STATUS REVIEW OF *Cirsium longistylum*

U.S.D.A. FOREST SERVICE - REGION 1

LEWIS AND CLARK NATIONAL FOREST

MONTANA

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SUMMARY

Cirsium longistylum is a perennial thistle that is endemic to central Montana primarily in the Little Belt Mountains. It is currently known from areas on the Lewis and Clark National Forest and on private lands in the Little Belt Mountains, and from one site on the Helena National Forest, Big Belt Mountains. Cirsium longistylum is currently on the Watch List of sensitive species for Region 1 of the U.S. Forest Service, and is categorized by the U.S. Fish and Wildlife Service as C2. In the 1991 list of Plant Species of Special Concern, Cirsium longistylum will be ranked by the Montana Natural Heritage Program as an S3 species; "rare in Montana (21+ occurrences)." Although there are only 20 locations currently mapped, many populations contain tens of thousands of individuals, and the species is nearly ubiquitous within moist to wet meadows in the Little Belt Mountains.

Cirsium longistylum occurs frequently in disturbed roadsides, meadows and openings in forests as well as undisturbed sites in native grasslands and grassy openings in forests. It occurs over a wide altitudinal range of about 4700-8000 feet. Cirsium longistylum reproduces both asexually from rhizomes and sexually by seeds. A weevil, Rhinocyllus conicus, which was introduced as a biological control for musk thistle (Carduus nutans), has attacked the seed heads of many C. longistylum plants. Although, the effect on seed production and population viability is not known, this insect could pose a threat to C. longistylum in the long term, and its impact should be evaluated.

Morphological variation in some local populations has led to questions about possible hybridization with another Cirsium species and about the systematic status of C. longistylum itself. Hybridization could also be a threat to the viability of C. longistylum populations. No threats are currently known from timber harvesting or domestic grazing.

Permanent plots were set up at three sites to study life history characteristics of C. longistylum. Density of C. longistylum varied from 0.24 plants/m^2 at Russian Creek to 2.1 plants/m^2 at Neihart. The percentage of plants in flower was highest at Russian Creek (35%), and was lower at Kings Hill and Neihart (28% and 17%, respectively). However the reverse trend was observed at the rosette stage where greater

percentage of rosette stage plants occurred at Neihart (83%), and reduced percentages were observed at Kings Hill and Russian Creek, (71% and 64%, respectively). From plot data, flowering Cirsium longistylum plants produce from 10 to 16 heads per plant.

In order to better understand the effect of the infestation of the weevil Rhinocyllus conicus on C. longistylum populations, five C. longistylum plants were were collected from each of five locations. All the heads from each plant were dissected and scored for presence or absence of the weevil. The plants contained a total of 366 heads, 225 of which contained one or more weevils. Thus, an average of 60 percent of the heads on an individual plant were infested. It is not known how this affects population size fluctuations. Monitoring data indicate that populations contained a good mix of both young and adult plants. It is possible that infestation rates are not high enough to limit this species, or that the Cirsium longistylum populations have very few predatory fauna.

Further studies should focus on the systematic status of C. longistylum, including the possibility of hybridization threats. Additional information is also needed to determine the range of C. longistylum in central Montana, and to assess the possible effect of the weevil infestation on these populations.

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I. SPECIES INFORMATION

A. CLASSIFICATION

1. **SCIENTIFIC NAME:** Cirsium longistylum Moore & Frankton.

2. **COMMON NAME:** long-styled thistle.

3. **FAMILY:** Asteraceae (= Compositae, Sunflower Family).

4. **GENUS:** The genus Cirsium occurs throughout the northern hemisphere and contains about 200 species, about 50 of which are native to North America (Cronquist 1955). Eleven native species occur in Montana along with two introduced (non-native) species from Eurasia (Dorn 1984).

5. **SPECIES:** Cirsium longistylum is endemic to central Montana and is currently known primarily from the Little Belt Mountains, with a single occurrence to the west in the Big Belt Mountains. The type specimen (Senn, Frankton & Gillett (5666) was collected in 1951, three miles southeast of Monarch, and is deposited at the Department of Agriculture, Ottawa (DAO). The earliest known specimen was collected in 1896 in the Little Belt Mountains (Moore and Frankton 1963). A chromosome number of 2n=34 has been reported for the type collection and all others determined (Mathews 1990, Moore and Frankton 1963).

   Variation of some local populations in both leaf and involucral characters has been interpreted to indicate hybridization between C. longistylum and perhaps C. hookerianum, which has been reported from the area (Gorman 1987, Ownbey 1987, Shelly 1986). Similarities to C. scariosum have also been noted (Moore and Frankton 1963). The incidence of these variant plants seems to be greater in disturbed sites than in undisturbed sites (Shelly 1986,), which is a common pattern in many cases of hybridization (Anderson 1953). More recently, Ownbey (1990) has stated that he thinks the variation "can be ascribed to intraspecific genetic variation" rather than hybridization. There is also some question about the identity of the plants from the area that were reported as C. hookerianum (Cronquist 1991). Thus, there are currently unresolved questions about the status of this species and further study is needed.

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. **FEDERAL STATUS:** Cirsium longistylum is on the Watch List for Region 1 of the U.S. Forest Service. Under the Endangered Species Act (U.S. Dept. of Interior 1990), administered by the U.S. Fish and Wildlife Service, this species is categorized as C2, ("current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling").

2. **STATE:** Cirsium longistylum has most recently been ranked by the Montana Natural Heritage Program as an S2 species ("imperiled in Montana because of rarity (6-20 occurrences)" (Shelly 1990). Although only 20 populations of C. longistylum are currently recorded, several contain tens of thousands of individuals and numerous other populations were observed that were not recorded. Thus, the rank will be changed to S3 on the 1991 list of Plant Species of Special Concern.

C. **DESCRIPTION**

1. **GENERAL NON-TECHNICAL DESCRIPTION:** Cirsium longistylum is a perennial thistle from thick, woody underground stems. The stems are 20-24 inches tall, ribbed, and are lightly hairy with long, cobwebby hairs. The basal rosette leaves are somewhat spiny, shallowly lobed, and are green, hairless above and densely white hairy below. The stem leaves are gray-green with long white cobwebby hairs, narrowly spear-shaped, about 10 times as long as wide (up to 6 inches long and 0.5 inch wide), with lobes about 1/3 the width. Smaller leaves are only shallowly lobed with numerous fine marginal spines to 0.2 inch long. The flower heads are about 1.2 inches high and 1 inch wide, usually in a tight cluster in the top 2/3 of the plant. In young plants, the upper part of the stem may be unexpanded and the flowers clustered at the top of the stem. The flower heads have a few small leaves beneath, the uppermost resemble the involucral (outer, subtending) bracts of the flower in shape. The involucre is 0.8 inch high with the outer bracts narrowly spear-shaped, 0.06-0.08 inch wide at the base, with a few glands or a dark blotch, the tip is slightly wider and has a slender 0.08 inch spine. The middle and inner involucral bracts are progressively less widened at the tip. Flowers are white, the petals 0.8-0.9 inch long with a basal ring of 30-40 tawny hairs 0.70-0.75 inch long. The anthers are 0.30-0.35 inch long. The style extends to 0.4 inch beyond the corolla tube. The seeds are 0.22-0.26 inch long and 0.08 inch wide, light brown and

sometimes flecked with purple (adapted from Moore and Frankton 1963).

2. **TECHNICAL DESCRIPTION:** Plant perennial by biennial offsets from stout, woody rhizomes; stems ribbed, lightly arachnoid pubescent with long multicellular hairs, 50-60 cm tall, to 1.5 cm thick at base; rosette leaves moderately spiny, margins with broad, shallow divisions, green and glabrous above, densely white pubescent beneath; cauline leaves gray-green arachnoid, with multicellular hairs above, white villous (long thin hairs with single long terminal cell and 1-several short basal cells) below, linear-lanceolate, base not decurrent, about 10 times as long as wide, to 15 cm long, 1.5 cm wide, lobed less than or equal to 1/3 the width, smaller upper leaves essentially entire, lobes ovate, often irregular with numerous fine marginal spines to 5 mm long; heads 3 cm high, 2.5 cm wide, arrangement variable, usually in a close terminal cluster but also 1-2 on stem apex and lateral branches, usually, many floriferous branches to 15 cm long, on terminal third of main stem; floriferous part of stem may be unexpanded in young plants with less than or equal to 5 heads grouped at the stem apex; heads subtended by a few reduced leaves, the uppermost about the size of the involucral bracts and approaching them in form, with gray multicellular hairs at right angles to the margin; involucre 2 cm high with 5-6 rows of bracts, outer bracts linear-lanceolate, base 1.5-2 mm wide, weakly glandular or with a dark blotch, surface glabrous, apical portion slightly dilated with a yellow lacerate fringe, tipped by a slender 2 mm spine; middle bracts similar but progressively less dilated-lacerate; inner bracts longer, lanceolate, tip not or only slightly lacerate, the lacerate margin varies from a conspicuous yellow fringe to minute irregular serrations and is best seen on young heads but never consists of fine lateral spines; flowers white, corolla 20-22 mm long, tube 7-9 mm, lobes 3.5-5.5 mm, pappus 18-19 mm, tawny, of 30-40 setae, longer setae clavellate; anthers, including appendages, 7.5-8.5 mm long, free tips usually incurved; style long-exserted to 1 cm beyond the corolla, tip to joint of style 3.5-5 mm; achenes 5.5-6.5 mm long, 2 mm wide, light brown sometimes with purplish flecks (adapted from Moore and Frankton 1963).

3. **LOCAL FIELD CHARACTERS:** The dilated, lacerate-fringed tip of the outer involucral bracts are characteristic of Cirsium longistylum, although some plants do not show this character well. It is perhaps best distinguished from C. hookerianum, with which it may

hybridize, primarily by the involucral bracts. In C. hookerianum, the bracts are not dilated and fringed, but are moderately to strongly hairy, while those of C. longistylum are glabrous or nearly so. Recent keys separating C. longistylum from other Cirsium species in Montana are in Dorn (1984), and Hitchcock and Cronquist (1973).

Photographs are included in Section V., pp. 67-71.

D. **GEOGRAPHICAL DISTRIBUTION**

1. **RANGE:** Cirsium longistylum occurs only in central Montana, primarily in the Little Belt Mountains, with a single recorded occurrence in the Big Belt Mountains to the west.

2. **CURRENT SITES:** In 1990, four new populations were mapped and the range of six populations was extended. Figure 1, p. 5, shows the locations of the mapped populations of Cirsium longistylum. The normal approach in rare plant surveys is to locate and map all populations. However, Cirsium longistylum is nearly ubiquitous to many of the meadows and roadsides at higher elevations in the Little Belt Mountains, and is common in moist streamside meadows at lower elevations. Thus, it was decided by the Forest that more emphasis should be placed on thorough collections of plant specimens and monitoring plots. The populations mapped represent only a fraction of individuals and populations observed to be present in the Little Belt Mountains.

3. **HISTORICAL SITES:** None.

4. **UNVERIFIED/UNDOCUMENTED SITES:** None.

5. **AREAS SURVEYED BUT SPECIES NOT LOCATED:** At higher elevations in the Little Belt Mountains where snowpack is maintained through early summer, Cirsium longistylum was observed to be common in open meadows. At lower elevations it was found to occur adjacent to streams and creeks, where soils remain moister later than in the surrounding uplands.

