% Shrub	27	37	31	33	37	35	29	24
% Midstory	49	49	85	76	76	66	58	80
% Canopy	95	94	93	98	89	94	93	96
Burrows	2	3	2	2	3	4	3	3
% Plots Burned	0	0	40	20	20	20	0	0

At this point in time, restoration activities needed to restore these sites to favorable conditions for CSBC would be very intense and cause a large amount of soil disturbance which could negatively impact current hydrological conditions. Therefore, these sites are considered historic sites for the CSBC and data are used for comparative purposes.

Habitat Restoration (Pine Thinning) Outreach Project

In June 2007, six plots were established in the same wetland area as Plot 110 (Moderate Condition Plot). Like all other plots, these plots consisted of quads to measure burrow density along with transects to measure/monitor habitat conditions. Baseline data were collected before restoration work began (June 2007) and plots were monitored thereafter. Data are summarized in Table 5 below. Average burrow numbers this year are slightly lower than those counted during pre-thinning conditions. The average % herbaceous layer increased after thinning as did the % shrub cover after thinning. There were no significant changes shrub and midstory percent canopy this year. However, the herbaceous layer has decreased this year. Average pine stand basal area (46/acre) is still slightly lower than pre-thinning conditions (52/acre).

Table 5. *Fallicambarus gordoni* burrow densities and habitat variables recorded within Habitat Restoration plots on the CSJFTC. 2007-2012.						
Averages	**Jun-07 (Pre-Thinning)**	**Aug-08**	**Aug-09**	**Aug-10**	**Aug-11**	**Aug-12**
% Herbaceous	83	97	94	92	90	86
% Shrubs	26	38	33	31	29	29
% Midstory	26	3	9	15	16	19
% Canopy	83	41	39	50	57	43
Burrows	14	16	18	14	15	13

This wetland was last burned in 2007. In order to keep the midstory and shrub layer down and allow the herbaceous layer to increase, this plot should be burned regularly. Pine thinning should also continue such that the canopy is opened in areas outside of the plot.

4.0 COGON GRASS MANAGEMENT

Accidentally and intentionally introduced into the United States in the early 1900's, Cogon grass, *Imperata cylindrica*, has since invaded natural ecosystems such as sand hills, flatwoods, and hammock edges and has become a serious weed problem in pastures, plantations, mine sites, and roadsides throughout the southeastern United States (Shilling et al., 1997). Cogon grass occurs on Camp Shelby Joint Forces Training Center and Desoto National Forest in Mississippi in a wide variety of habitats (e.g. roadsides, training sites, pine forests, and wetlands) and is widespread throughout the local area along roadsides and in pastures and pine plantations. Its continued spread threatens military training operations, gopher tortoise habitat and other biologically significant areas.

In 2012, CSFO continued efforts to assist with controlling this invasive species. We added to the Cogon grass GIS database by mapping newly-found Cogon grass patches as they were encountered. We treated 94.47 acres of Cogon grass with herbicide this year.

Herbicide Treatment Methods and Application Rates

For areas treated by TNC staff, herbicide brands and concentrations were the same as reported in last year's annual report. All herbicides were applied using either a hand sprayer attached to a backpack mounted tank or a boom sprayer attached to an ATV. In an effort to treat more cogon grass, we modified our strategy this year by mapping patches in our priority treatment areas in the Spring (adding a 2 m buffer around each patch to account for growth between spring mapping and treatment while including the usual spray buffer to account for underground rhizomes where tillers are not present) and using contract labor to treat the mapped cogongrass patches. New or missed patches encountered were mapped and treated during the herbicide treatment season. Contractors used the same concentration of herbicide (0.5% imazapyr and 2% glyphosate for upland patches and 2% glyphosate for wetland patches) as used by TNC staff. Patches were either hand sprayed or treated with a boom sprayer attached to an UTV.

During the 2012 spray season, 1,282 Cogon grass patches covering 94.47 acres were treated (Table 4.0-1.; Figure 4.0-1). Application rates for this spray season were 0.27 lbs imazapyr/acre and 2.58 lbs glyphosate/acre for TNC applications and 0.65 lbs imazapyr/acre and 5.51lbs glyphosate/acre for contractor applications. Herbicide efficacy will be evaluated in the coming spring.

4.1 Ground Cover Species Composition Assessment

Species composition assessments are performed to determine natural restoration patterns of previously treated Cogon grass patches. The methodology for these assessments is summarized in previous annual reports. This year, we observed four patches that appeared naturally restored. Visual natural restoration is when the original herbicide treatment boundary is no longer discernible and the plant community within the treatment area resembles that of the area outside the patch. To determine if the data captured matched or was similar to what was visually observed, data were categorized and compared by: 1) Visually restored patches 2) Not visually restored with no Cogon grass regrowth and 3) Not visually restored with Cogon grass regrowth. Data were evaluated by the most frequent species with cover greater than 50% for both patches and quadrats (Tables 4.0-2 and 4.0-3).

Quadrats within 10 meters of Treatment boundary

Since the area in which these assessments occur is within TA-44 (Gopher Tortoise Refuge), it is not surprising that the Bluestems (*Andropogon/Schizachyrium* spp.) are the most frequent ground cover with the highest percentage of cover. Blackberry (*Rubus* sp.) is also one of the most frequent ground cover species with cover at 62.5% around patches not visually restored (both with and without Cogon grass in the treatment patches this year). Blackberry among quadrats around the visually restored patches was 37.5% and 62.5% in previous years, but fell below 100% frequency. Average richness over the past four years was lowest (39) in quadrats around visually restored patches and highest (58) around not visually restored patches without Cogon grass regrowth. Average richness was 45 around not visibly restored patches with Cogon grass regrowth.

1) Visually Restored Patches

Four of the fifteen patches appeared visually restored this year. The average number of treatments among these patches was 4 times since 2004 and the average number of years where Cogon grass regrowth was not observed was 3 years. No Cogon grass regrowth was observed in any of these patches this year.

Three species had cover greater than 50%, with the Bluestems being the most frequent. Juniper leaf (*Polypremum procumbens*) was the second most frequent species and Pineland silk grass (*Pityopsis aspera*) was the third. Richness in these patches has decreased from 109 species (2008) to 63 species this year. Cogon grass (*Imperata cylindrica*) cover was 2.5% for 3 years (2008-2010). Although the average number of years where Cogon grass regrowth was not observed among these patches was 3 years, there has been no actual regrowth among these patches for the past two years. One patch had regrowth in 2009 and 2010, but did not occur in the same patch.

2) Not Visually Restored with no Cogon grass Regrowth

Seven of the fifteen patches were not visually restored and had no Cogon grass regrowth this year. The average number of treatments among these patches was 3 times since 2004 and the average number of years where there was no Cogon grass regrowth observed was 2 years.

Seven species had cover greater than 50% with Blackberry, Anise-scented goldenrod (*Solidago odora*) and Pineland silk grass being the most frequent this year. Richness has decreased from 134 species (2008) to 92 species this year. Cogongrass cover was 97.5% in 2008 and decreased to 2.5% in 2011.

3) Not Visually Restored with Cogon grass Regrowth

Four of the fifteen patches were not visually restored and all of them had Cogon grass regrowth this year (Table 4.0-2). The average number of treatments among these patches was 2 times and the average number of years where Cogon grass regrowth was not observed was 1 year.

Four species had cover greater than 50% and all of them were the most frequent among all species observed. Richness decreased from 120 species (2008) to 70 species this year. Cogon grass cover was 97.5% in 2008 and was reduced to 15% in 2011 and increased to 85% this year.

Discussion

At the beginning of monitoring in 2008, Cogon grass cover was lowest and less frequent among the visibly restored patches as compared to the patches not visibly restored this year (both with and without Cogon grass regrowth). Therefore, the retreatment area was smaller and thereby allowed other plant species to establish. Plant species richness was lower outside of the treated areas than within the treatment areas. This is expected since treated patches are dominated by pioneer species that thrive in disturbed areas and are expected to decrease over time as species which occupy more stable areas become established. Although richness remains higher within treatment areas than around them, there has been an overall decrease over time. Richness was lowest among visually restored patches; however, richness was similar to patches that were not visually restored with Cogon grass regrowth this year. The higher number of plant species (richness) in the patches not visibly restored with no Cogon grass regrowth this year is likely attributed to the number of patches within this category.

