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Survey for Multiple Rare Plant Species in the Big Lost River Drainage

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ABSTRACT

Due to limited knowledge of rare plant species on Bureau of Land Management Upper Snake Field Office lands in the Big Lost River Drainage, a survey was conducted on 6-9 June and 12-16 July 2010 to obtain preliminary data on presence of the following species: *Astragalus amnis-amissi* (Custer milkvetch), *Astragalus aquilonius* (Lemhi milkvetch), *Astragalus leptaleus* (park milkvetch), *Camissonia pterosperma* (wingfruit suncup), *Epilobium palustre* (marsh willowherb), *Ipomopsis polycladon* (spreading ipomopsis), *Oxytropis besseyi* var. *salmonensis* (Challis crazyweed), *Pediocactus simpsonii* (Simpson's hedgehog cactus), *Phacelia inconspicua* (obscure phacelia), *Pyrrocoma insecticruris* (bugleg goldenweed), and *Silene scaposa* var. *lobata* (Lost River catchfly). The study area is roughly bounded by Mackay on the north, Challis National Forest on the east and west, and Craters of the Moon National Monument on the south. The general habitat description for most of the areas surveyed is shrub steppe with dominant native plants being *Artemisia tridentata* (big sagebrush), *Pseudoroegneria spicata* (bluebunch wheatgrass), and *Poa secunda* (Sandberg bluegrass). Most sites were impacted by the non-native annual grass *Bromus tectorum* (cheatgrass) and showed evidence of livestock grazing. The substrate for the area is derived primarily from either limestone or volcanic materials. Eighteen sites were visited during this 2-week survey. At the sites where rare plants were found, subpopulations were mapped and data were collected on phenology, number of individuals, site characteristics, associated species, disturbances, and threats. Noxious weeds were also noted and mapped. During this survey I found 1 new population of *Astragalus amnis-amissi* at Berry Canyon, 1 new *Pediocactus simpsonii* population at Leslie Butte, and 3 new populations of *Silene scaposa* var. *lobata* at Flower Garden, Berry Canyon, and Rocky Canyon. One new population of *Pyrrocoma insecticruris* was found in both Butte and Blaine Counties in Upper Fish Creek. This is the first known record of *P. insecticruris* for Butte County and BLM Upper Snake Field Office. I relocated the population of *Astragalus amnis-amissi* at Lower Cedar Creek Canyon (EO 8) and the *Phacelia inconspicua* population at North of Sunset Cone (EO 5). The noxious weeds *Cirsium arvense* (Canada thistle), *Euphorbia esula* (leafy spurge), and *Hieracium aurantiacum* (orange hawkweed) were found in several locations, as well. This study was cursory given the short time frame, wide array of species, and large amount of ground to cover, but is a beneficial start to gaining more information on rare plants in the BLM Upper Snake Field Office. Investing more time in surveying for these species in these areas is suggested. This survey provides valuable habitat and location data for several rare plant species.

KEYWORDS

plant conservation, rare plants, Idaho native plants, *Astragalus amnis-amissi*, *Astragalus aquilonius*, *Astragalus leptaleus*, *Camissonia pterosperma*, *Epilobium palustre*, *Ipomopsis polycladon*, *Oxytropis besseyi* var. *salmonensis*, *Pediocactus simpsonii*, *Phacelia inconspicua*, *Pyrrocoma insecticruris*, *Silene scaposa* var. *lobata*, Lost River Range, Pioneer Mountains, Arco Peak, Appendicitis Hill, Leslie Butte

SUGGESTED CITATION

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INTRODUCTION

Lower elevations of the Big Lost River Drainage of eastern Idaho have potential to harbor many rare plant taxa but have not been extensively surveyed. Therefore a 2-week survey of this area was conducted in the summer of 2010 to provide information to the Bureau of Land Management (BLM) Upper Snake Field Office on the special status plants potentially located there. The primary species of focus were *Astragalus amnis-amissi*, *Astragalus aquilonius*, *Astragalus leptaleus*, *Camissonia pterosperma*, *Epilobium palustre*, *Ipomopsis polycladon*, *Oxytropis besseyi* var. *salmonensis*, *Pediocactus simpsonii*, *Phacelia inconspicua*, *Pyrrocoma insecticruris*, and *Silene scaposa* var. *lobata*. *Orthotrichum hallii*, *Draba incerta*, and *Salix farriae* were secondary species of interest and will not be elaborated on this report. *Draba incerta* and *Salix farriae* were considered secondary as they are typically high elevation species and this survey predominantly covered low to mid-elevations. A brief description of each of the priority species is below, and additional details are provided in Appendix 1. Based on estimated flowering time and habitat information my colleague and I surveyed for these plants in June and/or July.

Based on average flowering dates for the priority species, the June surveys primarily focused on *Astragalus amnis-amissi*, *Camissonia pterosperma*, *Ipomopsis polycladon*, *Pediocactus simpsonii*, and *Phacelia inconspicua*. July surveys were focused on *Astragalus amnis-amissi*, *Astragalus aquilonius*, *Astragalus leptaleus*, *Epilobium palustre*, *Pyrrocoma insecticruris*, and *Silene scaposa* var. *lobata*. Other specific species of focus for individual sites are mentioned in the individual site descriptions.

PRIORITY SPECIES

Astragalus amnis-amissi (Custer milkvetch) is a small taprooted perennial from the family Fabaceae that is endemic to east-central Idaho. The compound leaves have 7-13 leaflets. The leaflets commonly have an apical notch. The white flowers have purple markings and the pods are inflated with closely appressed short hairs (Moseley 1989). *Astragalus amnis-amissi* occurs at the base of and in cracks and ledges of limestone cliffs (Moseley 1989). The flowering range is early June to early July. *Astragalus amnis-amissi* is listed as G3 'Vulnerable' globally and S3 'Vulnerable' for the state of Idaho (NatureServe 2010).

Astragalus aquilonius (Lemhi milkvetch) is a taprooted perennial from the Fabaceae family that is endemic to east-central Idaho. It typically has multiple trailing stems, compound leaves with 9-23 leaflets, greenish white flowers with a purple tipped keel, and sessile, inflated, reddish-brown but not mottled, 1-celled pods (Moseley 1989). *Astragalus aquilonius* is commonly found in shrub steppe vegetation on southerly slopes with gravelly, sandy, or volcanic substrates. The flowering range is mid-June to mid-July. *Astragalus aquilonius* is listed as G3 'Vulnerable' globally and S3 'Vulnerable' for the state of Idaho (NatureServe 2010).

Astragalus leptaleus (park milkvetch) is a perennial from the family Fabaceae that is found in east-central Idaho, western Montana, and south through Wyoming into the

Colorado Rocky Mountains. It has a delicate habit with bright green leaflets and 2-3 white flowers with a purple tipped keel at the middle of the stem. The 1-celled pod is somewhat obcompressed and not visibly stipitate (Moseley 1991). *Astragalus leptaleus* is found in moist areas amongst willows and other riparian vegetation. The flowering range is mid-July to mid-August. NatureServe (2010) lists this plant as G4 'Apparently Secure' globally and S3 'Vulnerable' for Idaho.

Camissonia pterosperma (wingfruit suncup) is a small, hairy annual from the Onagraceae family found in California, Arizona, Utah, Nevada, Oregon, and Idaho. It has 4 minute white petals that have a yellow band near the base. The leaves are mostly linear to narrowly obovate and are usually < 13 mm long. The entire plant is typically from 2.5-10 cm tall (Hall 1991). *Camissonia pterosperma* is found on east, southeast, and southwest aspects in *Juniperus* (juniper)/*Artemisia* (sagebrush) woodlands on limestone or volcanic gravelly soils. The flowering range is late May to early June. NatureServe (2010) lists this plant as G4 'Apparently Secure' globally and S2 'Imperiled' in Idaho.

Epilobium palustre (marsh willowherb) is a perennial circumboreal species from the Onagraceae family that reaches south in North America into California, Colorado, Idaho, Kansas, Wisconsin and Pennsylvania. The stems are 1-4 dm tall and appear gray from fine, appressed hairs. The opposite leaves are 2-6 cm long and 4-6 mm wide. The pink to white flowers have 4 lobed petals and an inferior ovary. The grayish capsules are 3-6 cm long. This is a riparian species that typically blooms June through August (Giblin 2010). *Epilobium palustre* is listed as G5 'Secure' globally and S3 'Vulnerable' in Idaho (NatureServe 2010).

Ipomopsis polycladon (spreading ipomopsis) is a prostrate annual from the Polemoniaceae family that is distributed throughout the southwestern United States reaching as far east as Texas and north to Oregon and Idaho. The stem is glandular-puberulent, decumbent and is less than 1 dm. The leaves are puberulent below and can be entire, toothed, or pinnately lobed. The flowers have 5 white petals and the inflorescence has a head-like arrangement (Patterson 1993). *Ipomopsis polycladon* is found in sandy, semi-desert openings and flowers from mid- to late June. It is ranked as G4 'Apparently Secure' globally and S2 'Imperiled' for Idaho (NatureServe 2010).

Oxytropis besseyi var. *salmonensis* (Challis crazyweed) is a perennial Idaho endemic from the Fabaceae family. It has gray-green leaves and clusters of bright red to purplish-red flowers. Most of the plant, except the petals, is noticeably hairy (Earle 2001). *Oxytropis besseyi* var. *salmonensis* typically grows on sparsely vegetated slopes and dry washes on volcanic substrate. It flowers from June to early July. NatureServe (2010) lists this plant as T3 'Vulnerable' and S3 'Vulnerable' for Idaho.

Pediocactus simpsonii (Simpson's hedgehog cactus) is a highly variable species in the Cactaceae family that is found in most western and 2 mid-western states. This cactus is small, typically unbranched, and has flowers that range in color from white to bright pink. Flowering occurs in the spring to early summer and is found in a variety of habitats including pinyon-juniper woodlands, sagebrush, and prairie grasslands. NatureServe (2010) lists it as G4 'Apparently Secure' globally and S3 'Vulnerable' for Idaho.

Pediocactus simpsonii has commonly been misidentified in Idaho as *Coryphantha* species (Zimmerman & Parfitt 2003). At Leslie Butte in June, several cacti were located and were thought to be *P. simpsonii*. These were documented as such, but it was unclear whether they were *P. simpsonii* or *Coryphantha* spp. My colleague and I returned to Leslie Butte in July to collect the cactus. These collections were compared with herbarium records at the UI Stillingher Herbarium and appeared to be similar to several collections labeled as *Coryphantha missouriensis*. However, upon consulting Flora of North America (FNA) it was determined that the species collected at Leslie Butte, as well as the species labeled *C. missouriensis* in the UI Stillingher herbarium are all *P. simpsonii*.

Flora of the Pacific Northwest lists both *Coryphantha missouriensis* and *C. vivipara* as occurring in central Idaho (Hitchcock & Cronquist 1973). However, according to FNA *Pediocactus simpsonii* has been misidentified in Idaho with some *Coryphantha* species, including *C. missouriensis* and *C. vivipara* (Zimmerman & Parfitt 2003). "Plants of *C. missouriensis* are localized, inconspicuous (except for their red fruits in spring), and difficult for non-specialists to distinguish from more common species. Reports of *C. missouriensis* from Idaho are based on misidentified specimens of *P. simpsonii* (in the broad sense)" (Zimmerman & Parfitt 2003). Also, "*C. vivipara* is the most widespread, abundant and variable member of the genus, but it is rare in Mexico. Reports of it from Oregon, Idaho, and northern Utah are incorrect (A. D. Zimmerman 1985)" (Zimmerman & Parfitt 2003).

Phacelia inconspicua (obscure phacelia) is a branching annual forb from the Hydrophyllaceae family known only from Idaho and Nevada. It commonly reaches only 15 cm tall and has white to pale blue flowers arranged in a helicoid cyme. The pubescent leaves are entire and non-glandular. *Phacelia inconspicua* is typically found in openings in shrubby areas that are dominated by *Prunus virginiana* (chokecherry), *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush), *Symphoricarpos oreophilus* (mountain snowberry), and *Leymus cinereus* (basin wildrye) (Murphy 2002). It flowers from mid-June to early July. This plant is listed by NatureServe (2010) as G2 'Imperiled' globally and S1 'Critically Imperiled' in Idaho.

Pyrocoma insecticruris (bugleg goldenweed) is endemic to several counties in east-central Idaho and is in the family Asteraceae. It grows to 25-60 cm, has 1-5 red-tinged stems, petiolate basal leaves, clasping stem leaves and 3-10 heads per stem. The heads have 15-23 ray flowers and 35-50 disc flowers (Bogler 2006). *Pyrocoma insecticruris* is found in mountain meadows and flowers in mid- to late July. NatureServe (2010) lists this plant as G3 'Vulnerable' globally and S3 'Vulnerable' for Idaho.

Silene scaposa var. *lobata* (Lost River catchfly) is in the Caryophyllaceae family, is found in Idaho, Oregon and Nevada. The species is distinct due to its subscapose inflorescence and calyx, which has broadened and lanceolate veins (Morton 2005). The flowers are white and the plant is glandular with 1-2 pairs of small cauline leaves. The var. *lobata* is distinguished by having 4-lobed petals (Morton 2005). *Silene scaposa* var. *lobata* is typically found on north, northeast, or southeast slopes in sagebrush/bunchgrass areas

as well as in juniper/Douglas-fir (*Pseudotsuga menziesii*) woodlands. It flowers in early July to early August. NatureServe (2010) lists this variety as G4T4 'Apparently Secure' globally and SNR 'Not Ranked' for Idaho. At the species level, *Silene scaposa* is ranked S3 'Vulnerable' in Idaho.

STUDY AREA

The area of interest for this study is BLM Upper Snake Field Office lands in Custer, Blaine and Butte counties. This area is bounded by Mackay on the north, Challis National Forest on the east and west, and Craters of the Moon National Monument on the south (Figure 1). Locations of interest were chosen by BLM botanist Wendy Velman. Some areas were inaccessible in June due to poor road conditions.

The elevation for these surveys ranges from 1707-2377 m. Average annual temperature is 5.67°C (42.21°F) and average annual precipitation is 24.24 cm (9.5 in) (Western Regional Climate Center 2010). Geology is variable but can be characterized as predominantly volcanic or limestone parent materials. Soils information is included in the following site descriptions and was obtained from the USDA-Natural Resource Conservation Service (2010), as well as from on-site observations.

A variety of locations were visited. Each site has unique characteristics as well as some common characteristics. The general habitat description for most of the sites surveyed is shrub steppe, with dominant native plants being *Artemisia tridentata* (big sagebrush), *Pseudoroegneria spicata* (bluebunch wheatgrass), and *Poa secunda* (Sandberg bluegrass). Most sites were impacted by the non-native annual grass *Bromus tectorum* (cheatgrass), and some sites had noxious weeds *Cirsium arvense* (Canada thistle), *Euphorbia esula* (leafy spurge), and *Hieracium aurantiacum* (orange hawkweed).

Lower Cedar Creek Canyon

On the eastern and southeastern aspects of Lower Cedar Creek Canyon, an existing population of *Astragalus amnis-amissi* on Challis National Forest land was relocated and updated on 8 June 2010. This site was relocated on National Forest land with the hope that another population of *Astragalus amnis-amissi* would be located in similar habitat on adjacent BLM lands. *Astragalus amnis-amissi* was not found on BLM lands near this known site. The mouth of this canyon has steep limestone cliffs on the west side of the river. The ledges between the cliffs are dominated by *Juniperus scopulorum* (Rocky Mountain juniper), *Cercocarpus ledifolius* (curl-leaf mountain mahogany), *Artemisia tridentata*, and *Pseudoroegneria spicata*.

Little Cedar Creek Road

Little Cedar Creek Road was surveyed on 8 June 2010. I stopped at sparsely vegetated gravelly locations to look for *Oxytropis besseyi* var. *salmonensis*. This plant was previously reported on BLM lands in this vicinity, but the location in the original report appears to contain an error, and was not found here during this survey. A dry creek bed inhabited by *Cercocarpus ledifolius* at 1890 m (6200') was also surveyed (Figure 8). This area is rolling sagebrush land dissected by multiple canals and irrigated pastures at the

base of the Big Lost River Range. The soils in the foothills are primarily mixed alluvium and alluvium derived from limestone (USDA-NRCS 2010).

Mahogany Canyon

Near the mouth of Mahogany Canyon, open rocky spots with sparse vegetation were surveyed for *Oxytropis besseyi* var. *salmonensis* on 8 June 2010. These areas are dominated by *Artemisia* sp., *Poa secunda*, and various forb species including *Phlox* spp. and *Draba* spp. The substrate is alluvium derived from limestone (USDA-NRCS 2010).

Leslie Butte

Leslie Butte was surveyed on 7 June and 16 July 2010. The focus of both survey periods was *Pediocactus simpsonii*, *Astragalus amnis-amissi*, and *Astragalus aquilonius*. Leslie Butte is located near the Big Lost River between Arco and Mackay. This area is an *Artemisia tridentata*/A. *arbuscula*/bunchgrass plant community with *Cercocarpus ledifolius* interspersed among the numerous limestone outcrops. A two-track road bisects the surveyed portion of the butte.

Flower Garden

Flower Garden (also labeled Flower Canyon on some maps) was surveyed on 13 July 2010. I was particularly looking for *Silene scaposa* var. *lobata* and *Astragalus amnis-amissi* at this site. This area is dominated by *Artemisia tridentata*, *Purshia tridentata* (antelope bitterbrush), *Chrysothamnus viscidiflorus* (green rabbitbrush), *C. nauseosus* (rubber rabbitbrush), and *Poa secunda*. The creek bed has a dense cover of shrubs including *Purshia tridentata*, *Potentilla fruticosa* (shrubby cinquefoil), and *Artemisia tridentata*. The eastern side of the canyon also has *Populus tremuloides* (quaking aspen) stands. Both the eastern and western aspects are invaded by *Bromus tectorum*. Parent materials for the soils in this area are a mixture of loess and alluvium and colluviums derived from volcanic materials (USDA-NRCS 2010).

Mountain Spring in Corral Canyon

This riparian area was surveyed on 13 July 2010 for *Epilobium palustre*, *Astragalus leptaleus*, and *Salix farriae*. The vegetation is dominated by *Salix* spp. (willow), *Artemisia tridentata*, *Iris missouriensis* (western iris), and *Leymus cinereus*. *Mimulus guttatus* (seep monkeyflower), *Potentilla fruticosa*, and *Epilobium* sp. (willowherb) are also common.