E. **HABITAT:** Cirsium longistylum occurs frequently on disturbed roadsides, in meadows and openings in forests. Surrounding vegetation cover ranged from 10 to 95 percent depending on the site. Undisturbed habitats include Pinus contorta/Festuca idahoensis open forest and mixed meadows, and Abies lasiocarpa-Pinus albicaulis open forest and mixed

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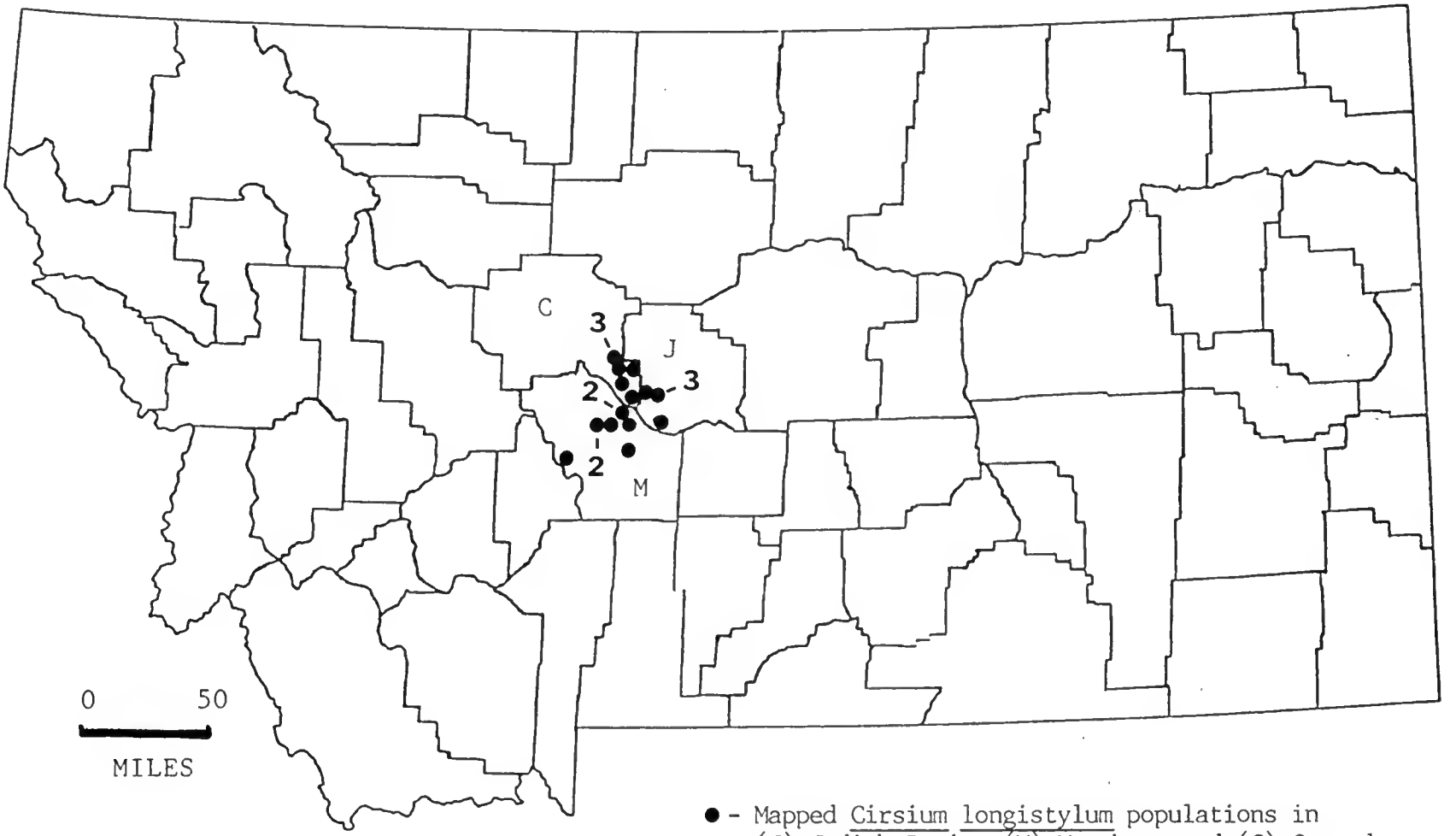


● - Mapped Cirsium longistylum populations in (J) Judith Basin, (M) Meagher, and (C) Cascade counties, Montana.

FIGURE 1

meadows near upper treeline. A photgraph of the habitat at Neihart (008) is included in Section V., p. 71.

1. **ASSOCIATED VEGETATION:** Cirsium longistylum populations occur in both disturbed and undisturbed habitats. The disturbed habitats are typically roadsides, trails, meadows and clearings. Species associated with the disturbed sites include:

Artemisia spp. (sagebrushes)
Bromus inermis (smooth brome)
Phleum pratense (timothy)
Poa pratensis (Kentucky bluegrass)
Cirsium arvense (Canada thistle)
Taraxacum officinale (common dandelion)

The undisturbed habitats are native grasslands and grassy openings in open forests. Associated species include:

Juniperus communis (common juniper)
Pinus contorta (lodgepole pine)
Pinus ponderosa (ponderosa pine)
Pseudotsuga menziesii (Douglas fir)
Potentilla fruticosa (shrubby cinquefoil)
Achillea millefolium (yarrow)
Agoseris glauca (pale agoseris)
Allium geyeri (Geyer's onion)
Androsace septentrionalis (northern fairy-candelabra)
Anemone multifida (cliff anemone)
Antennaria microphylla (rosy pussy-toes)
Antennaria racemosa (raceme pussy-toes)
Arenaria congesta (ballhead sandwort)
Aster occidentalis (western aster)
Astragalus alpinus (alpine milk-vetch)
Astragalus miser (weedy milk-vetch)
Campanula rotundifolia (lady's-thimble)
Cerastium arvense (field chickweed)
Claytonia lanceolata var. flava (yellow springbeauty)
Delphinium bicolor (little larkspur)
Equisetum arvense (field horsetail)
Festuca idahoensis (Idaho fescue)
Fragaria vesca (woods strawberry)
Fragaria virginiana (Virginia strawberry)
Frasera speciosa (giant frasera)
Galium boreale (northern bedstraw)
Gentiana calycosa (explorer's gentian)
Geranium richardsonii (white geranium)
Geranium viscosissimum (sticky geranium)
Geum triflorum (old man's whiskers)
Hedysarum sulphurescens (yellow hedysarum)
Heracleum sphondylium (cow-parsnip)

Koeleria macrantha (prairie junegrass)
Linum perenne (blue flax)
Lomatium cous (Cous biscuit-root)
Lupinus argenteus (silvery lupine)
Luzula campestris (field woodrush)
Microseris nigrescens (black-hairy microseris)
Pedicularis contorta (coiled-beak lousewort)
Penstemon procerus (small-flowered penstemon)
Penstemon rydbergii (Rydberg's penstemon)
Poa secunda (Sandberg's bluegrass)
Potentilla diversifolia (diverse-leaved cinquefoil)
Potentilla gracilis (slender cinquefoil)
Potentilla palustris (purple cinquefoil)
Rosa woodsii (woods rose)
Sedum lanceolatum (lance-leaved stonecrop)
Senecio integerrimus (western groundsel)
Senecio streptanthifolius (Rocky Mountain butterweed)
Senecio triangularis (arrowleaf groundsel)
Solidago multiradiata (northern goldenrod)
Spiranthes romanzoffiana (hooded ladies-tresses)
Stipa viridula (green needlegrass)
Thlaspi arvense (field pennycress)
Trifolium repens (white clover)
Vaccinium caespitosum (dwarf huckleberry)
Zigadenus elegans (glaucous zigadenus)

2. **TOPOGRAPHY:** Cirsium longistylum occurs predominantly at altitudes of 5200-7500 ft (1665-2400 m), with the lowest recorded location at 4680 ft (1475 m) and the highest recorded location at 8040 ft (2575 m).

3. **SOIL RELATIONSHIPS:** The soils under Cirsium longistylum populations in central Montana are developed in parent materials derived from a wide variety of geologic sources. These include hard, coarse-grained metamorphics of Precambrian age, Paleozoic limestones, dolomites and shales, and intrusive igneous rocks (Veseth and Montagne 1980, Weed 1900). Site-specific soil information for the sites is not available, but general information indicates that Cryochrepts, Cryoboralfs, and Lithic Cryoborolls are most likely (Montagne et al. 1982).

4. **REGIONAL CLIMATE:** The regional climate of central Montana is characterized by hot, dry summers and cold, snowy winters. The precipitation peak in central Montana is generally in May and June, and comes in the form of wet snow and rain (U.S. Department of Commerce 1982).

The climatic station closest to the central Montana sites is at Stanford, which at 4710 feet (1413 m), is

2000-3000 feet (600-900 m) lower than most of the sites in the Little Belt Mountains. Thus, precipitation is likely to be higher and temperatures on the average lower at the sites where populations occur. For the period 1951-1980 (U.S. Department of Commerce 1982), the January mean temperature was 20.5°F (-6.4°C), the July mean temperature was 65.2°F (18.5°C), and the annual mean temperature was 44.2°F (6.8°C). The mean annual precipitation was 15.3 in (38.3 cm) with May (3.01 in (7.5 cm)) and June (3.07 (7.7 cm)) being the wettest months.

F. POPULATION DEMOGRAPHY AND BIOLOGY

1. **PHENOLOGY:** Flowering occurs from late June to late August. Variation can be expected over the attitudinal range of occurrence (about 4700 ft (1504 m) to more than 8000 ft (2415 m), with populations at lower elevations and on warmer aspects flowering earlier than those at higher elevations and on cooler aspects.

2. **POPULATION SIZE AND CONDITION:** Cirsium longistylum is nearly ubiquitous within upper elevation moist meadow and roadside sites within the Little Belt Mountains. Only at lower elevations where moist sites are limited to creeks, streambeds and smaller moist meadows, do C. longistylum populations become more easily defined. The recorded populations range from 100 individuals covering 5 acres, up to tens of thousands of individuals covering 800 acres.

3. **REPRODUCTIVE BIOLOGY**

   a. **TYPE OF REPRODUCTION:** Cirsium longistylum apparently reproduces both asexually by biennial offsets from a perennial rhizome (Moore and Frankton 1963), and sexually by seeds produced from perfect flowers. Observations of populations indicate a good range of plants at each life history stage, from single whorl rosette, through larger multiple whorl rosettes, to flowering and fruiting adults. It is not yet certain that this species is a strict biennial. Small (single whorl) to large (multiple whorl) rosettes were observed in populations as well as flowering plants where the stem had bolted. Results of intensive studies started in 1990 should give a better indication of life history traits exhibited by this species.

   b. **POLLINATION BIOLOGY:** The pollination mechanisms are not known for Cirsium longistylum. It is

known to be pollinated by Bombus sp. (bumble bee), and it is likely that there are other pollinators. Whether self-pollination occurs is not known.

c. **SEED DISPERSAL AND BIOLOGY:** Numerous seeds are produced that are mostly wind dispersed by the prominent pappus that is about 3 times the length of the small achene. The heads of some plants in the Little Belt Mountains have been attacked by a weevil, Rhinocyllus conicus, which was introduced to North America from Europe as a biological control agent for Carduus nutans (Rees 1982, 1987). Weevil infestation rates, and the likely effect on seed production and population viability are unknown, although preliminary studies have begun.

G. DEMOGRAPHIC MONITORING TRANSECTS

During 1990, three permanent monitoring transects were established in populations of C. longistylum on the Lewis and Clark National Forest. The purpose of these transects is to provide more detailed data on the life history and population dynamics of C. longistylum. Data on survivorship and reproduction are important for understanding the biology of plants with limited distributions, especially when attempting to ensure their long-term preservation (Massey and Whitson 1980). Data may also indicate whether population sizes are declining, which may be the result of infestation by the weevil Rhinocyllus conicus.

STUDY SITES: The locations and the geographic details for each of the three transect locations, are as follows:

1. Russian Creek: Little Belt Mountains, South Fork of the Judith River drainage, just west of lower Russian Creek, Judith Basin County. Take Forest Rd. # 487 (South Fork of Judith River) ca. 22 miles southwest of Utica, Montana. From Forest Rd. # 487, travel 0.15 mile south on Forest Rd. # 2013; site is just east of road before reaching a small drainage in meadow; T11N, R10E, Section 11, SE¼NW¼NW¼. The plot location is provided on a map, Figure 2, p. 12.

   From plot center:

   63° and 84 paces to the first tall tree in gully.

33° and 71 paces to short dead snag (the one to the right).

198° and 27 paces to post at roadside.

Elevation: 6520 feet

Slope: level to 3 percent

Aspect: ENE

2. Kings Hill: Little Belt Mountains, just west of Kings Hill Pass, Meagher County. From the top of Kings Hill Pass, take Forest Rd. # 487 southeast to a point 0.1 mile before it intersects with Forest Rd. # 251. Plot is southwest of the Forest Rd. # 487; T12N, R8E, Section 2, SE¼SE¼NW¼. The plot location is provided on a map, Figure 3, p. 13.

From plot center;

121° and 22.5 paces to a cluster of stumps (14' high).

174° and 22.5 paces to tree with dead top.

240° and 15 paces to dead tree.

Elevation: 7880 feet

Slope: 15 percent

Aspect: SW

3. Neihart: Little Belt Mountains, 3 miles northwest of Neihart, Montana, Cascade County. From Neihart, travel south 1.5 miles on Hwy. 89, turn west on Forest Rd. # 834 (Harley Creek Road) and travel ca. 4 miles to intersection with Belt Park Road. Turn left and head south for 0.5 mile. Site is south east of road in small meadow; T14N, R7E, Section 27, NE¼NE¼NE¼. The plot location is provided on a map, Figure 4, p. 14.

