

**SURVEYS FOR THE CURRENT DISTRIBUTION AND ABUNDANCE
OF GIANT GARTER SNAKES (*THAMNOPHIS GIGAS*)
IN THE SOUTHERN SAN JOAQUIN VALLEY**

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INTRODUCTION

Giant garter snakes (*Thamnophis gigas*) (GGS) are endemic to the Central Valley of California and were once found in wetlands in the Valley from Butte County in the north to Buena Vista Lake in Kern County in the south (U.S. Fish and Wildlife Service, 1999). Over 90% of historic wetlands in the Central Valley have been lost to agriculture, drainage and irrigation projects, flood control projects, and urbanization (U.S. Fish and Wildlife Service, 1989). As a result of habitat loss and fragmentation, declining populations, and continuing threats to remaining populations, GGS were listed as a federally threatened species on October 20, 1993 (U.S. Fish and Wildlife Service, 1993) after the State of California listed the snake as threatened in 1971. The Federal recovery priority number for the GGS is 2C: full species, high degree of threat, high recovery potential. The draft recovery plan for GGS includes more complete surveys for distribution and abundance as well as habitat restoration to benefit GGS (U.S. Fish and Wildlife Service, 1999). Remnant wetlands, wildlife refuges, and wildlife-friendly agriculture, such as rice, continue to support GGS in varying levels of abundance.

The USGS has been researching the life history, habitat use, distribution and abundance of GGS since 1995 (Wylie, 1998; Wylie and Casazza, 2000a; 2000b; Wylie and Martin, 2004; Wylie et al., 1997a; 1997b; 2000; 2001; 2002; 2003a; 2003b; 2004a; 2004b). Our work in the Sacramento Valley shows that GGS have adapted to the extensive rice agriculture in this area as surrogate wetland habitat. Because GGS are relatively abundant in the Sacramento Valley, we have been able to complete successful radio telemetry studies to evaluate habitat use requirements, movement patterns, and response to habitat restoration. In the San Joaquin Valley, however, where GGS were originally described (Fitch, 1940), very little rice is grown, and current agricultural practices leave little water available for snakes during summer. It is likely that GGS are extirpated south of Fresno and populations are apparently severely reduced in the remainder of the San Joaquin Valley (Hansen and Brode, 1980; Hansen, 1988; Wylie, 1998; Dickert, 2003; Sloan, 2004).

We began survey work in 1998 to revisit areas in the San Joaquin Valley where GGS were found in the historical record (Wylie, 1998). We located a small number of GGS in the Grasslands Area around Los Banos, but did not discover GGS in many areas of historic occurrence. We were not able to complete the range-wide survey because of a lack of funds. Subsequent work in and around the Grasslands area by California Department of Fish and Game biologists confirm results of our earlier work that GGS exist in some historic areas, but in very low numbers (e.g., Dickert, 2003; Sloan, 2004). In our cooperative study with the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program (Wylie and Martin, 2004) we were informed of potential giant garter snake habitat that still exists in the Tulare/Buena Vista lake basins. This report summarizes the results of the USGS surveys for GGS in the San Joaquin Valley during the 2006 field season.

OBJECTIVE

Our objective was to complete a survey of historic locations of GGS in the southern San Joaquin Valley to understand the current distribution and abundance of GGS in the region. This knowledge will assist resource management agencies in assessing management practices that may affect GGS in the San Joaquin Valley.

METHODS

We planned our surveys using historical locations of GGS in the southern San Joaquin Valley derived from the California Natural Diversity Database maintained by the California Department of Fish and Game and from records reported by Fitch (1940) (Figure 1). Of these historic habitats only Buena Vista-Lake Evans and Fresno Slough (Figures 2 and 3) currently have suitable habitat for GGS. In addition, we surveyed areas that currently have suitable habitat for GGS, but were not locations of historic sightings at Kern Refuge, Kings River and North Kings River (Figures 4, 5, and 6). To sample habitat for GGS within a study area we deployed up to 50 modified floating minnow traps (Casazza et al., 2000) along the bank and vegetative edges of the habitat at each location during various time periods (Table 1). Traps were placed approximately 10 m apart. We checked traps daily, recorded all snakes, and counted prey species (fish, frogs, and tadpoles) in every tenth trap. We characterized vegetation and physical substrate structure within a one meter radius of each trap as a rough index of prey abundance in these habitats. We determined the percent vegetative cover composed of tules (*Scirpus acutus*), cattails (*Typha latifolia*), marsh primrose (*Ludwigia* spp.), and broad taxonomic categories such as trees, grasses, sedges, and dicotyledonous weedy plants such as thistle (e.g., *Cearaurea* spp., *Cirsina* spp., and *Salsola* spp.), smartweeds (*Polygonum* spp.), wild mustard (*Brassica* spp.) and wild radish (*Raphanus* spp.) which are hereinafter referred to as weedy dicots. We averaged these percentages over the traps in each trap line. We recorded adjacent farm field conditions (crop type, fallow, etc.) for each trap line on the first day of trapping. In addition to trapping, we also performed visual searches while walking (i.e. walking survey) through suitable wetland habitat near the trap lines. We recorded the route of the walking survey using GPS.

We conducted our survey during spring and summer 2006. At Buena Vista-Lake Evans we conducted one walking survey and maintained 50 traps at Lake Evans and 8 traps in a nearby holding pond during May (Table 1, Figure 2). At Fresno Slough, we conducted one walking survey and maintained 50 traps in June (Table 1, Figure 3). At Kern National Wildlife Refuge we maintained 50 traps in each of four different areas: Goose Lake Canal A, Goose Lake Canal B, Poso Creek, and Unit 2 (Figure 4). In addition, we conducted two walking surveys in May and two in June (Figure 4). At Kings River near Jackson Road we maintained 10 traps and conducted 3 walking surveys in June (Table 1, Figure 5). Habitat was not suitable for more traps at Kings River. At North Kings River we maintained 50 traps at each of two sites in June: Crescent Ditch and Grangeville Road (Table 1, Figure 6). We did not conduct walking surveys at this site because of the difficulty of access by foot. Locations of traps and walking surveys were mapped using aerial photographic imagery taken in 2005.

RESULTS

Buena Vista-Lake Evans

We captured one racer (*Coluber constrictor*), but no GGS (Table 1). At the holding pond, we counted more prey per day than at all but one other site (Table 2). The Lake Evans traps were largely surrounded by open water, with some tules and a little bare ground, terrestrial vegetation, and rock/riprap (Figures 9 and 10). At the holding pond the traps were surrounded by open water and tules (*Scirpus acutus*, primrose (*Ludwigia* spp.) and weedy dicots were the dominant vegetation types (Figures 9 and 10). Both trap lines were surrounded by dry fields, which are unlikely to harbor GGS (Table 1).

Fresno Slough

We captured one common kingsnake (*Lampropeltis getula*) and six gophersnakes (*Pituophis catenifer*), no GGS (Table 1) and a low number of potential prey (Table 2). The traps were mainly surrounded by open water and terrestrial vegetation (grass and weedy dicots), with a small amount of duckweed (*Lemna* and *Azolla*) and algae (Figures 11 and 12). Adjacent fields were actively irrigated for agriculture (Table 1).