Waddoups Canyon Road

Waddoups Canyon Road (also labeled Waddups Canyon on some maps) was used to access Mountain Spring on 13 July 2010. This area is a sagebrush steppe plant community. Parent materials are a mixture of alluvium and colluvium derived from limestone and volcanic materials (USDA-NRCS 2010).

Berry Canyon

On 15 July 2010, this survey began on the eastern/southeastern-facing slopes near the mouth of Berry Canyon close to a water tank. Survey at this location was focused on *Silene scaposa* var. *lobata*. Vegetation is dominated by *Artemisia tridentata* and *Pseudoroegneria spicata* with a variety of shrubs, bunchgrasses and forbs present

throughout the area. *Bromus tectorum* and the noxious weed *Euphorbia esula* (leafy spurge) are present. Parent materials are alluvium and colluvium derived from limestone (USDA-NRCS 2010).

Rocky Canyon

This canyon was surveyed on 8 June and 15 July 2010. In June, I surveyed approximately 1.6 km (1 mile) up the canyon along the base of limestone cliffs on the north-facing slopes of the canyon. The focus of this survey was *Camissonia pterosperma*, *Phacelia inconspicua*, *Astragalus amnis-amissi*, *A. aquilonius*, and *Silene scaposa* var. *lobata*. In July, the northern-facing slope near the mouth of the canyon was surveyed for *Silene scaposa* var. *lobata*. These slopes are dominated by *Artemisia tridentata*, *Festuca idahoensis* (Idaho fescue), and *Pseudoroegneria spicata*. *Cercocarpus ledifolius* increases on the upper slopes. Parent materials are derived from limestone (USDA-NRCS 2010).

Brier Canyon

Brier Canyon (also labeled Brief Canyon on some maps) was visited on 7 June 2010. This canyon was surveyed briefly, as thunderstorms cut the survey time short. The focus of this survey was primarily *Camissonia pterosperma*, *Phacelia inconspicua*, *Astragalus amnis-amissi*, and *A. aquilonius*. This canyon has an old dam located near the mouth and a sheer cliff wall located on the western side of the canyon. This survey was conducted on the northwestern aspects (east side of the canyon). The plant community is dominated by *Artemisia tridentata*, *Chrysomthamnus viscidiflorus*, *Cercocarpus ledifolius*, *Pseudoroegneria spicata*, and *Poa secunda*. The wash in the bottom of the canyon was dry in June. The soil is derived from limestone and there are many limestone outcrops and cliffs throughout the canyon (USDA-NRCS 2010).

Trail Creek & Hammond Canyon

Trail Creek and areas of Hammond Canyon were surveyed from the road on 9 June 2010. Stops were made periodically at locations that appeared to have promising habitat for *Oxytropis besseyi* var. *salmonensis*, *Phacelia inconspicua*, and *Camissonia pterosperma*. This canyon was moderately grazed and is dominated by *Artemisia tridentata*, *Purshia tridentata*, and bunchgrasses. There are also several drainages with *Populus tremuloides* stands. The soils are primarily derived from volcanic materials (USDA-NRCS 2010).

Arco Peak

Arco Peak was surveyed on 7 June 2010 for *Camissonia pterosperma*, *Phacelia inconspicua*, *Astragalus amnis-amissi*, and *A. aquilonius*. This area is a sagebrush/bunchgrass plant community with *Juniperus scopulorum* along the ridges and rocky cliff areas. *Poa secunda* and *Pseudoroegneria spicata* are the dominant bunchgrasses interspersed amongst *Artemisia tridentata*, *A. arbuscula* (low sagebrush) and *Atriplex confertifolia* (shadscale saltbush). Many native forbs are also present. The substrate is loose, gravelly limestone with limestone cliffs and outcrops (USDA-NRCS 2010).

Ella Mine

The area adjacent to an old mine and near Champagne Creek was surveyed for *Pyrrocoma insecticruris* and *Oxytropis besseyi* var. *salmonensis* on 12 July 2010. *Artemisia tridentata* and bunchgrasses dominate the open gravelly area near the mine. *Poa secunda*, *Elymus elymoides* (bottlebrush squirreltail), and *Pseudoroegneria spicata* were present. *Leymus cinereus* increases down slope and towards the dry creek bed. The soils are derived from volcanic materials (USDA-NRCS 2010).

Deadman Canyon

This survey was conducted on 7 June 2010 in order to relocate a known site of *Camissonia pterosperma*. This population was not relocated, though the survey was brief due to heavy rains and poor road conditions. This area is a sagebrush/bunchgrass plant community with *Juniperus scopulorum*, *Artemisia tridentata*, *A. arbuscula*, *Chrysothamnus nauseosus*, and *Poa secunda*. A variety of native forbs are present as well. The soils are alluvium derived from limestone (USDA-NRCS 2010).

Upper Fish Creek

Given the close proximity of a known location of *Pyrrocoma insecticruris*, this was the focus of the Upper Fish Creek survey. Access to the Upper Fish Creek site was through Forest Service roads and land and was surveyed on 16 July 2010. The area surveyed is a mixture of sagebrush hillsides, open mountain meadows and forested areas. The hillsides are dominated by *Artemisia tridentata*, *Symphoricarpos oreophilus*, bunchgrasses, *Eriogonum* spp. (buckwheat), *Phlox* spp., and scattered *Pseudotsuga menziesii*. The mountain meadows are dominated by *Carex* spp. (sedge) and *Festuca idahoensis* with *Koeleria macrantha* (prairie junegrass), and *Eriogonum* spp. Parent materials for the soils in this area are a mix of alluvium, colluvium, and eolian deposits from volcanic materials, sandstone, siltstone, conglomerate, and/or metamorphic sources (USDA-NRCS 2010).

Little Cottonwood Springs

After obtaining permission from Craters of the Moon National Monument personnel, the road along Little Cottonwood Springs was used to access the Blizzard Basin area. This road was accessed on 14 July 2010 past the Craters of the Moon group campground, which is near Sunset Cone. My colleague and I were attempting to survey Blizzard Basin; however, in a full day of hiking we only made it to the South Lava Creek drainage, therefore, South Lava Creek was surveyed instead of Blizzard Basin. At the end of Little Cottonwood Springs Road, we headed west over the saddle and into the South Lava Creek drainage. The route to South Lava Creek after leaving the Little Cottonwood Springs riparian zone is dominated by *Artemisia tridentata*, *Pseudoroegneria spicata*, *Lupinus laxiflorus* var. *calcaratus* (spurred lupine), and *Balsamorhiza sagittata* (arrowleaf balsamroot). *Symphoricarpos oreophilus*, *Purshia tridentata*, *Astragalus* spp. (milkvetch), and scattered *Leymus cinereus* are also common. Soils in this area are derived from colluvium and eolian deposits from volcanic, metamorphic, sandstone, and/or siltstone sources (USDA-NRCS 2010).

South Lava Creek

South Lava Creek was accessed from the south via Little Cottonwood Springs on 14 July 2010. The focus of this survey was *Astragalus amnis-amissi*, *A. aquilonius*, and *Oxytropis besseyi* var. *salmonensis*. The saddle on the southeastern portion of South Lava Creek is sparsely vegetated with *Poa secunda* and *Astragalus* sp. The hillslope vegetation on the northern aspects is dominated by *Festuca idahoensis* and *Poa secunda*. *Leucopoa kingii* (spike fescue), *Castilleja* sp. (paintbrush), and *Sedum* sp. (stonecrop) are also common. Rocky areas are dominated by *Poa secunda*, *Oryzopsis hymenoides* (Indian ricegrass), *Elymus elymoides*, *Astragalus* sp., *Phlox* sp., and *Artemisia arbuscula*. The southern slopes are dominated by *Artemisia tridentata*, with the draws supporting *Populus tremuloides* stands. Close to the *Populus tremuloides* stands, *Prunus virginiana* (chokecherry), *Symphoricarpos oreophilus*, and *Festuca idahoensis* are common. A few old prospect pits were found on the survey route. Soils in this area are derived from colluvium and eolian deposits from volcanic, metamorphic, sandstone, and/or siltstone sources (USDA-NRCS 2010).

Sunset Cone

Sunset Cone is located on Craters of the Moon National Monument land and was visited on 9 June 2010 to relocate a known *Phacelia inconspicua* population (EO 5). This area is dominated by *Artemisia tridentata*, *Prunus virginiana*, *Pseudoroegneria spicata*, and *Leymus cinereus*. There is a *Populus tremuloides* stand adjacent to the *Phacelia inconspicua* site. Soils in this area are primarily derived from volcanic materials (USDA-NRCS 2010).

METHODS

Prior to field surveys, it was determined that myself and another Idaho Natural Heritage Program botanist would conduct this survey during 1 week in early June and 1 week in mid-July in order to maximize the number of rare species flowering. Initially, areas of interest were located on BLM maps, and priority sites, site access, and species of interest were determined by BLM botanist Wendy Velman. In the late winter and early spring I reviewed existing EO locations and recorded specimen label data at the University of Idaho Stillinger Herbarium for the primary species of interest. I noted location, associated species, and flowering time from the labels. The specimens were also photographed. A photo guide for these priority species was made to assist with field identification of these species (Appendix 1). The photo guide also included identifying characteristics, habitat, and flowering time.

The first survey was conducted from 6-9 June 2010. Some June sites were inaccessible due to poor road conditions from seasonal rains. Based on flowering periods and location of surveys, the species of focus during this time period were *Astragalus amnis-amissi*, *A. aquilonius*, *A. leptaleus*, *Camissonia pterosperma*, *Ipomopsis polycladon*, *Oxytropis besseyi* var. *salmonensis*, *Pediocactus simpsonii*, and *Phacelia inconspicua*.

The second survey was conducted from 12-16 July 2010. Species of focus for this time period were also determined by flowering period and survey locations. These species

were *Astragalus amnis-amissi*, *A. aquilonius*, *A. leptaleus*, *Epilobium palustre*, *Oxytropis besseyi* var. *salmonensis*, *Pyrrocoma insecticruris*, *Salix farriae*, and *Silene scaposa* var. *lobata*. Of the eighteen sites visited, only two sites, Leslie Butte and Rocky Canyon, were visited in both June and July.

For each site visited, dominant species were noted, survey routes were tracked with Garmin GPS units to approximately ± 4 m accuracy, and photos were taken to record general site and plant community information. Photos were taken of the habitat and of individual plants to highlight the phenology and identifying characteristics (Appendix 2). TrackLogs were also used to map some survey routes. All rare plant subpopulations were documented by taking GPS points with the GPS unit held directly over the plant of interest. This was a preliminary survey with multiple sites and species to survey. Therefore, the GPS points do not necessarily represent the full extent of the populations. GPS points were converted to shapefiles and mapped using ArcGIS (Appendix 3). Site features such as terrain, associated species, disturbances and threats were noted. Numbers of individuals were estimated, as well. Noxious weeds and other threats were also documented.

Plant collections were made for some unknown plants and for rare plants with populations vigorous enough to allow for a collection. The rare plant collections will be deposited with the BLM Upper Snake Field Office and/or the Idaho Natural Heritage Program Herbarium.

Two existing Element Occurrences (EOs) were relocated and updated (EOs are used in Natural Heritage Program methodology to map separate populations of a species). These were the Lower Cedar Creek *Astragalus amnis-amissi* site (EO 8) and the North of Sunset Cone *Phacelia inconspicua* site (EO 5). Relocation of these sites was beneficial to determine phenology of the plants and to refine search images for the plants and habitat.

An Idaho Natural Heritage Program Rare Plant Observation Form was filled out for each population located or relocated (Appendix 4). Any population or occurrence separated by >1 km (0.62 mi) was considered distinct. Subpopulations were defined as a discrete group of plants separated from another group by at least 15 m (50 ft).

RESULTS

During this survey I found 1 new population of *Astragalus amnis-amissi* at Berry Canyon, 1 new *Pediocactus simpsonii* population at Leslie Butte, and 3 new populations of *Silene scaposa* var. *lobata* at Flower Garden, Berry Canyon, and Rocky Canyon. One new population of *Pyrrocoma insecticruris*, was found in both Butte and Blaine Counties in Upper Fish Creek (Figure 2). This is the first known *P. insecticruris* record for Butte County and BLM Upper Snake Field Office. I relocated the population of *Astragalus amnis-amissi* at Lower Cedar Creek Canyon (EO 8) and the *Phacelia inconspicua* population at North of Sunset Cone (EO 5). The noxious weeds *Cirsium arvense* (Canada thistle), *Euphorbia esula* (leafy spurge), and *Hieracium aurantiacum* (orange

hawkweed) were found in several locations, as well (Figure 3). The invasive annual grass *Bromus tectorum* was found in many locations surveyed. Other invasive non-natives found are noted below.

Results are presented below by location and then expanded on by species in the discussion section.

Lower Cedar Creek Canyon

On 8 June 2010 *Astragalus amnis-amissi* was relocated in Lower Cedar Creek Canyon on Challis National Forest land (EO 8) (Figure 4). I counted 10-20 individual plants in this population, and of these, approximately 50% were flowering/fruiting (Figure 5 & 6). This plant was found growing at the base of limestone cliffs, in limestone talus within 1 m of the cliff base, and from cracks in the cliffs on eastern to southeastern aspects at 2300-2375 m (7545-7791 ft) elevation (Table 1). This population was associated primarily with *Artemisia arbuscula*, *Cercocarpus ledifolius*, and *Juniperus scopulorum* (Table 2). The limestone talus was sparsely vegetated, and *A. amnis-amissi* growing out of the limestone crevices were the only species to inhabit those sites. *Bromus tectorum* and livestock feces and livestock trails were located near these subpopulations. Due to the steep canyon walls in Cedar Creek Canyon several GPS points “bounced” to unsurveyed locations. These points were deleted. Therefore, the Lower Cedar Creek Canyon map (Figure 4) shows 2 waypoints which reflect the general vicinity of the *A. amnis-amissi* subpopulations.

Little Cedar Creek Road

During the 8 June 2010 survey (Figure 7) a cactus was located and initially recorded as *Coryphantha* sp. It is now clear that this cactus was *Pediocactus simpsonii*, therefore this site should be re-surveyed in the future. A stand of *Cercocarpus ledifolius* in an old channel of Cedar Creek was also documented here (Figure 8). This is apparently the lowest elevation occurrence of *C. ledifolius* in the region. Irrigation ditches, canals, roads, livestock and wildlife trails are all common disturbances in this area.

Mahogany Canyon

On 8 June 2010 a cactus initially recorded as *Coryphantha* sp. was located (Figure 9). This site should be re-surveyed in the future as it is now clear that this cactus was *Pediocactus simpsonii*. No weed invasions were noted.

Leslie Butte

Several cacti were documented on 7 June 2010, but it was unclear whether these cacti were *Pediocactus simpsonii* or *Coryphantha* sp. (Figure 10). On 16 July 2010 the site was revisited and 2 specimens were collected. These specimens were confirmed as *P. simpsonii* after consulting University of Idaho Stillinger Herbarium records and Flora of North America. *P. simpsonii* was not flowering during both survey times. Six subpopulations of *P. simpsonii* were located on Leslie Butte in June and July (Figure 11 & 12). Within these subpopulations approximately 9 individuals were documented. These were all found on sparsely vegetated gravelly limestone on lower to mid-slopes between 1780-1853 m (5840-6080 ft) elevation (Table 1). Aspects ranged from northern to western. All subpopulations were associated with *Artemisia tridentata*, *Poa secunda*,

and *Pseudoroegneria spicata*. *Chrysothamnus nauseosus*, *Oryzopsis hymenoides*, and *Opuntia polyacantha* (plains pricklypear) were present at all but 1 of the subpopulations (Table 3).

The southern aspect of the surveyed portion of Leslie Butte is invaded by *Bromus tectorum* and *Verbascum thapsus* (common mullein). Potential threats to *Pediocactus simpsonii* are primarily weed invasion and a two-track trail that bisects the butte. Cactus collectors may also be a threat, though no direct evidence of collecting was seen. I surveyed a small portion of the northwestern section of Leslie Butte. The un-surveyed portion should be surveyed for *P. simpsonii*, *Astragalus amnis-amissi* and *Silene scaposa* var. *lobata* due to the presence of potential habitat for these species.

Flower Garden

On 13 July 2010 I surveyed the eastern and western sides of this canyon as well as the creek bed (Figure 13). A small flowering population of *Silene scaposa* var. *lobata* (approximately 5 individuals) was located at 2109 m elevation on the upper slope of the western side of the canyon, which is an east-northeast aspect (Table 1 and Figure 14 & 15). This population was associated with *Artemisia tridentata*, *Purshia tridentata*, *Chrysothamnus viscidiflorus*, *Poa secunda*, and *Elymus elymoides* (Table 6). Both the eastern and western sides of the canyon were invaded by *Bromus tectorum*. Livestock grazing was noted in the surveyed portion of the canyon as evidenced by livestock trails and livestock feces. Several of the *Silene* stems were browsed (Figure 16).

Mountain Spring in Corral Canyon

This riparian area was surveyed on 13 July 2010 and no sensitive species were located (Figure 17). Mountain Spring appeared to be moderately to heavily impacted by livestock as evidenced by trampling, livestock feces, and short stubble height throughout the riparian zone (Figure 18). The noxious weed *Cirsium arvense* was located here, as well.

Waddoups Canyon Road

On 13 July 2010 small patches of *Euphorbia esula* were located in several locations along this road which was used to access Mountain Spring (Figure 19). Points were taken at these locations. No rare plant surveys were conducted due to a lack of time.

Berry Canyon

On 15 July 2010 a new population of *Astragalus amnis-amissi* was located in the northeastern portion of the Berry Canyon survey area (Figure 20). Five subpopulations with a total of approximately 20-30 individuals were found, and of these approximately 75% were flowering/fruiting (Figure 21). There are likely many more subpopulations within Berry Canyon, but I could not survey all possible sites due to time constraints. These plants were all associated with limestone outcrops, lower to mid-slope positions, east-southeastern to southern aspects, and around 1951-1999 m (6400-6558 ft) elevation (Table 1). The majority of the sites were also associated with *Artemisia tridentata* and *Pseudoroegneria spicata* (Table 2 and Figure 22). These populations were sparsely vegetated. *Bromus tectorum* was found at all subpopulations.