From plot center:

145° and 25.5 paces to standing dead tree.

55° and 28 paces to a cluster of spruce trees.

227° and 17 paces to a pair of small lodgepole next to road.

Elevation: 6960 feet

Slope: 17 percent

Aspect: NE

METHODS: At each of the three sites described above, a piece of re-bar approximately four feet long was driven into the center of a plot to a depth of two feet and painted bright orange. Plot radii varied depending on the density of plants at a site, but ranged from 15 (4.6 m) to 39 feet (11.9 m). A measuring tape was hooked over the center pin and held at about 6 inches from the top by a knot. Starting at north, the direction (in degrees) and distance (in feet and inches) to the first plant from the stake was recorded, along with the phenological status of the plant (and hence around in a circle within the specified radius until all plants were recorded). Plants were placed in size classes that appeared to best relate to age. These included:

R = Rosette

Rs = small rosette, 1 whorl of basal leaves
Rm = medium rosette, 2 whorls of basal leaves
Rl = large rosette, > 2 whorls of basal leaves

P = Plant that has bolted.

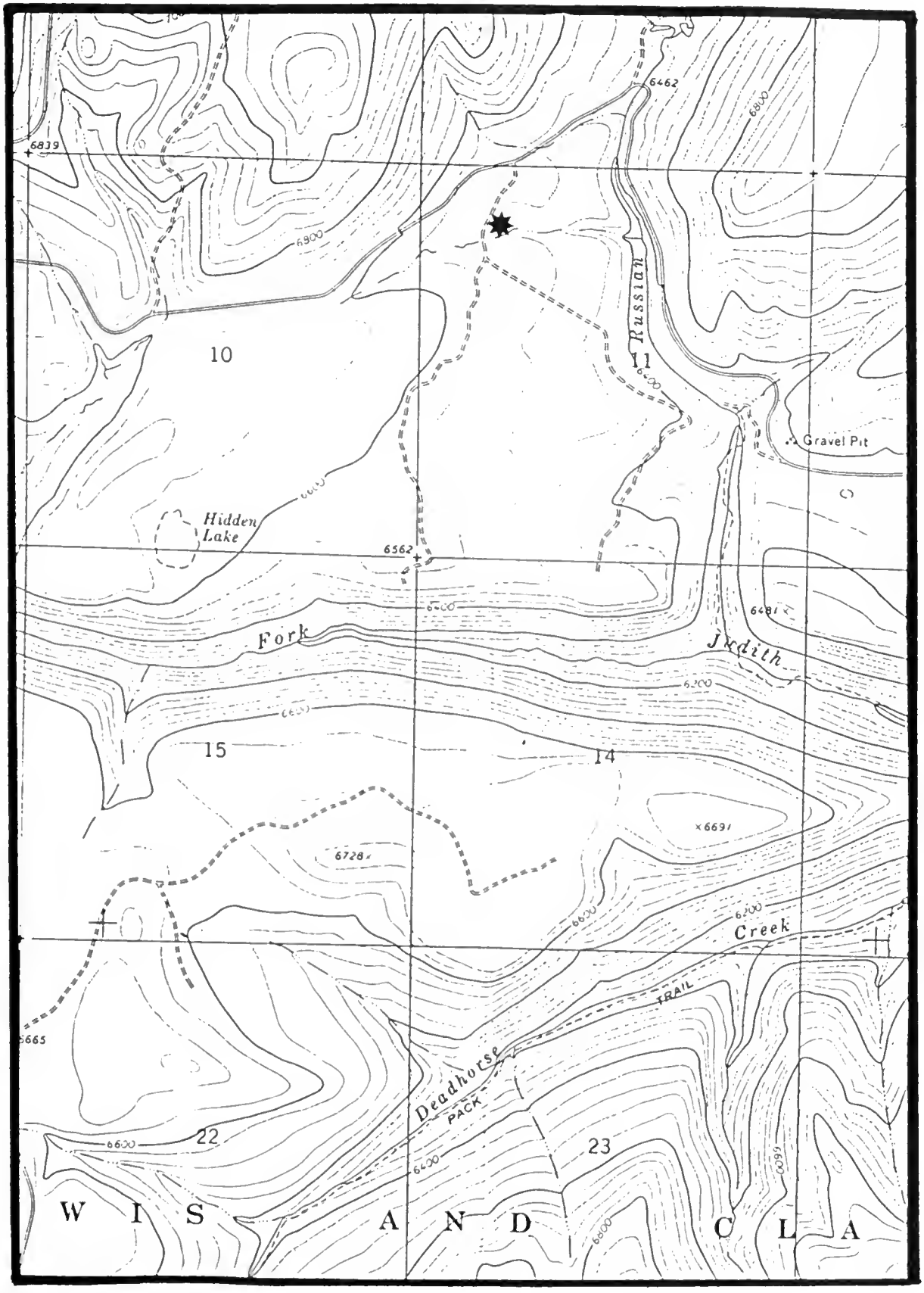
Ph(x)= Plant with (x) number of open, flowering heads

Pb(x)= Plant with (x) number of closed heads (involucral bracts completely enclosed flowers)

Dead - a dead stem from the previous year

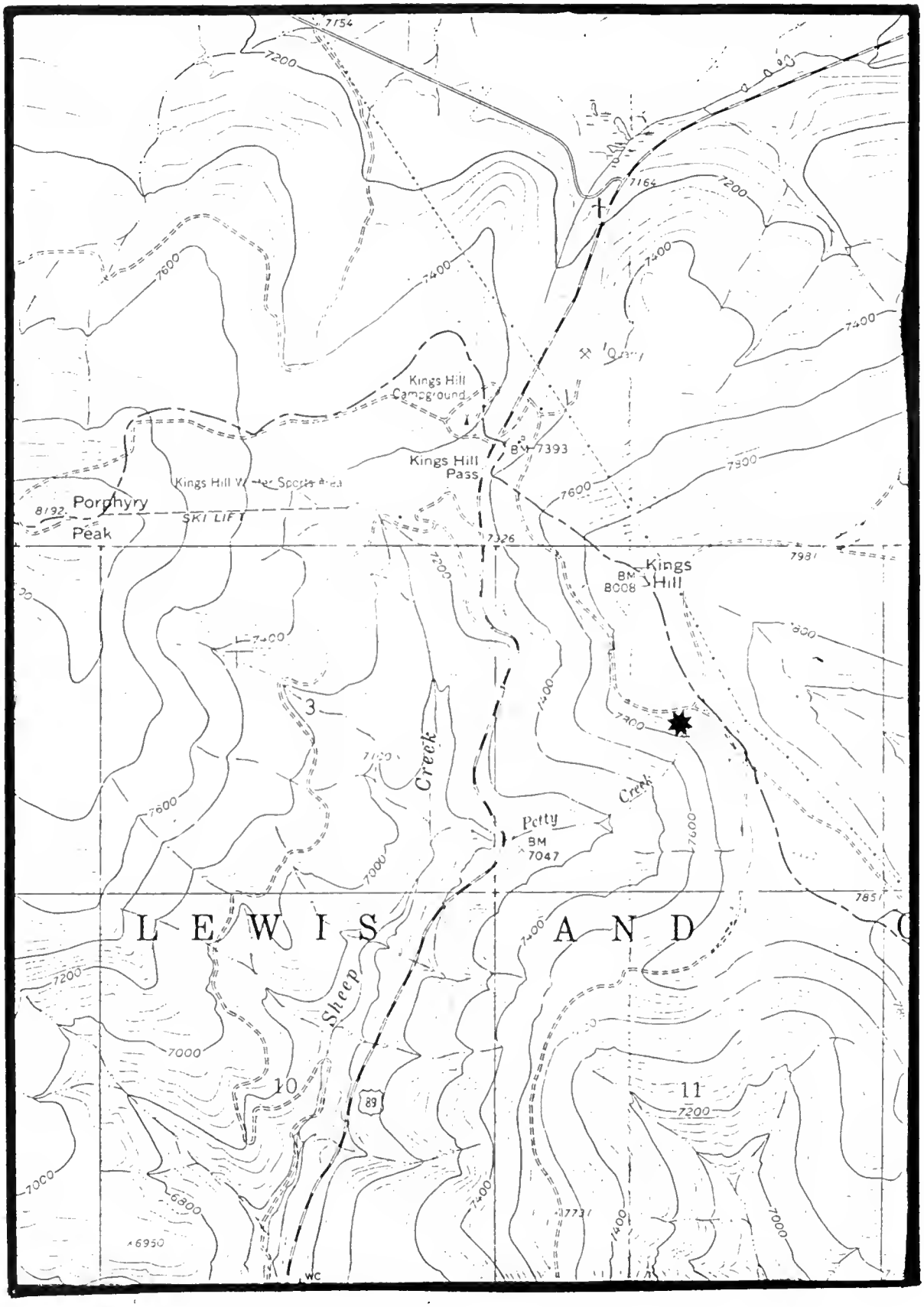
Thus, a plant that had three flowering heads and three unopened heads would be recorded as Ph3b3. Ph(x)b(x)h(x)b(x) indicates a plant with more than one flowering stem per rosette.

Raw data recorded for each site are provided in Section VI., Demographic Monitoring Data, pp. 72-78.



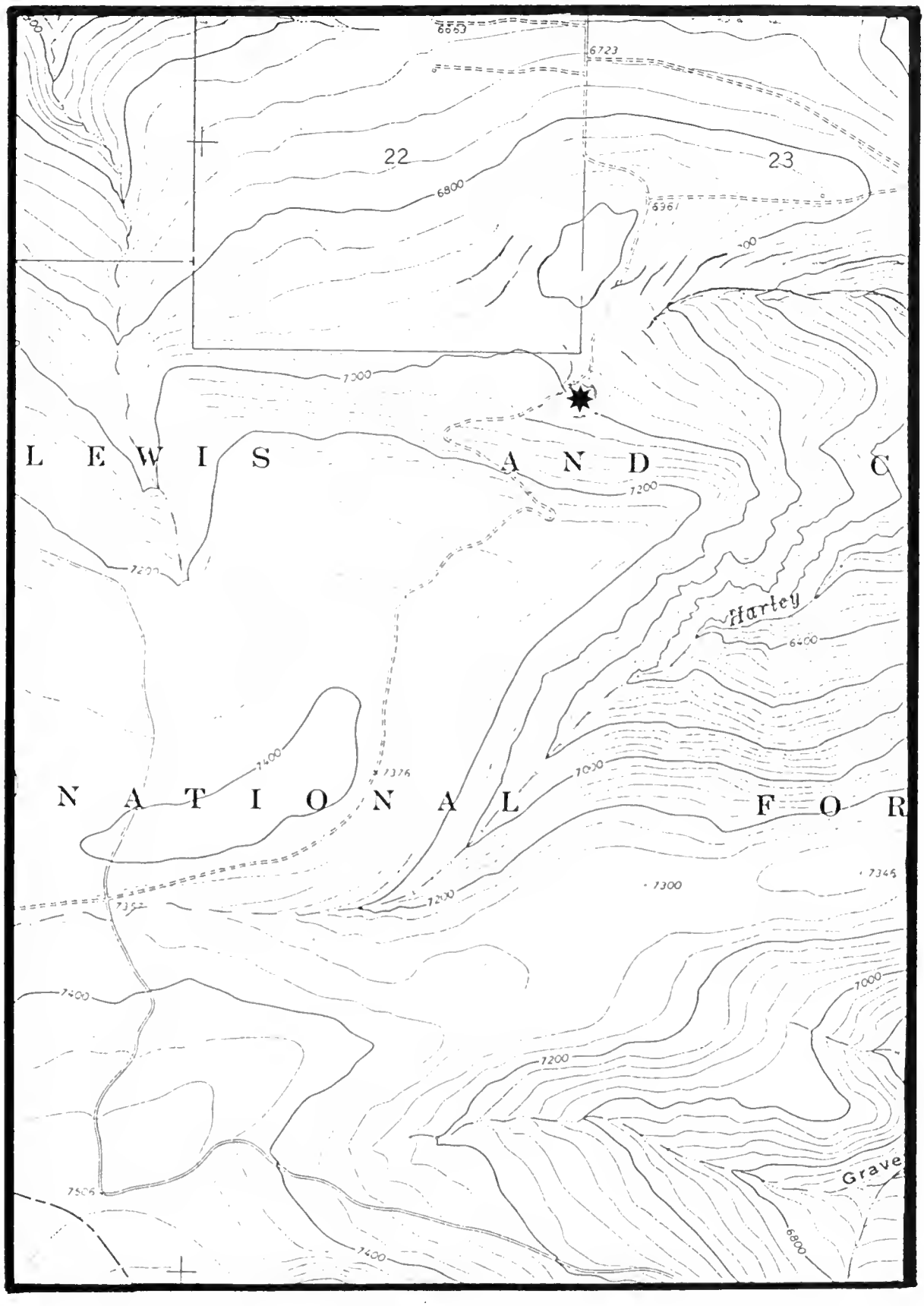
U.S.G.S. Russian Flat Quadrangle (7.5')

Figure 2. Location of Russian Creek permanent study plot Cirsium longistylum, Judith Basin County, Montana.