In terms of cover and frequency, the Bluestems are the highest within quadrats around all treated Cogon grass patches. Therefore, one would expect the treated area to be the same or similar. Bluestem cover was the same among visually restored and not visually restored without Cogon grass regrowth as in the quadrats surrounding these patches and slightly lower in not visibly restored patches with Cogon grass regrowth. The difference was that Blackberry cover and frequency was higher in patches not visually restored without Cogon grass regrowth. Juniper leaf and the Panic grasses were higher in cover and frequency in patches not visibly restored with Cogon grass regrowth.

Juniper leaf and Blackberry are early invaders of disturbed areas while the dominant Bluestems (*Andropogon virginicus* and *Schizachyrium scoparium*) occupy less frequently disturbed sites (by comparison). The large cover and frequency of Blackberry around the treated patches could be attributed to disturbances caused by a combination of felled trees and salvage work that occurred after Hurricane Katrina coupled with the management history of the site. Bluestems are known to increase in abundance after fire and herbicide treatments (Miller, 2005). Therefore, it appears as though these species can be used as indicators of progression towards natural restoration in this particular site. We will continue to evaluate these patches to determine whether or not the same patterns emerge among all (or most) of the patches.

Management Considerations

Cogon grass management requires monitoring after herbicide treatment as, depending on the age of the patch, retreatment will likely be required to eradicate it from the site. Cogon grass regrowth often occurs within 1-3 years after treatment and can vary in size and distribution within the treatment area. If regrowth is not observed within the treatment area for three consecutive years after herbicide treatment, the patch may be considered eradicated, however, it is important to periodically monitor the area for new patch development; especially if there are other patches nearby that are being treated, but may be responding differently due to age or herbicide (e.g. nearby wetland treated patches).

Since not all land managers have the resources to monitor treated patches for species composition, cover and frequency, visual assessments may be performed based on the surrounding plant community structure as it relates to overall habitat management goals and presence/absence of Cogon grass. As in the case of the Gopher Tortoise Refuge (TA-44) where the area is being managed for Longleaf pine communities, visual assessments can be made by cover (using the Daubenmire Cover Scale) and frequency of pioneer plant species (“early

invaders") such as Juniper leaf and Blackberry versus those that occupy less disturbed areas such as the Bluestems. Post treatment monitoring of Cogon grass patches is an integral component of management. The use of indicator species can be incorporated with monitoring through visual assessments where natural restoration is part of the management goals.

Table 4.0-1. 2012 Cogon grass treatments on CSJFTC. Patches were treated with a 2% Glyphosate and 0.5% Imazapyr solution (upland patches) or a 2% Glyphosate solution (wetland patches).

Month	Treatment Area	Total Patches	Acres
March	Cantonment (Tactical Driver Course construction)	31	1.04
September	OP 6	11	1.44
	OP 13	6	0.28
	OP 14	8	0.51
	Range 18	59	3.63
	Range 19	6	0.47
	Range 41	108	6.28
	Range 42	10	2.08
	Range 43	14	3.6
	Range 45	145	20.88
	Range 46/47	36	2.41
	T44 and T43	69	3.12
	FP 90/119	41	1.87
	Cantonment Area	252	10.58
	State lands	42	8.36
	DoD 7	10	0.39
	DoD 10	27	2.95
	DoD 35	56	3.98
	EAG	73	12.94
	East Gate Road	12	0.51
	FS Road. 369E1 (From Grapevine to FS Rd. 369E)	4	0.32
	Rifle Range Rd, (SUP boundary to Grapevine Rd.)	7	0.06
	Grapevine Rd.	132	2.07
	South Tank Trail	100	0.99
October	Lake Janney dam reconstruction	1	0.24
	DoD 18	17	2.24
	DoD 11	3	0.24
	Cantonment Area	1	0.06
November	State lands	1	0.93
Total		**1282**	**94.47**

Table 4.0-2. Comparison of ground cover species composition, frequency and cover (Daubenmire midpoints) data among 15 treated Cogon grass patches evaluated since 2008. Data included are species with 100% frequency and cover greater than 50% during the 2012 evaluation period (with the exception of Cogon grass).

2012 Visibly Restored Patches

	2012		2011		2010		2009		2008	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Andropogon/Schizachyrium (Bluestems)	97.5	100	97.5	100	97.5	100	97.5	100	62.5	100
Polypremum procumbens (Juniper leaf)	62.5	75	2.5	50	2.5	50	15.0	75	15.0	75
Pityopsis aspera (Pineland silk grass)	62.5	50	15.0	75	0.0	0	0.0	0	2.5	50
Imperata cylindrica (Cogon grass)	0.0	0	0.0	0	2.5	25	2.5	25	2.5	50

2012 Not Visibly Restored Patches (without Cogon grass regrowth)

	2012		2011		2010		2009		2008	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Rubus sp. (Blackberry)	97.5	100	97.5	86	97.5	100	97.5	100	97.5	100
Andropogon/Schizachyrium (Bluestems)	97.5	86	97.5	100	97.5	86	97.5	86	97.5	100
Polypremum procumbens (Juniper leaf)	97.5	86	15.0	71	0.0	0	2.5	14	15.0	86
Pinus palustris (Longleaf pine-grass stage)	97.5	57	97.5	100	97.5	100	62.5	57	15.0	86
Solidago odora (Anise-scented goldenrod)	62.5	100	37.5	100	15.0	100	15.0	100	15.0	86
Pityopsis aspera (Pineland silk grass)	62.5	100	15.0	86	0.0	0	0.0	0	15.0	43
Panicum spp. (Panic grasses)	62.5	57	85.0	86	97.5	100	62.5	43	2.5	14
Imperata cylindrica (Cogon grass)	0.0	0	2.5	29	2.5	14	15.0	57	97.5	71

2012 Not Visibly Restored Patches (with Cogon grass regrowth)

	2012		2011		2010		2009		2008	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Polypremum procumbens (Juniper leaf)	97.5	100	15.0	50	15.0	25	15.0	50	2.5	25
Panicum spp. (Panic grasses)	97.5	100	85.0	100	37.5	100	62.5	50	0.0	0
Andropogon/Schizachyrium (Bluestems)	85.0	100	97.5	100	62.5	100	0.0	0	37.5	100
Rubus sp. (Blackberry)	62.5	100	97.5	100	0.0	0	97.5	100	85.0	100
Imperata cylindrica (Cogon grass)	85.0	100	15.0	75	15.0	75	62.5	25	97.5	75

Table 4.0-3. Comparison of species composition, frequency and cover data among quadrats within 10 meters of the treatment boundary of the 15 treated Cogon grass patches evaluated since 2008. Data included are species with 100% frequency and cover greater than 50% during the 2012 evaluation period.

