Notes on *Lythrum salicaria* L. in Texas and on its distribution on Palo Duro Creek, Randall County, Texas

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ABSTRACT

Purple loosestrife (*Lythrum salicaria* L.) is an invasive, exotic plant in North America. We mapped the distribution of this plant on the terminal 5.7 km of Palo Duro Creek, Randall County, Texas, in 2009. We also searched for it along the margins of other creeks/rivers associated with this section of Palo Duro Creek, including the first 10.5 km of the Prairie Dog Town Fork of the Red River. Further, we collated 16 records from Texas collected specimens located in herbaria, including a Gray County record that has not been previously annotated. Purple loosestrife distribution along Palo Duro Creek is still restricted to the area where it was initially documented in 1975. Published on-line **www.phytologia.org** *Phytologia 96(4): 225-234 (Oct 1, 2014).* ISSN 030319430

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Purple loosestrife (*Lythrum salicaria* L.) is a perennial wetland plant that is native to Eurasia (Stuckey 1980). It was first introduced to eastern North America in the late 1700s through shipping and again in the early 1800s as a medicinal herb and ornamental (Stuckey 1980, Malecki et al. 1993, Cox 1999). It occurs in damp floodplains, wet meadows, freshwater marshes, and along open (non-forested) stream and pond margins (Thompson et al. 1987, Cox 1999). It spread rapidly due to its ability to colonize disturbed wetlands, constructed waterways, and irrigation canals (Thompson et al. 1987), tendency to displace/out-compete most native species (e.g., *Typha latifolia* L., Weihe and Neely 1997), prolific seeding (Thompson et al. 1987), lack of suppression by herbivores (Galatowitsch et al. 1999), and popularity with horticulturists and beekeepers (Hayes 1979, Stuckey 1980, Thompson et al. 1987). Where established, it often occurs in monocultures (Weihe and Neely 1997). It may impact the life-cycle (e.g., pollination) of native species (e.g., *L. alatum* Pursh, Brown et al. 2002), alter plant, insect, fish, bird, and mammal communities (Grout et al. 1997, Weihe and Neeley 1997, Blossey et al. 2001, Catling 2005, Schooler et al. 2006, 2009), and negatively impact wetland ecosystems (Grout et al. 1997, Blossey et al. 2001, Schooler et al. 2006). In the United States, it is estimated that purple loosestrife collectively cost conservation agencies and landowners $45 million per year in forage losses, control costs (e.g., chemical, biological, and mechanical treatment), and wetland restoration costs (Malecki et al. 1993, Pimentel 2009, Barbier et al. 2013).

Herbaria records from two Texas locations (Randall and Hardin Counties) are reported in Stuckey's (1980) review of the species distribution (see also Figure 8 in Thompson et al. 1987 and page 432 of Turner et al. 2003). Stuckey's (1980) Hardin County record was first annotated in Flook (1975); it involves a specimen collected near Sour Lake, Texas, on 25 Jun 1971 (Collectors: *Amerson & Watson 540*, Southern Methodist University [SMU] herbarium). The disposition of this specimen is currently unknown – it was likely misidentified, has since been re-determined, and is now filed under a different species name (A. Neill, Botanical Research Institute of Texas). However, if it was correctly identified, it may have involved a population that did not establish, as the plant is not currently thought to be present in southeast Texas (Jason Singhurst, Botanist, Texas Parks and Wildlife Department, pers. comm.). Although the Texas Invasives Database (www.texasinvasives.org) lists no purple loosestrife records, at least two other websites devoted to tracking invasive species (e.g., Early Detection and Distribution Mapping System [www.eddmaps.org] and Discover Life [www.discoverlife.org]) suggest purple loosestrife occurs in Jefferson County. In both cases, this information is linked to a newsletter article (Sorby 1991) that suggests the plant occurs "in the area of Beaumont, Texas." The newsletter article does not reference its information source, but it is likely referring to the Sour Lake record (Flook 1975), which was collected < 25 km from Beaumont. Unfortunately, information from Sorby's (1971) article was entered into the U.S. Geological Survey's Nonindigenous Aquatic Species database (reference 10097, P. Fuller, personal communication) as a Jefferson County occurrence and subsequently picked up during data ingestion from that website. In addition, Womack and Schuster (1987) report a specimen from a stock pond in Delta County, Texas, that was accessioned by the SMU herbarium.