U.S.G.S. Kings Hill Quadrangle (7.5')

Figure 3. Location of Kings Hill permanent study plot, Cirsium longistylum, Meagher County, Montana.



U.S.G.S. Belt Park Butte Quadrangle (7.5')

Figure 4. Location of Neihart permanent study plot, Cirsium longistylum, Cascade County, Montana.

RESULTS: Plot data for the three sites are summarized in Table 1., pp. 16. Density of C. longistylum plants varied from 0.24 plants/m^2 at Russian Creek to 2.1 plants/m^2 at Neihart. The percentage of flowering plants was highest at Russian Creek (35%), and was lower at Kings Hill and Neihart (28% and 17%, respectively). However, the reverse trend was observed for plants at the rosette stage, with a greater percentage of rosettes occurring at Neihart (83%) and reduced percentages observed at Kings Hill and Russian Creek (71% and 64%, respectively). The highest number of large and medium rosettes were observed at Neihart.

Cirsium longistylum plants produced 10 to 16 heads per plant.

TABLE 1. Summary of life history monitoring data for *Cirsium longistylum* at three sites in the Little Belt Mountains on the Lewis and Clark National Forest in 1990.

	Russian Creek	Kings Hill	Neihart
Elevation (ft)	6520	7880	6960
Date read	27 July	30 July	31 July
Total # plants of current year plants recorded	107	113	142
Density (plants/m^2)	0.24	1.7	2.18
# plants flowering	37	32	24
% of plants flowering	35%	28%	17%
# small rosette plants	26	31	42
# medium rosette plants	23	37	54
# large rosette plants	20	13	22
total # plants at rosette stage	69	81	118
% of plants at rosette stage	64%	71%	83%
mean # of heads (open or unopened) per flowering plant ($\pm$ SD, n)	16.4 $\pm$ 8.4 n = 37	10.5 $\pm$ 7.7 n=32	14.6 $\pm$ 5.8 n=24

H. POPULATION ECOLOGY

1. BIOLOGICAL INTERACTIONS

a. **COMPETITION:** No studies have been done on competitive interactions, either intraspecific or interspecific. However, the frequent occurrence of C. longistylum in disturbed sites and in open, unshaded areas suggests that it is not very tolerant of shading. It would likely do poorly on sites with closed canopies.

b. **HERBIVORY:** The seed heads of some plants in the Little Belt Mountains have been attacked by a weevil, Rhinocyllus conicus, which was introduced to North America from Europe as a biological control agent for Carduus nutans (Rees 1982, 1987). The weevil was introduced in several locations including Bozeman Montana in the early seventies. Within several years, the weevils had moved out within a 500 miles (800 km) radius of the original establishment location. Weevil infestation rates, and the likely effect on seed production and population viability are unknown, although preliminary studies have been begun. Dr. Charles Turner (USDA, Albany, California, pers. comm.), a specialist in the fauna of members of the Asteraceae (Sunflower Family), has recently completed a study of the weevil's impact on a rare thistle native to California. Although the data have not been completely analyzed, it was his opinion that the weevil was having little effect on this rare thistle that is restricted to serpentine warmspring sites. He also made the observation that new world members of the Cirsium genus were very depauperate in herbivorous fauna in comparison to old world species. It should be noted that the weevil has infested a number of native species in the genus Cirsium (Turner et al. 1987).

While the rate of seed predation is not clear in the case of C. longistylum, it is a matter of concern because seed predation can have a magnified effect on succeeding life history stages, resulting in greatly reduced seedling establishment and recruitment of new plants (Louda et al. 1990). Herbivory of other

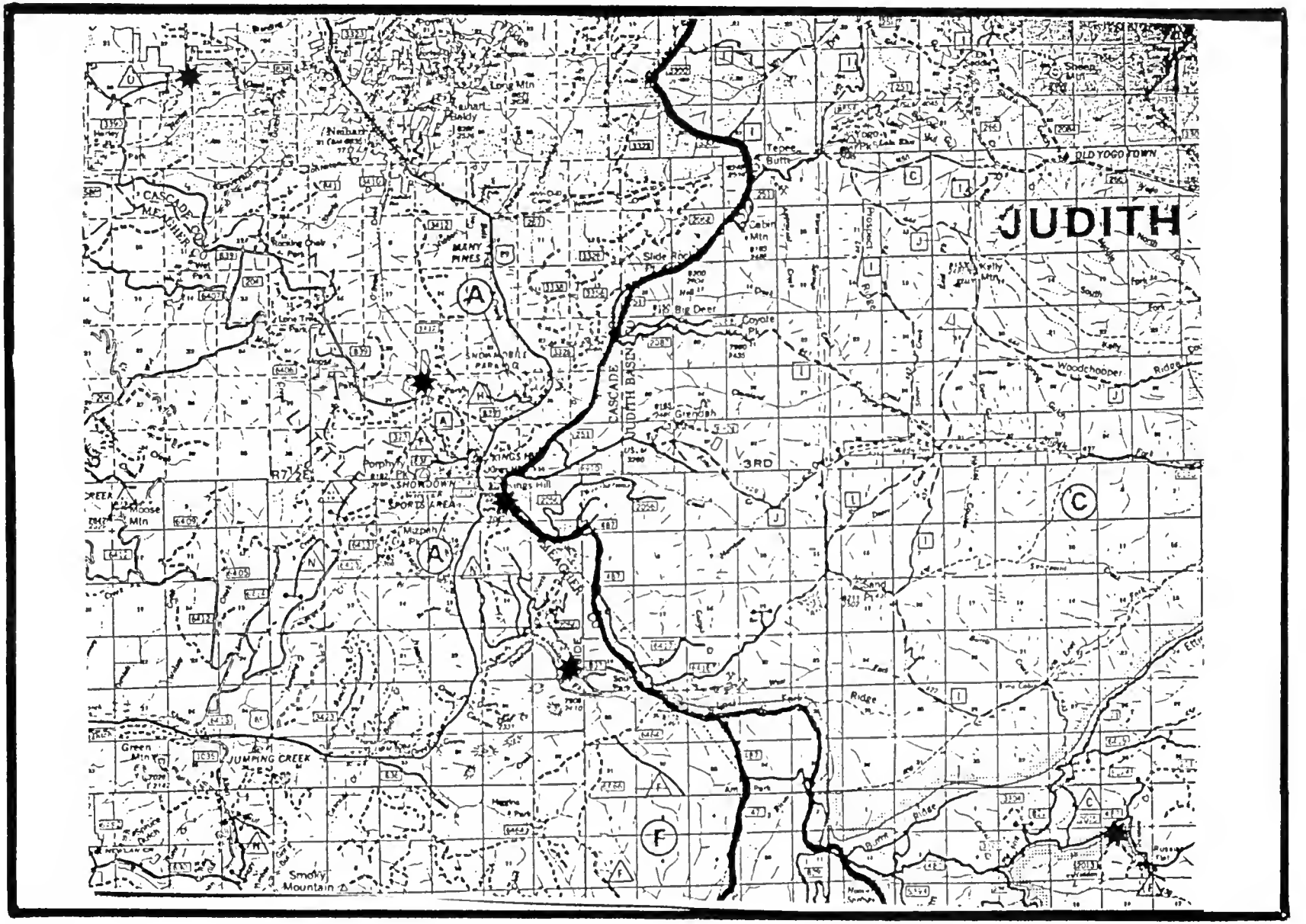
parts of the plant has not been studied although thistles, generally, are not affected much by grazing.

I. PRELIMINARY STUDIES OF WEEVIL INFESTATION

METHODS: To get a preliminary estimate of the number of heads per plant of Cirsium longistylum infested by Rhinocyllus conicus, five plants each were randomly collected from five locations. The total number of heads on each plant were counted and dissected, and then scored as to whether or not they contained weevil larvae. Collection site locations are provided on a map, Figure 4, p. 19.

RESULTS: The raw and summarized data from this study are provided in Table 2, p. 20. The twenty-five C. longistylum plants sampled contained a total of 366 heads. Two-hundred twenty-five of these heads contained one or more weevils. Thus approximately 60 percent of the heads on plants were infested. The degree of infestation and the impact on the seed production were not measured. This would take an involved study. However, different sites showed different levels of infestation of individual plants, with the lowest rate of infestation occurring at Kings Hill and O'Brien Park. After adult weevils lay eggs on plants in the spring, the eggs hatch and the larvae burrow into the flower heads (Rees 1982). Higher elevation locations may limit weevil survival due to variable temperatures. It is not known how weevil infestation affects populations size fluctuations. Monitoring data currently indicate that populations contained a good mix of both rosettes and flowering plants. It is possible that infestation rates are not high enough to limit this species, or that the Cirsium longistylum populations have very few predatory fauna; a hypothesis put forth by Dr. C. Turner (U.S.D.A., Albany, CA, pers. comm.).

FIGURE 5



U.S.D.A. Forest Service, Lewis and Clark National Forest, Jefferson Division Map, reduced by 30 percent showing the locations of collection points for Cirsium longistylum plants used in the weevil infestation study.

Table 2. Number and percent of heads of *Cirsium longistylum* infested by *Rhinocyllus conicus*.

PLOT #	PLANT	NUMBER OF HEADS ON PLANT	NUMBER OF INFESTED HEADS	PERCENT OF HEADS INFESTED
1 (Lower Russian Creek)				
	1	6	4	67%
	2	33	30	90%
	3	10	8	80%
	4	24	23	95%
	5	15	13	86%
2 (Deadman Creek)				
	1	11	11	100%
	2	13	13	100%
	3	15	15	100%
	4	10	10	100%
	5	19	19	100%
3 (O'Brien Park)				
	1	9	2	22%
	2	6	0	0%
	3	10	1	10%
	4	17	2	12%
	5	21	9	43%
4 (Kings Hill)				
	1	15	1	6%
	2	15	5	33%
	3	9	7	78%
	4	11	2	18%
	5	15	3	20%
5 (Neihart)				
	1	22	10	45%
	2	20	13	65%
	3	14	11	78%
	4	10	3	30%
	5	16	10	62%
Totals				
	25	366	225	AVERAGE PERCENT OF HEAD INFESTATION 58%

J. LAND OWNERSHIP

1. Eighteen of the twenty recorded occurrences of Cirsium longistylum in Montana are on land managed by the U.S. Forest Service. Specific information for each occurrence is given below, and exact locations are listed in Section IV., 26-46.

   a. U.S.D.A. Forest Service

   Lewis and Clark National Forest

   Kings Hill Ranger District

   Kings Hill (002)
   Forest Green (003) (partially private)
   Monarch (004)
   Bender Creek Trail (005)
   Jumping Creek Campground (007)
   Neihart (008) (partially private)
   Long Baldy (009)
   O'Brien Creek (010) (partially private)
   South Fork Deadman Creek (011)
   Hay Coulee (012)
   Belt Creek (013)
   Paine Gulch (014)
   Servoss Mountain (015)
   Upper Bear Gulch (017)
   Skunk Gulch (018)
   Thornquist Gulch (019)
   Russian Flat (020)

   Helena National Forest

   Townsend Ranger District

   Thompson Gulch/Gipsy Creek (006)

   b. Private Land

   Monarch SE (001)
   Forest Green (003) (partially Forest Service)
   Neihart (008) (partially Forest Service)
   O'Brien Creek (010) (partially Forest Service)
   Lake Sutherlin (016)

II. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. THREATS TO CURRENTLY KNOWN POPULATIONS

1. **GRAZING:** Grazing by domestic livestock is not known to pose any current threat to Cirsium longistylum populations.

2. **TIMBER HARVEST:** Timber harvest is not known currently to pose a threat to any Cirsium longistylum populations.

3. **WEED CONTROL:** A weevil, Rhinocyllus conicus, which was introduced as a biological control for musk thistle (Carduus nutans), has attacked the seed heads of some Cirsium longistylum plants in the Little Belt Mountains. The effect on seed production and population viability is not known. This insect could pose a threat to Cirsium longistylum in the long term, and its effect should be fully evaluated. A preliminary study has been begun.