Farther up the canyon near the western extent of the survey, a new population of *Silene scaposa* var. *lobata* was located (Figure 20). Two subpopulations were found with approximately 30 individuals combined, most of which were flowering (Figure 23). This population was on northern aspects and mid-slope at 2067 m (6781 ft) elevation (Table 1). Associated species included *Festuca idahoensis*, *Artemisia tridentata*, and *Pseudoroegneria spicata* (Table 6 & Figure 24).

Bromus tectorum was dominant in some areas of Berry Canyon and prevalent at all *Astragalus amnis-amissi* sites (Figure 25). The noxious weed *Euphorbia esula* was present along the road in the canyon bottom and was moving up into the hills in some places. At one point *Euphorbia esula* was located within 1 m of a *Silene scaposa* var. *lobata* subpopulation. It was encroaching on potential *Astragalus amnis-amissi* habitat in some areas (Figure 26). Points were taken throughout the survey route where this noxious weed was encountered, but other outbreaks were likely present beyond the area surveyed. This area appeared to be moderately impacted by cattle as evidenced by extensive livestock trailing and terracing and livestock feces (Figure 27).

Rocky Canyon

During the 8 June 2010 survey of this area, no new rare plant records were produced. I primarily surveyed the lower to mid-slopes on the northern aspects of this canyon (Figure 28). The southern aspects should be surveyed for *Astragalus amnis-amissi* as there are multiple limestone cliffs and outcrops that could provide potential habitat.

On 15 July 2010 *Silene scaposa* var. *lobata* was found near the mouth of Rocky Canyon (Figure 28). Five subpopulations were found and approximately 90 individual plants were counted; most of which were flowering (Figure 29). This population was found on lower to mid-slopes on northerly aspects at 1768 m (5800 ft) elevation, and in gravelly limestone soils (Table 1). Associated species were dominated by *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Poa secunda*, *Pseudoroegneria spicata*, *Koeleria macrantha*, and *Astragalus* spp. (Table 6). Threats to this population include *Bromus tectorum* and *Euphorbia esula* invasion. *Euphorbia esula* was found close to 1 of the subpopulations. Also, the flat area just below this population was planted with *Agropyron cristatum* (crested wheatgrass).

Brier Canyon

On 7 June 2010 no sensitive plant species were located (Figure 30). Further survey of this canyon could be beneficial as the base of the limestone cliffs could potentially support *Astragalus amnis-amissi* populations. No invasive plant problems were noted.

Trail Creek & Hammond Canyon

No sensitive species were located here during the 9 June 2010 survey (Figure 31).

Arco Peak

No sensitive plant species were located on 7 June 2010 (Figure 32). A more extensive survey later in the summer is warranted as this is a promising location to find *Silene scaposa* var. *lobata*. A large patch of *Sisymbrium altissimum* (tumblemustard) was noted near the survey route.

Ella Mine

No sensitive plant species were located in the area surveyed on 12 July 2010 (Figure 33). I was primarily looking for *Pyrrocoma insecticruris* based on a potential sighting in the Ella Mine vicinity. I did find *Helianthella uniflora* (little sunflower), which is potentially a look-a-like species prior to flowering.

Deadman Canyon

No sensitive species were located during the 7 June 2010 survey (Figure 34).

Upper Fish Creek

On 16 July 2010 a single population made up of 3 subpopulations of *Pyrrocoma insecticruris* was located on the Blaine/Butte county line and near the boundary of the Upper Snake and Shoshone field offices (Figure 35 & 36 & 40). Population numbers were estimated at 200-350 individuals. This is a rough estimate as the plants were abundant and not yet flowering, which made counting difficult (Figure 37). It appeared that at least 50% of these individuals would flower shortly. This population was found on a northerly aspect (0°) at mid-slope around 2377 m (7798 ft) elevation (Table 1). It occupied a nearly level area that appeared to hold more moisture than the surrounding slopes. The mountain meadows where this population was found were dominated by *Carex* spp. and *Festuca idahoensis* (Figure 38). *Koeleria macrantha*, *Eriogonum* spp., *Geum triflorum*, *Achillea millefolium*, *Senecio* sp., and *Crepis atriobarba* (slender hawksbeard) were also present (Table 5). Mountain meadows south of these initial findings were surveyed and appeared to be good habitat for *P. insecticruris* but no more populations were located. The noxious weed *Hieracium aurantiacum* was located close to the *Pyrrocoma* population. An old two-track road that goes through the Butte County portion of the population and livestock activity (Figure 39) are potential threats.

Little Cottonwood Springs

No sensitive species were located en route to South Lava Creek during the 14 July 2010 survey (Figure 41).

South Lava Creek

No sensitive species were located during the 14 July 2010 survey (Figure 41), however, it was noted that this area could potentially harbor *Phacelia inconspicua* due to similar habitat and the proximity of the *P. inconspicua* site near Sunset Cone. Mid-July was likely too late to be an effective time to survey for this small annual. Grazing activity was noted in riparian areas.

Sunset Cone

On 9 June 2010 *Phacelia inconspicua* was relocated to update the existing EO and determine phenology (Figure 42). The plant was flowering, which made it easier to locate this small annual forb (Figure 43). Due to time limitations, no counts were made. Most of the plants located were in openings created by a wildlife trail on a northeastern slope around 1707 m (5600 ft) elevation (Table 1). The vegetation was dominated by *Prunus virginiana*, *Artemisia tridentata*, *Leymus cinereus*, and *Symphoricarpos oreophilus* (Table 4 and Figure 43). A moderate amount of *Bromus tectorum* and *Alyssum alyssoides*

(yellow alyssum) were also found. Cattle, elk, and pocket gopher disturbances were noted in this population.

DISCUSSION

Astragalus amnis-amissi was relocated in Lower Cedar Creek Canyon (EO 8) and a new population was discovered in Berry Canyon (Figure 2). The Lower Cedar Creek population was first discovered in June 1979, but little information was reported. Our updates provide associated species, aspect, and slope position data for this EO. The Berry Canyon survey covered a small portion of the slope and produced 5 subpopulations of *A. amnis-amissi* (Figure 20). There is significant amount of unsurveyed habitat in Berry Canyon that has potential to extend the *A. amnis-amissi* population at this site. In addition, there are many other sites on BLM lands within the Big Lost River Drainage that have potential habitat for *A. amnis-amissi*. The most obvious potential threat to these populations is weed invasion. *Bromus tectorum* and *Euphorbia esula* were the 2 invasive species encountered with *A. amnis-amissi*. *A. amnis-amissi* populations at the base of limestone cliffs in talus are potentially vulnerable to weed invasion. In Berry Canyon I encountered several sites where *Bromus tectorum* or *Euphorbia esula* dominated sites such as these (Figure 25 & 26).

According to NatureServe *Astragalus amnis-amissi* was known from 13 locations prior to this survey. Existing EOs support that this plant is found at the base of or near limestone cliffs between 1600-2500 m (5250-8200 ft) elevation. After reviewing the information from existing EOs and adding this new data, it appears that *A. amnis-amissi* has been found on most aspects including south, southeast, southwest, east, northeast, north, and west slopes. Therefore, I suggest that limestone outcrops and cliffs on all aspects at this elevation range be surveyed to gain a better population estimate for this rare plant.

Pediocactus simpsonii was documented at 1 new site, Leslie Butte, during this survey (Figure 10). Six subpopulations were documented at this location. All subpopulations were associated with *Artemisia tridentata*, *Poa secunda*, and *Pseudoroegneria spicata* (Table 2). This population was found on gravelly limestone, north to southwest aspects, around 1800 m (5905 ft) elevation, and on lower to mid-slopes (Table 1). *P. simpsonii* was also noted at Little Cedar Creek Road and Mahogany Canyon during June surveys, but little information was collected due to uncertainty over identification.

Currently this cactus has 41 EOs listed. However, due to mistaken identifications in the past, there is potential for there to be many more. Returning to these and other similar sites earlier in the spring when the cacti are in bloom is suggested before making final decisions on the status of this species. Flowering is not necessary for identification of these cacti but will make them easier to locate.

There are 6 known EOs for *Phacelia inconspicua* in Idaho and EO 5, North of Sunset Cone was revisited (Figure 42). This site visit was primarily to refine search images and determine phenology. While this population is not located on BLM land, it is in close proximity to BLM Upper Snake Field Office land, and many sites were noted across the

study area that appeared to support potential habitat. North and east facing slopes with *Prunus virginiana*/*Symphoricarpos oreophilus*/*Leymus cinereus* should be surveyed further. *Bromus tectorum* and *Alyssum alyssoides* were noted in this population. The spread of non-natives like *Bromus tectorum* could potentially threaten this population. This small annual is usually observed in shrub openings suggesting that this plant requires some type of disturbance in order to maintain these populations.

There were 86 known populations of *Pyrrocoma insecticruris* in Idaho prior to this survey. The population found at Upper Fish Creek during this survey is the first confirmed location for *Pyrrocoma insecticruris* in Butte County, as well as the BLM Upper Snake Field Office (Figure 36). A fence bisects this population which was assumed to be the Butte/Blaine County boundary (Figure 40). The population found was located on a north slope in a mountain meadow and associated with *Carex* sp., *Festuca idahoensis*, and *Geum triflorum* (Table 2). Disturbances noted were the presence of the noxious weed *Hieracium aurantiacum* near the population, cattle sign (Figure 39), and a two-track road which goes through the Butte County portion of the population. Future threats include weed invasion, off road vehicle use, and potential effects from cattle grazing. *Hieracium aurantiacum* was present in low quantities, and I recommend controlling small populations before it expands.

Three new populations of *Silene scaposa* var. *lobata* were located in Flower Garden, Berry Canyon, and Rocky Canyon (Figure 2). Prior to this survey there were 21 known locations of this variety in Idaho. These populations were found primarily on northerly aspects in sagebrush/bunchgrass plant communities. *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, and *Poa secunda* were present within all the populations and subpopulations (Table 2). *Pseudoroegneria spicata* was noted in all but 1 subpopulation.

Silene scaposa var. *lobata* occurs on southwest, west, north, and east aspects as well as in moist drainages and dry canyon bottoms. The elevation range is approximately 1700-2500 m (5577-8202 ft) elevation. Weed invasion and impacts from cattle grazing are potential threats. At the Flower Garden site several plants had been browsed (Figure 16), however it is unclear whether this was from domestic animals or wildlife. At the Berry Canyon and Rocky Canyon sites the noxious weed *Euphorbia esula* was found close to *Silene scaposa* var. *lobata* subpopulations (Figure 20 & 28). *Euphorbia esula* is a perennial weed that has been shown to displace native plant communities, threaten rare plants, and reduce wildlife habitat (DiTomaso 2000). Also, infestations of *Euphorbia esula* can reduce the livestock carrying capacity on infested areas (DiTomaso 2000 and Leistriz et al. 1992). It is recommended that the BLM eradicate *Euphorbia esula* in Berry Canyon and Rocky Canyon. The existing populations were not extensive, but could become so if not controlled.

There is much land within the BLM Upper Snake Field Office that could potentially support *Silene scaposa* var. *lobata*. Further exploration and discovery of this plant will help to determine the necessity of continued tracking. There is some question as to the rarity of this variety; a more extensive survey focusing on this plant alone would shed more light on this topic.

Three noxious weeds were found throughout this survey (Figure 3). *Euphorbia esula* was found in Rocky Canyon, Berry Canyon, and Waddoups Canyon Road. It was in close proximity to rare plants at the first 2 sites. *E. esula* populations were all relatively small and isolated at the time of this survey and it is suggested that the BLM eradicate these populations in order to retain the productivity of the areas, and protect the native and rare plant communities and wildlife habitat.

Hieracium aurantiacum is a perennial noxious weed that was found during the Upper Fish Creek Survey. Only a few plants were found and it is recommended that the BLM eradicate this population as it occurs close to a new population of *Pyrrocoma insecticruris* (Figure 17). *Hieracium aurantiacum* is unpalatable and has the propensity to increase rapidly and compete aggressively in pasture and native plant communities (Callihan et. al 1997). Eradicating this small population before it becomes unmanageable would benefit native and rare plant communities, wildlife habitat, and livestock productivity on these rangelands.

Cirsium arvense is a perennial noxious weed that was found in Mountain Spring (Figure 35). *Cirsium arvense* generally infests disturbed areas initially and spreads quickly from creeping rhizomes (Beck 2008). It also reduces forage potential in rangelands. This is a difficult invasive plant to control, however, attempting to eradicate/control is suggested.

A few miscellaneous points were also recorded during this survey. Three instances of sage grouse were recorded at Flower Garden (Figure 44). Also of potential interest is a fence near Lower Antelope Creek Cemetery which, according to our maps, is on public lands, and was painted orange indicating private land (Figure 44). This fence was photographed and GPS points taken (Figure 45).

Given the time constraints on this survey and the array of species and sites to survey within that window of time, this study should be viewed as a cursory survey. Many of these species are also difficult to identify and/or locate unless in flower. So, given the varying phenology of these plants and the large area to be explored, I suggest that more time be given to surveying for these sensitive species throughout the flowering season.

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TABLES

Table 1. Site characteristics for observed rare plant locations and subpopulations.

Species	Location-Subpop	Aspect	Slope Position	Elevation (m)	Substrate	Genets (#)
<i>Astragalus amnis-amissi</i>	Lower Cedar Creek Canyon (EO8)-1	80-145°	mid	2300-2375	limestone talus & crevices	10 to 20
	Berry Canyon-1	135-185°	mid	1951	limestone talus & crevices	5
	Berry Canyon-2	170°	mid	1963	limestone talus & crevices	4
	Berry Canyon-3	170°	lower to mid	1987	limestone talus & crevices	3
	Berry Canyon-4	150°	lower to mid	1975	limestone talus & crevices	4
	Berry Canyon-5	118-130°	lower to mid	1999	limestone talus & crevices	4
<i>Pediocactus simpsonii</i>	Leslie Butte-1	0°	lower	1780	gravelly limestone	1
	Leslie Butte-2	330°	lower	1804	gravelly limestone	1
	Leslie Butte-3	350-10°	lower	1853	gravelly limestone	1
	Leslie Butte-4	270°	lower	1817	gravelly limestone	2
	Leslie Butte-5	270°	lower	1817	gravelly limestone	1
	Leslie Butte-6	220°	lower to mid	1804	gravelly limestone	3
<i>Phacelia inconspicua</i>	Sunset Cone (EO5)-1	40-50°	lower	1707	sandy volcanic soil	no count
<i>Pyrrocoma insecticruris</i>	Upper Fish Creek-1	0°	mid	2377	volcanic soil	100 to 200
	Upper Fish Creek-2	0°	mid	2377	volcanic soil	~50
	Upper Fish Creek-3	0°	mid	2377	volcanic soil	~50 to 100
<i>Silene scaposa</i> var. <i>lobata</i>	Berry Canyon-1	35°	mid	2067	limestone soil	15 to 20
	Berry Canyon-2	45°	mid	2067	limestone soil	8
	Flower Garden-1	60°	upper	2109	volcanic soil	5
	Rocky Canyon-1	350°	lower to mid	1768	gravelly limestone soil	1 to 5
	Rocky Canyon-2	350°	lower to mid	1768	gravelly limestone soil	25 to 30
	Rocky Canyon-3	350°	lower to mid	1768	gravelly limestone soil	30 to 35
	Rocky Canyon-4	350°	lower to mid	1768	gravelly limestone soil	8
	Rocky Canyon-5	350°	lower to mid	1768	gravelly limestone soil	12

Table 2. Associated species for *Astragalus amnis-amissi*.

Associates	N/I*	LCC†-1	BC‡-1	BC-2	BC-3	BC-4	BC-5
<i>Alyssum alyssoides</i>	I			x			
<i>Artemisia arbuscula</i>	N	x					
<i>Artemisia dracunculus</i>	N		x				
<i>Artemisia tridentata</i>	N	x	x	x		x	x
<i>Balsamorhiza sagittata</i>	N						x
<i>Bromus tectorum</i>	I	x		x	x	x	x
<i>Calochortus</i> sp.	N						x
<i>Cercocarpus ledifolius</i>	N	x			x		
<i>Chrysothamnus nauseosus</i>	N		x			x	
<i>Chrysothamnus viscidiflorus</i>	N	x					
<i>Hackelia patens</i>	N						x
<i>Juniperus scopulorum</i>	N	x					
<i>Leptodactylon pungens</i>	N						x
<i>Leymus cinereus</i>	N		x	x			
<i>Mentzelia laevicaulis</i>	N		x	x			
<i>Opuntia polyacantha</i>	N	x					
<i>Oryzopsis hymenoides</i>	N	x			x		
<i>Penstemon</i> sp.	N						x
<i>Petrophytum caespitosum</i>	N	x					
<i>Phlox</i> sp.	N	x					
<i>Pinus flexilis</i>	N	x					
<i>Poa secunda</i>	N	x					x
<i>Pseudoroegneria spicata</i>	N	x	x		x	x	x
<i>Ribes cereum</i>	N	x			x	x	
<i>Rosa</i> sp.	N		x				
<i>Senecio integerrimus</i>	N						x
<i>Sisymbrium altissimum</i>	I		x	x			
<i>Stanleya viridiflora</i>	N				x	x	
<i>Stephanomeria minor</i>	N				x	x	x
<i>Stipa comata</i>	N		x				
<i>Symphoricarpos oreophilus</i>	N		x			x	x
<i>Tragopogon dubius</i>	I		x				

* N/I= Native/Introduced; †LCC=Lower Cedar Creek Canyon, EO8; ‡ BC=Berry Canyon

Table 3. Associated species for *Pediocactus simpsonii*.

Associates	N/I*	LB†-1	LB-2	LB-3	LB-4	LB-5	LB-6
<i>Artemisia arbuscula</i>	N		x	x	x		x
<i>Artemisia tridentata</i>	N	x	x	x	x	x	x
<i>Bromus tectorum</i>	I						x
<i>Cercocarpus ledifolius</i>	N		x				
<i>Chrysothamnus nauseosus</i>	N	x				x	
<i>Leptodactylon pungens</i>	N					x	
<i>Opuntia polyacantha</i>	N	x				x	
<i>Oryzopsis hymenoides</i>	N	x	x	x			x
<i>Phlox</i> sp.	N	x					
<i>Poa secunda</i>	N	x	x			x	x
<i>Pseudoroegneria spicata</i>	N	x			x	x	x
<i>Sedum</i> sp.	N		x				
<i>Stipa comata</i>	N			x			x

* N/I=Native/Introduced; † LB=Leslie Butte

Table 4. Associated species for *Phacelia inconspicua*.