Kern Refuge

We captured 1 racer, 7 western rattlesnakes (*Crotalus oreganus*), 12 common kingsnakes, 7 gophersnakes, and 7 common garter snakes (*Thamnophis sirtalis*) but no GGS (Table 1). Managed wetlands and some dry fields surrounded most trapping areas. Open water and emergent vegetation (tules, cattails (*Typha latifolia*), and primrose) were the dominant features near most traps (Figures 13 and 14).

Kings River

We captured no snakes of any species at the Kings River site. We counted more prey/day here than at all but one other site (Table 2). Dense duckweed and tules surrounded most traps and adjacent fields were dry and fallowed (Table 1, Figures 15 and 16).

North Kings River

We captured one common kingsnake and two gophersnakes, a few fish and tadpoles, but no GGS (Tables 1 and 2). Open water and aquatic vegetation encircled most traps (Figures 17 and 18). Surrounding lands were either riparian areas or used for irrigated agriculture (Table 1).

DISCUSSION

We did not see or catch any GGS in the Southern San Joaquin Valley in 2006. Several historical GGS locations reported by Fitch (1940) that we visited are now located in dry fields where no suitable habitat for GGS exists nearby (Figures 7 and 8). We conducted walking surveys and set traps near historical locations at Buena Vista-Lake Evans reported by Fitch (1940) and at Fresno Slough recorded in 1975 (California Natural Diversity Database, California Department of Fish and Game), but found no evidence of GGS in the area.

Immediately surrounding the traps and survey areas, landscape and vegetation features were similar to areas inhabited by GGS in the Sacramento Valley. Agricultural practices in the San

Joaquin Valley appear to leave little water available to GGS in the summer when snakes are active. Our investigation supports the assumption of the U.S. Fish and Wildlife Service (1999) that GGS have been extirpated from their historic range south of Fresno. However, suitable habitat now exists in this southern part of the snake's historic range so that reintroduction could be considered, particularly for the Fresno Slough and the Kern National Wildlife Refuge where water is permanently maintained in wetland habitats.

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Table 1. Summary of trapping efforts in Southern San Joaquin Valley, 2006. COCO = *Coluber constrictor*, LAGE = *Lampropeltis getula*, PICA = *Pituophis catenifer*, CROR = *Crotalus oreganus*, THSI = *Thamnophis sirtalis*, UNSP = Unknown snake

Study Site	Snakes Caught	Adjacent Field Conditions	2006 Trapping Dates
Buena Vista-Lake Evans	COCO (1)	irrigated (non-rice) crop; dry/fallowed	18 May – 1 June
Fresno Slough	LAGE (1); PICA (6)	irrigated (non-rice) crop	5 June – 22 June
Kern Refuge	COCO (1); CROR (7); LAGE (12); PICA (7); THSI (7); UNSP (8)	wetlands; dry/fallowed	3 May – 30 May
Kings River	N/A	dry/fallowed	June – 1 July
North Kings River	LAGE (1); PICA (2)	dry/fallowed; riparian; irrigated (non-rice) crop	7 June – 29 June

Table 2. Trap contents counted in traps in Southern San Joaquin Valley, 2006. Total counted and total per day (in parenthesis) are reported for each prey item.

Trap Line	Dates	Frogs	Tadpoles	Fish	Total Prey
Buena Vista-Lake Evans	5/16-6/1	0	2 (0.13)	12 (0.75)	14 (0.88)
Buena Vista-Holding Pond	5/18-6/1	0	13 (0.93)	15 (1.07)	28 (2.00)
Fresno Slough	6/5-6/22	1 (0.06)	7 (0.41)	5 (0.29)	13 (0.76)
Kern Refuge-Goose Lake Canal A	5/3-5/30	0	7 (0.26)	10 (0.37)	17 (0.63)
Kern Refuge-Goose Lake Canal B	5/9-6/2	0	6 (0.25)	3 (0.13)	9 (0.38)
Kern Refuge-Poso Creek	5/2-5/19	0	7 (0.41)	16 (0.94)	23 (1.36)
Kern Refuge-Unit 2	5/1-5/15	0	2 (0.14)	1 (0.07)	3 (0.21)
Kings River-Jackson Road	6/8-7/1	0	45 (1.96)	1 (0.04)	46 (2.00)
North Kings River-Crescent Ditch	6/7-6/29	0	51 (2.32)	130 (5.91)	181 (8.23)
North Kings River-Grangeville Road	6/6-6/22	0	3 (0.19)	8 (0.50)	11 (0.69)