4. **HYBRIDIZATION:** This is currently only a speculative threat since it is not clear that hybridization is occurring or that it is threatening the integrity of C. longistylum as a distinct species. However, introgressive hybridization (Anderson 1953) with a more numerous species could potentially swamp C. longistylum as a distinct genetic entity. Introgressive hybrids typically occur in disturbed areas ('hybridized habitats') and with increasing disturbance can increase their population size and contact between the parent species to the point that parent populations can be overwhelmed genetically. Introgression is often a natural process but may also be triggered or increased by human disturbance. Studies are needed to determine if hybridization is, in fact, occurring and, if so, to determine its effect on C. longistylum.

B. MANAGEMENT PRACTICES AND RESPONSE:

No information is available on responses to specific management actions. However, C. longistylum seems able to occupy lightly disturbed sites, but is as often found in native habitat.

C. RECOMMENDATIONS FOR MAINTAINING VIABLE POPULATIONS:

The following recommendations are made to ensure that the long-term viability of Cirsium longistylum

populations is maintained on U.S. Forest Service land in Montana.

1. Protection of natural habitats that currently support Cirsium longistylum populations. Management plans on the Lewis and Clark National Forest and the Helena National Forest should take all known populations into consideration and prevent disturbance of the sites.

2. Notification of U.S. Forest Service personnel of sites on U.S. Forest Service lands. To prevent inadvertent impacts on currently known sites, personnel involved in planning activities should be provided with a description and photographs of C. longistylum. It is especially important that engineers, and range conservationists at the Ranger District level recognize this plant in order to avoid disturbing its habitat.

D. RECOMMENDATIONS FOR FURTHER ASSESSMENT

1. Further field surveys of potential habitats. Additional field surveys should be made in central Montana in portions of the Helena National Forest in the Big Belt Mountains to locate and delineate the extent of the range of C. longistylum.

2. Establishment of monitoring studies to assess population condition and status. Monitoring studies should be continued at several locations to better determine population dynamics and the effects of seed weevil infestation on C. longistylum.

3. Further systematic studies: Additional studies are needed on the systematics of C. longistylum, its variation in central Montana, and its relationship to other Cirsium taxa in the area, including possibly Cirsium hookerianum. Extensive collections from Cirsium populations in the Little Belt Mountains, Big Belt Mountains and the Sawtooth Range should be made and sent to a Dr. Arthur Cronquist, New York Botanical Garden for study and identification.

III. LITERATURE CITED

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IV. ELEMENT OCCURRENCE PRINT-OUTS AND MAPS

Occurrence number: 001

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: MONARCH SE
EO rank:
EO rank comments:

County: CASCADE

USGS quadrangle: MONARCH

Township-range: 015N007E Section: 14 Precision: M
Township-range comments:

Survey date:	1951-08-23	Elevation:	4740
First observation:	1951	Slope/aspect:	
Last observation:	1951-08-23	Size (acres):	0

Location:
LITTLE BELT MOUNTAINS, 3 MILES SOUTHEAST OF MONARCH (TYPE LOCALITY).

Element occurrence data:
UNKNOWN; COLLECTION CONSISTS OF THREE SHEETS, ONE BEARING A ROSETTE ONLY; DIRECTIONS GIVEN FOR THIS COLLECTION ARE NOT IN THE TOWNSHIP, RANGE & SECTION GIVEN IN THE BPA RIVERS STUDY.

General site description:
UNKNOWN.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:
VOUCHER - SENN, FRANKTON & GILLETT (5666), 1951, DAO (HOLOTYPE); ALSO RECORDED IN BPA RIVERS STUDY.

Information source:
MOORE, R.J., AND C. FRANKTON. 1963. CYTOTAXONOMIC NOTES ON SOME CIRSIUM SPECIES OF THE WESTERN U.S. CAN. J. BOT.41:1553.

Occurrence number: 002

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: KINGS HILL
EO rank: D
EO rank comments: 1986: ADJACENT TO ROADS, SOME EVIDENCE OF POSSIBLE HYBRIDIZATION.

County: MEAGHER
CASCADE

USGS quadrangle: KINGS HILL

Township-range: 012N008E Section: 03 Precision: S
Township-range comments: NE4NE4,2N2,SE4;11N2;12NW4,1NW4;T13NR8W:34SE4,SW4

Survey date: 1987-07-16 Elevation: 7280
First observation: 1951 Slope/aspect:
Last observation: 1990-07-31 Size (acres): 500

Location:
LITTLE BELT MOUNTAINS, ENTRANCE TO SHOWDOWN SKI AREA, 0.4 MILE SOUTH OF KINGS HILL CAMPGROUND ALONG HWY. 89. POPULATION EXTENDS EAST TO THE TOP OF KINGS HILL AND SOUTH AND EAST ALONG RIDGES.

Element occurrence data:
1986: FREQUENT; 41 PLANTS STUDIED, WITH 32 HAVING FEATURES OF C. LONGISTYLUM, AND 9 HAVING FEATURES APPARENTLY INTERMEDIATE BETWEEN C. LONGISTYLUM AND C. HOOKERIANUM. 1990: EXTENDED POPULATION BOUNDARIES, TENS OF THOUSANDS OF PLANTS.

General site description:
DISTURBED AREAS ALONG HIGHWAY AND NEAR LARGE TURNOUT, GRAVELLY SURFACE WITH SANDY SOIL BENEATH, AND IN MEADOWS. ASSOCIATED SPECIES: BROMUS SPP., CAREX SPP., POA PRATENSIS, ARTEMISIA SPP.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
VOUCHERS-RAMSTETTER, J. (7), 1983, MONTU; SENN, FRANKTON & GILLETT (5670), 1951, DAO; SCHASSBERGER, L. (396), 1990, MN. ADDITIONAL WATERSHEDS: 10030105 AND 10040103.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 003

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: FOREST GREEN
EO rank:
EO rank comments:

County: MEAGHER

USGS quadrangle: KINGS HILL

Township-range: 012N008E Section: 32 Precision: M
Township-range comments: NE4

Survey date: 1983-07-14 Elevation: 6000
First observation: 1953 Slope/aspect:
Last observation: 1953- Size (acres): 0

Location:
LITTLE BELT MOUNTAINS, 20 MILES SOUTH OF NEIHART, FOREST GREEN RESORT.

Element occurrence data:
UNKNOWN; FOREST GREEN AREA WAS SEARCHED IN 1983 BY J. RAMSTETTER, BUT NO PLANTS WHICH COULD BE CONCLUSIVELY IDENTIFIED AS C. LONGISTYLUM WERE FOUND.

General site description:
MEADOWS, CLEARINGS, AND GRAVELLY ROADSIDES.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHER-SENN (6207), 1953, DAO; MENTIONED WITH JUMPING CREEK CAMPGROUND SITE IN BPA RIVERS STUDY.

Information source:
MOORE, R. J., AND C. FRANKTON. 1963. CYTOTAXONOMIC NOTES ON SOME CIRSIUM SPECIES OF THE WESTERN U.S. CAN. J. BOT.41:1553.

Occurrence number: 004

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: MONARCH
EO rank: D
EO rank comments: VERY SMALL POPULATION, ADJACENT TO ROAD.

County: CASCADE

USGS quadrangle: MONARCH

Township-range: 015N007E Section: 03 Precision: S
Township-range comments: NE4NE4

Survey date: 1983-07-15 Elevation: 4680
First observation: 1983 Slope/aspect:
Last observation: 1986-07-24 Size (acres): 1

Location:
FROM MONARCH ON HWY. 89, GO EAST 1 MILE ON DRY FORK ROAD (#120); SITE IS ON NORTH SIDE OF ROAD.

Element occurrence data:
2 PLANTS IDENTIFIED AS C. LONGISTYLUM; ANOTHER THISTLE POSSIBLY C. HOOKERIANUM IS ABUNDANT IN THE AREA; ADDITIONAL PLANTS MAY OCCUR ALONG ROAD #120 FOR SEVERAL MILES TO THE EAST; 1 PLANT IDENTIFIED AS C. LONGISTYLUM DURING 1986 SURVEY.

General site description:
ROCKY, GRAVELLY DITCH BOTTOM; ASSOCIATED WITH DISTURBED GRASSLAND: POA PRATENSIS, BROMUS INERMIS, PHLEUM PRATENSE.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
NONE.

Information source:
SHELLY, J.S. 1986. FIELD SURVEYS IN LEWIS & CLARK, PONDERA, AND MEAGHER COUNTIES OF 22-24 JULY.

Occurrence number: 005

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: BENDER CREEK TRAIL
EO rank: D
EO rank comments: DISTURBED AREA, ADJACENT TO ROAD AND NUCLEAR MISSILE SILO.

County: CASCADE

USGS quadrangle: BARKER

Township-range: 015N008E Section: 23 Precision: S
Township-range comments: NE4

Survey date: 1986-07-24 Elevation: 5360
First observation: 1983 Slope/aspect:
Last observation: 1990-07-22 Size (acres): 1

Location:
LITTLE BELT MOUNTAINS, CA.9 MILES EAST OF MONARCH, JUNCTION OF TRAIL #318 (BENDER CREEK TRAIL) AND ROAD #120 (DRY FORK BELT CREEK ROAD).

Element occurrence data:
1986: 20 PLANTS COUNTED; EVIDENCE OF POSSIBLE HYBRIDIZATION WITH CIRSIUM HOOKERIANUM. 1990: 10 PLANTS COUNTED.

General site description:
IN GRASSY OPENINGS AND ON ROADSIDE; WITH PINUS PONDEROSA, P. CONTORTA, PSEUDOTSUGA MENZIESII, ACHILLEA MILLEFOLIUM, PHLEUM, LINUM; ADJACENT TO NUCLEAR MISSILE SILO.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHERS-RAMSTETTER, J. (2), 1983, MONTU; SHELLY, J.S. (1253b) AND W. PHILLIPS, 1986.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST SIXTH AVE., HELENA, MT 59620.

Occurrence number: 006

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: THOMPSON GULCH/GIPSY CREEK
EO rank:
EO rank comments:

County: MEAGHER
BROADWATER

USGS quadrangle: GIPSY LAKE
BOULDER BALDY
GURNETT CREEK EAST

Township-range: 009N004E Section: 32 Precision: M
Township-range comments: 27,28,33,31,30;T9NR3E: 25,36

Survey date: 1983-07-18 Elevation: 7400
First observation: 1976 Slope/aspect:
Last observation: 1983-07-18 Size (acres): 0

Location:
SCATTERED IN SUBPOPULATIONS ALONG ROAD #139 FOR 6.4 MILES TO THE WEST.

Element occurrence data:
SOME SUBPOPULATIONS HAVE >100 PLANTS; ANOTHER THISTLE POSSIBLY C. HOOKERIANUM OCCURS IN ALL AREAS (HYBRIDIZATION?).

General site description:
MOIST FIELDS AND ALONG ROADSIDE; WITH LUPINUS, SOLIDAGO; SPECIES "OCCURS IN MOIST FIELDS AND ALONG ROADSIDES FOR A 6.4 MI. STRETCH OF 139" (RAMSTETTER, 1983).

Land owner/manager:
HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:
VOUCHERS-RAMSTETTER, J. (11,13), 1983, MONTU; DORN, R.D. (2783), 1976, MONTU; RECORDED IN BPA RIVERS STUDY. SUBPOPULATION INFORMATION ON FILE AT MTNHP. POPULATION ALSO IN WATERSHED 10030101.

Information source:
RAMSTETTER, J. 1983. SITE SURVEY AND SPECIAL PLANT SURVEY FORMS (SEE GMF).

Occurrence number: 007

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: JUMPING CREEK CAMPGROUND
EO rank:
EO rank comments:

County: MEAGHER

USGS quadrangle: MOOSE MOUNTAIN

Township-range: 012N007E Section: 36 Precision: S
Township-range comments: NE4

Survey date:
First observation: 1983
Last observation: 1990-07-27

Elevation: 5920
Slope/aspect:
Size (acres): 5

Location:
JUMPING CREEK CAMPGROUND (U.S. HWY 89, CA. 17.5 MILES SOUTH OF NEIHART).

Element occurrence data:
FREQUENT IN MOIST MEADOWS AND IN LIGHTLY-DISTURBED AREAS OF CAMPGROUND.