Associates	N/I*	SC†-1
<i>Alyssum alyssoides</i>	I	x
<i>Artemisia tridentata</i>	N	x
<i>Balsamorhiza sagittata</i>	N	x
<i>Bromus tectorum</i>	I	x
<i>Leymus cinereus</i>	N	x
<i>Lithospermum ruderales</i>	N	x
<i>Lomatium triternatum</i>	N	x
<i>Lupinus</i> sp.	N	x
<i>Populus tremuloides</i>	N	x
<i>Prunus virginiana</i>	N	x
<i>Senecio</i> sp.	N	x
<i>Symphoricarpos oreophilus</i>	N	x

* N/I=Native/Introduced; † SC=Sunset Cone, EO5

Table 5. Associated species for *Pyrrocoma insecticruris*.

Associates	N/I*	UFC†-1	UFC-2	UFC-3
<i>Achillea millefolium</i>	N	x	x	x
<i>Agropyron</i> sp.	?			x
<i>Artemisia tridentata</i>	N	x	x	x
<i>Astragalus</i> sp.	N	x		
<i>Carex</i> sp.	N	x	x	x
<i>Crepis atriobarba</i>	N	x		
<i>Eriogonum</i> sp.	N	x		
<i>Festuca idahoensis</i>	N	x	x	x
<i>Geum triflorum</i>	N	x	x	x
<i>Koeleria macrantha</i>	N	x	x	
<i>Lupinus</i> sp.	N	x	x	
<i>Senecio</i> sp.	N		x	

* N/I=Native/Introduced; † UFC=Upper Fish Creek

Table 6. Associated species for *Silene scaposa* var. *lobata*.

Associates	N/I*	BC†-1	BC†-2	FG‡-1	RC¥-1	RC-2	RC-3	RC-4	RC-5
<i>Amelanchier alnifolia</i>	N			x					
<i>Antennaria</i> sp.	N	x			x	x	x		
<i>Artemisia tridentata</i>	N	x	x	x	x	x	x		x
<i>Astragalus</i> sp.	N	x			x	x	x		
<i>Balsamorhiza sagittata</i>	N	x							
<i>Calochortus</i> sp.	N	x			x	x	x		
<i>Castilleja</i> sp.	N	x			x	x	x		
<i>Chrysothamnus viscidiflorus</i>	N	x		x	x	x	x		
<i>Cordylanthus ramosus</i>	N				x	x	x		
<i>Elymus elymoides</i>	N			x					
<i>Erigeron</i> sp.	N	x			x	x	x		
<i>Eriogonum</i> sp.	N	x		x					
<i>Euphorbia esula</i>	I		x					x	x
<i>Festuca idahoensis</i>	N	x	x						
<i>Heuchera</i> sp.	N	x							
<i>Juniperus</i> sp.	N	x						x	x
<i>Koeleria macrantha</i>	N	x			x	x	x		
<i>Lupinus</i> sp.	N	x							
<i>Opuntia polyacantha</i>	N			x					
<i>Petrophytum caespitosum</i>	N	x							
<i>Poa secunda</i>	N	x		x	x	x	x		x
<i>Pseudoroegneria spicata</i>	N	x	x		x	x	x		x
<i>Purshia tridentata</i>	N			x					
<i>Sedum lanceolatum</i>	N	x			x	x	x		
<i>Symphoricarpos oreophilus</i>	N				x	x	x		
<i>Tetradymia canescens</i>	N	x							
<i>Zygadenus venenosus</i>	N	x							

* N/I=Native/Introduced; † BC=Berry Canyon; ‡ FG=Flower Garden; ¥ RC=Rocky Canyon

FIGURES

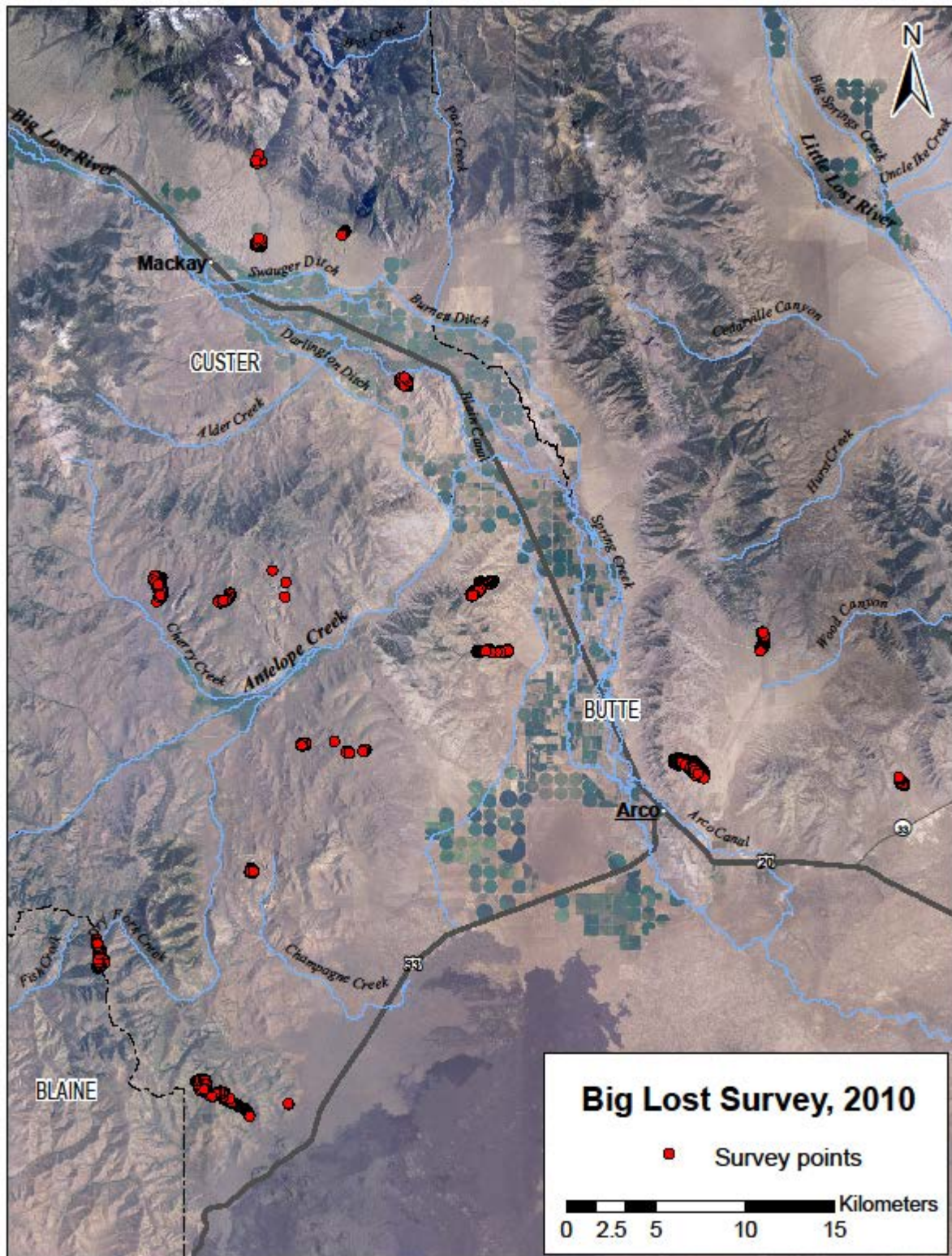


Figure 1. All survey points 2010 survey in the Big Lost River drainage.

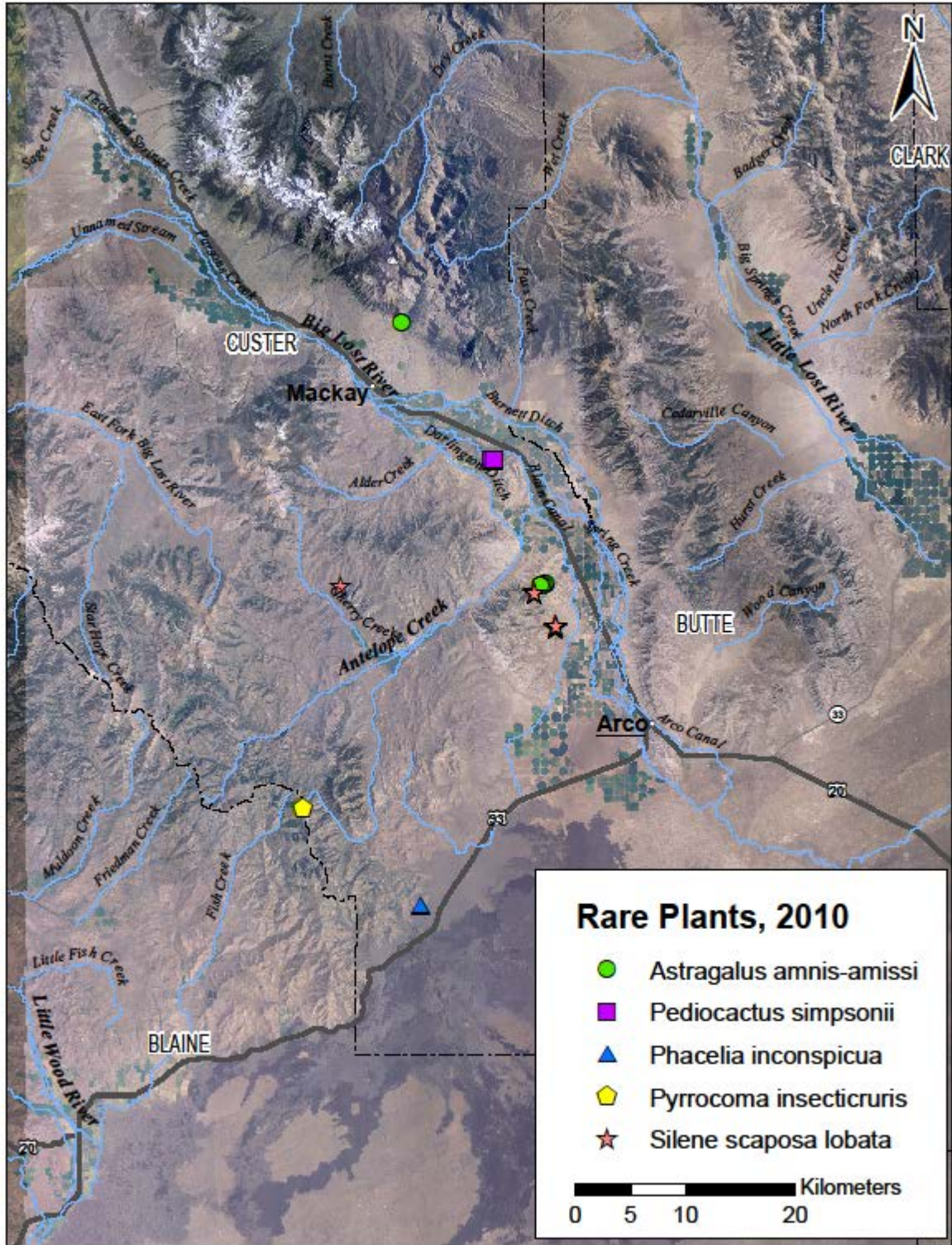


Figure 2. Rare plants map, showing all rare plant populations documented during the 2010 survey in the Big Lost River drainage.

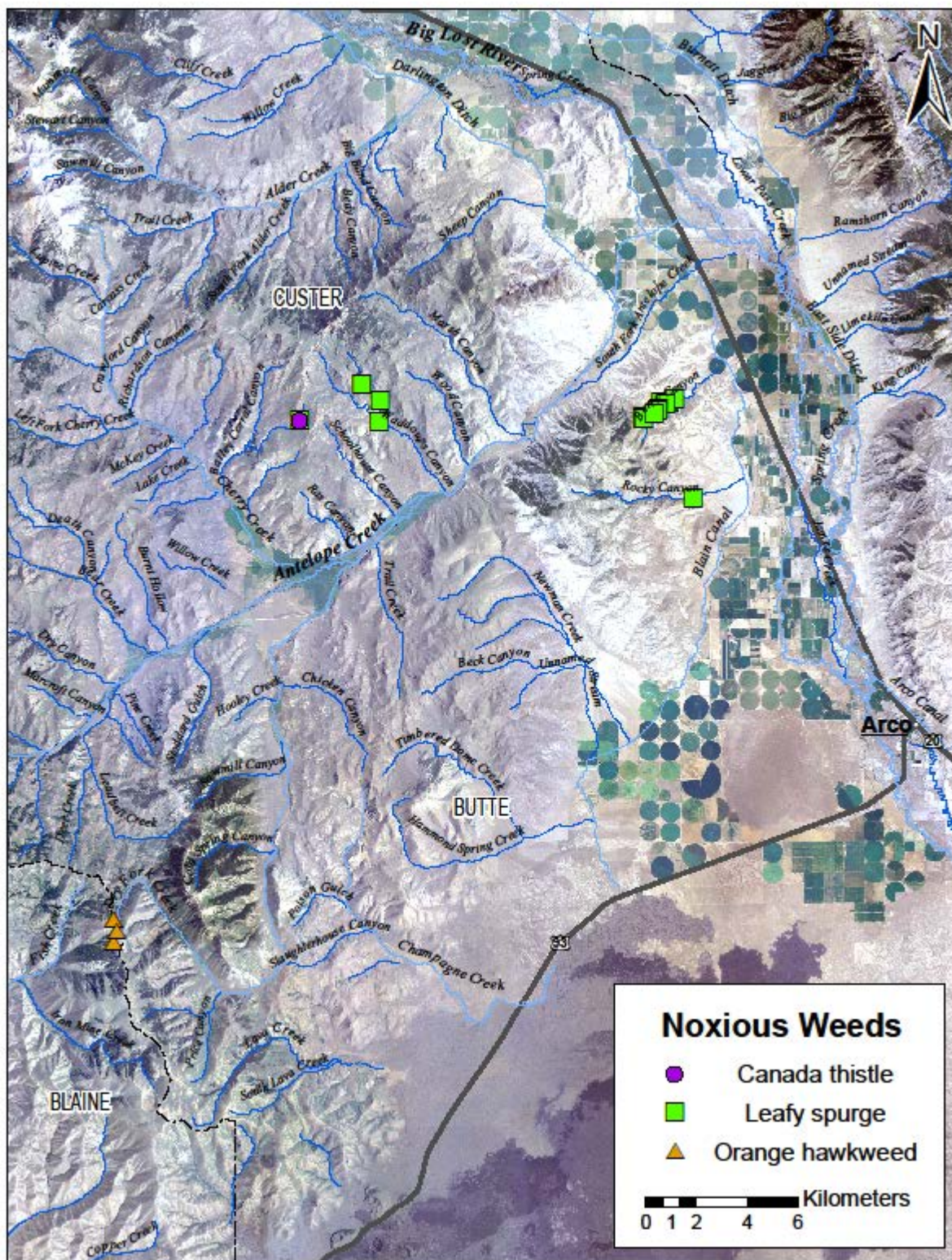


Figure 3. Noxious weeds map, showing all noxious weed populations documented during 2010 survey in the Big Lost River Drainage.

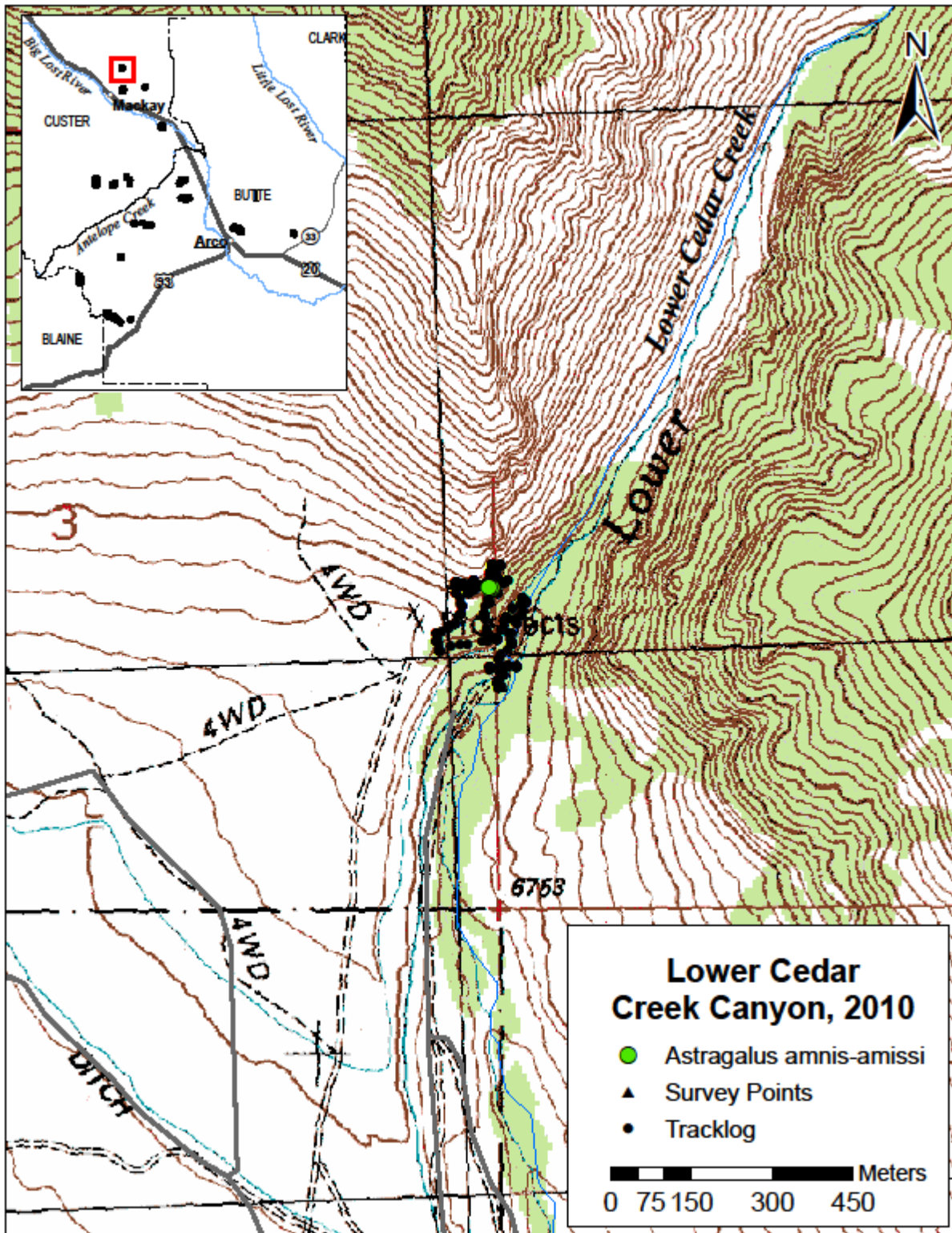


Figure 4. Lower Cedar Creek Canyon survey map, showing relocated *Astragalus amnis-amissi* site (EO 8), survey points, and TrackLogs from 8 June 2010.