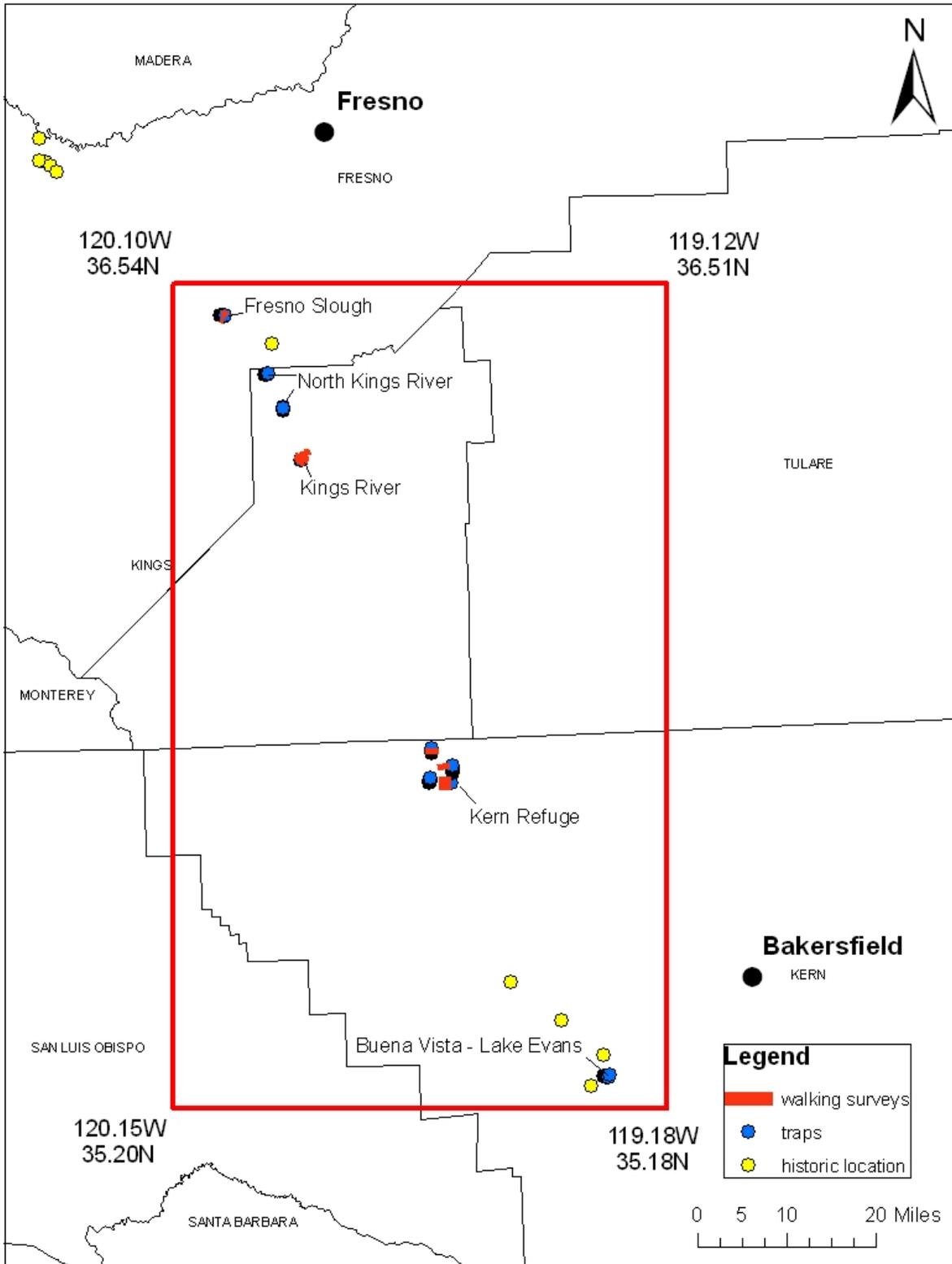


Figure 1. Historic locations of GGS in the southern San Joaquin Valley and areas surveyed during this study.



Figure 2. Locations of traps and walking survey and a historic location of a GGS reported by Fitch (1940) near Buena Vista-Lake Evans in the Southern San Joaquin Valley, 2006.

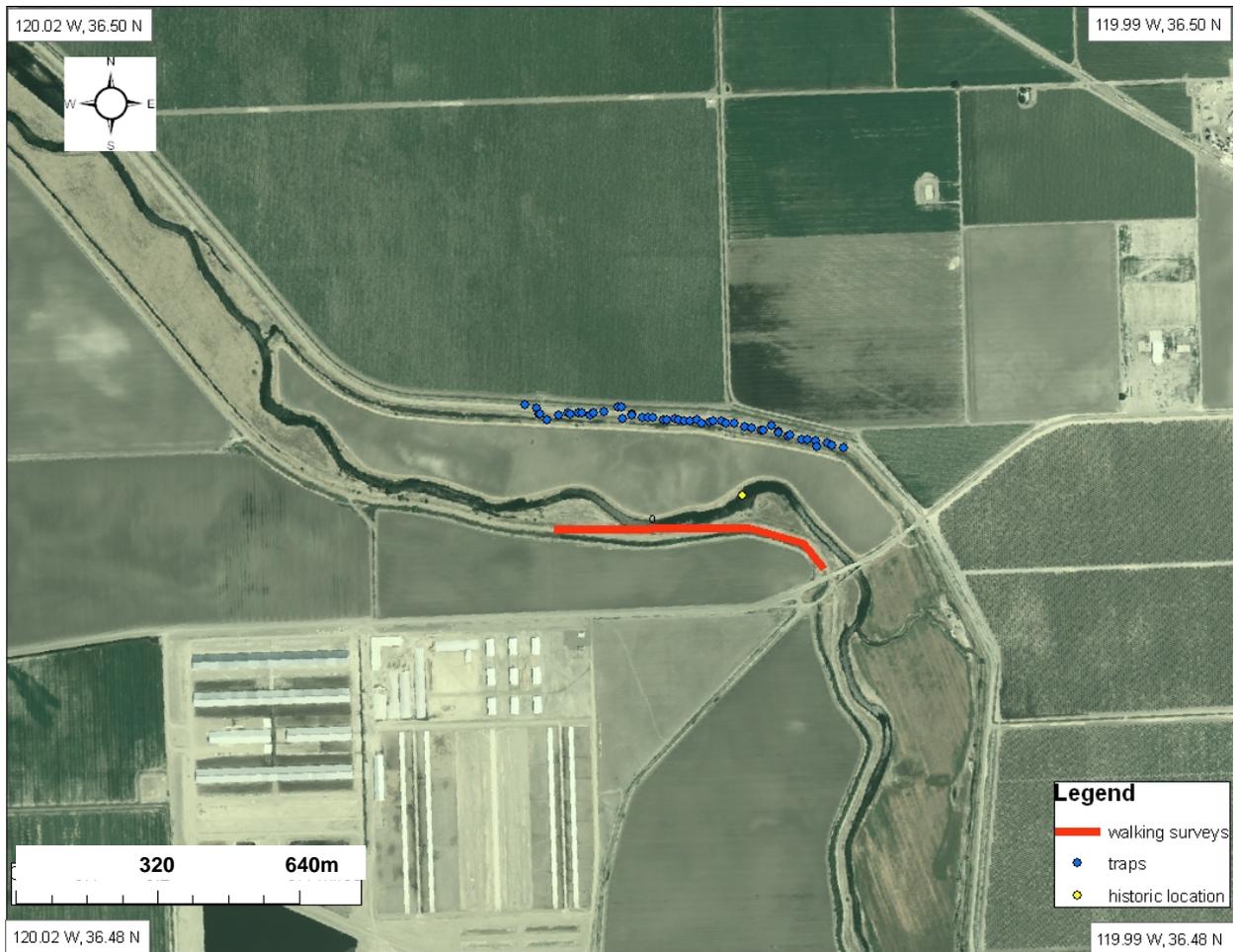


Figure 3. Locations of traps and walking survey and a historic location of a GGS recorded in 1975 (California Natural Diversity Database, California Department of Fish and Game) near Fresno Slough in the Southern San Joaquin Valley, 2006.