2012 Visibly Restored Patches								
	2012		**2011**		**2010**		**2009**	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Andropogon/Schizachyrium (Bluestems)	97.5	100	97.5	100	97.5	100	97.5	100
2012 Not Visibly Restored Patches (without Cogon grass regrowth)								
	2012		**2011**		**2010**		**2009**	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Andropogon/Schizachyrium (Bluestems)	97.5	100	97.5	100	97.5	100	97.5	100
Rubus sp. (Blackberry)	62.5	100	15.0	100	100.0	100	100.0	100
2012 Not Visibly Restored Patches (with Cogon grass regrowth)								
	2012		**2011**		**2010**		**2009**	
Scientific name (Vernacular name)	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**	**% Cover**	**% Frequency**
Andropogon/Schizachyrium (Bluestems)	97.5	100	97.5	100	97.5	75	97.5	100
Rubus sp. (Blackberry)	62.5	100	97.5	75	97.5	100	97.5	100

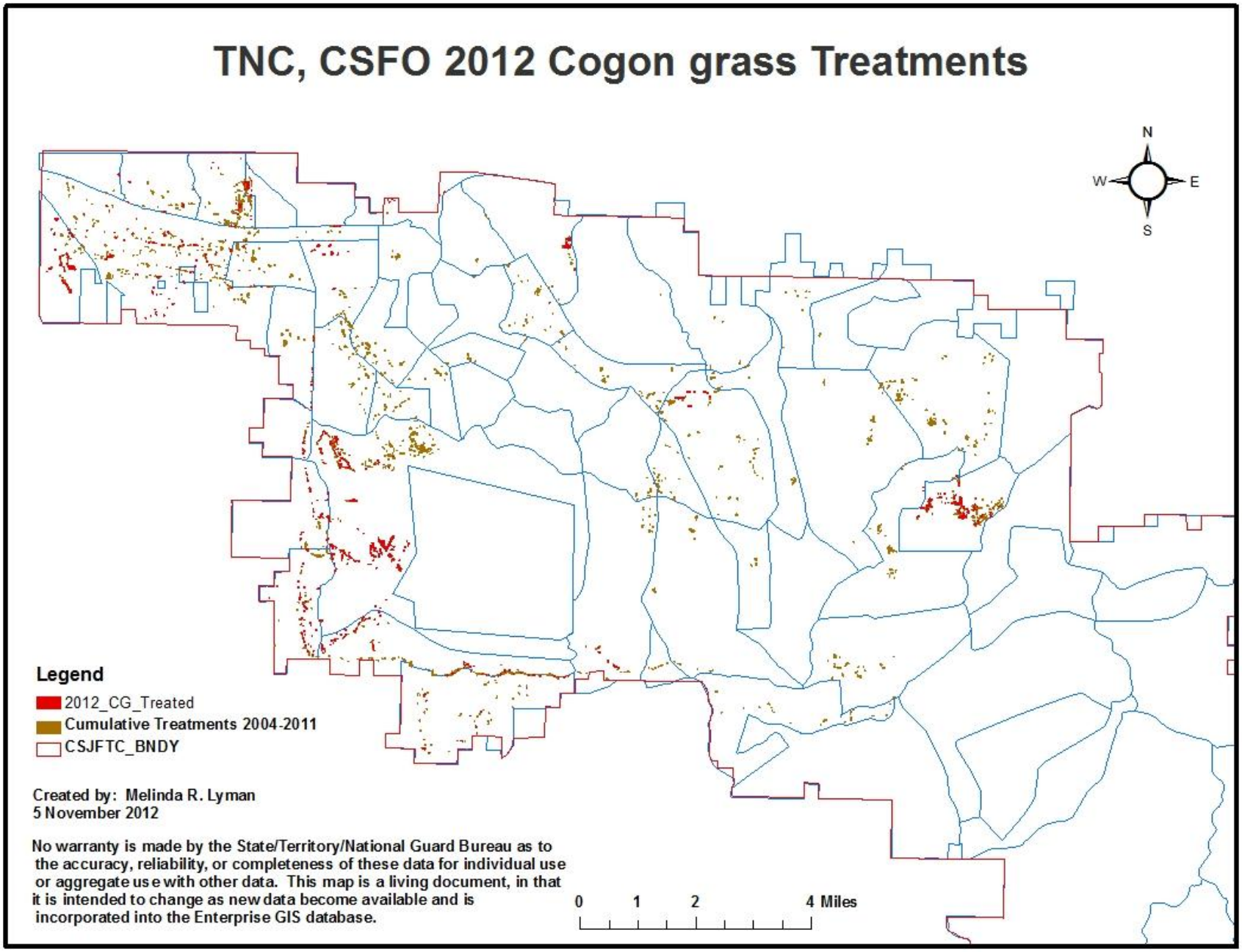


Figure 4.0-1. Location of Cogon grass infestations treated on CSJFTC during the 2012 spray season.

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5.0 BLACK PINESNAKE

In 2004, an investigation into the life history and ecology of the Black Pinesnake (*Pituophis melanoleucus lodingi*) was initiated on the Camp Shelby Joint Forces Training Center (CSJFTC), and this project has continued through 2012. A description of the project's scope, general *P. m. lodingi* background information, and the pre-existing state of knowledge pertaining to the Black Pinesnake for a variety of topic areas has been reported elsewhere (Yager *et al.* 2005). General *P. m. lodingi* capture information for the 2012 season (10 December 2011 to 1 December 2012) is summarized below.

5.1 General Captures

In 2012, a total of 10 (8M: 2F) new *P. m. lodingi* were captured on the CSJFTC (Table 5.1-1). Additionally, one snake was recaptured from a previous trapping season (i.e. 2010). Traps (See Lee 2009, for trap design) accounted for the majority (70%) of the captures this year (Table 5.1-1). Trapping efforts took place at the following locations during the years specified: 2004-2006: T-44 (east, middle, and west roads), and Paret Tower shelter wood area (S. side of Paret Tower at intersection with HWY 29); 2007- May 2008: DoD blocks 10, 25, 37, 41, 42, 43; August 2009-2011: Mars Hill, and adjacent to FS Road 339 (i.e., Site 7). During April and May of 2011, traplines were re-installed in T-44 [2 traplines per road (east, middle, and west)], and we continued to run these traplines in 2012. More pinesnakes were captured in 2010 than in any of the previous years, and this is likely an artifact of the high quality pinesnake habitat that can be found at Mars Hill and Site 7. Likewise, the high number of pinesnakes captured in T-44 suggests that this area provides quality habitat conditions for the species. The fact that pinesnakes were captured in at least some of the DoD blocks surveyed (e.g. DoD 37, 42, and 43), indicates: 1.) these areas provide conditions that are favorable to some aspect of the snakes' ecology; or 2.) snakes merely pass through these areas to locate better habitat conditions. Radio telemetry work conducted upon the pinesnakes that were captured in the DoD blocks suggests the former, and these snakes spent the majority of their time within the confines of the DoD block (although they made occasional movements beyond the block(s) boundary). Habitat restoration work that has already occurred, or is scheduled to take place in these DoD blocks should benefit the species by opening the canopy and reducing the shrubby mid-story, thereby increasing herbaceous growth and primary productivity at the ground level.

Twenty percent of the new pinesnakes in 2012 were found as they attempted to cross a road (Table 5.1-1; AOR + DOR); however, one (10%) of these snakes was found dead on the road. The fact that 14 (38%) of the 37 pinesnakes that have been found on the road over the past eight years were found dead is disturbing, as is the fact that these 14 individuals represent ~13% of all the pinesnakes that have been found on the CSJFTC from 2004 – 2012 (Table 5.1-1). Majority of the pinesnakes found on the road (n = 37), were found during the last two weeks of May through the first two weeks of June, a time period when *P. m. lodingi* are known to breed (Lee, *In Prep*.) and corresponds with the peak activity for Black Pinesnakes both in Mississippi and on Camp Shelby (See Yager *et al*. 2005; Lee *In Prep*.). This time period may also correspond with increased levels of traffic on the CSJFTC because of annual training (but more data is needed). The effect that roads have upon the *P. m. lodingi* population(s) on Camp Shelby and in southern Mississippi warrants further investigation. Efforts to minimize the impacts that roads have upon *P. m. lodingi* (and other rare species), such as road closures, creation of under-

the-road tunnel systems in conjunction with drift fences (see Langton 1989), and/or public awareness campaigns (*i.e.*, snake crossing signs, brochures, public outreach programs) should be utilized if the snake's long term viability is valued.