Figure 5. *Astragalus amnis-amissi* at Lower Cedar Creek Canyon, growing from base of limestone cliff, 8 June 2010.



Figure 6. *Astragalus amnis-amissi* habitat at Lower Cedar Creek Canyon, 8 June 2010.

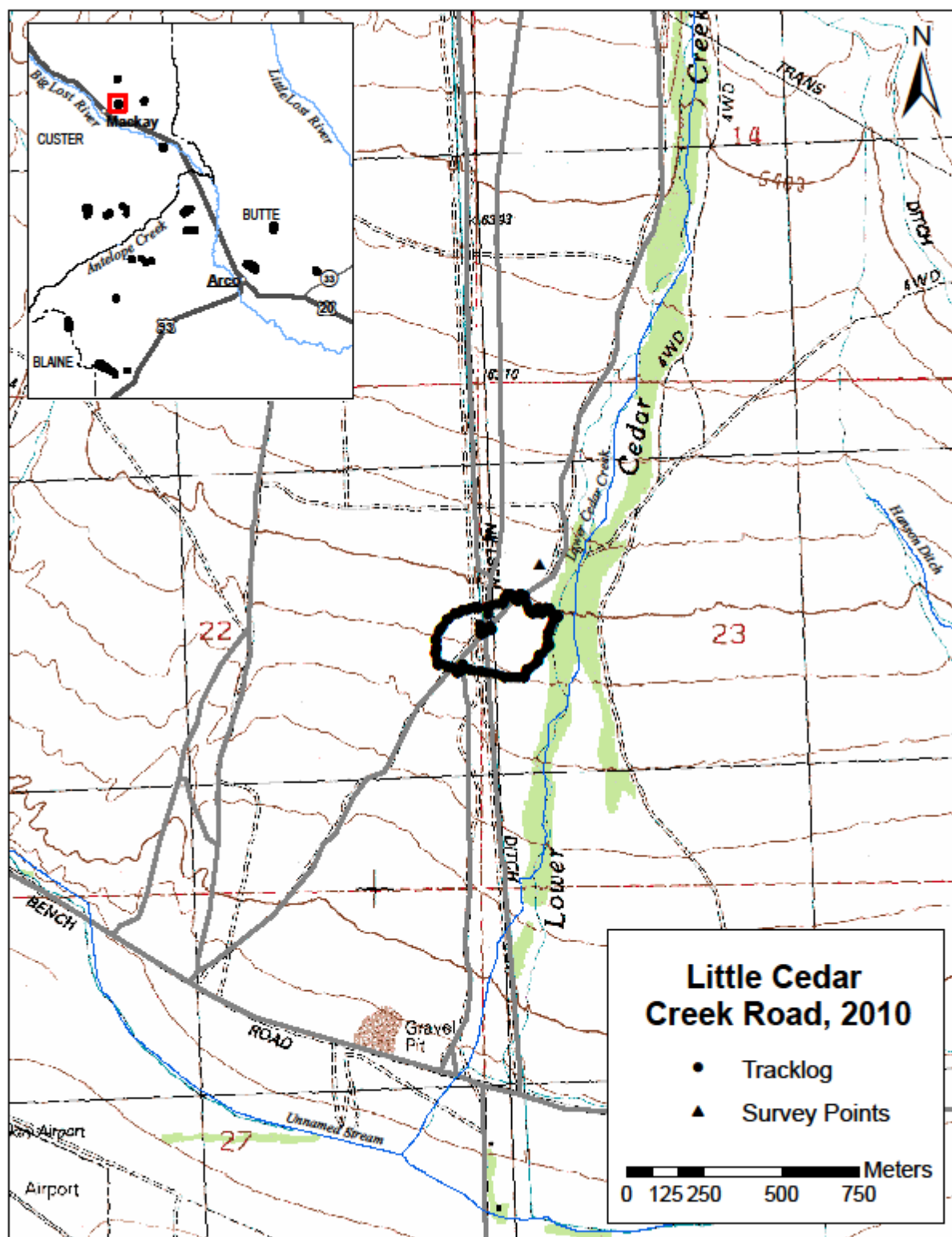


Figure 7. Little Cedar Creek Road survey map, 8 June 2010.



Figure 8. *Cercocarpus ledifolius* stand at 1890 m in old creek channel near Little Cedar Creek road, 8 June 2010.

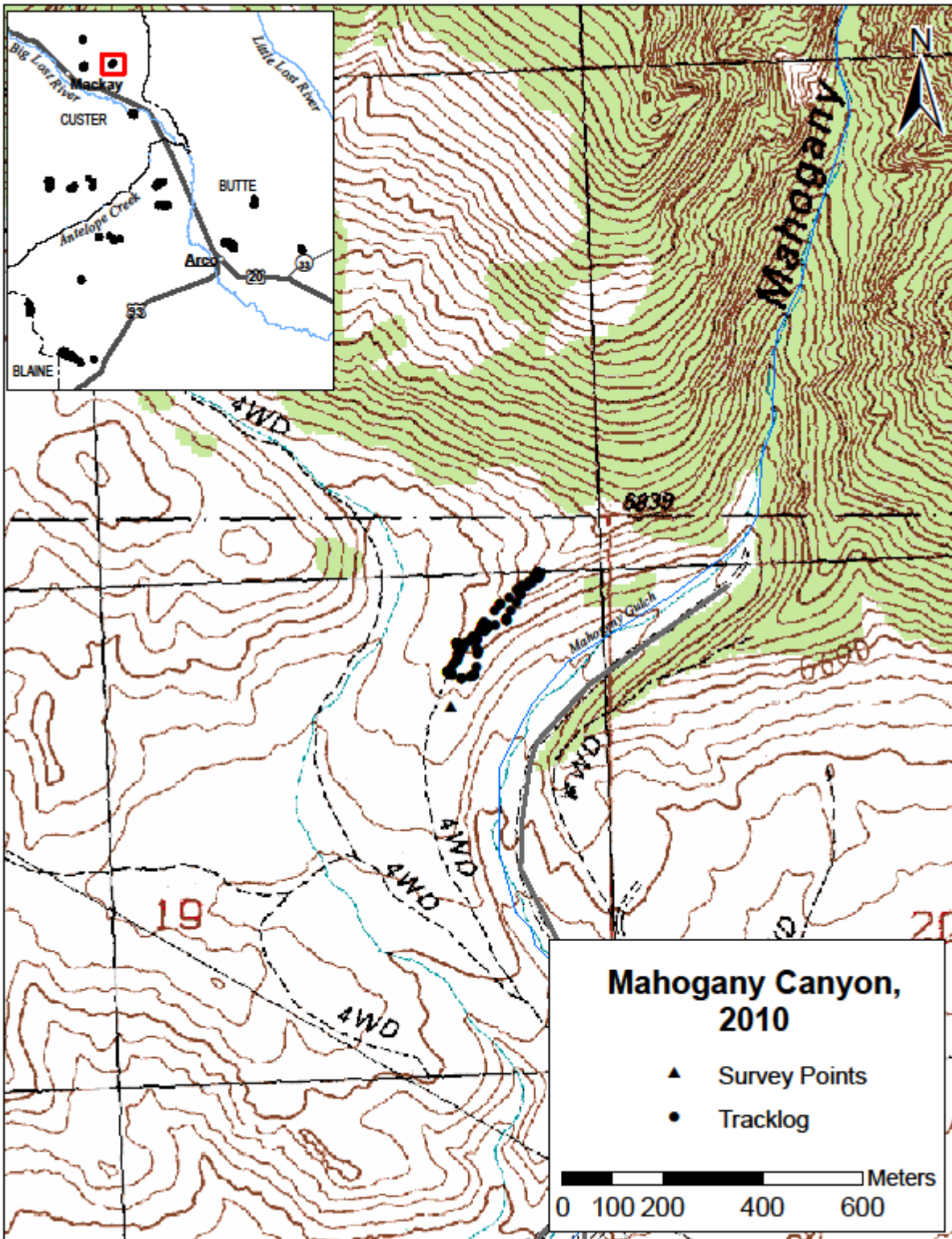


Figure 9. Mahogany Canyon survey map, 8 June 2010.

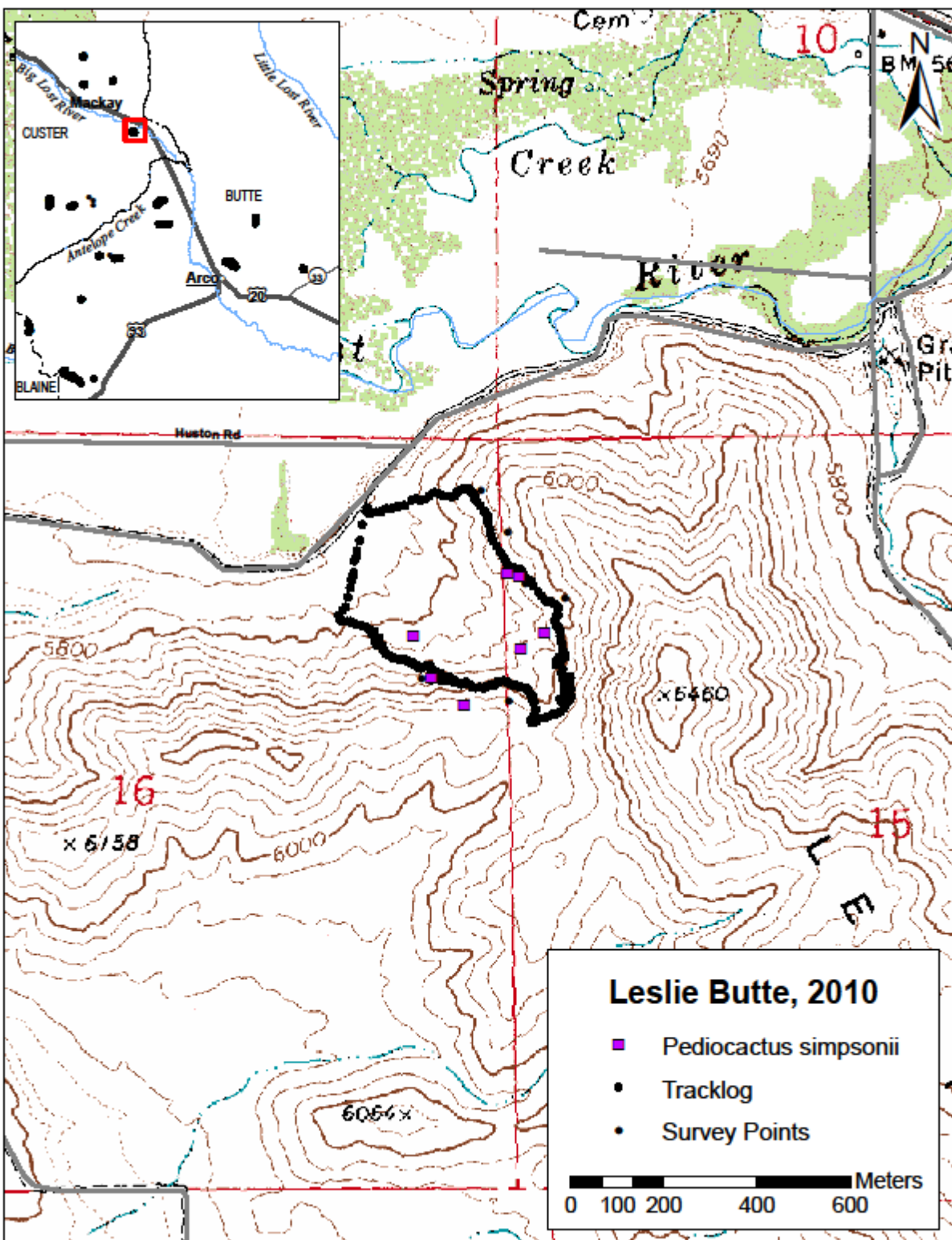


Figure 10. Leslie Butte survey map, including *Pediocactus simpsonii* subpopulation points, Tracklogs, and survey points from 7 June and 16 July 2010.



Figure 11. Leslie Butte habitat near *Pediocactus simpsonii* site, 7 June 2010.



Figure 12. *Pediocactus simpsonii* at Leslie Butte in limestone talus, 7 June 2010.

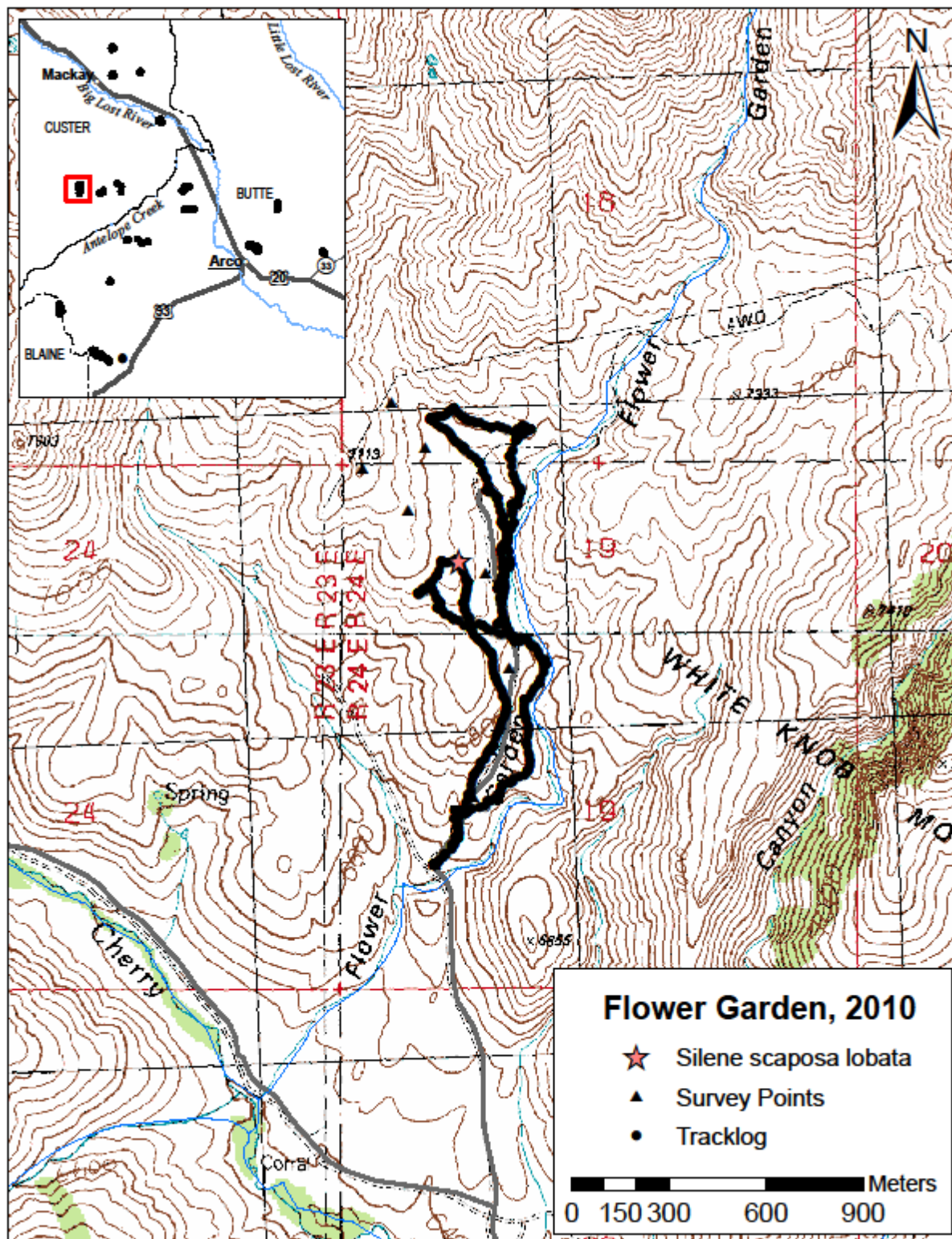


Figure 13. Flower Garden survey map, showing *Silene scaposa* var. *lobata* population location, survey points and Tracklogs, 13 July 2010.



Figure 14. *Silene scaposa* var. *lobata* in Flower Garden, 13 July 2010.



Figure 15. Flower Garden habitat with red flagging marking *Silene scaposa* var. *lobata* location, 13 July 2010.



Figure 16. Browsed *Silene scaposa* var. *lobata* at Flower Garden site, 13 July 2010.