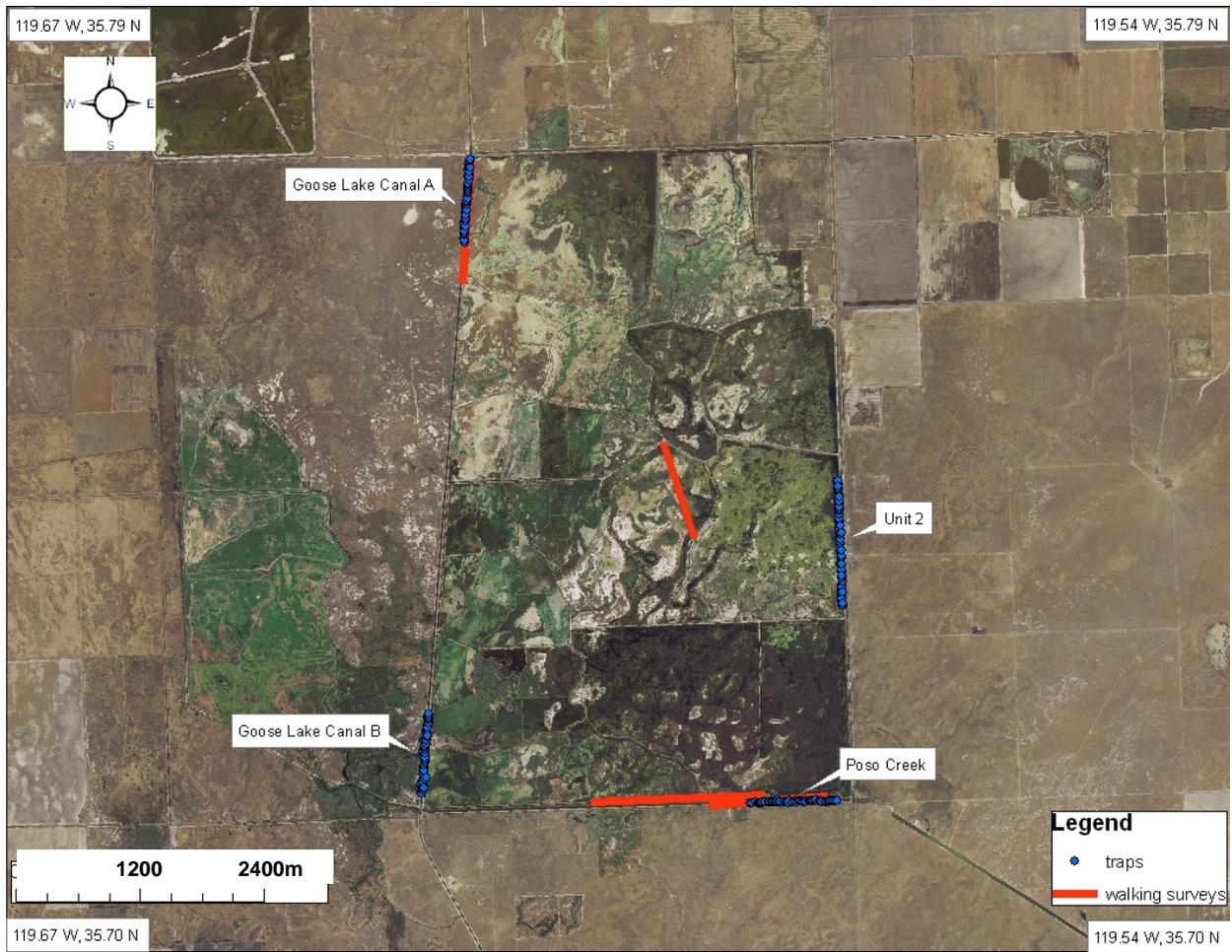


Figure 4. Locations of traps and walking surveys at Kern Refuge in the Southern San Joaquin Valley, 2006.

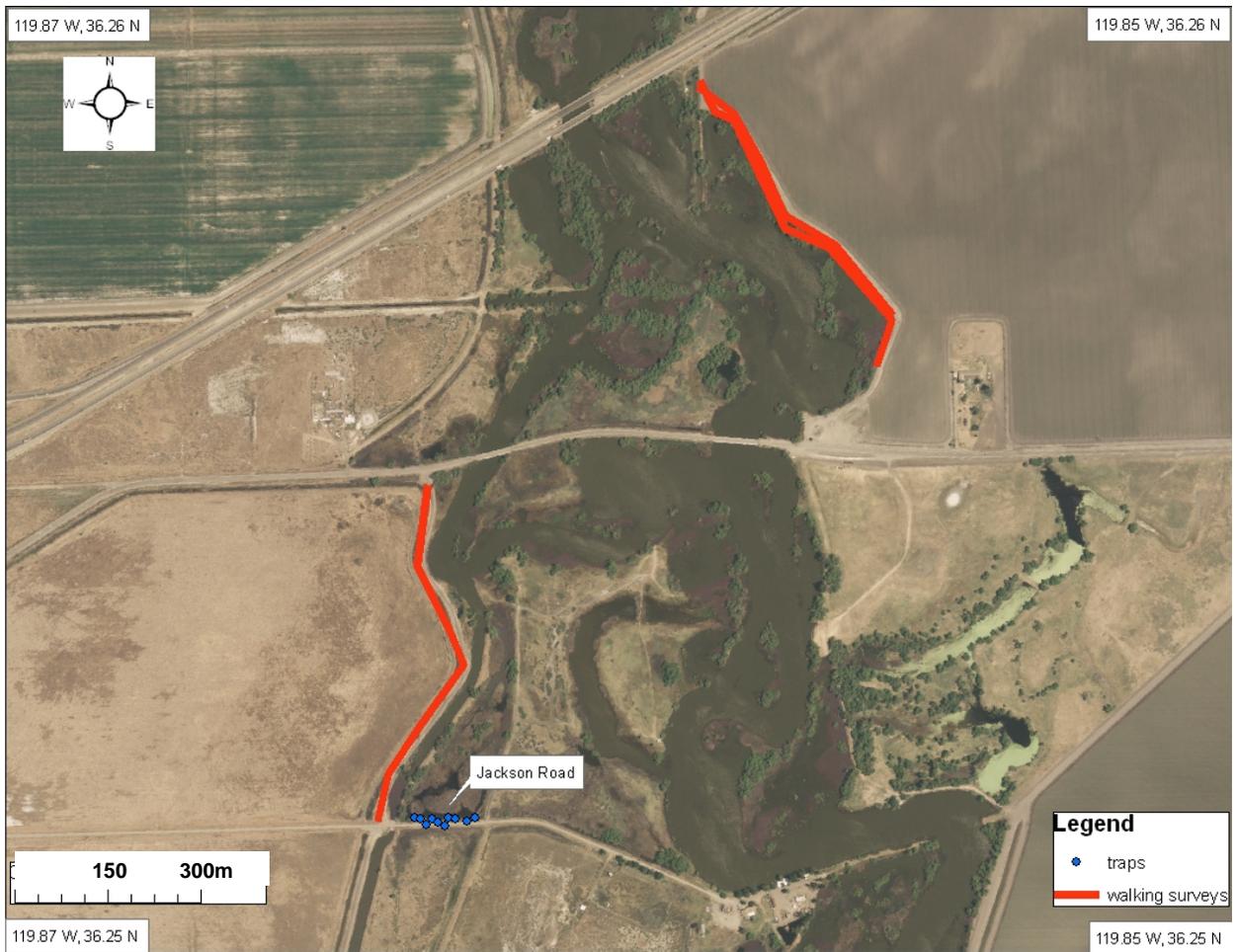


Figure 5. Locations of traps and walking surveys on the Kings River in the Southern San Joaquin Valley, 2006.



Figure 6. Trap locations on the North Kings River in the Southern San Joaquin Valley, 2006.



Figure 7. Historic location of GGS in the Southern San Joaquin Valley reported by Fitch (1940), now located in dry areas unsuitable for garter snakes.