5.2 Black Pinesnake Conservation Measures

Black Pinesnake populations are thought to have declined considerably over the years because of numerous factors, and the majority of the remaining populations are currently found on federally owned lands. While it is unfortunate that any populations have been lost, the fact that most are under federal jurisdiction is a benefit, and presents a unique opportunity to conserve the populations that remain. Taking proactive steps now to restore the snake's habitat, and conserve the populations that remain could likely prevent the need to list the species federally in the future. Consequently, a draft Candidate Conservation Agreement (CCA) for the Black Pinesnake was developed and submitted to the MSARNG for review and comment on 18 November 2008. Revisions to the document were made on 8, 9 May and 20 July 2009. At the request of MSARNG personnel, a presentation regarding the proposed Black Pinesnake CCA was given at the annual CSJFTC Rare Animal Inspection Tour on 19 May 2010. Staff from TNC's Camp Shelby Field Office worked with individuals from the USFS and MDWFP to develop agency-specific commitments (June, and October; respectively) and the revised draft was submitted to the USFWS for final review on 12 October 2011. In December of 2012 staff from the USFWS's Ecological Services Office in Jackson began reviewing the proposed CCA, and a request for minor revisions (e.g. change the names for agency points of contact) was made on 3 December.

5.3 Pilot Volunteer Black Pinesnake Trapping Effort and Other Records

On 9 April 2012, a trapline similar to those used on Camp Shelby, was constructed on a private landowner's (McCoy) property located in Hurley, Jackson County, MS. The landowner volunteered his time to run the trapline in an effort to capture Black Pinesnakes and other species indigenous to the area. While no Black Pinesnakes were captured in the traps, an adult female was captured by hand in close proximity to the trapline. In 2013, we hope to recruit additional volunteers in Lamar and Harrison County (where distribution data are scarce).

Six other Black Pinesnake records (specimens captured, photographed, or observed) from areas off Camp Shelby were made/ reported to Conservancy staff in 2012 (Table 5.3-1). Two snakes were reported from each, Stone and Greene Counties, and one snake was reported for Harrison and Lamar Counties (Table 5.3-1). The Lamar County record, while being six years old, is of particular interest as the current USFWS Species Assessment and Listing Priority Assignment Form (http://ecos.fws.gov/docs/candidate/assessments/2013/r4/C029_V01.pdf) only lists *P. m. lodingi* as historically (not currently) occurring in the county. The only other known Lamar Co. record is from 16 May 1966 (MMNS 7776).

Recruiting volunteers to trap for, and/ or report sightings of snakes throughout the animal's range could be a cost-effective means of gathering much needed distribution data, and will help us to focus our conservation efforts for the species.

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Table 5.1-1. Number of *Pituophis melanoleucus lodingi* (excluding recaptures) found, and the method by which they were detected on the Camp Shelby Joint Forces Training Center from 2004 through 2012. AOR or DOR = Alive or Dead on Road, respectively; U = unknown sex; Field = incidental field capture; OP = Overall percentage. (N = 111).

	2004			2005		2006		2007		2008		2009		2010		2011		2012		ALL YEARS			
Capture method	♂	♀	**U**	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	**U**	**OP**
Road																							
AOR	1	1	2	0	4	1	3	0	1	0	1	1	2	3	0	2	0	1	0	9	12	2	22.8%
DOR	2	1	0	2	0	1	0	1	1	0	1	0	1	1	1	0	1	1	0	8	6	0	13.9%
Trap	2	2	0	3	7	4	2	0	1	2	0	1	2	5	8	4	3	6	1	27	26	0	52.5%
Field	2	3	0	0	2	2	2	1	0	0	2	2	3	1	0	0	0	0	1	8	13	0	20.8%
TOTAL	7	7	2	5	13	8	7	2	3	2	4	4	8	10	9	6	4	8	2	52	57	2	
GRAND TOTAL	16			18		15		5		6		12		19		10		10		111			

Table 5.3-1 *Pituophis melanoleucus lodingi* Reported to Conservancy Staff in 2012 (off Camp Shelby). U = Unknown sex. AOR or DOR = Alive or Dead on Road, respectively. AIF = Alive in Field.

Date	Sex	Status	Age	General Location	County	Observer	Comments
20-Mar-12	M	AIF	Adult	Tuxachanie Trail	Harrison	James Flaherty	Morphometric data collected by TNC staff.
20-Mar-12	U	AOR	Adult	Wire Road	Stone	Doyle Bond	Photograph.
22-May-12	M	DOR	Adult	HWY 57	Greene	Matt Hinderliter & David Felder	Specimen retained. Morphometric data collected by TNC staff.
22-May-12	U	DOR	Adult	HWY 57	Greene	Matt Hinderliter & David Felder	Specimen not retained. Observation.
2-Oct-12	M	AIF	Adult	Wiggins Airport	Stone	Culpepper & Associates	Morphometric data collected by TNC staff and released.
Jun-06	U	AIF	Adult	Residence	Lamar	Ron Smith	Observation. No additional data.

6.0 RARE PLANT INVENTORY

The MSARNG GIS database of federal, USFS PETS (Proposed Endangered, Threatened and Sensitive), and state-listed plant species currently consists of 76 species with 817 occurrences (Table 6.0-1). A total of 82 rare plant species have been documented on Camp Shelby (1 Federally endangered; 82 state-listed, and 24 USFS PETS, however, E.O. records and spatial data are missing for 6 of these species (see Tables in the 2011 Annual Report). One new record of Silky camellia (*Stewartia malacodendron*) was added to the GIS database this year. Data are attached in an excel spreadsheet (Appendix 2b.): flora_special_species_site_2012.

Table 6.0-1. Federal, USFS PETS and state listed plant occurrences on CSJFTC. Data are sorted alphabetically by species.

Family	Species	Common name	Occurrences	Heritage Rank	USFS Rank
Scrophulariaceae	*Agalinis aphylla*	Coastal Plain false foxglove	27	G3G4; S2S3	N/A
Scrophulariaceae	*Agalinis filicaulis*	Thin stemmed false foxglove	2	G3G4; S2?	N/A
Scrophulariaceae	*Agalinis viridis*	Green false foxglove	1	G4?; S2S3	N/A
Rosaceae	*Agrimonia incisa*	Incised groovebur	17	G3; S2S3	S-C
Poaceae	*Aristida condensata*	Sandhills threeawn grass	1	GT4?; S3S4	N/A
Poaceae	*Aristida simpliciflora*	Southern threeawn grass	5	G3G4; S1	S-P
Asclepiadaceae	*Asclepias rubra*	Red milkweed	2	G4G5;S3S4	N/A
Ophioglossaceae	*Botrychium jenmanii*	Alabama grapefern	10	G3G4; S1S2	S-C
Ophioglossaceae	*Botrychium lunarioides*	Winter grapefern	2	G4?; S1?	N/A
Orchidaceae	*Calopogon barbatus*	Bearded grasspink orchid	23	G4; S2S3	N/A
Orchidaceae	*Calopogon oklahomensis*	Oklahoma grasspink orchid	7	G4?; S1?	N/A
Cyperaceae	*Carex impressinervia*	Southern few-fruited sedge	1	G1G2; S1	S-P
Cyperaceae	*Carex picta*	Painted sedge	7	G4G5; S3S4	N/A
Cupressaceae	*Chamaecyparis thyoides*	Atlantic white cedar	2	G4; S2	N/A
Poaceae	*Chasmanthium ornithorhynchum*	Birdbill wood-oats grass	1	G4; S1S2	N/A
Asteraceae	*Chromolaena ivifolia*	Ivy-leaf thoroughwort	2	G5; S3S4	N/A
Asteraceae	*Chrysogonum virginianum*	Green and gold	6	G5; S3	N/A
Asteraceae	*Cirsium lecontei*	LeConte's thistle	2	G2G3;S1S2	N/A
Orchidaceae	*Cleistes bifaria*	Spreading pogonia orchid	27	G4?; S3	S-C
Cornaceae	*Cornus alternifolia*	Alternate-leaf dogwood	5	G5; S2	N/A
Fabaceae	*Dalea carnea var. gracilis*	Pine Barrens prairie-clover	2	G5T3T4; S2S3	N/A
Poaceae	*Dichanthelium nudicaule*	Naked-stem panic grass	18	G3?; S2	N/A
Dryopteridaceae	*Dryopteris ludoviciana*	Southern woodfern	1	G4; S1	N/A
Cyperaceae	*Eleocharis melanocarpa*	Black-fruited spikerush	1	G4; S1	N/A
Cyperaceae	*Eleocharis robbinsii*	Robbins' spikerush	2	G4G5; S2	N/A
Orchidaceae	*Epidendrum conopseum*	Greenfly orchid	1	G4; S2	N/A
Ericaceae	*Epigaea repens*	Trailing arbutus	32	G5; S3S4	N/A
Ericaceae	*Gaylussacia nana*	Confederate huckleberry	1	G5; S2S3	N/A
Gentianaceae	*Gentiana catesbaei*	Elliott's gentian	2	G5;S1	N/A