In July 2007, we observed purple loosestrife (Figure 1) growing in the flood plain of Palo Duro Creek immediately west of Highway 60, Canyon, Randall County, Texas. Herein, we describe a survey to document the extent of, and map, locations of purple loosestrife up- and downstream from this area. The purpose of the mapping effort was to collect information for use in containing, controlling, and eradicating the plant from the site.

MATERIALS AND METHODS

In July, 2007, purple loosestrife was collected from the site where we initially observed it (green polygon in Figure 2) and also photo documented (Figure 1). Collected specimens were shipped to Jason Singhurst, Botanist, Texas Parks and Wildlife Department, for identification. These specimens were cataloged (accession number 064503) into the Baylor University Herbarium, Waco Texas.

As part of a Boy Scouts of America® Eagle Scout service project (for Jason C. Ray), portions of Palo Duro Creek and the Prairie Dog Town Fork of the Red River in Randall County, Texas, were surveyed for purple loosestrife. The survey took place on 18 July 2009. Additionally, we surveyed areas of Spring Draw and Tierra Blanca Creek immediately upstream of their confluences with Palo Duro Creek (35.00229°N -101.91526°W and 35.00208°N -101.90270°W, respectively). The western edge of the survey area was FM 2590 and Palo Duro Creek (Figure 2). The eastern limit of the survey area was where the Prairie Dog Town Fork of the Red River exits the east boundary of Camp Don Harrington, a Boy Scouts of America® property (35.04273°N -101.83544°W; location "B" in Figure 2).

Surveys were conducted when purple loosestrife was in bloom and conspicuous. All surveyors were familiarized with the plant, include blooming and non-blooming forms (non-blooming plants were typically small), as well as species with somewhat similar flower color (e.g., *Polygonum pensylvanicum* L.). *L. californicum* Torr. & Gray, a native species that is somewhat common in playa wetlands in the Texas Panhandle (Haukos and Smith 1997, 2004), is not likely to be confused with purple loosestrife due to stem and leaf color, leaf shape, inflorescence, flower arrangement, and flower abundance (Graham 1975, Haukos and Smith 1997). Surveyors were split into 4 groups of 4-5 individuals (groups consisting of 1 adult surveyor plus Boy Scout surveyors); each group was assigned a section of the survey area to

cover. Permission to access both private and public property for the survey was received by J.C. Ray prior to the survey. Surveyors walked each side of their assigned section of creek/river. All ponds and damp areas near the creek/river beds were also surveyed. Surveyors recorded the location of individual plants or stands/patches of purple loosestrife with a hand-held GPS unit (e.g., Garmin eTrex®) if available, or marked the approximate location of plants on a large-scale paper map. All marked locations (GPS or paper) were transferred to a geospatial database using ArcGIS (ESRI®) so that the coordinates (Appendix A) could be used to locate plants for herbicide treatment. Plants and plant clusters identified by surveyors were verified by W.P. Johnson before individual plant treatment.

In an attempt to gather information on purple loosestrife specimens from our search area and elsewhere in Texas, we searched online databases (e.g., North American Network of Small Herbaria, Consortium of Northern Great Plains Herbaria) using search terms *Lythrum salicaria* and Texas, or by drilling down through their scientific classification and examining each *L. salicaria* record (e.g., Texas A&M University Vascular Plant Specimen List). Additionally, we contacted selected herbaria when references/annotations in literature suggested they might hold Texas specimens and when their records could not be accessed remotely.

RESULTS AND DISCUSSION

We surveyed approximately 19.2 km of creek/river (Figure 3), including approximately 1.1 km of watercourses on Palo Duro Creek Golf Course (all owned by City of Canyon), 1.1 km of Spring Draw (all owned by West Texas A&M University), 0.8 km of Tierra Blanca Creek, 5.7 km of Palo Duro Creek, and 10.5 km of the Prairie Dog Town Fork of the Red River (starting at the confluence of Palo Duro and Tierra Blanca creeks). No purple loosestrife was found on Spring Draw, Tierra Blanca Creek, or the Prairie Dog Town Fork of the Red River.