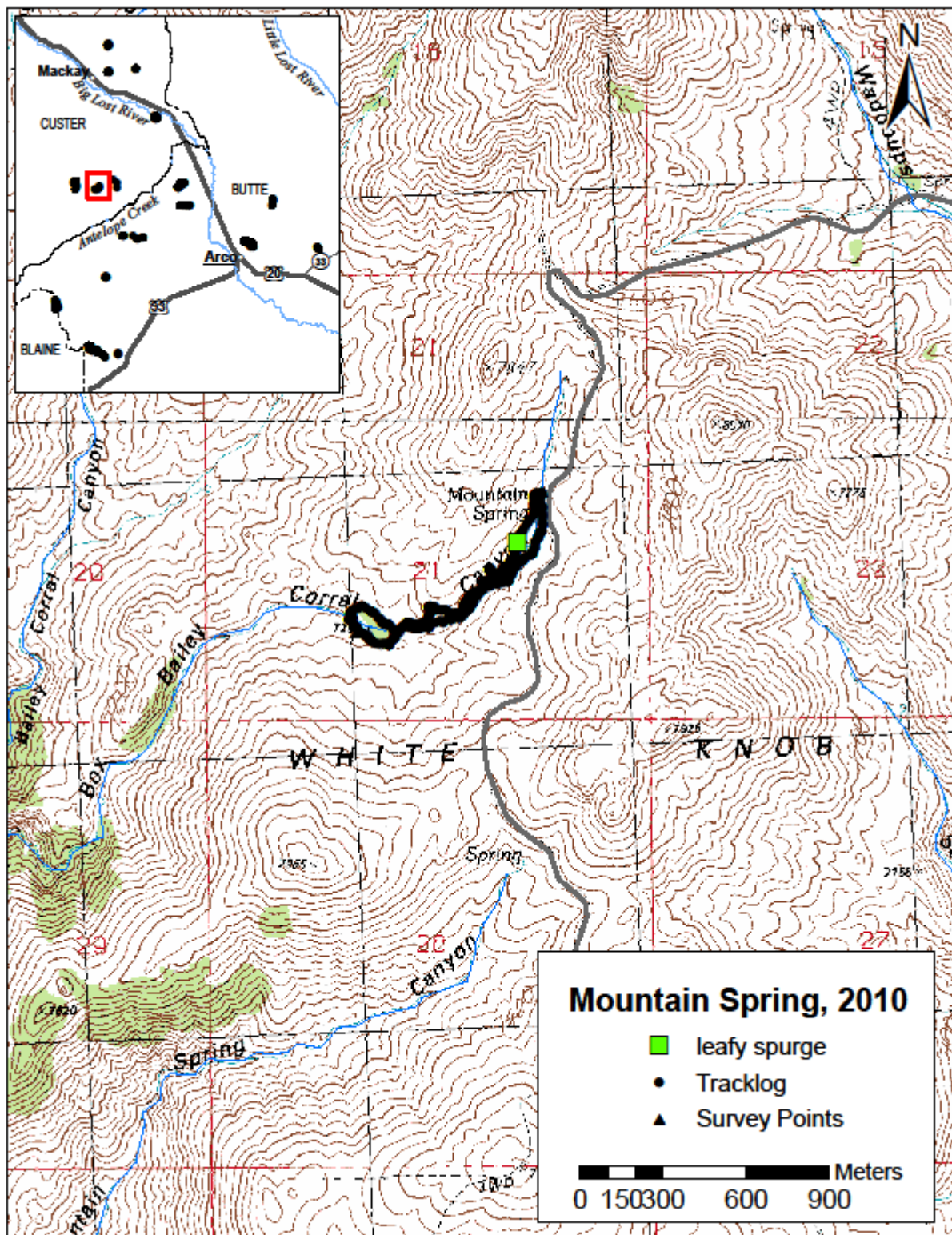


Figure 17. Mountain Spring survey map with observed noxious weed *Euphorbia esula* (leafy spurge) location, Tracklog, and survey points, 13 July 2010.



Figure 18. Cattle disturbance in Mountain Spring riparian zone, 13 July 2010.

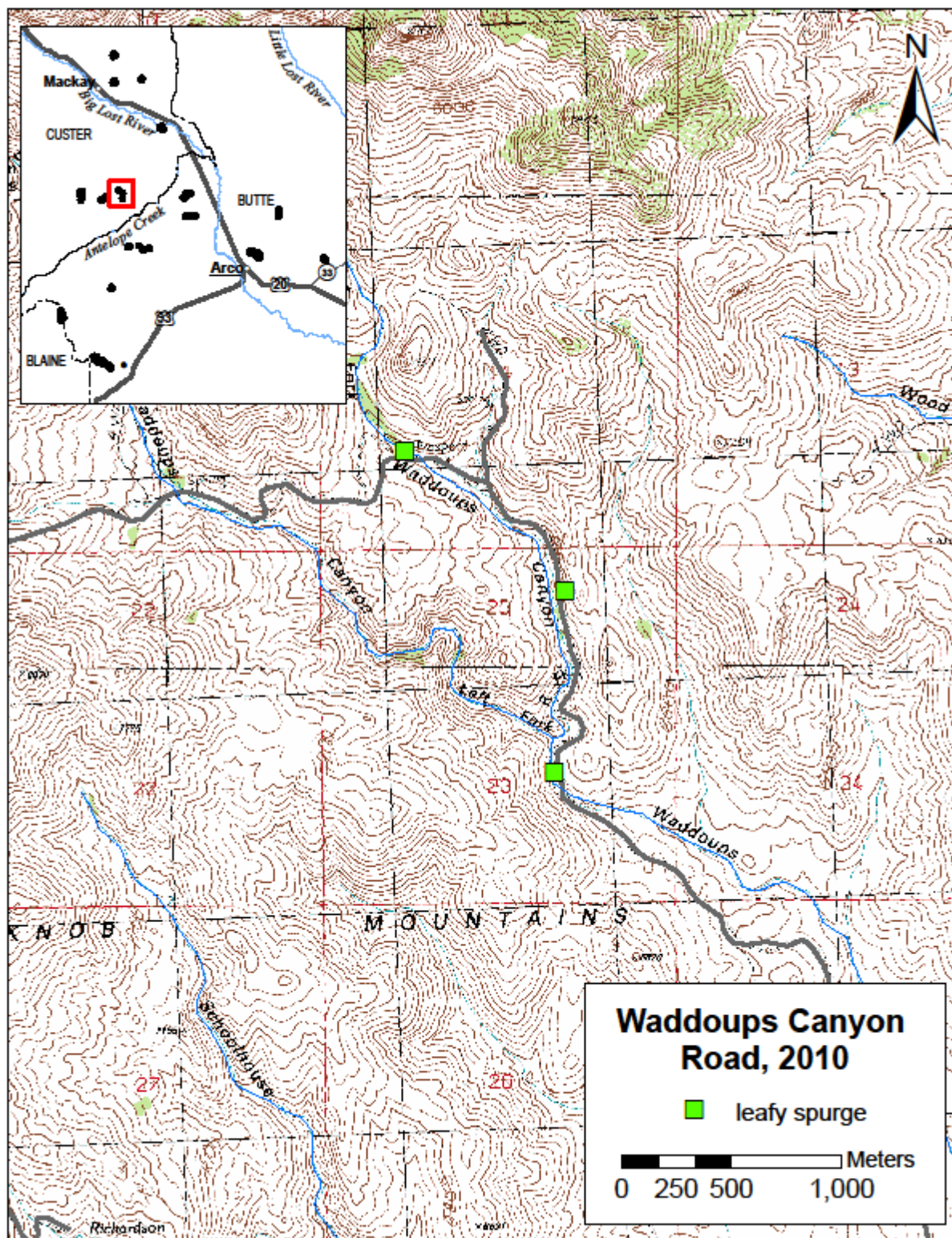


Figure 19. Waddoups Canyon Road survey map with observed noxious weed *Euphorbia esula* (leafy spurge) locations, 13 July 2010.

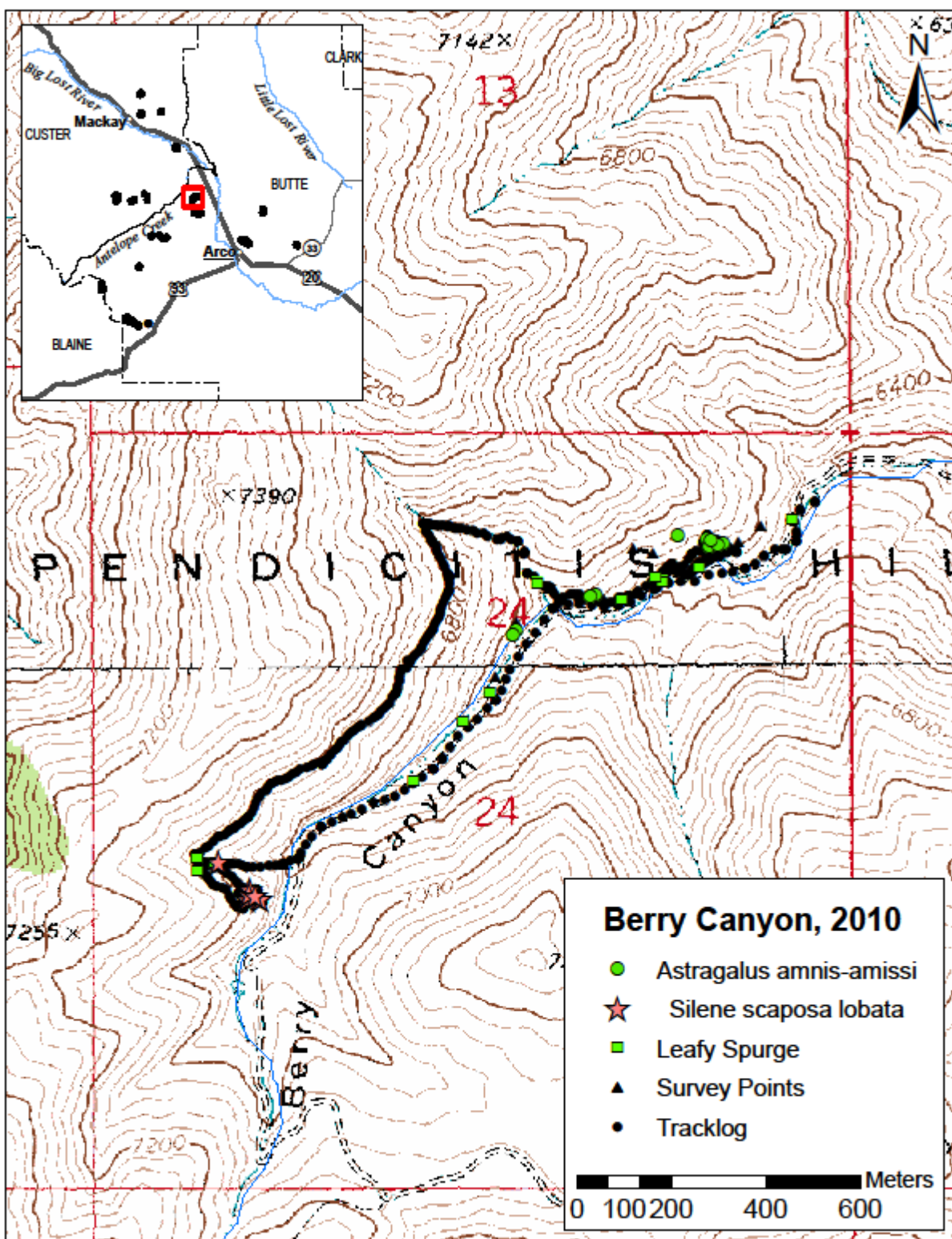


Figure 20. Berry Canyon survey map with *Astragalus amnis-amissi*, *Silene scaposa* var. *lobata*, noxious weed *Euphorbia esula* (leafy spurge) locations, survey points, and Tracklog, 15 July 2010.



Figure 21. Fruiting *Astragalus amnis-amissi* growing from limestone crevice in Berry Canyon, 15 July 2010.



Figure 22. *Astragalus amnis-amissi* habitat in Berry Canyon, 15 July 2010.



Figure 23. *Silene scaposa* var. *lobata* in Berry Canyon, 15 July 2010.



Figure 24. Habitat for *Silene scaposa* var. *lobata* at Berry Canyon, 15 July 2010.



Figure 25. *Bromus tectorum* adjacent to limestone outcrop and potential *Astragalus amnis-amissi* habitat in Berry Canyon, 15 July 2010.



Figure 26. Noxious weed *Euphorbia esula* near limestone outcrop and invading potential *Astragalus amnis-amissi* habitat in Berry Canyon, 15 July 2010



Figure 27. Livestock trailing in Berry Canyon, 15 July 2010.

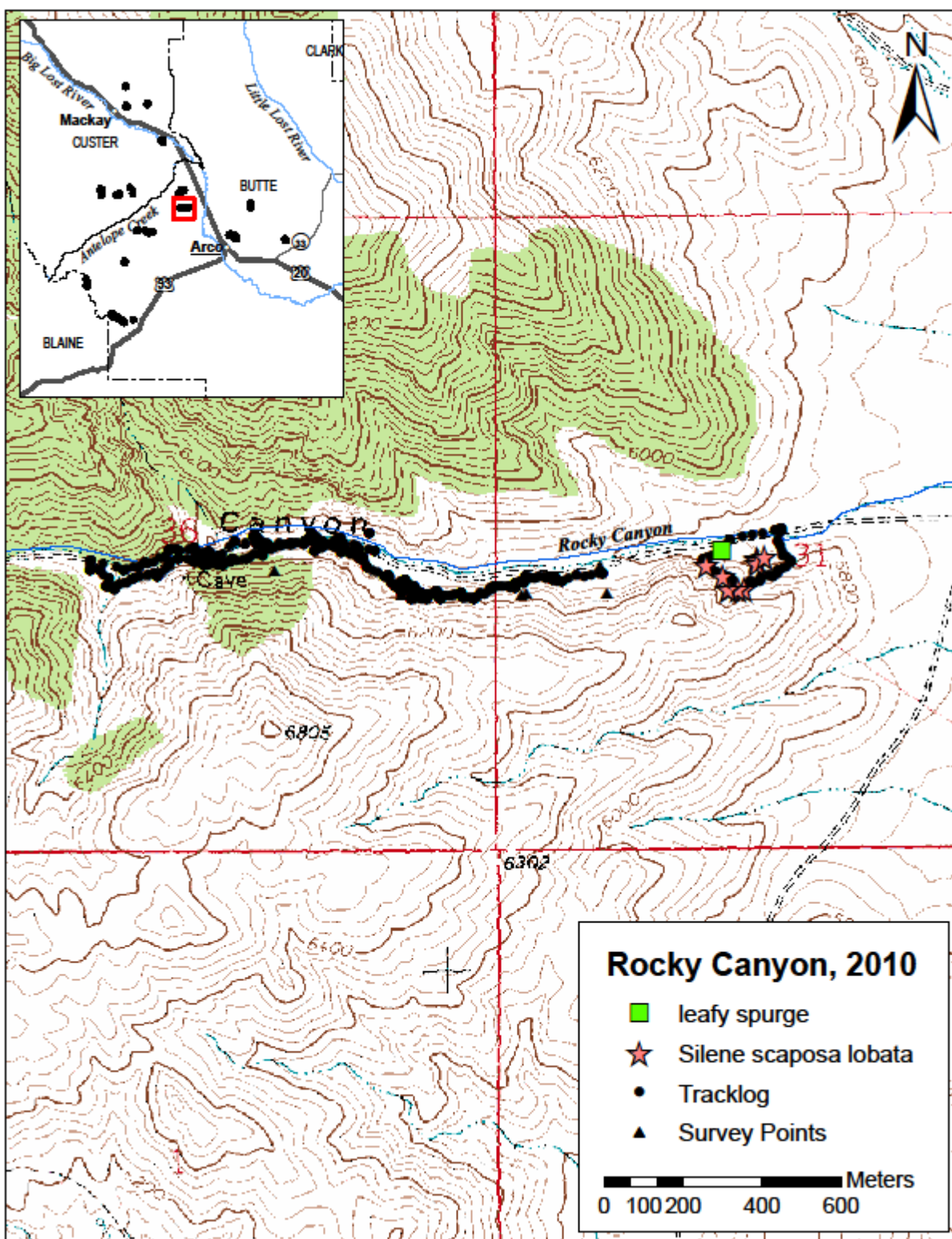


Figure 28. Rocky Canyon survey map highlighting noxious weed *Euphorbia esula* (leafy spurge) location, *Silene scaposa* var. *lobata* subpopulations, Tracklog, and survey points, 8 June and 15 July 2010.



Figure 29. *Silene scaposa* var. *lobata* habitat in Rocky Canyon, individual plants marked by arrows and orange flagging, 15 July 2010.

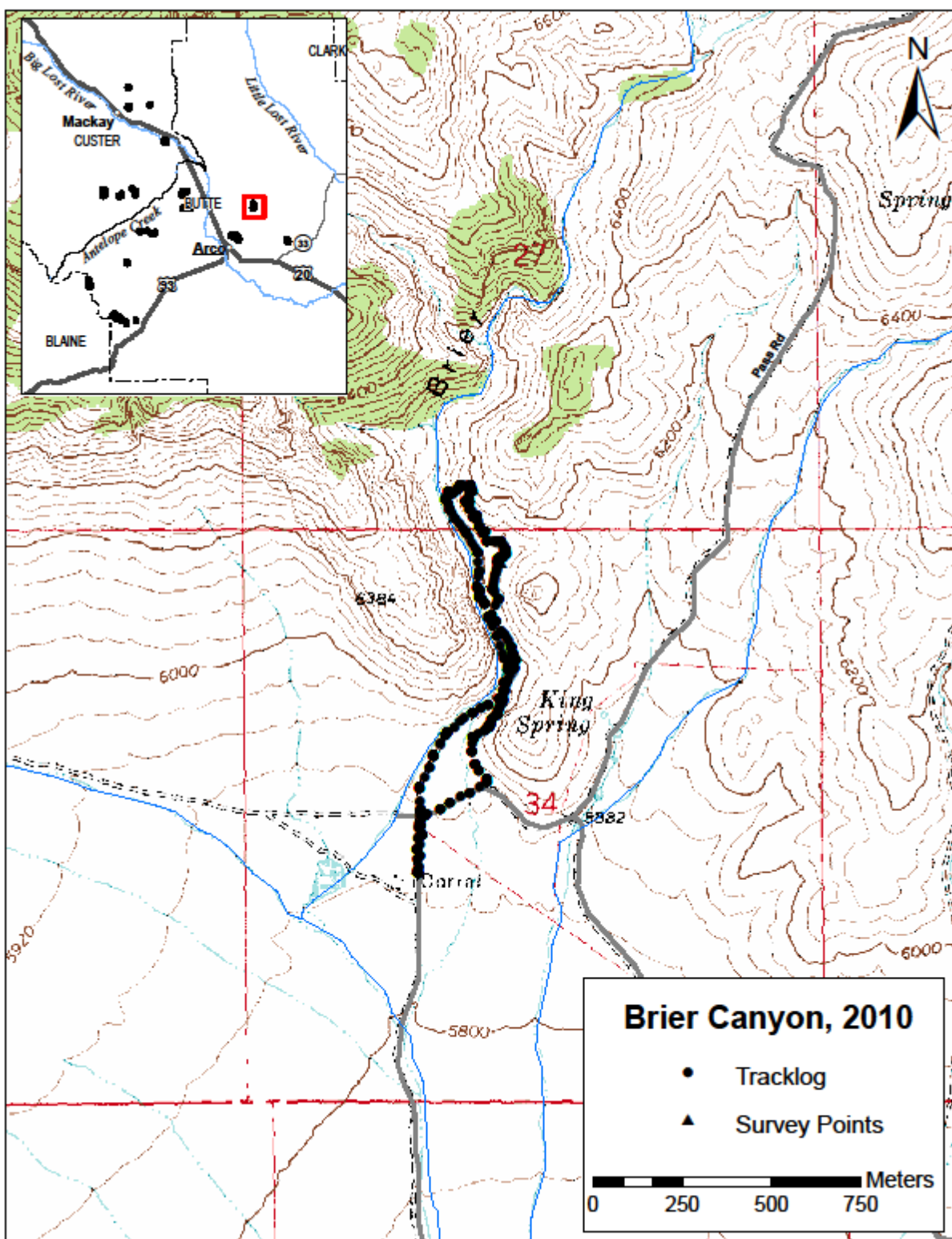


Figure 30. Brier Canyon survey map, 7 June 2010.