Table 6.0-1 Continued

Family	Species	Common name	Occurrences	Heritage Rank	USFS Rank
Theaceae	*Gordonia lasianthus*	Loblolly bay	30	G5; S3	N/A
Hamamelidaceae	*Hamamelis ovalis*	Running witch-hazel	21	G?;S1	N/A
Orchidaceae	*Hexalectris spicata*	Crested coral-root orchid	1	G5; S2	N/A
Aquifoliaceae	*Ilex amelanchier*	Juneberry holly	4	G4; S3	N/A
Aquifoliaceae	*Ilex myrtifolia*	Myrtle holly	7	G5?; S3S4	N/A
Isoetaceae	*Isoetes louisianensis*	Louisiana quillwort	128	G2; S2	E-C
Juncaceae	*Juncus gymnocarpus*	Naked-fruit rush	24	G4; S3	N/A
Eriocaulaceae	*Lachnocaulon digynum*	Pineland bogbutton	1	G3; S2	S-C
Lauraceae	*Lindera subcoriacea*	Bog spicebush	12	G2; S2	S-C
Lycopodiaceae	*Lypodiella cernua var. cernua*	Nodding clubmoss	1	G5; S2S3	N/A
Scrophulariaceae	*Macranthera flammea*	Flameflower	22	G3; S3?	S-C
Asteraceae	*Marshallia trinervia*	Broad-leaf Barbara's button	7	G3; S3	S-C
Asclepiadaceae	*Matelea obliqua*	Climbing milkweed	2	G4?; S2?	N/A
Liliaceae	*Melanthium virginicum*	Virginia bunchflower	63	G5; S3S4	N/A
Asteraceae	*Mikania cordifolia*	Florida Keys hempweed	3	G5; S3S4	N/A
Haloragaceae	*Myriophyllum laxum*	Loose watermilfoil	1	G3; S1	S-C
Menyanthaceae	*Nymphoides aquatica*	Big floatingheart	3	G5; S2S3	N/A
Menyanthaceae	*Nymphoides cordata*	Little floatingheart	3	G5; S2S3	N/A
Saxifragaceae	*Parnassia grandifolia*	Large-leaf grass-of-Parnassus	13	G3; S2	N/A
Araceae	*Peltandra sagittifolia*	White arum	32	G3G4; S3	N/A
Lentibulariaceae	*Pinguicula primuliflora*	Southern butterwort	6	G3G4; S3	S-C
Orchidaceae	*Platanthera blephariglottis*	Large white-fringed orchid	5	G4G5; S2	N/A
Orchidaceae	*Platanthera cristata*	Crested fringed orchid	2	G5; S3	N/A
Orchidaceae	*Platanthera integra*	Yellow fringeless orchid	4	G3G4; S3	S-C
Polygalaceae	*Polygala hookeri*	Hooker's milkwort	6	G3; S1S2	S-C
Polygalaceae	*Polygala leptostachys*	Slender-spike milkwort	5	G2G4; S?	S-C
Orchidaceae	*Pteroglossaspis ecristata*	Giant orchid	1	G2G3; S1	N/A
Arecaceae	*Rhapidophyllum hystrix*	Needle palm	6	G4; S3	N/A
Cyperaceae	*Rhynchospora crinipes*	Hairy-peduncled beakrush	1	G2; S1	S-C
Cyperaceae	*Rhynchospora macra*	Large beakrush	8	G3; S3	S-C
Cyperaceae	*Rhynchospora stenophylla*	Chapman's beakrush	11	G4; S2S3	N/A
Acanthaceae	*Ruellia pinetorum*	Pine Barren Ruellia	35	G5T3T4; S3	S-C
Alismataceae	*Sagittaria isoetiformis*	Quillwort arrowhead	2	G4?; S1?	N/A
Schisandraceae	*Schisandra glabra*	Scarlet woodbine	3	G3; S3	S-C
Cyperaceae	*Schoenoplectus etuberculatus*	Canby bulrush	4	G3G4; S3S4	N/A
Selaginellaceae	*Selaginella ludoviciana*	Louisiana spikemoss	1	G3G4; S1S2	N/A
Poaceae	*Sorghastrum apalachicolense*	Open indiangrass	52	G3Q; S3S4	N/A

Table 6.0-1 Continued

Family	Species	Common name	Occurrences	Heritage Rank	USFS Rank
Theaceae	*Stewartia malacodendron*	Silky camellia	27	G4; S3S4	N/A
Convolvulaceae	*Stylisma aquatica*	Water dawnflower	2	G4; S1	N/A
Convolvulaceae	*Stylisma pickeringii*	Pickering's dawnflower	1	G4; S1	N/A
Poaceae	*Tridens carolinianus*	Carolina fluffgrass	32	G3G4; S3S4	S-C
Poaceae	*Tridens chapmanii*	Chapman's redtop grass	15	G5T3T5; SNR	N/A
Orchidaceae	*Triphora trianthophora*	Threebirds orchid	1	G3G4; S2S3	N/A
Lentibulariaceae	*Utricularia purpurea*	Purple bladderwort	1	G5; S2S3	N/A
Liliaceae	*Uvularia floridana*	Florida bellwort	3	G3; S1	S-C
Xyridaceae	*Xyris drummondii*	Drummond's yelloweyed-grass	4	G3; S3	S-C
Xyridaceae	*Xyris scabrifolia*	Harper's yelloweyed-grass	10	G3; S2S3	S-C

7.0 ANIMAL INVENTORY

7.1 Element of Occurrences (E.O.)

A total of 60 new Element of Occurrence records (representing 10 species, and 63 individuals) were entered into the CSJFTC rare animal database, and sent to the Mississippi Museum of Natural Sciences on 27 November 2012. The E.O. records this year include: 28 Eastern Coachwhips (*Coluber flagellum*), 15 Eastern Diamond-backed Rattlesnakes (*Crotalus adamanteus*), 10 Black Pinesnakes (*Pituophis melanoleucus lodingi*), 4 Red Salamanders (*Pseudotriton ruber*), 1 Mole King Snake (*Lampropeltis calligaster rhombomaculata*), 1 Slender Glass Lizard (*Ophisaurus attenuatus*) 1 Eastern Coral Snake (*Micrurus fulvius*), 1 Gulf Crayfish Snake (*Regina rigidia sinicola*), 1 Bald Eagle (*Haliaeetus leucocephalus*), and 1 Bachman's Sparrow (*Aimophila aestivalis*). Additionally, two species (i.e., Eastern Diamond-backed Rattlesnake and Black Pinesnake) representing 16 individuals (i.e., nine and seven; respectively) were found adjacent to the CSJFTC S.U.P. area and incorporated into the database.

7.2 Fish of Camp Shelby

Mississippi is home to over 288 inland fish species (204 diadromous, 69 anadromous, and 15 exotic), and ranks fifth in fish diversity for the southeastern United States (Ross, 2001). From 1994- 1996 a survey of the CSJFTC's lotic and lentic habitats was conducted and a list of the fish species found was generated (Leonard, *et al*. 2000; Appendix 9). A total of fifty-four species were identified (Leonard *et al*., 2000). On 28 October 2010, we initiated a survey of the CSJFTC's fish species because we believed the species richness was greater than previously reported. This survey continued through 2012.

Aquatic ecosystems were sampled using a variety of methods including aquatic traps, electrofishing, seine nets, and dip-net surveys. Aquatic traps were placed in various streams and ponds to passively capture fish, while electrofishing, seine nets, and dip-nets were used in smaller streams and ponds to actively collect individuals. Fish were identified in the field or collected and brought to the lab for identification. An individual of each species was retained as a voucher specimen and will be deposited into the Mississippi Museum of Natural Sciences collection upon project completion.