Purple loosestrife appears to be well established in the portions of Palo Duro Creek between Palo Duro Creek Golf Course and BNSF Railway (Figure 3). Although stands in this area are not monotypic (they are interspersed with *Typha* spp. and *Schoenoplectus* spp.), they could be described as a Class II level of infestation ([mature plants with 10 or more flowering stems per rootstock and clumps sometimes coalescing, forming aggregate masses], Thompson et al. 1987). All other detections within the surveyed area were individual plants. Individual plants and Class II levels of infestations may still be contained, controlled, or eradicated through treatment (Thompson et al. 1987, Mullen 1998).

Although exact locations of specimens acquired by L.C. Higgins (Table 1) are unknown, they include descriptions such as "Palo Duro Creek north of Canyon," "Palo Duro Creek west of HWY 87," and "Hunsley Hills Golf Course" (which is now Palo Duro Creek Golf Course), all areas that were covered by our survey. Considering its invasive nature throughout North America (Galatowitsch et al. 1999), it is surprising that the plant, although established, remains relatively localized along the creek after 30 years. Even so, the seed bank may continue to increase without treatment allowing the plant to remain an invasive threat. Numerous small dams along Palo Duro Creek largely prevent downstream flow except in severe flood events and they may be a factor influencing the current distribution of the plant. Much of the area downstream of the infested zone seems suitable for purple loosestrife, especially the open margins and wet meadows associated with the Prairie Dog Town Fork of the Red River. Severe flood events, particularly if coinciding with dropping of seeds or seed germination (newly germinating seeds may float, Thompson et al. 1987) could potentially lead to downstream dispersal.

Searches of herbaria resulted in 16 specimens from Texas (Table 1), 14 of which were from Palo Duro Creek, Canyon, Randall County. The herbarium specimen from Randall County referenced in Stuckey (1980) was not located, but his annotations indicate it was collected by *Higgins 9529* on 24 July 1975 on Palo Duro Creek, Canyon, Texas; this was the same date and approximate location as several

other specimens collected by L.C. Higgins (Table 1). The two other records were from Delta (reported by Womack and Schuster 1987) and Gray counties. We were not able to locate the specimen collected in Hardin County (Flook 1975).

CONCLUSIONS

Although purple loosestrife has been documented along Palo Duro Creek in the past (Stuckey 1980), efforts from our survey provide an update on its status. Additionally, we report a herbarium record for Gray County that has not yet been incorporated into reports pertaining to the species distribution in Texas (Turner et al. 2003). Howells (1992) suggested that purple loosestrife is "not problematic" in Texas, and our results suggest the plant has a limited, but established presence in the state. Locations where specimens were collected in Delta, Gray, and Hardin counties warrant additional field investigations, as the current status of purple loosestrife in these areas is unknown.

Mapping efforts from this study are being used in attempts to control the species spread and prevent further seed production/proliferation. Thompson et al. (1987) noted the simple presence of established purple loosestrife, as documented on Palo Duro Creek in this study, suggests it has the potential to become problematic. Aggressive treatment of purple loosestrife has been questioned (Hager and McCoy 1998) due to its impacts to native flora and fauna being potentially overstated (i.e., too few well-conceived research efforts documenting negative impacts, particularly pertaining to impacts on species of concern) relative to the high costs of annual control efforts nationwide (Pimentel 2009); however, these arguments are generally aimed at situations where infestation levels would make it difficult to prevent further spread of the species.

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Table 1. Herbarium specimens of *Lythrum salicaria* collected in Texas.