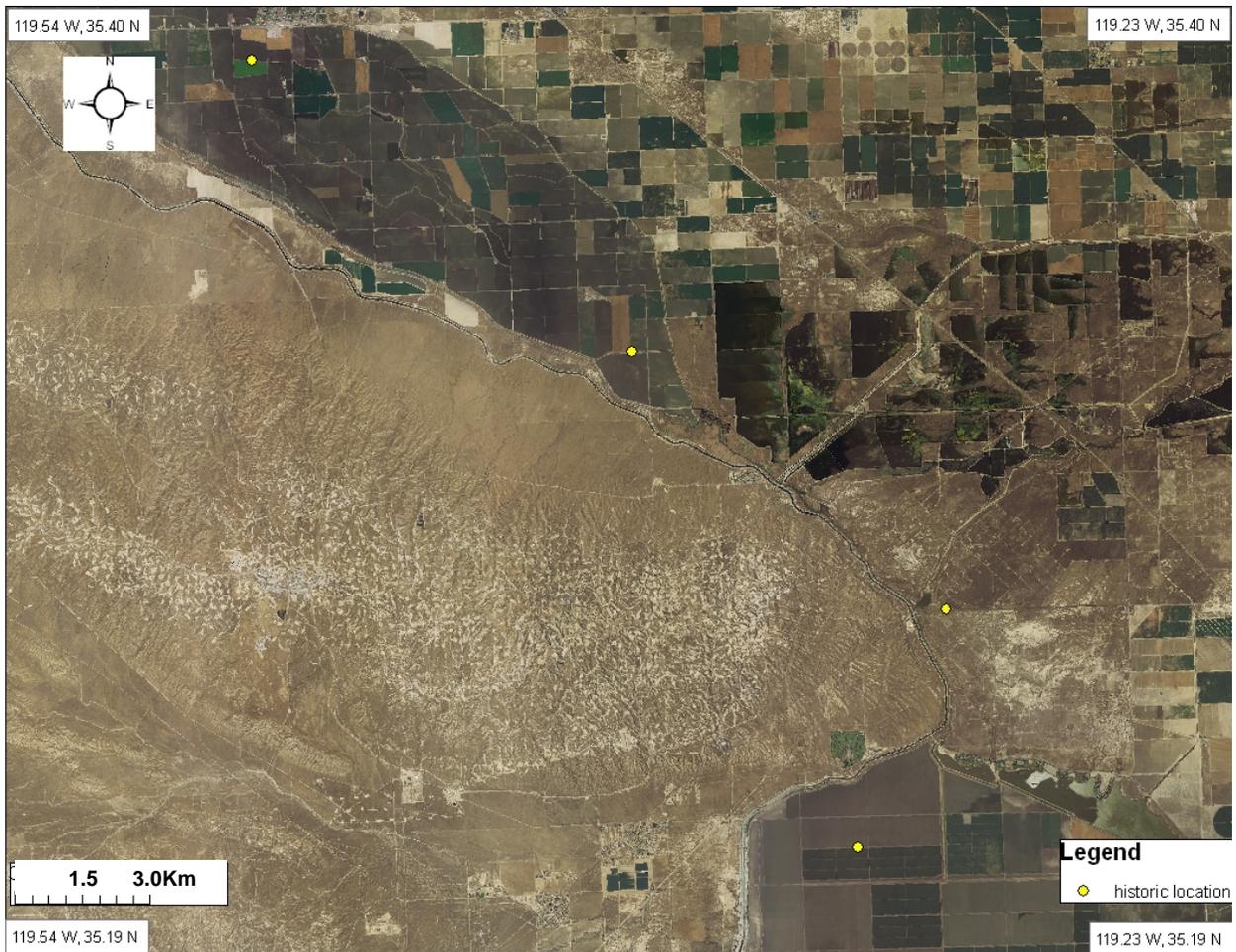


Figure 8. Additional historic locations of GGS in the Southern San Joaquin Valley reported by Fitch (1940), now located in dry areas unsuitable for garter snakes.

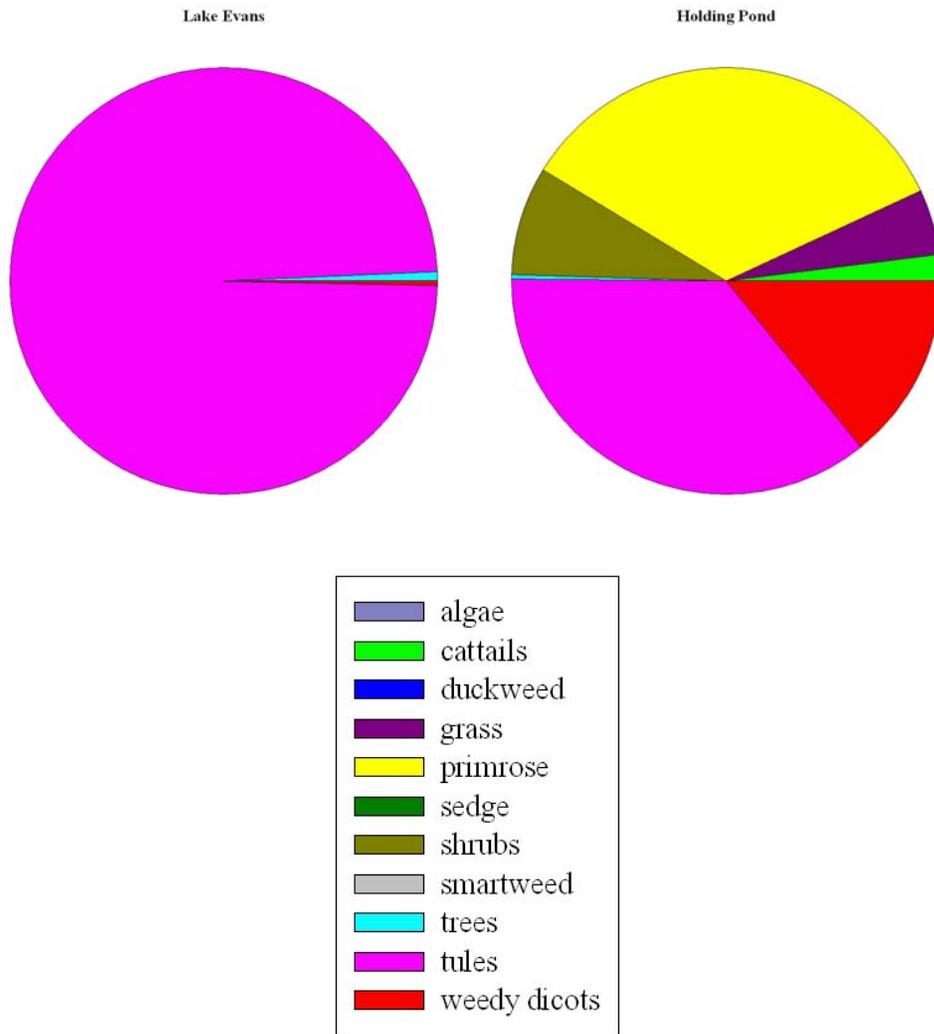


Figure 9. Vegetative characteristics adjacent to trap lines at Buena Vista-Lake Evans.