During our survey we documented 44 species of fish including 7 not previously reported for the CSJFTC (Table 7.2-1), bringing the total number of known fish species on CSJFTC to 61. In 2012, a Bowfin (*Amia calva*) was captured and represents not only a new species for the CSJFTC, but a County (i.e. Perry) record for Mississippi (Ross, 2001). Sampling will continue through 2013 and an amended list will be provided in next year's annual report. We intend to publish our results in the primary literature, similar to what has been done for reptiles and amphibians of the CSJFTC (Lee, 2009).

Table 7.2-1. Fish species documented on Camp Shelby Joint Forces Training Center. Data collected during 2012 survey and results from 1994-1996 survey.

Species	Common Name	CSJFTC 2012	CSJFTC 1996
Ambloplites ariommus	Shadow Bass	x	x
Ameriurus natalis	Yellow Bullhead	x	x
Ameriurus nebulosus	Brown Bullhead	x	
Amia calva	Bowfin	x	
Ammocrypta vivax	Scaly Sand Darter		x
Anguilla rostrata	American Eel	x	
Aphredoderus sayanus	Pirate Perch	x	x
Centrarchus macropterus	Flier		x
Cyprinella venusta	Blacktail Shiner		x
Elassoma zonatum	Banded Pygmy Sunfish	x	x
Ericymba buccata	Rough Shiner	x	x
Erimyzon oblongus	Creek Chubsucker		x
Erimyzon tenuis	Sharpfin Chubsucker	x	x
Erymizon sucetta	Lake Chubsucker	x	x
Esox americanus	Grass Pickerel	x	x
Esox niger	Chain Pickerel		x
Etheostoma chlorosomum	Bluntnose Darter		x
Etheostoma lynceum	Brighteye Darter		x
Etheostoma parvipinne	Goldstripe Darter	x	x
Etheostoma stigmaeum	Speckled Darter	x	x
Etheostoma swaini	Gulf Darter	x	x
Etheostoma whipplei	Redfin Darter		x
Fundulus blairae	Western Starhead Topminnow		x
Fundulus notatus	Blackstripe Topminnow		x
Fundulus notti	Southern Starhead Topminnow	x	x
Fundulus olivaceus	Blackspotted Topminnow	x	x
Gambusia affinis	Western Mosquitofish	x	x
Hypentelium nigricans	Northern Hogsucker	x	x
Icthyomyzon gagei	Southern Brook Lamprey	x	x
Lepisosteus oculatus	Spotted Gar	x	
Lepomis cyanellus	Green Sunfish		x
Lepomis gulosus	Warmouth	x	x
Lepomis humilis	Orange-spotted Sunfish	x	
Lepomis macrochirus	Bluegill	x	x
Lepomis marginatus	Dollar Sunfish	x	x
Lepomis megalotis	Longear Sunfish	x	x
Lepomis microlophus	Redear Sunfish		x
Lepomis miniatus	Redspotted Sunfish	x	x

Table 7.2-1 Continued			
Species	**Common Name**	**CSJFTC 2012**	**CSJFTC 1996**
Luxilus chrysocephalus	Striped Shiner	x	x
Lythrurus roseipinnis	Cherryfin Shiner	x	x
Lythrurus umbratilis	Redfin Shiner		x
Micropterus punctulatus	Spotted Bass	x	
Micropterus salmoides	Largemouth Bass	x	x
Minytrema melanops	Spotted Sucker		x
Moxostoma poecilurum	Blacktail Redhorse	x	x
Nocomis leptocephalus	Bluehead Chub		x
Notemigonus crysoleucas	Golden Shiner		x
Notropis baileyi	Rough Shiner	x	x
Notropis buccatus	Silverjaw Minnow	x	x
Notropis longirostris	Longnose Shiner		x
Notropis texanus	Weed Shiner		x
Notropis winchelli	Clear Chub		x
Noturus funebris	Black Madtom		x
Noturus gyrinus	Tadpole Madtom		x
Noturus leptacanthus	Speckled Madtom	x	x
Noturus nocturnus	Freckled Madtom		x
Oposopoedus emiliae	Pugnose Minnow	x	x
Percina nigrofaciata	Blackbanded Darter	x	x
Percina sciera	Dusky Darter	x	
Pomoxis annularis	White Crappie	x	x
Pteronotropis signipinnis	Flagfin Shiner	x	x
Semotilus atromaculatus	Creek Chub		x
Total		44	54

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Leonard, S.W., J.H. Moore, and C.M. Duran. 2000. Mississippi Military Department Biological Inventory Camp Shelby 1994-1999. Mississippi Museum of Natural Sciences Technical Report 112, Jackson, Mississippi.

Lee, J.R. 2009. The Herpetofauna of the Camp Shelby Joint Forces Training Center in the Gulf Coastal Plain of Mississippi. Southeastern Naturalist. 8:639-652.

7.3 Eastern Diamond-backed Rattlesnake Records

In August of 2011, the US Fish and Wildlife Service (USFWS) received a petition requesting that the Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) be listed as a threatened species and that critical habitat be designated under the Endangered Species Act. The authors of the petition stated that no current (i.e. within the past 10 years) records exist for the DeSoto National Forest. Since 2004, we have found 136 *C. adamanteus* on the Camp Shelby Joint Forces Training Center (Perry and Forrest Counties). Of these, 62 individuals (46%) were found dead on the road (DOR), and the remaining 74 individuals (54%) were found alive (e.g., captured in traps, while attempting to cross the road, or incidental field captures). Furthermore, while traveling throughout the southern portion of the state we have found 17 additional individuals (8 alive: Forrest County = 1, Jackson County = 3, Stone County = 3, Wayne County = 1; 9 DOR: Forrest County = 4, Jackson County = 1, Jasper County = 1, Perry County = 1, Stone County = 2). The Jasper County record appears to represent a novel distribution record for the species, according to Martin and Means (2000). The USFWS is currently evaluating the status of the species and will issue a 12-month finding in 2013 (USFWS 2012).

LITERATURE CITED

Martin, W.H. and D.B. Means. 2000. Distribution and habitat relationships of the eastern diamondback rattlesnake (*Crotalus adamanteaus*). Herpetological Natural History 7(1): 9-34.

USFWS. 2012. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition To List the Eastern Diamondback Rattlesnake as Threatened. Federal Register 77: 27403-27411.

8.0 BIOLOGICAL ASSESSMENT, SURVEYS AND DOCUMENT REVIEW

We provide biological assessments and surveys for endangered, threatened, and rare species on an as needed basis. In addition, we review MSARNG environmental documents as relevant to rare species. After conducting the surveys, any findings and management recommendations are summarized and submitted to the MSARNG.

Gopher Tortoise Burrow and Rare Animal Surveys

- GT burrow surveys for the following locations
    - Ranges 3, 18, 19, 40, 41-43, 45, 50
    - OPs 5, 6, 7, 8
    - FPs 65, 68, 74, 75, 86, 87, 89, 98, 101, 105, 106, 77-79, 121, 122, 125, 127, 128, 130, 136
    - TA-28 Platoon Lanes 1-4
    - TA-43
    - DoD 18
    - From these and other surveys an additional 44 tortoise burrows were added to the database in 2012.