Date Collected	Catalog Number	Location (County)	Herbarium[1]	Collector, collector ID	Source
24 Jul 1975	UTC00149021	Palo Duro Creek (Randall)	UTC	L.C. Higgins, 9529	SEINet[2]
24 Jul 1975	25157	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 9529	R. Kazmaier
24 Jul 1975	00290954[3]	Palo Duro Creek (Randall)	TEX-LL	L.C. Higgins, 9529	Flora of Tex. Database[4]
24 Jul 1975	365705	Palo Duro Creek (Randall)	NY	L.C. Higgins, 9529	GBIF data portal[5]
28 Aug 1975	365704	Palo Duro Creek (Randall)	NY	L.C. Higgins, 9753	GBIF data portal[5]
28 Aug 1975	25458	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 9753	R. Kazmaier
11 Jul 1976	30672	Palo Duro Creek (Randall)	WTS	S. Christiansen, 155	R. Kazmaier
6 Sep 1976	30769	Palo Duro Creek (Randall)	WTS	S. Christiansen, 318	R. Kazmaier
4 Jul 1977	25169	Lake McClellan (Gray)	WTS	L.C. Higgins, 9516	R. Kazmaier
2 Sep 1977	366329	Palo Duro Creek (Randall)	NY	L.C. Higgins, 11366	GBIF data portal[5]
2 Sep 1977	33795	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 11366	R. Kazmaier
1 Jul 1982	BRIT21435[3]	near Ben Franklin (Delta)	BRIT-SMU	C. Womack, 109	A. Neill
8 Sep 1984	50600	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 14878	R. Kazmaier
30 Oct 1984	50769	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 15086	R. Kazmaier
5 Sep 1986	365795	Palo Duro Creek (Randall)	NY	L.C. Higgins, 16998	GBIF data portal[5]
5 Sept 1986	54409	Palo Duro Creek (Randall)	WTS	L.C. Higgins, 16998	R. Kazmaier

[1]UTC = Utah State University; WTS = West Texas A&M University; TEX-LL = University of Texas-Austin; NY = New York Botanical Garden; BRIT-SMU = Southern Methodist University/Botanical Research Institute of Texas
[2]swbiodiversity.org/seinet <accessed 24 Jan 2014>
[3]barcode number
[4]Plant Resources Center, www.biosci.utexas.edu/prc/Tex.html <accessed 23 Jan 2014>
[5]www.gbif.org <accessed 24 Jan 2014> and sciweb.nybg.org <accessed 6 Feb 2014>

Figure 1. Photos: (A) patch of *Lythrum salicaria* (the purple flowering plant); (B) a robust clump of *L. salicaria*; and (C) blooms of *L. salicaria*. The plants in these photos were all located about 230 meters west southwest of the Palo Duro Creek – Hwy 60 intersection in Canyon, Randall, County, Texas (approximately 34.99648° -101.92128°). Photos taken 27 July 2007 by W.P. Johnson.