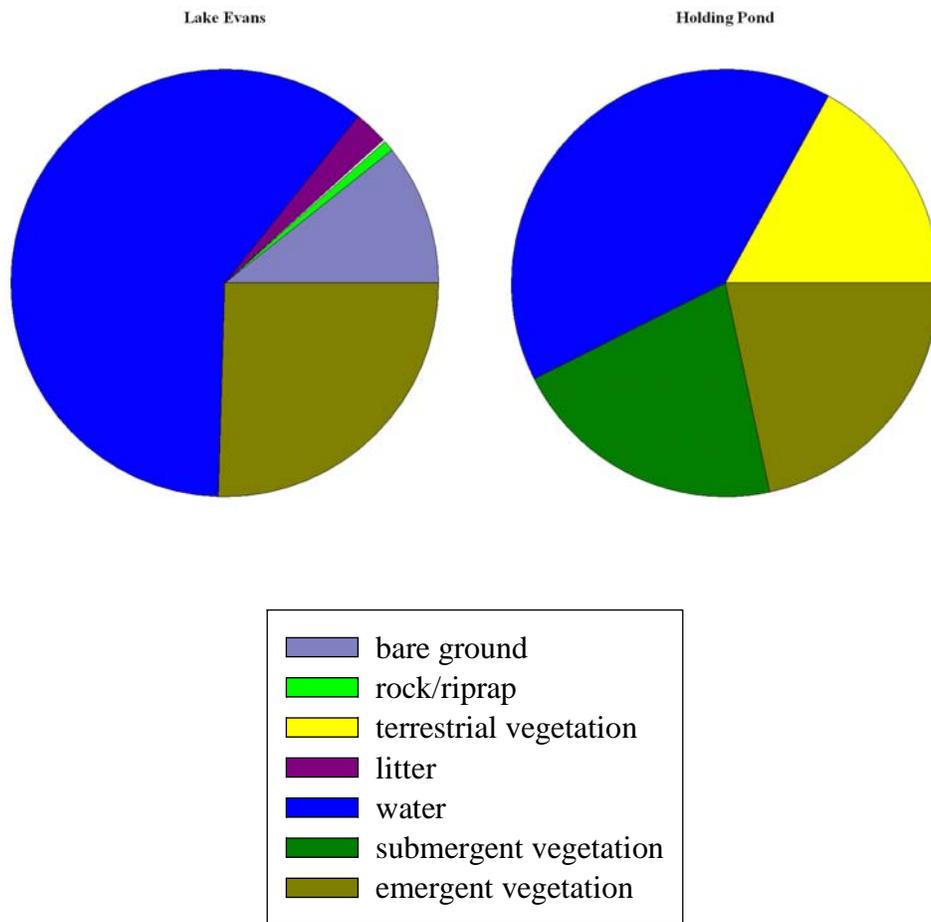


Figure 10. Habitat characteristics adjacent to trap lines at Buena Vista-Lake Evans.

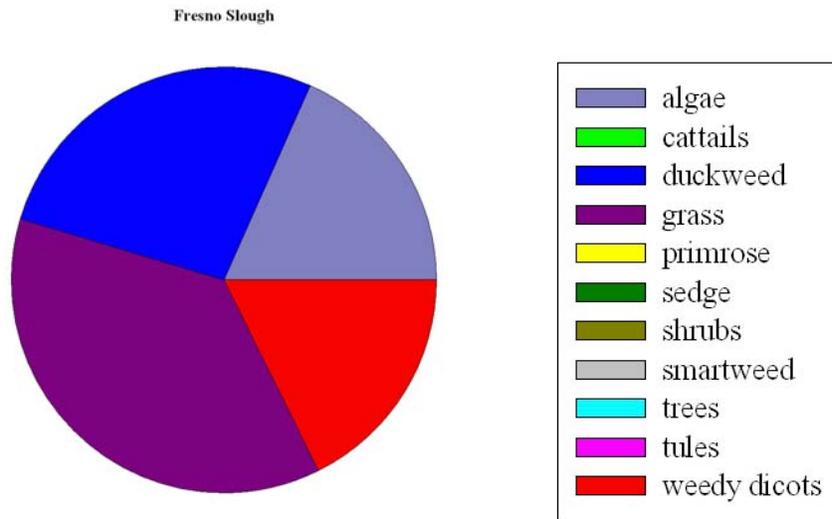


Figure 11. Vegetative characteristics adjacent to the trap line at Fresno Slough.

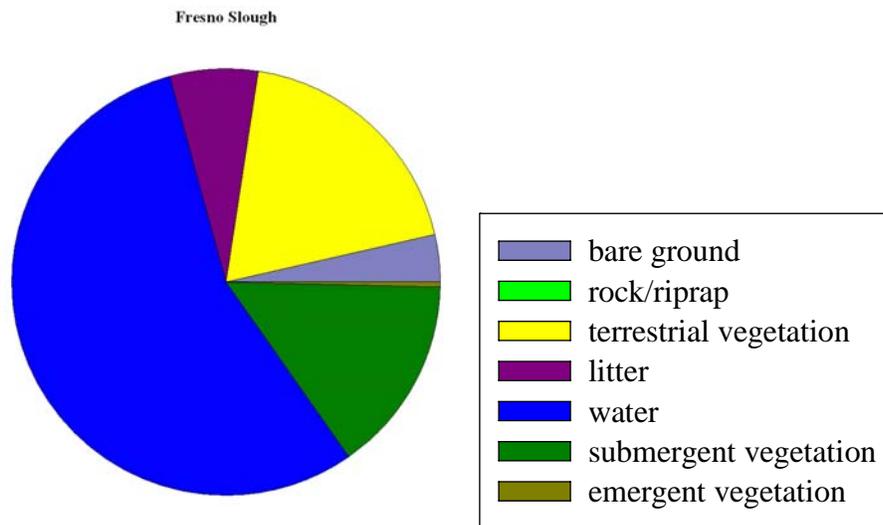


Figure 12. Habitat characteristics adjacent to the trap line at Fresno Slough.