Rare Plant Surveys

- TA-11 (Milky Creek) for historical Needle Palm *(Rhapidophyllum hystrix*) locations
- TA-44 (Middle Creek)

Other

- Cogon grass surveys for the following locations:
    - Range 10 (including water line extension project area)
    - Tactical Maneuver Driver Course road widening project area
    - Cantonment area
    - DoDs 10, 35
    - East-Air-to-Ground
    - TAs 43 and 44
    - FP's 90 and 119
    - Ranges 18, 19, 41, 42, 43, 44/45, 46/47
    - Ops 6, 13, 14
    - Grapevine Road and South Tank Trail to Pearce's Creek Bridge
- Assisted with prescribed burns on the following locations:
    - West of Gas Chamber Road and C-17 Airstrip
    - North of Lee Avenue (West of Headquarters building)
    - West side of Lake Walker
    - Gopher Tortoise Headstart Pen
    - North of Headquarters building
    - Mike's Pond (TNC property)
    - Old Fort Bayou (TNC property)

Document Review Related to Rare Species

- USFWS 5 Year Status Review for Louisiana Quillwort
- USFWS Annual Review for the Black Pinesnake
- USFWS Eastern Diamondback Rattlesnake 90-day finding

Element of Occurrence Reports

- See Section 7.1

Other Reports

- USDA-APHIS-WS Mammal Management Environmental Assessment

9.0 PROFESSIONAL PRESENTATIONS, POSTERS, AND PUBLICATIONS

Jones, P.C., R.B. King, R.L. Bailley, N.D. Bieser, K. Bissell, H. Campa III, T. Crabill, M.D. Cross, B.A. Degregorio, M.J. Dreslik, F.E. Durbian, D.S. Harvey, S.E. Hecht, B.C. Jellen, G. Johnson, B.A. Kingsbury, M.J. Kowalski, **J.R. Lee**, J.V. Manning, J.A. Moore, J. Oakes, C.A. Phillips, K.A. Prior, J.M. Refsnider, J.D. Rouse, J.R. Sage, R.A. Seigel, D.B. Shepard, C.S. Smith, T.J. Vandewelle, P.J. Weatherhead, and A. Yagi. 2012. Rangewide Analysis of Eastern Massasauga Survivorship. Journal of Wildlife Management. 76:1576-1586.

Lee, J.R.. 2012. Black Pinesnakes of Camp Shelby and Additional Herpetofauna Projects. Rare Species Inspection Tour. 1 June 2012, Camp Shelby, MS.

Lee, J.R. (*In Prep*). Life History attributes of the Black Pinesnake (*Pituophis melanoleucus lodingi*) in Southern Mississippi. Journal of Herpetology.

Lee, J.R. and D. Shaneyfelt. *Terrapenne carolina* (Three-toed Box Turtle) diet. (*In Press*). Herpetological Review.

Lee, J.R., D.J. Newman III, T. Wallin, and J. Tupy. Dusky Gopher Frog (*Lithobates sevosus*) Translocation Effort. 27-28 September 2012, Mississippi Chapter of The Wildlife Society, Ocean Springs, MS.

Lee, J.R. 2011. Mississippi Gopher Frog Translocation. Museum Technical Report #178. MS Dept. Wildlife, Fisheries and Parks, Jackson, MS. December 2011. 21 p.

Lyman, M.R. 2012. Louisiana Quillwort Monitoring Update. Rare Species Inspection Tour. 1 June 2012, Camp Shelby, MS.

Lyman, M.R. 2012. Monitoring the Camp Shelby Burrowing Crayfish and its Habitat for the Candidate Conservation Agreement. Rare Species Inspection Tour. 1 June 2012, Camp Shelby, MS.

Lyman, M.R. 2012. Conserving Critical Lands: Camp Shelby Conservation Program. 31 October 2012. Mississippi Chapter Conservation Meeting for The Nature Conservancy's Global Challenges: Global Solutions Strategies.

Lyman, M.R. and D. Shaneyfelt. (*In Prep*). Demography and Life History of Louisiana Quillwort (*Isoetes louisianensis* Thieret) within Select Mississippi Populations (working title). Journal not yet determined.

Newman, D.J. III. 2012. Fish Inventory of Camp Shelby. Rare Species Inspection Tour. 1 June 2012, Camp Shelby, MS.

Newman, D.J. III, M. Sisson, J. Tupy, **J.R. Lee**, D. Baxley, and J. Pechmann. Translocation of the Dusky Gopher Frog. *Lithobates sevosus* Reintroduction Workshop. 9-11 March 2012, Memphis, TN.

Newman, D.J. III and J.R. Lee. (*In Review*). *Lampropeltis getula holbrookii* (Speckled Kingsnake) diet. Herpetological Review.

Newman, D.J. III and J.R. Lee. (*In Prep*). Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus*) Occurrence on the Camp Shelby Joint Forces Training Center. Journal not yet determined.

Rauch, T., **J.R. Lee**, and A. Lawler. (*In Review*). Green Salamander (*Aneides aeneus*) populations in Mississippi: An update. Mississippi Academy of Sciences.

Steen, D.A., C.J. W. McClure, J.C. Brock, D.C. Rudolph, J.B. Pierce, **J.R. Lee**, W.J. Humphries, B.B. Gregory, W.B. Sutton, L.L. Smith, D.L. Baxley, D.J. Stevenson, and C. Guyer. 2012. Landscape-level influences of terrestrial snake occupancy within the southeastern United States. Ecological Applications. 22:1084-1097.

Steen, D.A., C. J.W. McClure, L.L. Smith, B.J. Halstead, C.K. Dodd, Jr., W.B. Sutton, **J.R. Lee**, D.L. Baxley, W.J. Humphries, and C. Guyer. (*In Press*). The effect of coachwhip presence on body size of North American racers suggests competition between these sympatric snakes. Journal of Zoology.

Steen, D.A., D.J. Stevenson, J.C. Beane, M.J. Aresco, J.C. Godwin, S.P. Graham, L.L. Smith, J.M. Howze, D.C. Rudolph, Pierce, J.B., **J.R. Lee**, B.B. Gregory, J. Jensen, S.H. Stiles, J.A. Stiles, N.H. Nazdrowicz, C. Guyer. (*In Press*). Terrestrial Movements of the Red-bellied Mudsnake (*Farancia abacura*) and Rainbow Snake (*F. erytrogramma*). Herpetological Review.

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Tupy, J., M. Sission, **J. Lee**, D. Baxley, M. Murphy, and J. Pechmann. 2012. Translocation of the endangered Dusky Gopher Frog. 8-14 August 2012, World Congress of Hepetology, Vanouver, Canada.

Wallin, T., and J.R. Lee. (*In Review*). Eastern Diamond-backed Rattlesnake Species Profile. Created for MS TNC Website.

Wallin, T., and J.R. Lee and T.G. Jackson. (*In Press*). *Micrurus fulvius* (Harlequin Coralsnake) Diet. Herpetological Review.

Wallin, T., D.J. Newman III and J.R. Lee. (*In Prep*). *Agkistrodon contortrix* (Copperhead) behavior: Death feigning. Herpetological Review.

10.0 WORKSHOPS/FIELD TRIPS/ETC.

Our office organized workshops and field trips relating to conservation of rare species management on CSJFTC. We participated in planning meetings hosted by the USFS to address management of habitats occupied by rare species.

TNC Organized Workshops:

- 2012 Annual Rare Species Inspection Tour, 1 June
  Participating organizations: MSARNG, TNC, USFS, USFWS, MDWFP
  Presentations included summaries of research & monitoring activities concerning six listed species: the Gopher Tortoise (*Gopherus polyphemus*), Black Pinesnake (*Pituophis melanoleucus lodingi*), Camp Shelby Burrowing Crayfish (CSBC - *Fallicambarus gordoni*), Louisiana Quillwort (*Isoetes louisianensis*) and Red-cockaded Woodpecker (*Picoides borealis*). Addtionally, presentations were given on herpetofauna and fish survey projects.