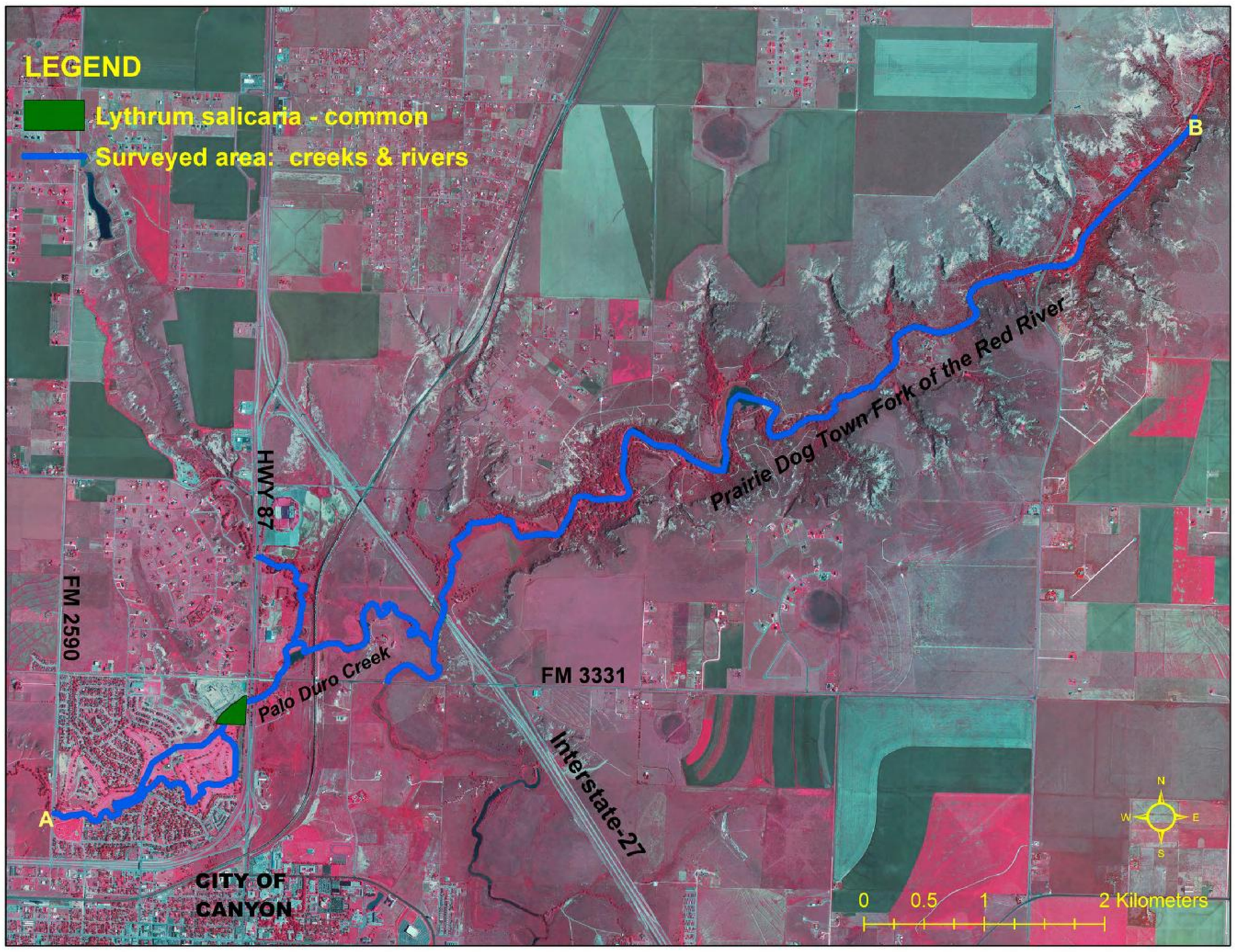

Figure 2. Creek and river margins surveyed for purple loosestrife (A = western extent of surveyed area; B = eastern extent of surveyed area) on 18 July 2009, Randall County, Texas. All highlighted sections (blue) of creek/rivers were searched. The area marked as "*Lythrum salicaria*-common" captures the area of the pictures in Figure 1. Background image 17 December 2004, courtesy of National Agriculture Imagery Program, Farm Services Agency, U.S. Department of Agriculture, Salt Lake City, Utah.