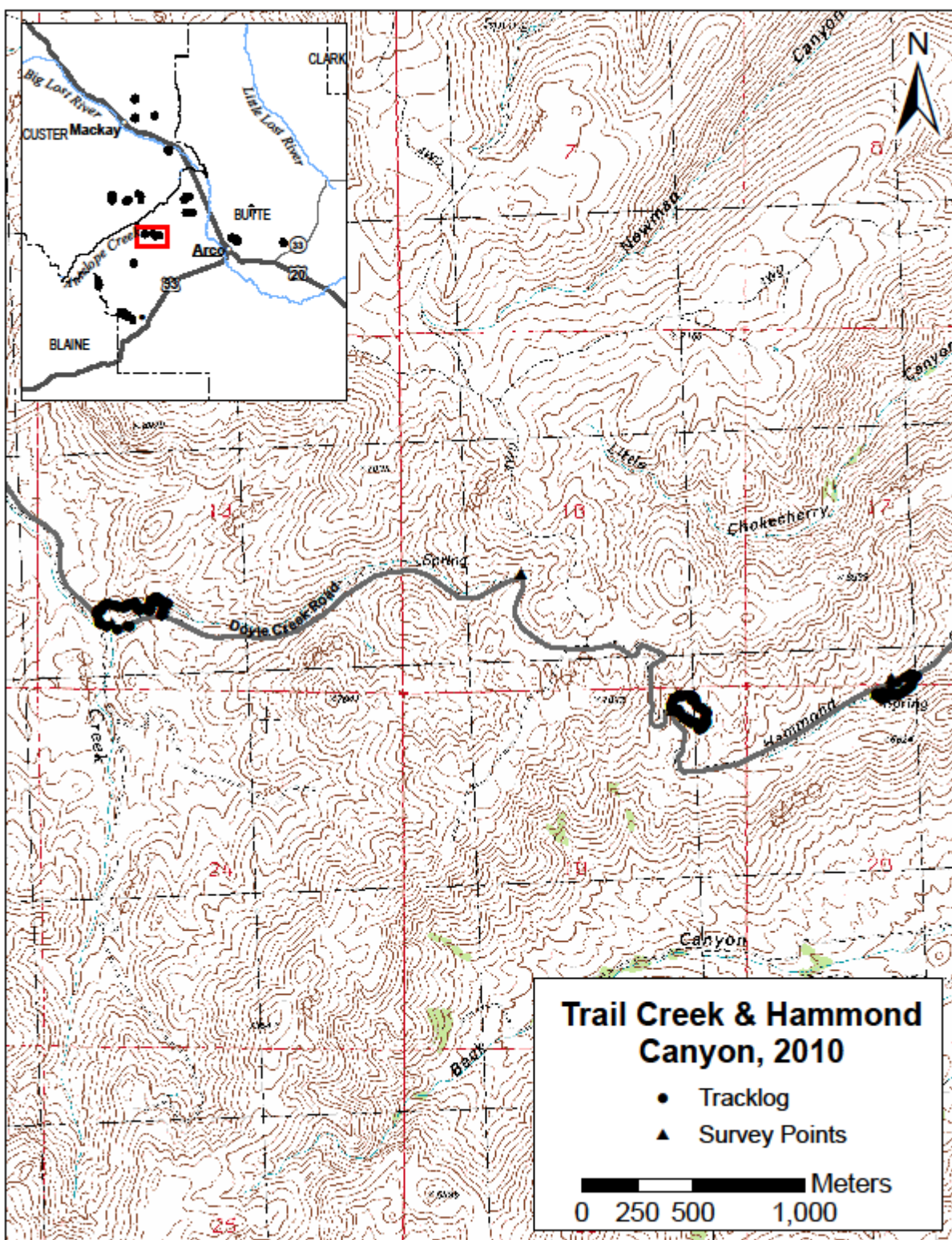


Figure 31. Upper Trail Creek and Hammond Canyon survey map, 9 June 2010.

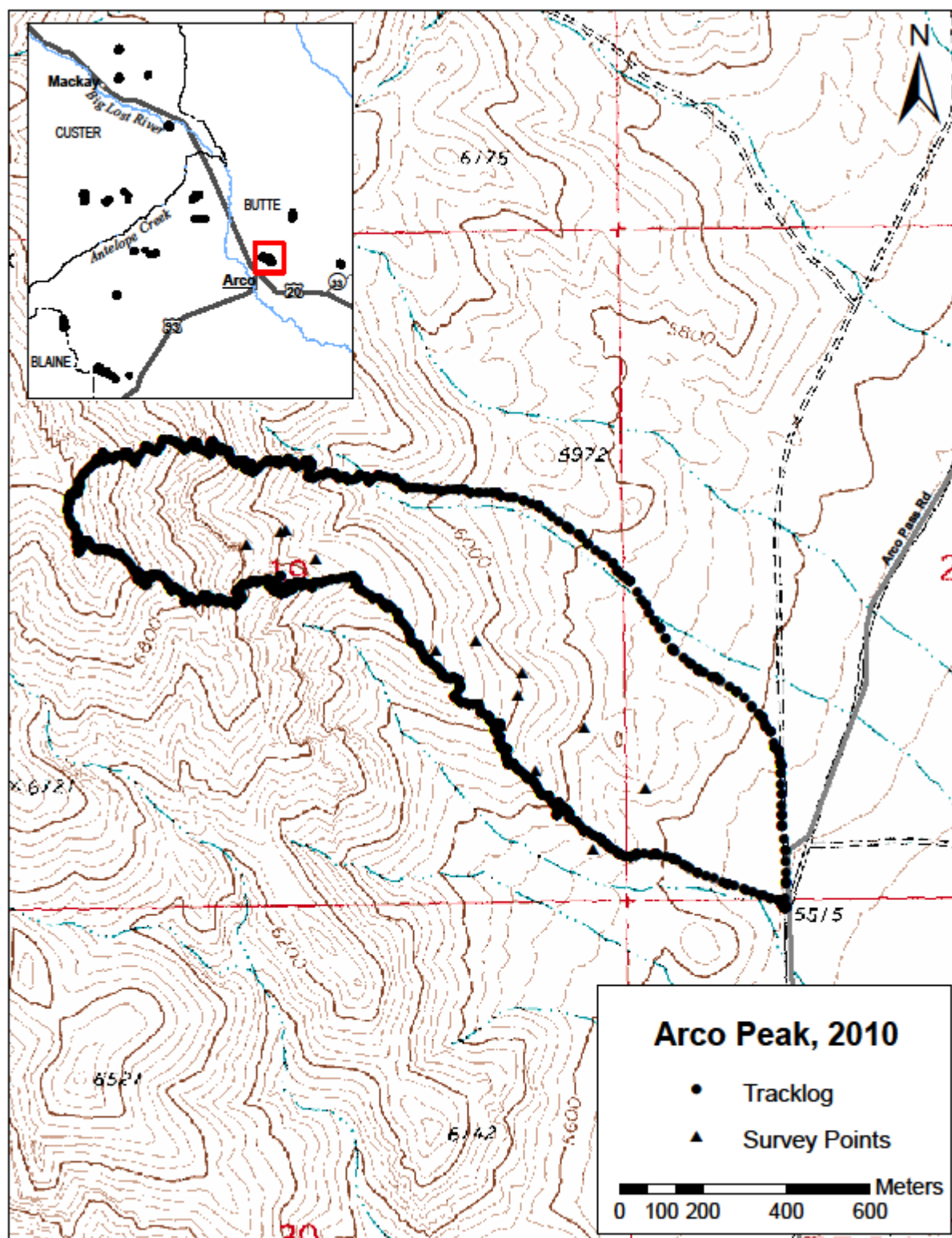


Figure 32. Arco Peak survey map, 7 June 2010.

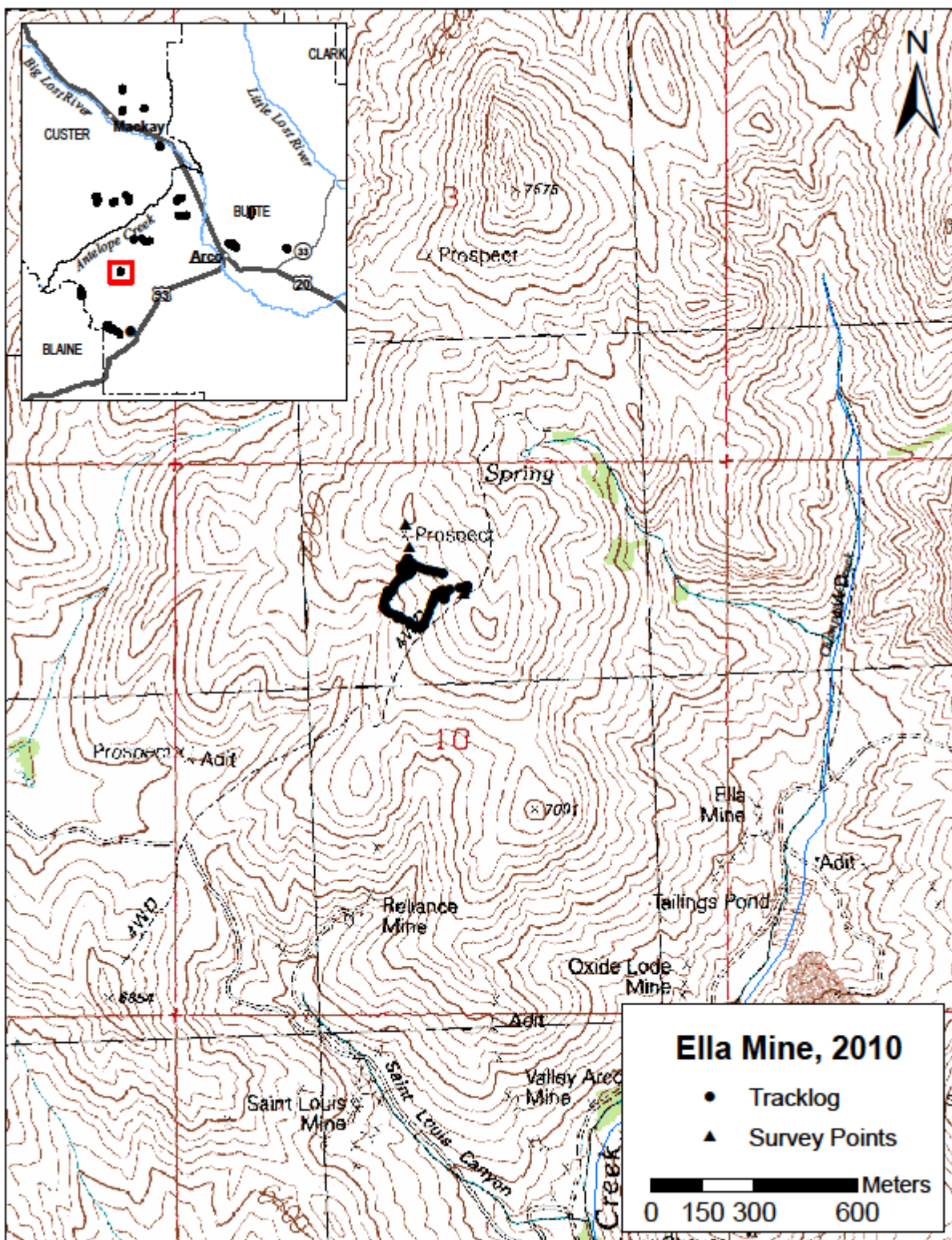


Figure 33. Ella Mine survey map, 12 July 2010.

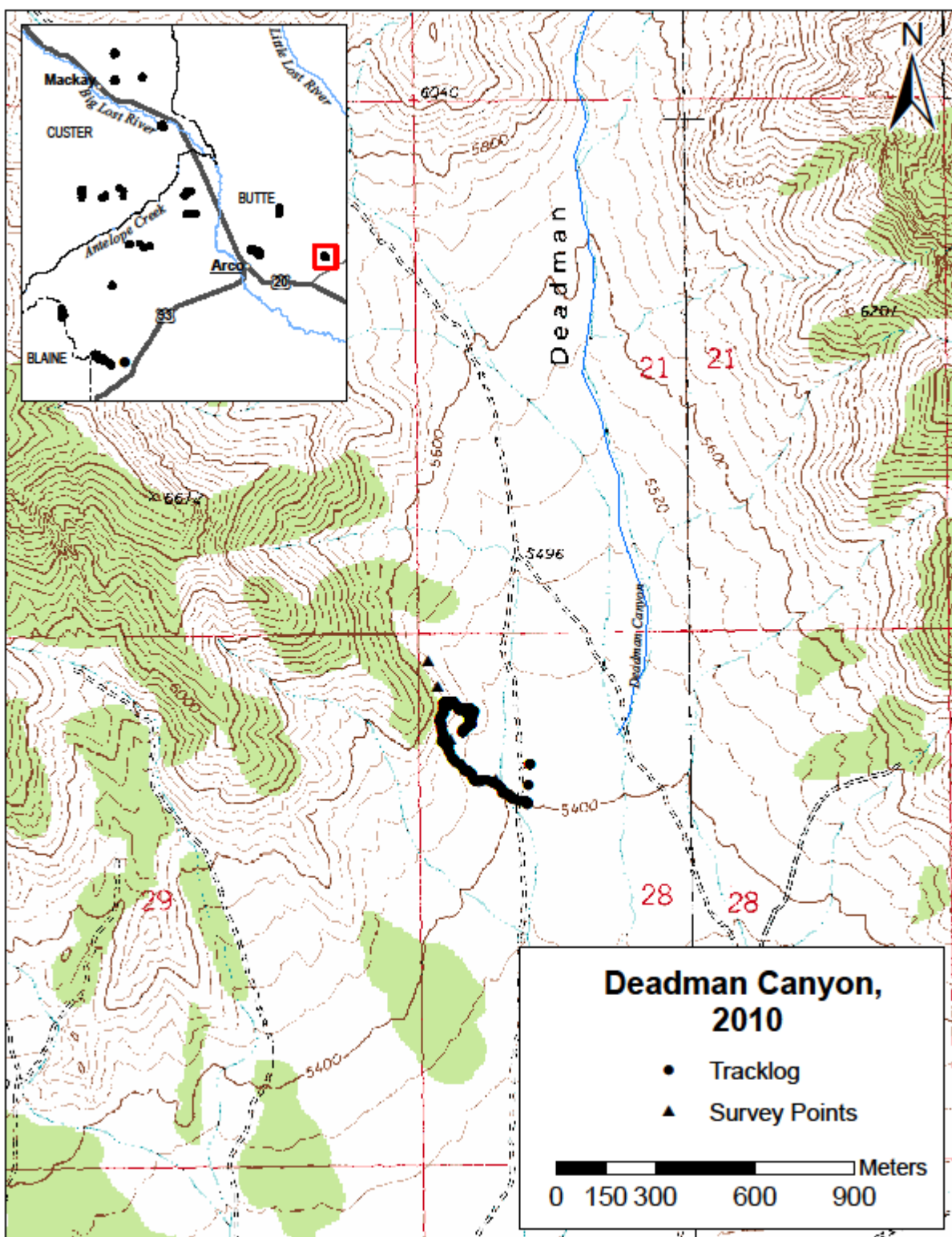


Figure 34. Deadman Canyon survey map, 7 June 2010.

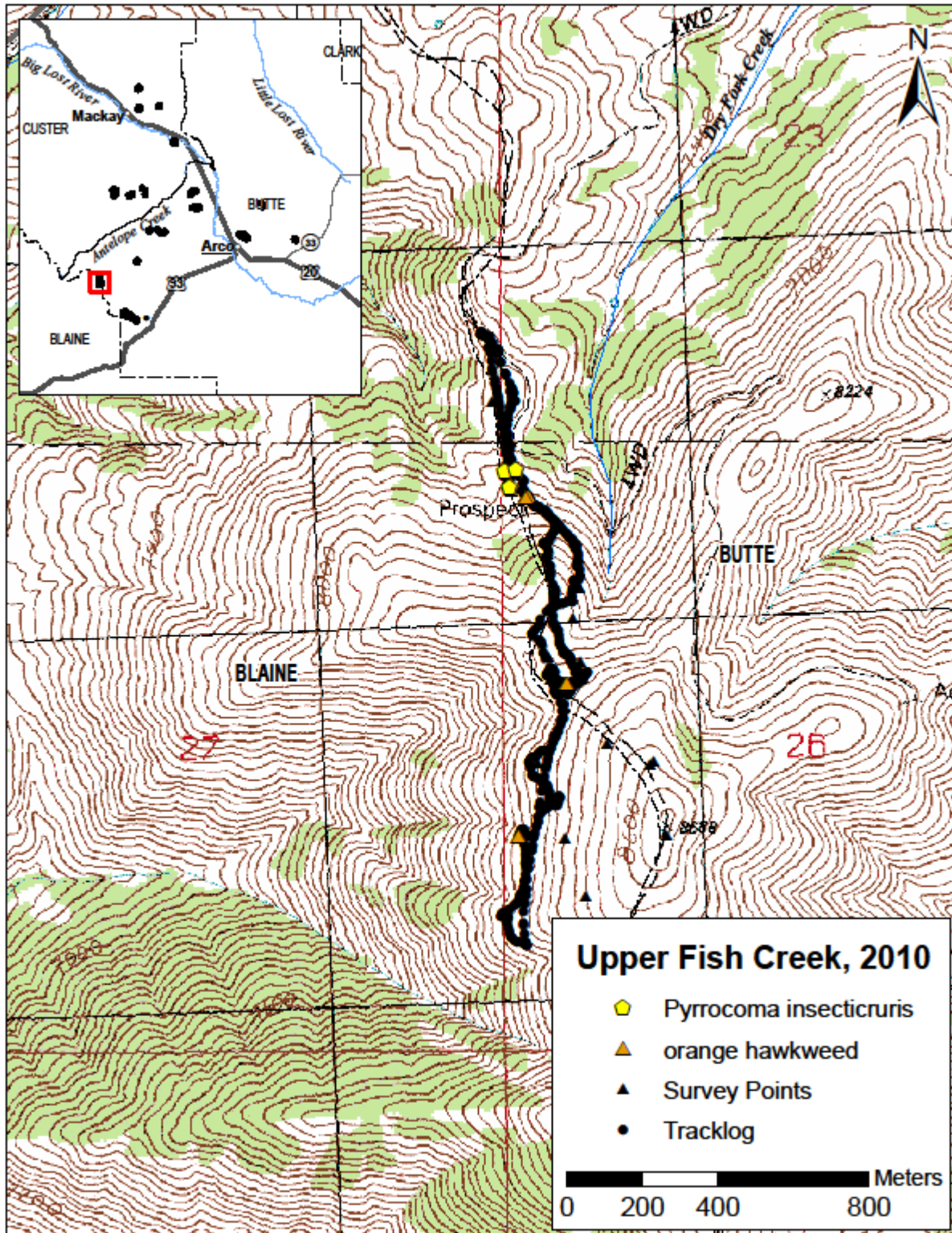


Figure 35. Upper Fish Creek survey map highlighting *Pyrocoma insecticuriis* subpopulations, noxious weed *Hieracium aurantiacum* (orange hawkweed) locations, survey points, and Tracklog, 16 July 2010.