- Gopher Tortoise Hatchling Blood Collection Workshop, 4 April

Field Trips and Educational Presentations:

"Snakes of Camp Shelby and the DeSoto National Forest." (3 April; Lucedale Library)-Jim Lee

"Snakes of Camp Shelby and the DeSoto National Forest" at TNC's Wild-Walk-Run Event (28 April; Jackson, MS)-Jim Lee and Donald Newman

"Reptiles and Amphibians of Camp Shelby" to Forrest Co. Ag. High School (2 May)-Jim Lee

Gave tour and presentation to Dr. Matthew Chatfield's Coastal Herpetology Class (9 students; CSJFTC; 18 May 2012)- Jim Lee, Donald Newman, and Tanya Wallin

Gave tour of CSJFTC inventory and Gopher Tortoise work to Bruce Alt (24 May)-Jim Lee

Gave tour of CSJFTC and Black Pinesnake research project to John Ginter (Biologist from AZ; 29-31 May)-Jim Lee, Donald Newman, Tanya Wallin

Gave tour/ presentation to Dr. Tommy Rauch's Graduate Ecology Course (19 June, CSJFTC)-Jim Lee, Donald Newman, Tanya Wallin

"Reptiles and Amphibians of Camp Shelby" to 30 7th graders at MDWFP Fish Camp (26 July; Paul B. Johnson S.P.)-Jim Lee, Donald Newman, Tanya Wallin

"Reptiles and Amphibians of Camp Shelby" at Camp Shelby's Fall Festival (30 October-Headquarters Building)-Donald Newman, Dustin Shaneyfelt

"Reptiles and Amphibians of Camp Shelby" to ~25 soldiers of the PA 28th division (2 November.; Environmental Lab)-Jim Lee

"Reptiles and Amphibians of Camp Shelby" to 23 Perry County Middle School students (9 November; Environmental Lab)-Jim Lee

Meetings and Trainings:

Performance Management Online Course, 9 January-Melinda Lyman

CONNECT WebEx Training-January-Melinda Lyman, Jim Lee

Pack Test for Prescribed Fire Certification, 20 January-Dustin Shaneyfelt

Dusky Gopher Frog Critical Habitat Public Meeting (Gulfport, MS), 31 January-Jim Lee, Donald Newman

ArcGIS Desktop I: Getting Started with GIS (ArcGIS v10.0 training), 8-9 February-Dustin Shaneyfelt and Donald Newman

DeSoto National Forest Longleaf Pine Restoration meeting (Wiggins, MS), 9 February-Melinda Lyman

DeSoto National Forest Camp Shelby Stewardship Meeting (Wiggins, MS), 23 February-Melinda Lyman

CONNECT Basics WebEx Training, 6 March-Melinda Lyman, Dustin Shaneyfelt, Donald Newman

East Gulf Coastal Plain Joint Venture-Southern Pine Desired Forest Conditions Meeting (Spanish Fort, AL), 27-28 March-Melinda Lyman

Dusky Gopher Frog Reintroduction Action Plan Meeting (Memphis, TN), 9-11 March-Jim Lee, Donald Newman

I-100 Introduction to ICS (Online), 30 April, Tanya Wallin

TNC's Concur Training (Online), 30 April, Tanya Wallin

S-190 Introduction to Wildland Fire Behavior (Online), 4 May, Tanya Wallin

DeSoto National Forest Cogongrass Treatment Coordination Meeting (Ashe Nursery), 10 May-Melinda Lyman, Dustin Shaneyfelt

TNC Staff Enrichment Conference, 21-26 May, Donald Newman

TNC's Enterprise Learning Management Training (Online), 23 May, Tanya Wallin

S-130 Firefighter Training (Vancleave, MS), 30 May, Tanya Wallin

Training burn with Bryan Kreiter (Vancleave, MS), 30 May, Tanya Wallin

TNC's Corporate Credit Card Training (Online), 4 June, Tanya Wallin

Information Assurance Awareness Training (Online), 7 June, Tanya Wallin

FEMA IS-700 National Incident Management Systems (NIMS) (Online), 12 June, Tanya Wallin

TNC Performance Management Training for Program Managers (Online/Conference Call), 14 June-Melinda Lyman, Jim Lee

TNC's Human Resources New Employee Orientation (Online), 14 June, Tanya Wallin

TNC's Human Resources Benefits Orientation (Online), 21 June, Tanya Wallin

TNC's PeopleSoft Overview (Online), 25 June, Tanya Wallin

TNC's Ethics and Compliance Training (Online), 11 July, Tanya Wallin

MS Pesticide Applicator Recertficiation-11 July-Dustin Shaneyfelt

TNC Conservation Staff Meeting (Jackson, MS), 16 July-Melinda Lyman, Jim Lee

Camp Shelby Fire Planning Meeting, August-Melinda Lyman, Jim Lee

FEMA IS-700 National Incident Management System (NIMS) training, 8 August-Melinda Lyman, Jim Lee, Donald Newman, Dustin Shaneyfelt.

TNC Grants Management Certification (Online), 7 August-Melinda Lyman, Jim Lee

S-290 Intermediate Wildland Fire Behavior Online training, 21 August-Jim Lee

Mississippi Chapter of the Wildlife Society Meeting, 27 September-Jim Lee, Donald Newman, Tanya Wallin

S-131 Advanced Firefighter Training and S-133 Look Up, Look Down, Look Around Training (Vancleave, MS), 3 October-Jim Lee

Gopher Tortoise Council Meeting (Bainbridge, GA), 4-7 October,-Jim Lee, Donald Newman, Tanya Wallin

USFS Certified Pesticide Applicator Recertification-9 October-Dustin Shaneyfelt

Crew Boss Academy (Camp Shelby, MS), 10-19 October-Jim Lee

Longleaf Pine Management Research Project Meeting with USM Professor, Grant Harley, 25 October-Melinda Lyman

TNC MS Chapter Global Strategies: Global Solutions Conservation Meeting (Jackson, MS), 31 October-1 November-Melinda Lyman, Jim Lee

DoD Mandatory Information Assurance online training, 29 October-all staff.

Annual Fire Refresher, 12 December-all staff

Other:

Professional Memberships- Southeastern Partners in Amphibian and Reptile Conservation (SEPARC), Society for the Study of Amphibians and Reptiles (SSAR), Southeastern/Mississippi Exotic Pest Plant Council, Gopher Tortoise Council, Southern Appalachian Botanical Society, Mississippi Academy of Sciences, The Wildlife Society, Partners in Amphibians and Reptiles Conservation (PARC)

Additional assistance:

- Provided supplies to Dr. Jeanne Jones and Nicole Hodges (MS State) for ongoing soil and vegetation analysis project with USFWS-Jim Lee
- Assisted TNC's fire team with fireline preparation and property posting-Jim Lee
- Collected *Bufo* egg masses for researchers collaborating with MDWFP staff-Jim Lee
- Bioquest site visit at Gulf Coast Community College-Jim Lee, Donald Newman
- Provided USFWS with information regarding Camp Shelby Burrowing Crayfish-Jim Lee
- Set up herpetofauna trapline on Volunteer (McCoy's) property, as part of collaborative Black Pinesnake trapping effort-Jim Lee, Donald Newman
- Conducted frog vocalization survey of Camp Shelby on established North American Amphibian Monitoring Program (NAAMP) route-Jim Lee, Donald Newman, Tanya Wallin
- Provided snake species to Bryan Fedrick for "Snake Day" at the MMNS-Jim Lee
- TNC clean-up day and Connect BBQ-all staff
- Provided Bryan Kreiter with rare species information related to Healthy Forests Reserve Program-Jim Lee
- Provided Black Pinesnake photos to MDWFP for presentation -Jim Lee
- Collaborated with USM PhD student (Aaron Holbrook) on Gopher Tortoise telemetry project-Jim Lee, Donald Newman
- Provided amphibian photos to Adam T. Rohnke (MSU Biologist) for wetland book -Jim Lee
- Developed Job Hazard Analysis (JHA) and Snake Identification and Envenomation Guidelines for the Chapter's Health and Safety Plan-Jim Lee
- Assisted MDWFP with bat mist-netting on Camp Shelby-Jim Lee, Donald Newman, Tanya Wallin

- Collected Dead on the Road (DOR) venomous snakes for Mark Margres, graduate student at Florida State University-Jim Lee, Donald Newman
- Assisted with habitat quality measurement definitions for the EGCPJV Southern Pine Desired Forest Conditions-Melinda Lyman
- Performed vegetation monitoring at TNC's Red Creek and Old Fort Bayou mitigation banks-Melinda Lyman
- DeSoto National Forest Annual Clean-up (Black Creek)-all staff
- Was interviewed for a radio show to talk about TNC's work-Melinda Lyman