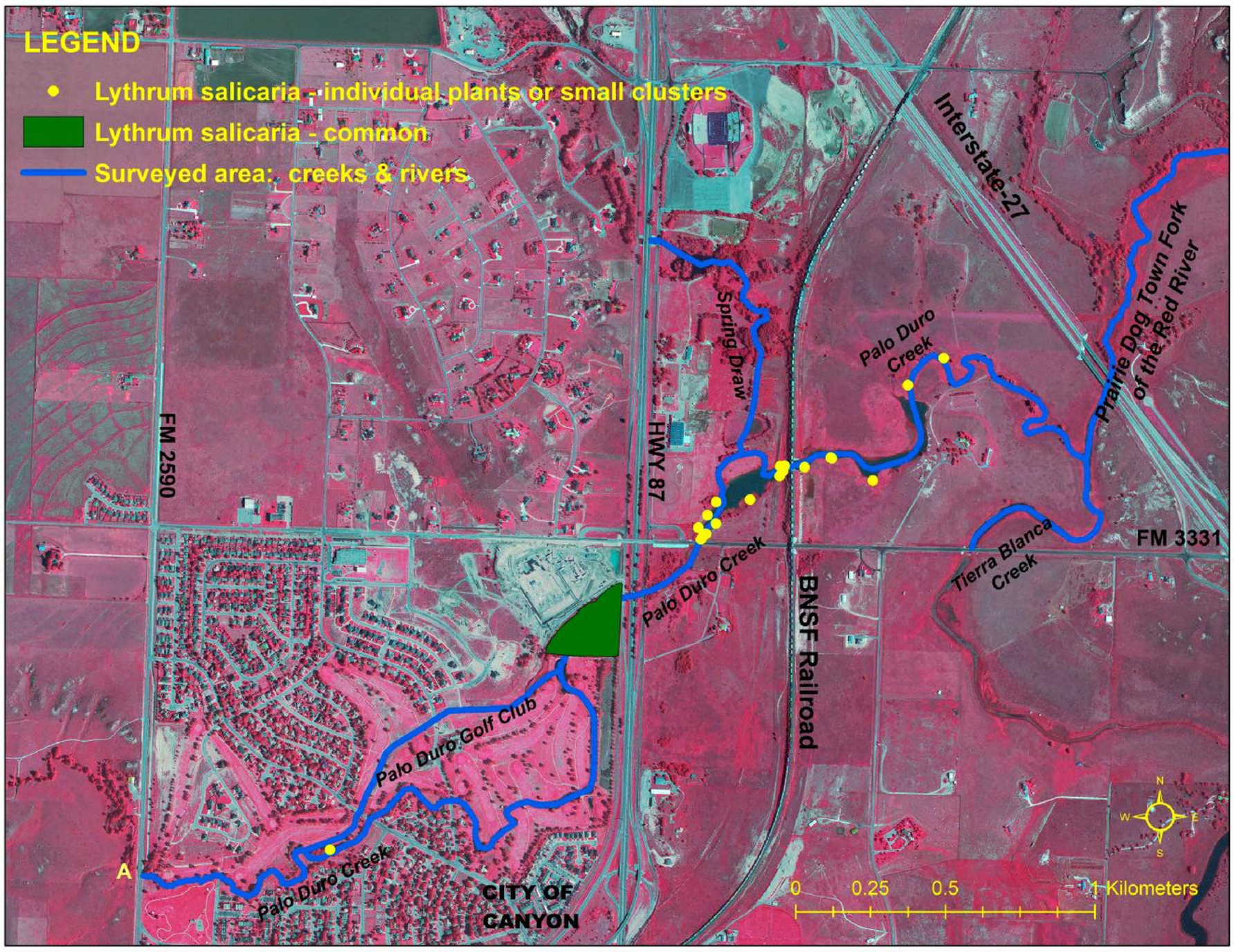

Figure 3. Distribution of purple loosestrife along Palo Duro Creek in Randall County, Texas, on 18 July 2009. All highlighted (blue) sections of creeks/rivers were searched (A = west extent of surveyed area). The area marked as "*Lythrum salicaria*-common" captures the area of the pictures in Figure 1. Background image 17 December 2004, courtesy of National Agriculture Imagery Program, Farm Services Agency, U.S. Department of Agriculture, Salt Lake City, Utah.

Appendix A. Coordinates (decimal degrees) of individual *Lythrum salicaria* plants and small clumps/clusters located by the 18 July 2009 mapping effort (see Figure 3). Plants in the area immediately west of the Palo Duro Creek – Hwy 60 intersection (the area represented by the green polygon in Figure 3) are not included. Coordinates are in Geographic Coordinate System: GCS North American 1983, Datum: D North American 1983.

Latitude	**Longitude**
35.00221°	-101.91207°
35.00217°	-101.91199°
35.00152°	-101.91049°
35.00447°	-101.90935°
35.00531°	-101.90808°
34.98994°	-101.92999°
34.99972°	-101.91667°
35.00009°	-101.91617°
35.00088°	-101.91495°
35.00158°	-101.91393°
35.00176°	-101.91384°
35.00187°	-101.91299°
35.00187°	-101.91375°
35.00188°	-101.91396°
35.00036°	-101.91656°
35.00076°	-101.91622°
34.99995°	-101.91690°
34.99958°	-101.91678°
34.99976°	-101.91660°