General site description:
MOIST MEADOWS AND INTO CAMPGROUND.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHER-RAMSTETTER, J. (9), 1983, MONTU; SCHASSBERGER, L. (398), MN.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 008

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: NEIHART
EO rank:
EO rank comments:

County: CASCADE

USGS quadrangle: BELT PARK BUTTE

Township-range: 014N007E Section: 07 Precision: S
Township-range comments: 22,23,24,25,26;T14NR8E:19,30

Survey date:		Elevation:	7000
First observation:	1983	Slope/aspect:	
Last observation:	1990-07-27	Size (acres):	160

Location:
NEIHART; POPULATION EXTENDS WEST UP HARLEY CREEK AND NORTH TO UPLAND MEADOWS.

Element occurrence data:
FREQUENT; IN MOIST STREAMSIDE HABITATS AND MOIST MEADOWS OF UPLAND AREAS.

General site description:
IN OPEN AREAS AND ALONG STREAMS, WITH PHLEUM PRATENSE AND CAMPANULA ROTUNDIFOLIA.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:
VOUCHER-RAMSTETTER, J. (3), 1983, MONTU; SCHASSBERGER, L. (403), 1990, NY; TENTATIVELY ANNOTATED BY CRONQUIST AS C. HOOKERIANUM, 1991, PREVIOUSLY ANNOTATED C. LONGISTYLUM, G. OWNBEY, 1990.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 009

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: LONG BALDY
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: YOGO PEAK
NEIHART

Township-range: 014N009E Section: 19 Precision: G
Township-range comments:

Survey date:	1896-08-19	Elevation:	8000
First observation:	1896	Slope/aspect:	
Last observation:	1896-08-19	Size (acres):	0

Location:
"LONG BALDY, LITTLE BELT MOUNTAINS."

Element occurrence data:
UNKNOWN.

General site description:
UNKNOWN

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHER - FLODMAN (880), 1896, NY. MOORE & FRANKTON (1963) STATE THAT THE SITE IS IN JUDITH BASIN COUNTY, I.E., NEAR BIG BALDY MOUNTAIN. LONG MOUNTAIN AND NEIHART BALDY, IN CASCADE COUNTY, LIE JUST TO THE WEST, AND MAY ALSO BE THE AREA OF COLLECTION.

Information source:
MOORE, R.J., AND C. FRANKTON. 1963. CYTOTAXONOMIC NOTES ON SOME CIRSIUM SPECIES OF THE WESTERN U.S. CAN.J. BOT. 41:1553

Occurrence number: 010

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: O'BRIEN CREEK
EO rank:
EO rank comments:

County: CASCADE
MEAGHER

USGS quadrangle: KINGS HILL
MOOSE MOUNTAIN
BELT PARK BUTTE

Township-range: 013N008E Section: 28 Precision: S
Township-range comments: NW4,29NE4,CENTER,30NE4,19SW4,SE4,NE4

Survey date:
First observation: 1990
Last observation: 1990-07-27

Elevation: 7200
Slope/aspect:
Size (acres): 800

Location:
LITTLE BELT MOUNTAINS, WEST OF KINGS HILL ALONG F.S. ROAD #839 FROM O'BRIEN PARK TO LONE TREE PARK.

Element occurrence data:
PROBABLY HUNDREDS OF THOUSANDS OF PLANTS PRESENT.

General site description:
IN OPEN MEADOWS AND FORESTS AND ALONG ROADWAYS, WITH POA PRATENSE, KOELERIA MACRANTHA, ASTRAGALUS ALPINA, GERANIUM VISCOSISSIMUM, ACHILLEA MILLEFOLIUM, ASTER OCCIDENTALIS.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHER - SCHASSBERGER, L. (401), 1990. TENTATIVELY IDENTIFIED BY G. OWNBEY.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 011

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: SOUTH FORK DEADMAN CREEK
EO rank: BC
EO rank comments: 1986: LARGE POPULATION, PARTIALLY OCCURS IN DISTURBED AREAS.

County: MEAGHER

USGS quadrangle: KINGS HILL
SAND POINT

Township-range: 012N008E Section: 24 Precision: S
Township-range comments: S2,NW4,25NE4,T12NR9E:19S2,20SW4,30NE4,29N2

Survey date: 1990-07-27 Elevation: 6800
First observation: 1986 Slope/aspect:
Last observation: 1990-07-27 Size (acres): 600

Location:
LITTLE BELT MOUNTAINS, SOUTH FORK DEADMAN CREEK DRAINAGE, ALONG LEWIS & CLARK NF RD. #837, CA. 1 MILE FROM US HWY 89 UP INTO SPUR PARK (ALONG ROAD AND ON ADJACENT, LIGHTLY-DISTURBED SLOPES).

Element occurrence data:
1986: OF 19 PLANTS STUDIED, 3 DISPLAYED FEATURES SUGGESTING HYBRID CONTACT WITH C. HOOKERIANUM. 1990: FREQUENT; SEVERAL TENS OF THOUSANDS OF PLANTS.

General site description:
AT LOWER ELEVATIONS: PINUS CONTORTA FOREST ON NE-FACING SLOPE. AT HIGHER ELEVATIONS (SPUR PARK): ABIES LASIOCARPA/PINUS ALBICAULIS PARKLAND, WITH FESTUCA IDAHOENSIS, GEUM TRIFLORUM, POTENTILLA FRUTICOSA, AND PENSTEMON PROCERUS.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
1986: SIGHT RECORD. 1990: VOUCHER, SCHASSBERGER, L. (399), MN. ADDITIONAL FIELD SURVEY NEEDED THROUGHOUT REGION.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 012

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: HAY COULEE
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: WOODHURST MOUNTAIN

Township-range: 014N011E Section: 29 Precision: S
Township-range comments: CENTER

Survey date:		Elevation:	5920
First observation:	1990	Slope/aspect:	LEVEL / EAST
Last observation:	1990-08-07	Size (acres):	60

Location:
LITTLE BELT MOUNTAINS, SOUTH OF SAGE CREEK UP HAY COULEE, CA. 15 MILES WEST OF UTICA.

Element occurrence data:
FREQUENT; MORE THAN 5,000 INDIVIDUALS.

General site description:
IN OPEN MEADOW, WITH PHLEUM PRATENSE AND GERANIUM VISCOSISSIMUM.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
HEAVILY-GRAZED MEADOW. AREA MAY HAVE BEEN BURNED IN THE SAGE CREEK FIRE OF 1990.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 013

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: BELT CREEK
EO rank: B
EO rank comments: LARGE POPULATION, ADJACENT TO ROAD.

County: CASCADE

USGS quadrangle: NEIHART

Township-range: 013N008E Section: 15 Precision: S
Township-range comments: N2

Survey date: 1986-07-24 Elevation: 6080
First observation: 1986 Slope/aspect:
Last observation: 1986-07-24 Size (acres): 1

Location:
LITTLE BELT MOUNTAINS, BELT CREEK, ALONG US HWY 89, 1 MILE SOUTH OF JEFFERSON CREEK, CA. 4 MILES SOUTHEAST OF NEIHART.

Element occurrence data:
170 PLANTS COUNTED, 85 ON EACH SIDE OF THE CREEK; OF 41 PLANTS STUDIED, 24 WERE IDENTIFIED AS C. LONGISTYLUM AND 4 AS C. HOOKERIANUM?; 13 DISPLAYED CHARACTERISTICS INTERMEDIATE BETWEEN THE TWO.

General site description:
GRASSY OPENINGS ALONG CREEK, AND NEAR HIGHWAY.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
SIGHT RECORD, VOUCHER SPECIMEN VOIDED; AREA SURVEYED WITH WAYNE PHILLIPS, USFS, GREAT FALLS.

Information source:
SHELLY, J.S. 1986. FIELD SURVEYS IN LEWIS & CLARK, PONDERA, AND MEAGHER COS. OF 22-24 JULY.

Occurrence number: 014

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: PAINE GULCH
EO rank: B
EO rank comments: PLANTS VARIABLE INDICATING POSSIBLE HYBRIDIZATION; DISTURBED MEADOW

County: CASCADE

USGS quadrangle: MONARCH

Township-range: 015N007E Section: 12 Precision: S
Township-range comments: W2,11NE4

Survey date: 1987-06-30 Elevation: 5200
First observation: 1987 Slope/aspect:
Last observation: 1987-06-30 Size (acres): 2

Location:
LITTLE BELT MOUNTAINS, PAINE GULCH, CA. 1.5 - 2.2 MILES UPSTREAM FROM CONFLUENCE WITH BELT CREEK.

Element occurrence data:
11-50 PLANTS OBSERVED.

General site description:
DISTURBED MEADOW.

Land owner/manager:
PAINE GULCH PROPOSED RESEARCH NATURAL AREA
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
POSSIBLE HYBRIDIZATION WITH C. HOOKERIANUM.

Information source:
KRATZ, A. 1987. [FIELD WORK IN PAINE GULCH WITH WAYNE PHILLIPS (USFS): 29 JUNE - 2 JULY.]

Occurrence number: 015

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: SERVOSS MOUNTAIN
EO rank:
EO rank comments:

County: CASCADE

USGS quadrangle: BARKER

Township-range: 015N008E Section: 21 Precision: S
Township-range comments: W2

Survey date: 1987-06-30 Elevation: 6400
First observation: 1987 Slope/aspect:
Last observation: 1987-06-30 Size (acres):

Location:
LITTLE BELT MOUNTAINS, SOUTHEAST SIDE OF SERVOSS MOUNTAIN, NORTH OF DIVIDE BETWEEN RUBY CREEK AND HENN GULCH.

Element occurrence data:
UNKNOWN.

General site description:
FOUND ALONG A MOTORCYCLE TRAIL.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
SITE NOT SURVEYED IN DETAIL; BOUNDARY IS APPROXIMATE.

Information source:
KRATZ, ANDREW. LOLO NATIONAL FOREST, BUILDING 24, FORT MISSOULA, MISSOULA, MT 59801.

Occurrence number: 016

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: LAKE SUTHERLIN
EO rank:
EO rank comments:

County: MEAGHER

USGS quadrangle: VOLCANO BUTTE

Township-range: 010N008E Section: 15 Precision: M
Township-range comments:

Survey date:		Elevation:	5500
First observation:	1986	Slope/aspect:	
Last observation:	1986-07-24	Size (acres):	0

Location:
0.5 MILE EAST OF LAKE SUTHERLIN (CA. 7 MILES NE OF WHITE SULPHUR SPRINGS).

Element occurrence data:
UNKNOWN.

General site description:
IN MOIST MEADOW, WITH ASTER OCCIDENTALIS AND ERIGERON SPP.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:
NONE.

Information source:
LACKSCHEWITZ, K.H. (11026). 1986. SPECIMEN # 103745. MONTU.

Occurrence number: 017

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: UPPER BEAR GULCH
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: BANDBOX MOUNTAIN

Township-range: 014N010E Section: 26 Precision: S
Township-range comments: SW4SW4,27SE4SE4,35NW4NW4

Survey date:		Elevation:	6280
First observation:	1990	Slope/aspect:	
Last observation:	1990-03-28	Size (acres):	10

Location:
LITTLE BELT MOUNTAINS, UPPER BEAR GULCH, CA. 20 MILES WEST OF UTICA, MT.

Element occurrence data:
CA. 100 PLANTS.

General site description:
SCATTERED ALONG A MEADOW NEAR STREAMSIDE.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
VOUCHER - SCHASSBERGER, L. (412), 1990, MN. TENTATIVELY VERIFIED BY G. OWNBEY.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 018

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: SKUNK GULCH
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: BANDBOX MOUNTAIN

Township-range: 014N010E Section: 33 Precision: S
Township-range comments: NW4,SE4

Survey date:
First observation: 1990
Last observation: 1990-08-07

Elevation: 6280
Slope/aspect:
Size (acres): 60

Location:
LITTLE BELT MOUNTAINS, SKUNK GULCH, CA. 12 MILES NORTHEAST OF SAPPHIRE VILLAGE.

Element occurrence data:
SEVERAL HUNDREDS OF PLANTS, IN FLOWER (TOTAL NOT COUNTED).

General site description:
IN MEADOW ALONG CREEK, WITH FESTUCA SCABRELLA AND GERANIUM VISCOSISSIMUM.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
VOUCHER - SCHASSBERGER, L. (412), 1990, MN. TENTATIVELY IDENTIFIED BY G. OWNBEY.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 019

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: THORNQUIST GULCH
EO rank:
EO rank comments:

County: MEAGHER

USGS quadrangle: COXCOMBE BUTTE

Township-range: 011N007E Section: 17 Precision: S
Township-range comments: NW4

Survey date:
First observation: 1990
Last observation: 1990-07-26

Elevation: 5800
Slope/aspect:
Size (acres): 30

Location:
LITTLE BELT MOUNTAINS, THORNQUIST GULCH, CA. 13 MILES NORTH OF WHITE SULPHUR SPRINGS.