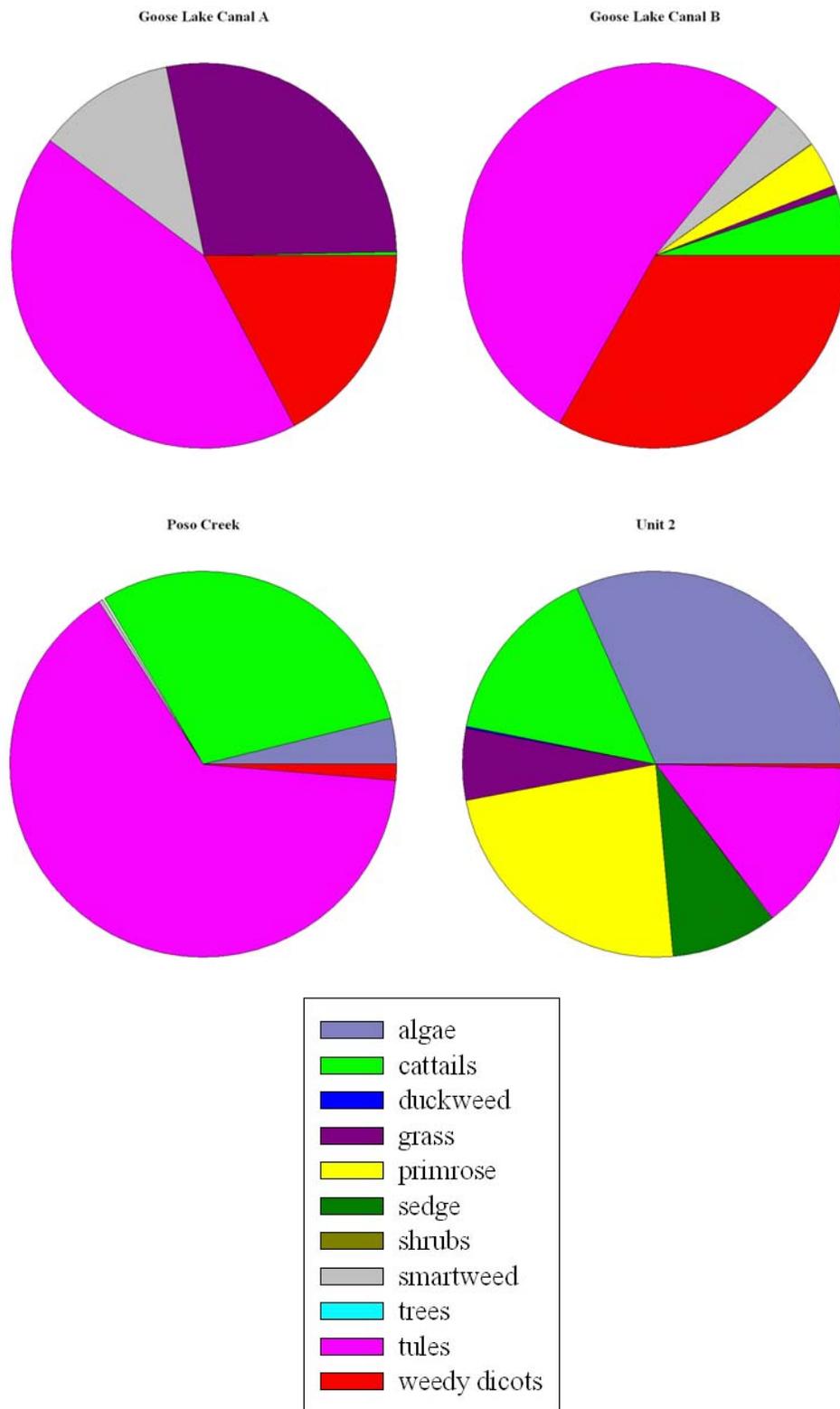


Figure 13. Vegetative characteristics adjacent to the trap lines at Kern Refuge.

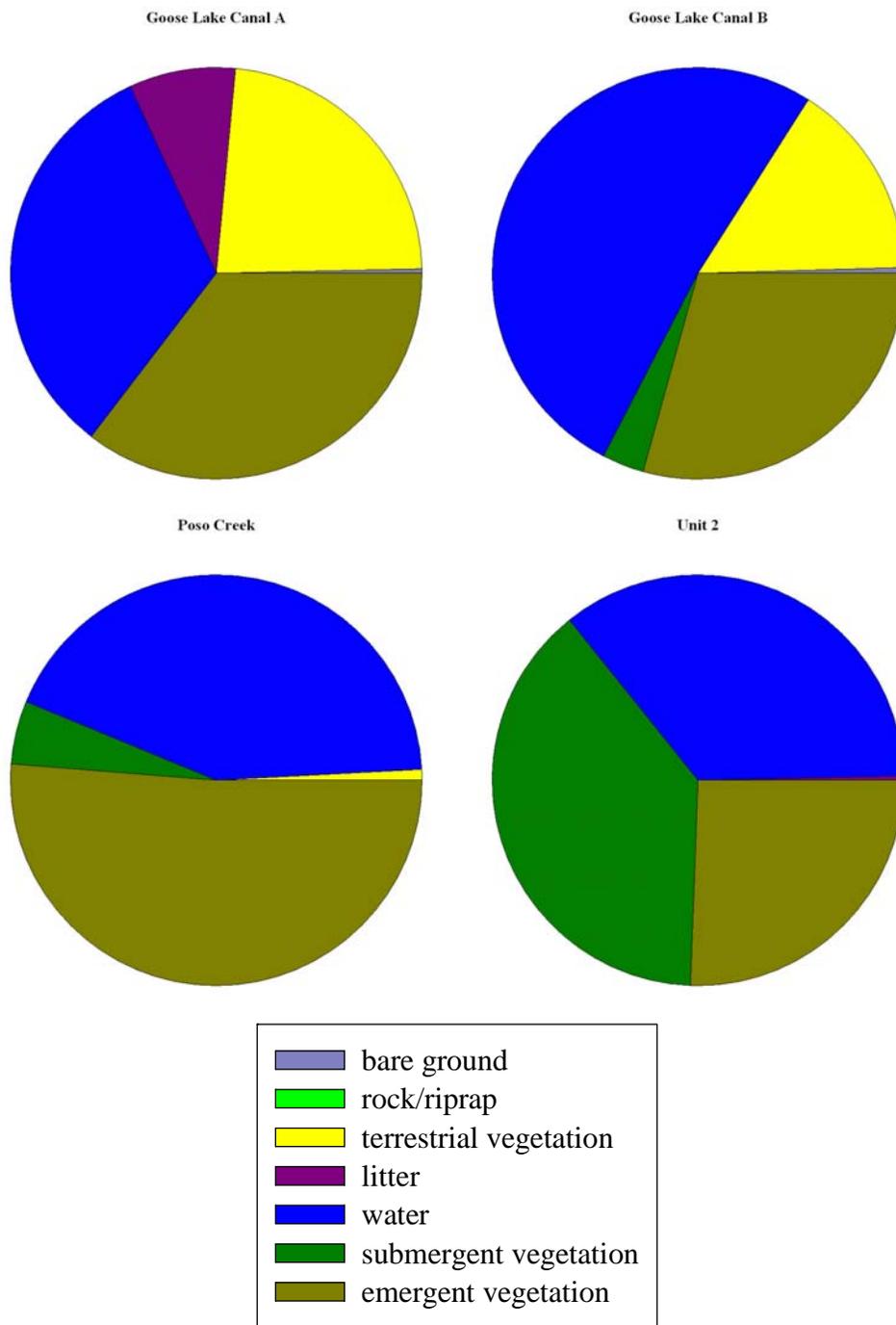


Figure 14. Habitat characteristics adjacent to the trap lines at Kern Refuge.

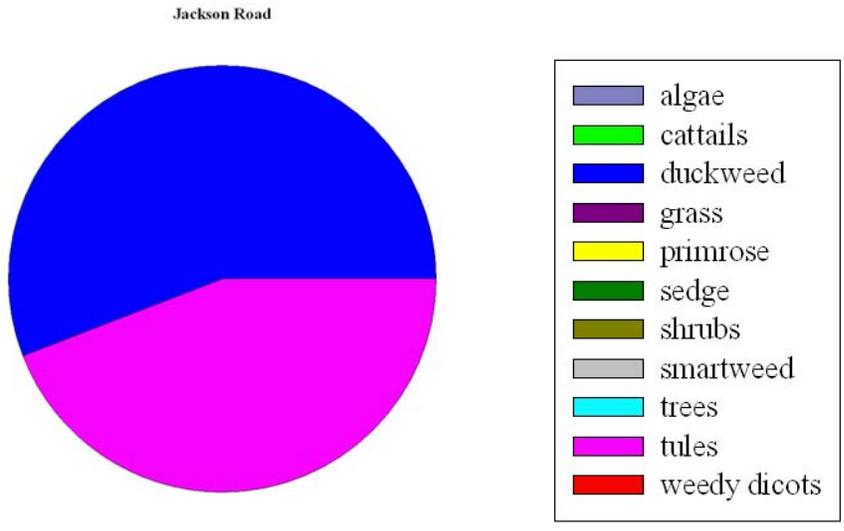


Figure 15. Vegetative characteristics adjacent to the trap line at Kings River.