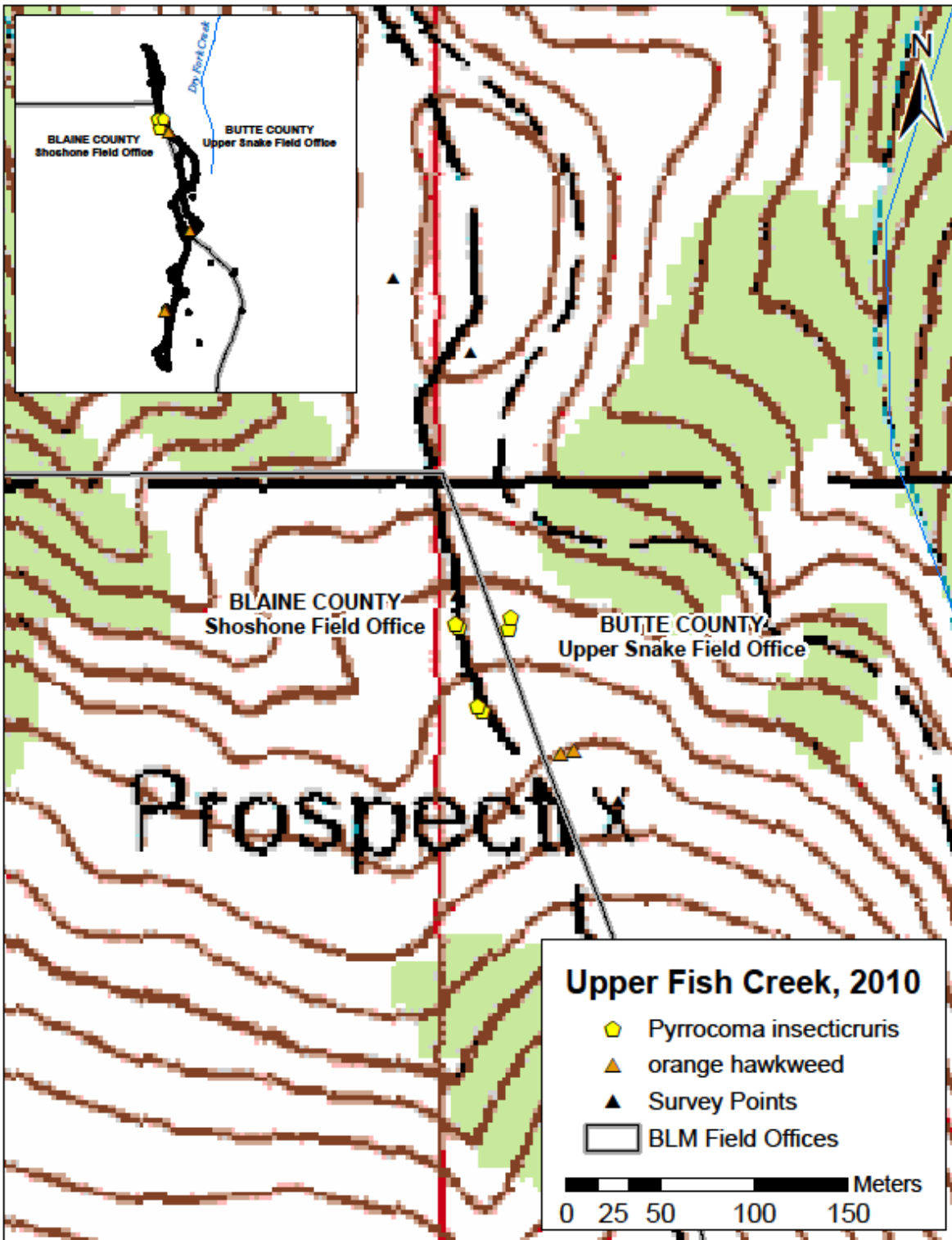


Figure 36. Upper Fish Creek survey map with a close up on *Pyrocoma insecticaris* subpopulations in relationship to Blaine County, Shoshone Field Office and Butte County, Upper Snake Field Office boundaries, noxious weed *Hieracium aurantiacum* (orange hawkweed) locations, and survey points, 16 July 2010.



Figure 37. *Pyrrocoma insecticuri* in Upper Fish Creek, 16 July 2010.



Figure 38. Habitat for *Pyrrocoma insecticuri* at Upper Fish Creek, 16 July 2010.



Figure 39. Cowpie adjacent to *Pyrrocoma insecticruris* plant at Upper Fish Creek location, 16 July 2010.



Figure 40. Butte/Blaine County boundary bisecting *Pyrrocoma insecticruris* population at Upper Fish Creek, 16 July 2010.

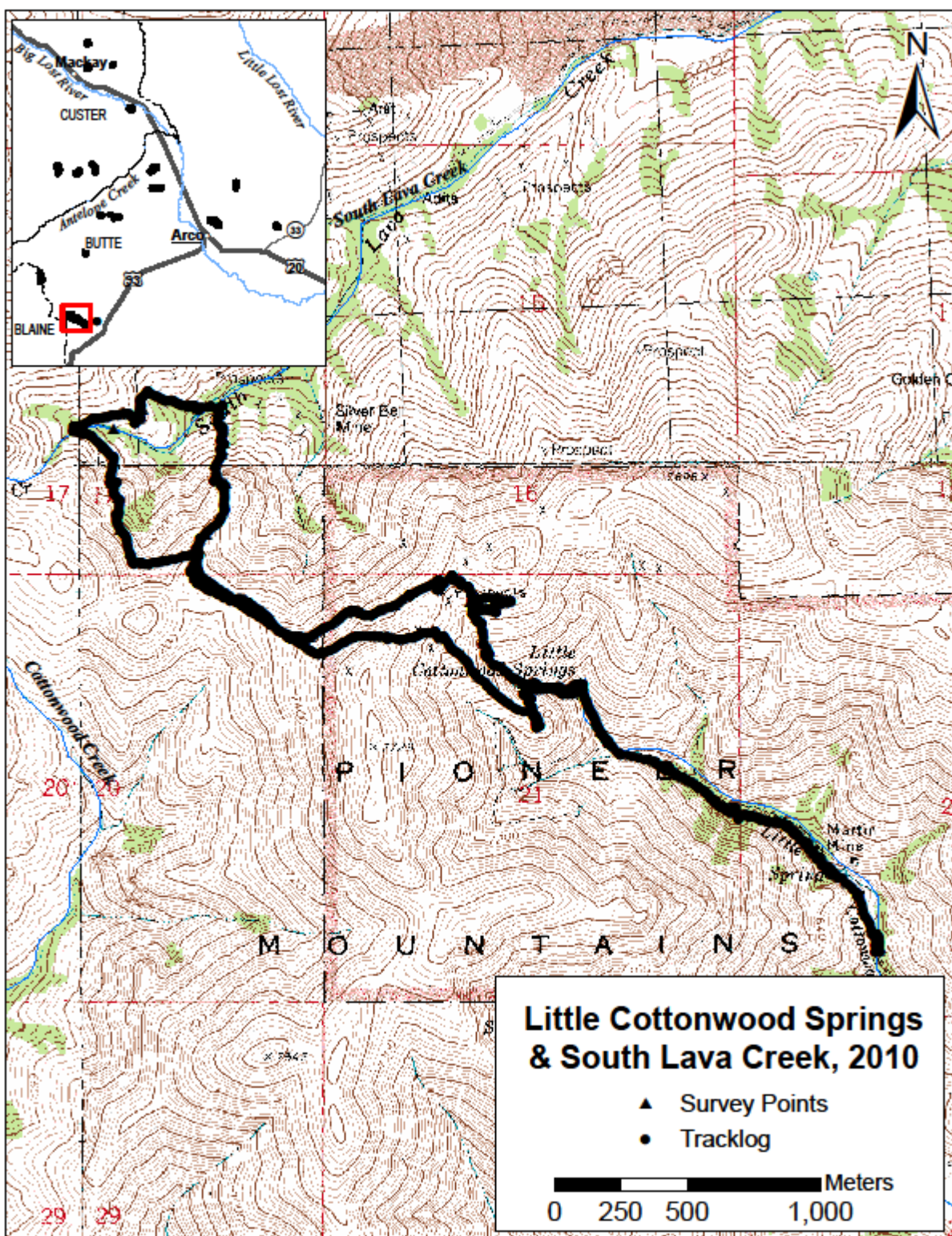


Figure 41. Little Cottonwood Springs and South Lava Creek survey map, 14 July 2010.

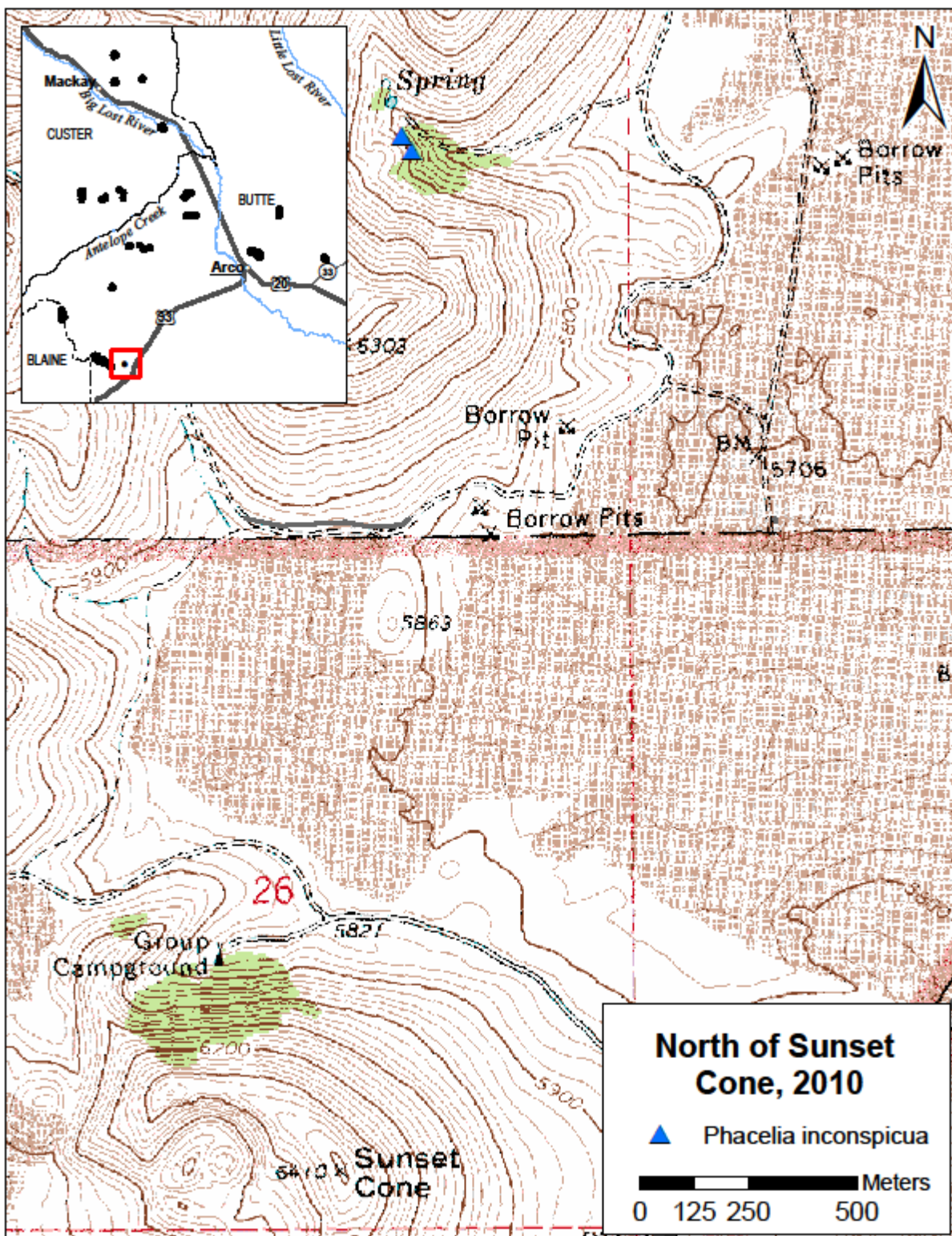


Figure 42. Sunset Cone map of *Phacelia inconspicua* EO 5 location, 9 June 2010.



Figure 43. *Phacelia inconspicua* at Sunset Cone, 9 June 2010.



Figure 44. Habitat for *Phacelia inconspicua* at Sunset Cone, 9 June 2010.

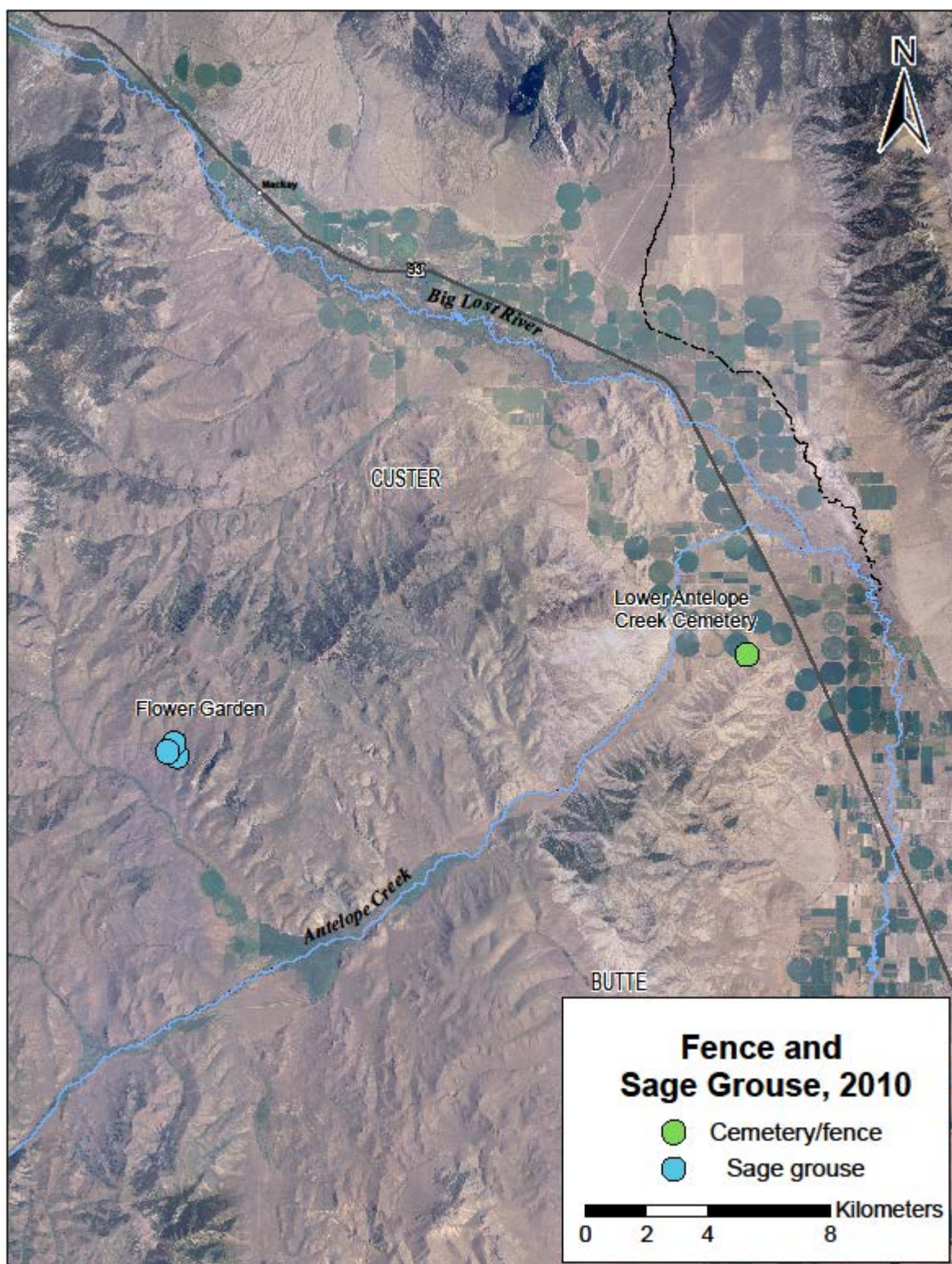


Figure 45. Locations of orange fence posts marking apparent public land, 16 July 2010, and sage grouse, 13 July 2010.



Figure 46. Apparent public land with orange fence posts near Lower Antelope Cemetery, 16 July 2010.