Element occurrence data:
CA. 50 PLANTS.

General site description:
NEAR JEEP ROAD, ALONG STREAM.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:
VOUCHER - SCHASSBERGER, L. (397), 1990, NY. TENTATIVELY IDENTIFIED BY A. CRONQUIST.

Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.

Occurrence number: 020

Global rank: G2Q Forest Service status: WATCH LIST
State rank: S2 Federal Status: C2

Survey site name: RUSSIAN FLAT
EO rank:
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: RUSSIAN FLAT

Township-range: 011N010E Section: 11 Precision: S
Township-range comments: NW4,10NW4SE4,NE4,12SW4

Survey date:		Elevation:	6520
First observation:	1990	Slope/aspect:	5% / EAST
Last observation:	1990-07-24	Size (acres):	80

Location:
LITTLE BELT MOUNTAINS, RUSSIAN CREEK, CA. 18 MILES WEST OF SAPPHIRE VILLAGE.

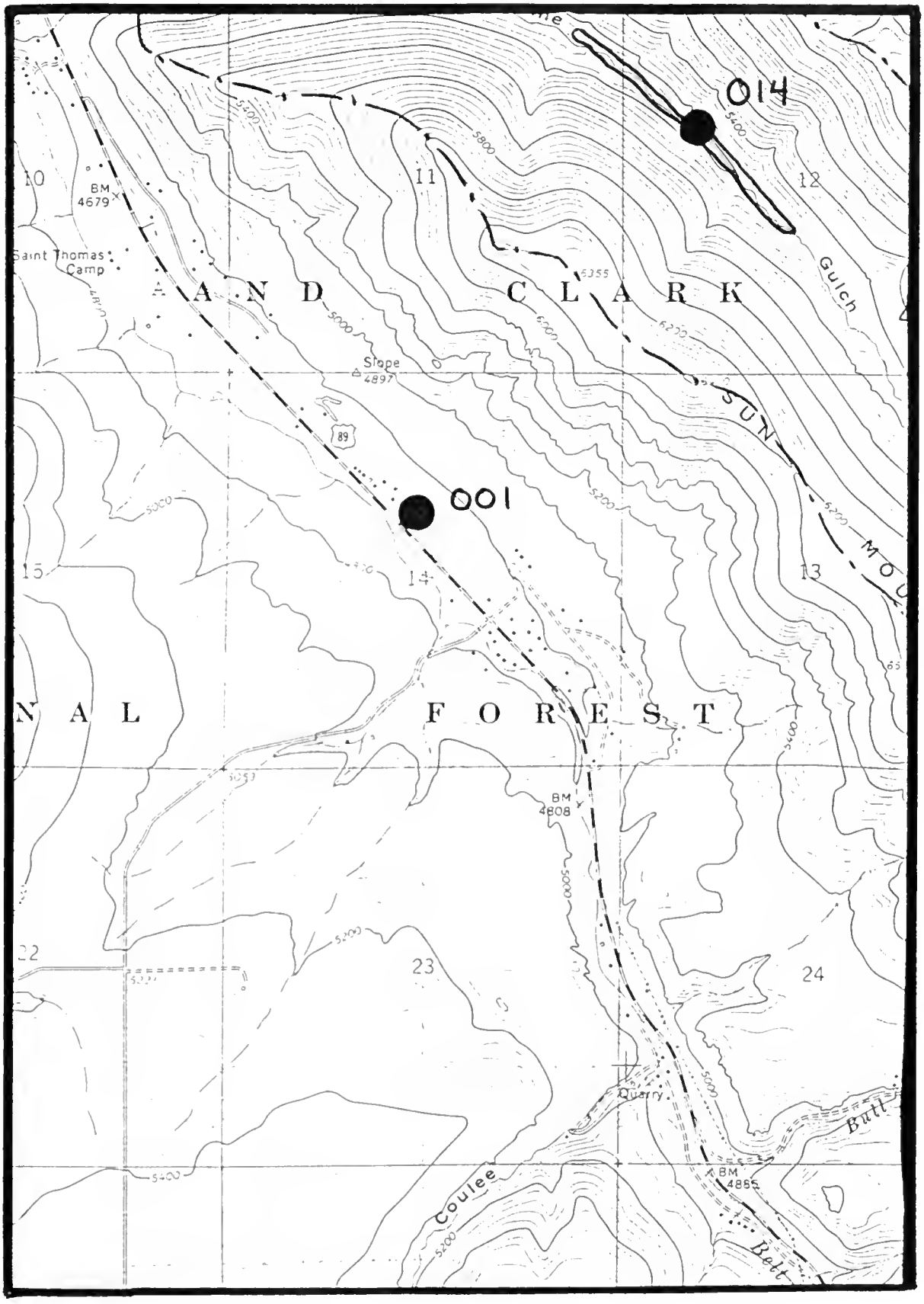
Element occurrence data:
THOUSANDS OF PLANTS PLUS SCATTERED INDIVIDUALS EXTENDING TO THE EAST CA. 1 MILE.

General site description:
LARGE POPULATION IN OPEN MEADOW, WITH POTENTILLA FRUTICOSA, POTENTILLA DIVERSIFOLIA, ACHILLEA MILLEFOLIUM, ANTENNARIA MICROPHYLLA, FESTUCA IDAHOENSIS, GEUM TRIFLORUM, AND PHLEUM PRATENSE.

Land owner/manager:
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:
NONE.

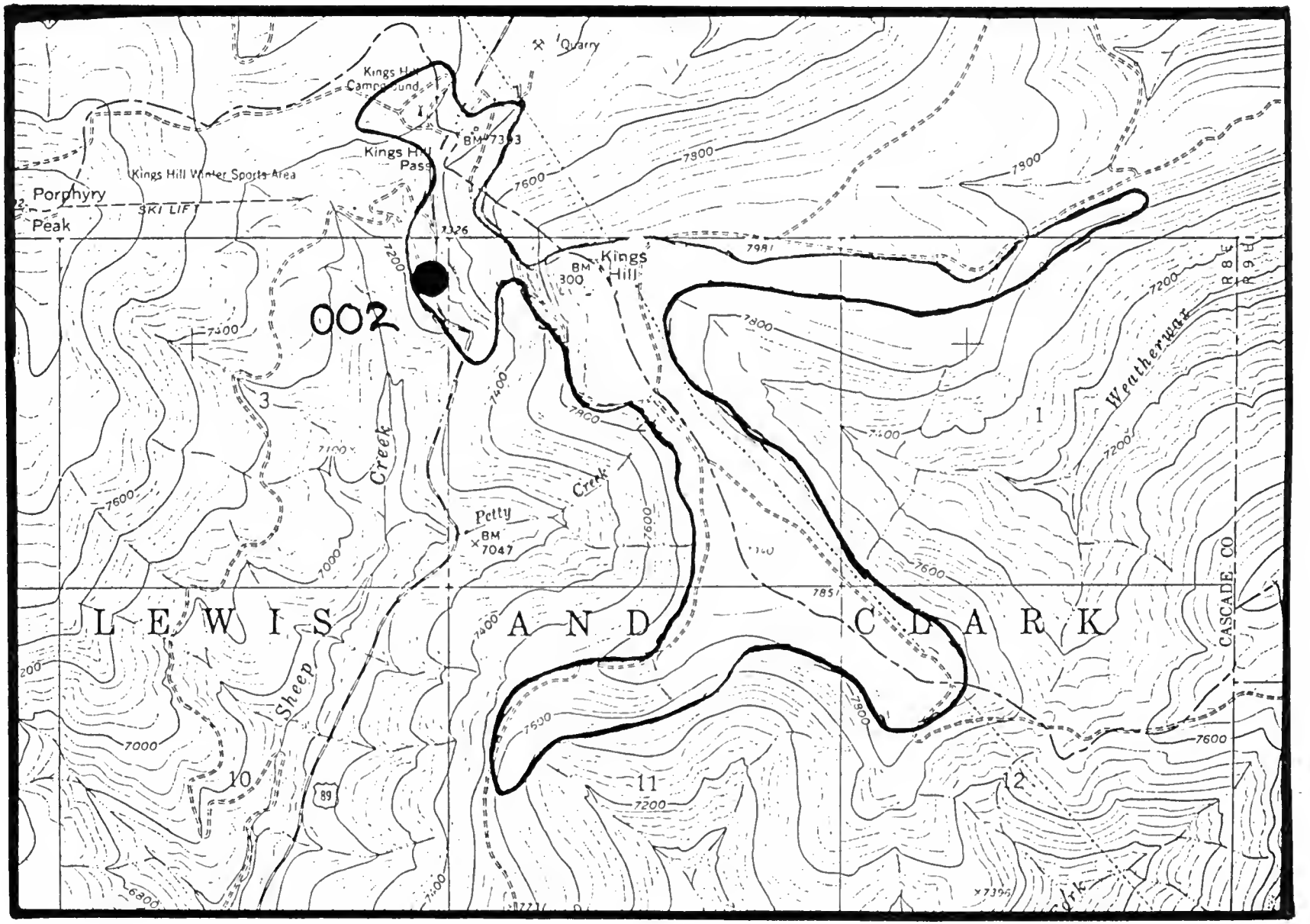
Information source:
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 EAST 6TH AVE., HELENA, MT 59620.



Cirsium longistylum

Monarch SE (001)
Paine Gulch (014)

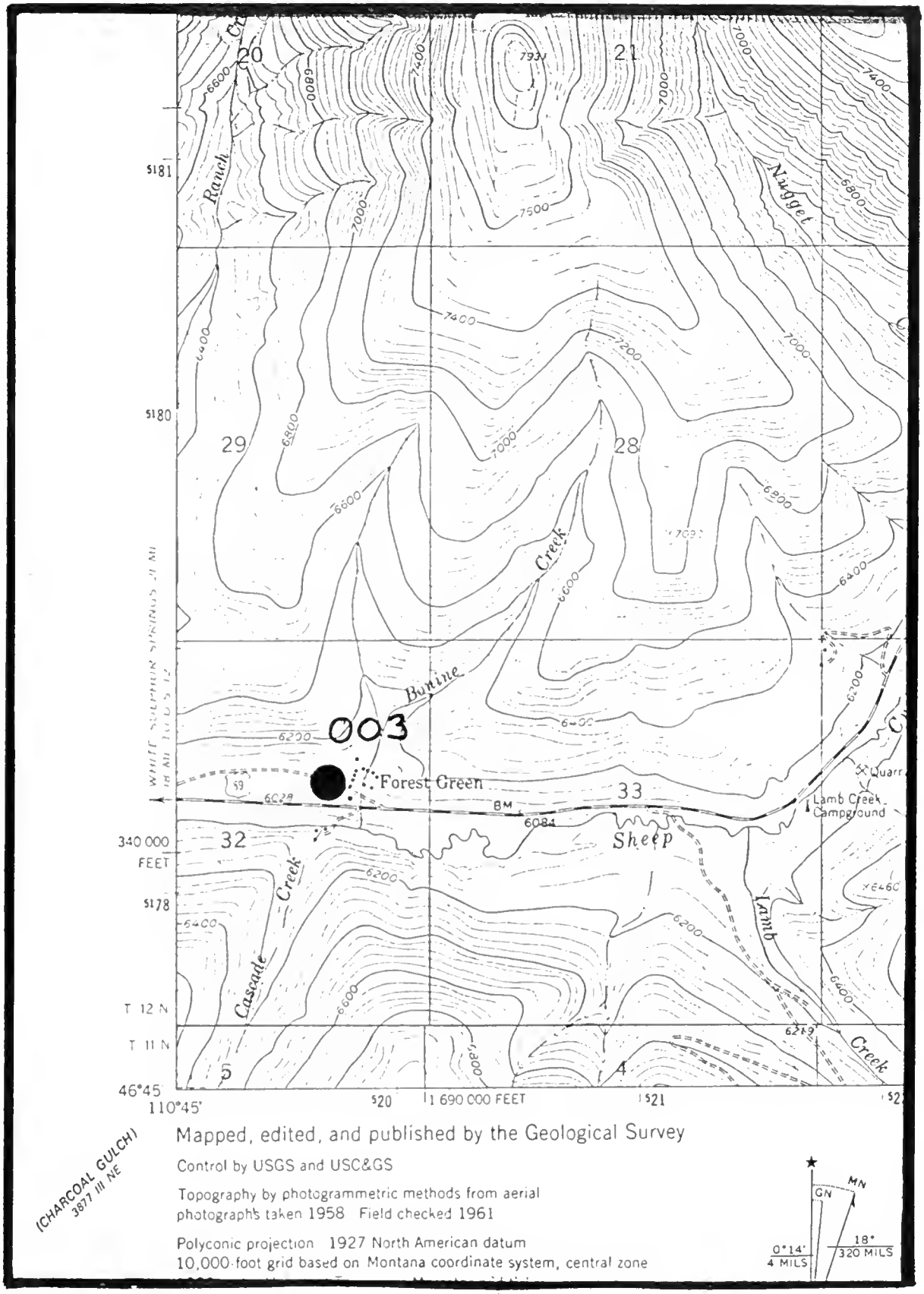
U.S.G.S. Monarch Quadrangle (7.5')