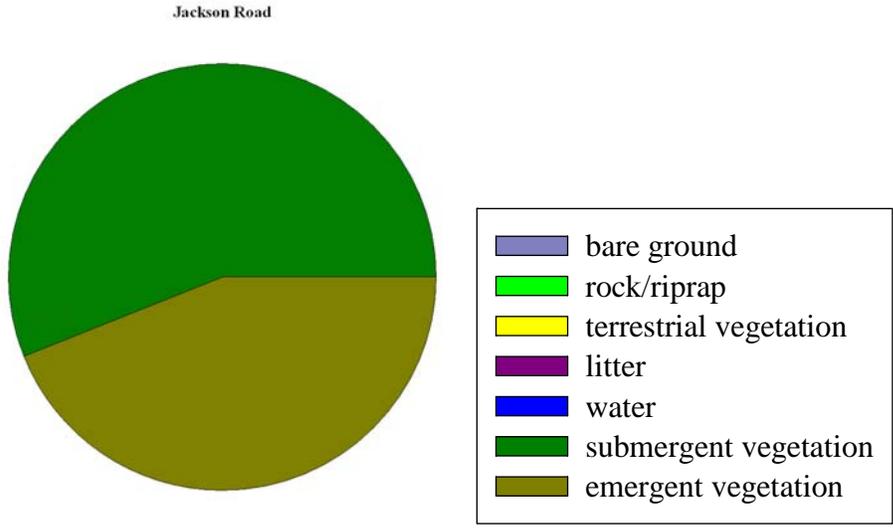


Figure 16. Habitat characteristics adjacent to the trap line at Kings River.

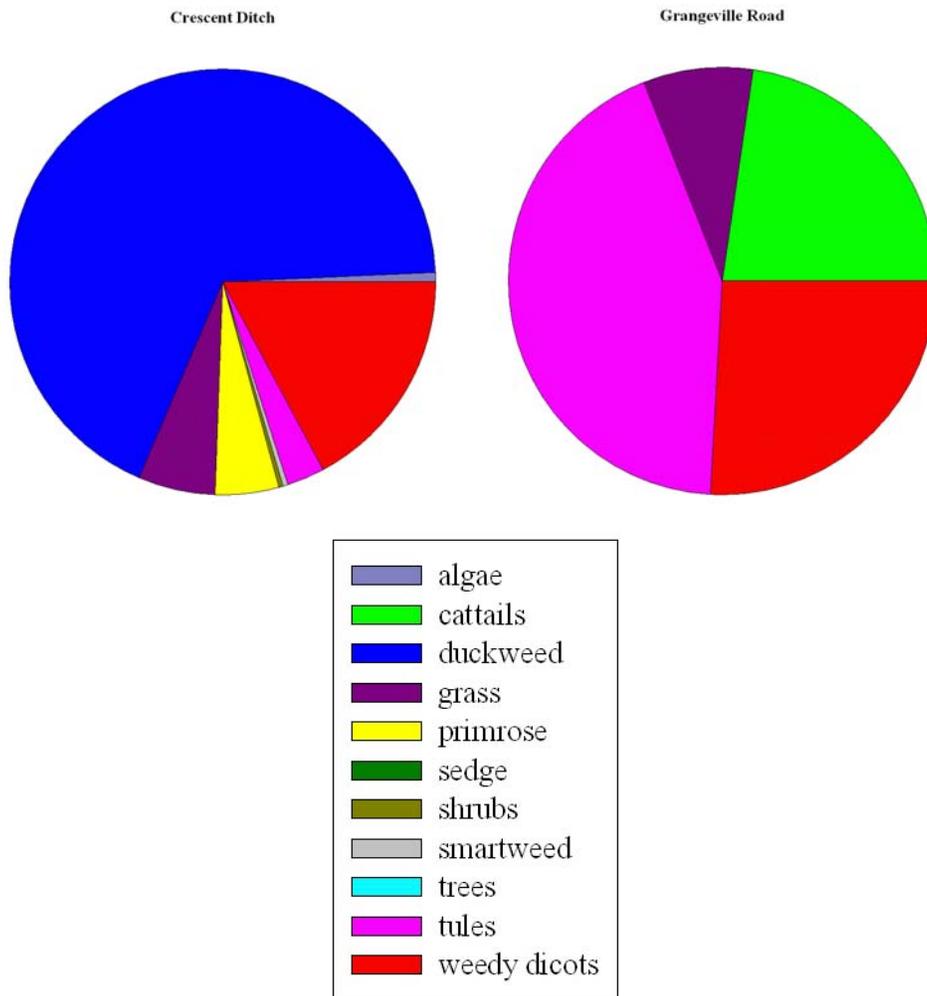


Figure 17. Vegetative characteristics adjacent to trap lines at North Kings River.

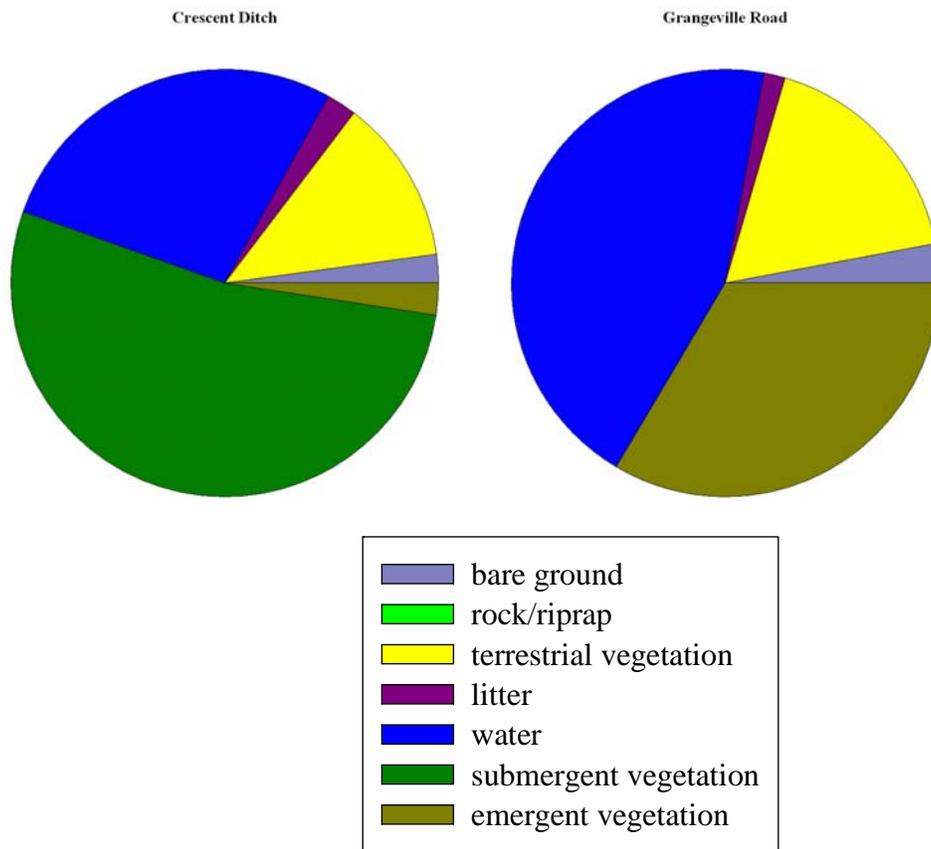


Figure 18. Habitat characteristics adjacent to trap lines at North Kings River.