Cirsium longistylum

Kings Hill (002)

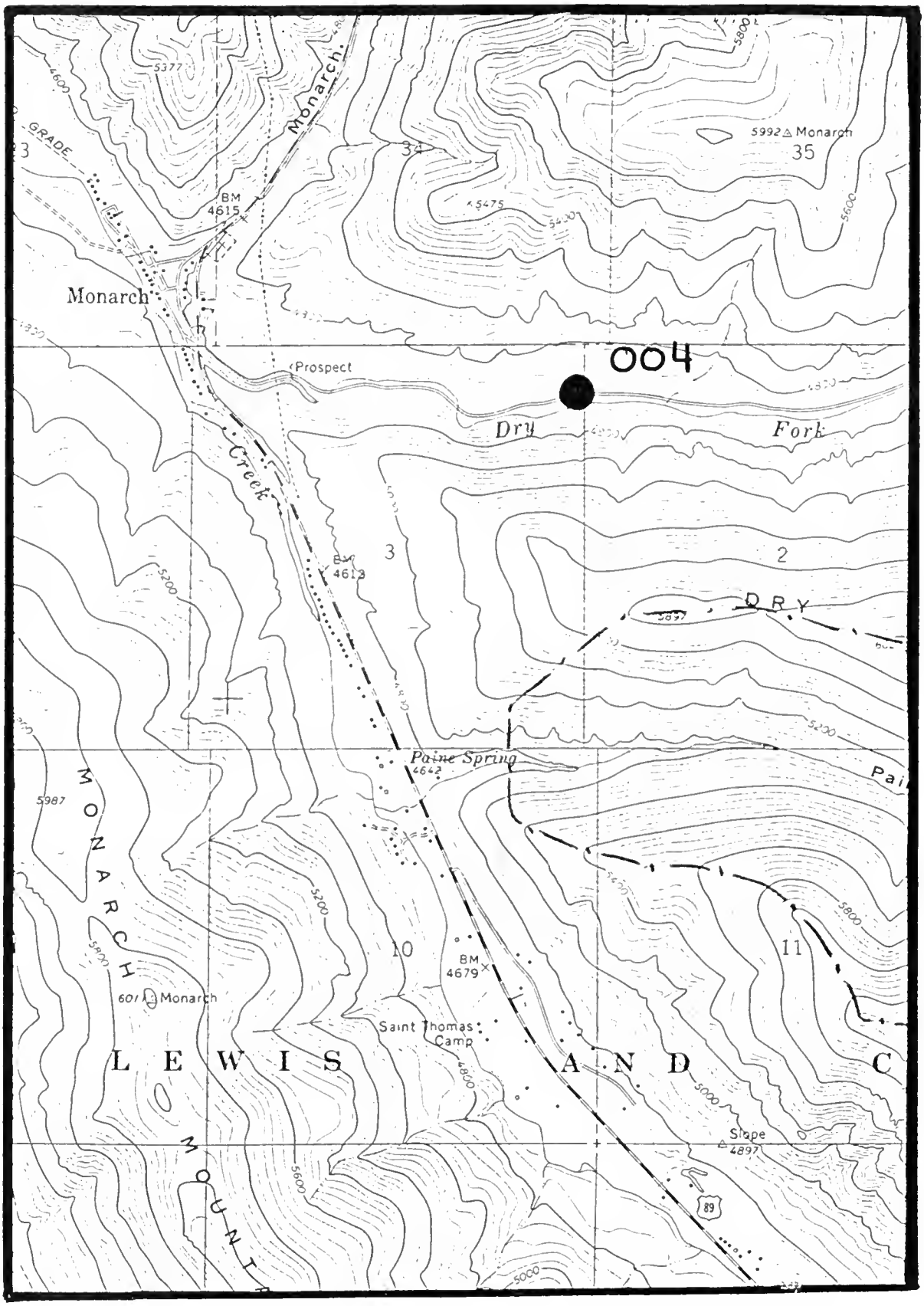
U.S.G.S. Kings Hill Quadrangle (7.5')



Cirsium longistylum

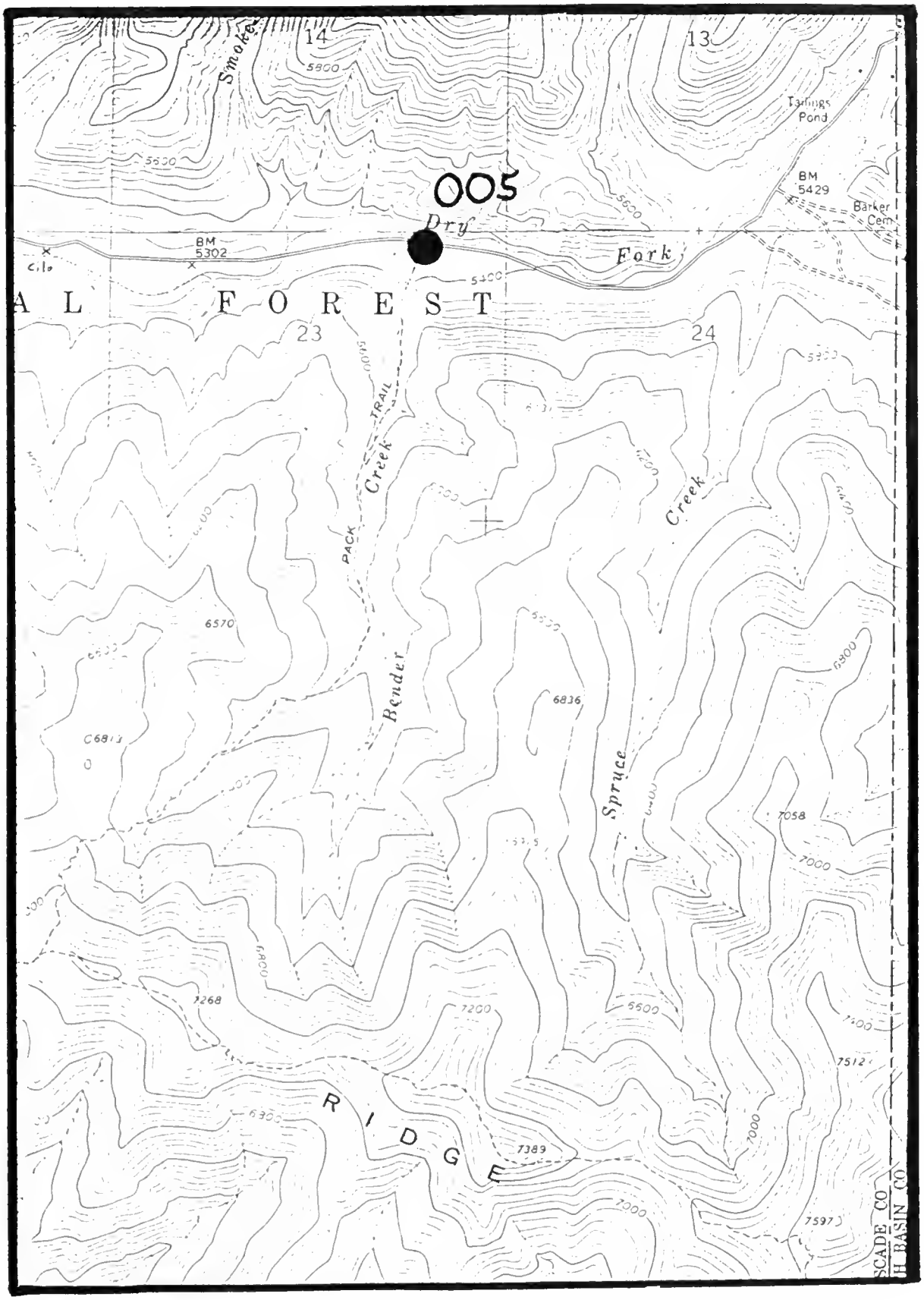
Forest Green (003)

U.S.G.S. Kings Hill Quadrangle (7.5')



Cirsium longistylum Monarch (004)

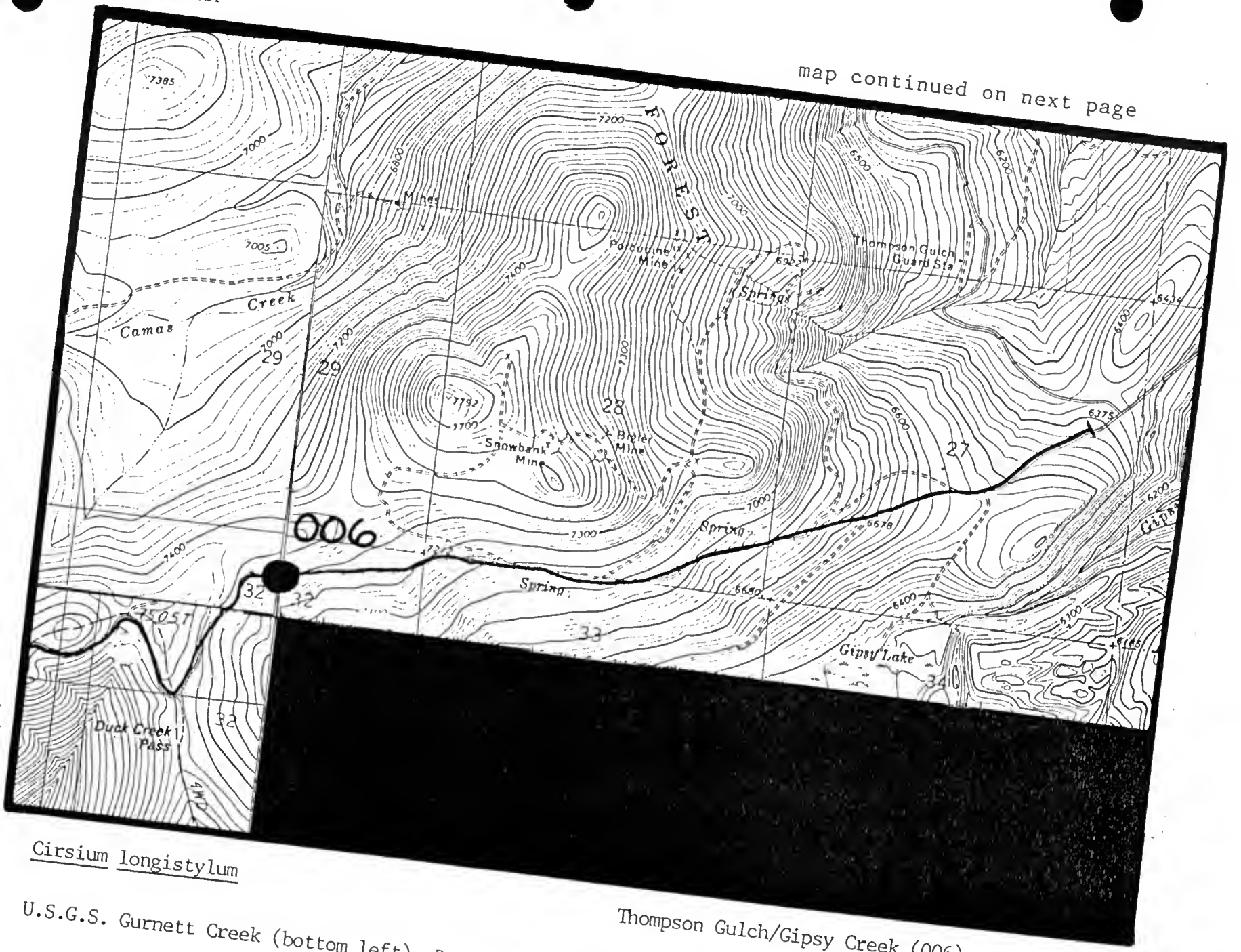
U.S.G.S. Monarch Quadrangle (7.5')



Cirsium longistylum Bender Creek Trail (005)

U.S.G.S. Barker Quadrangle (7.5')

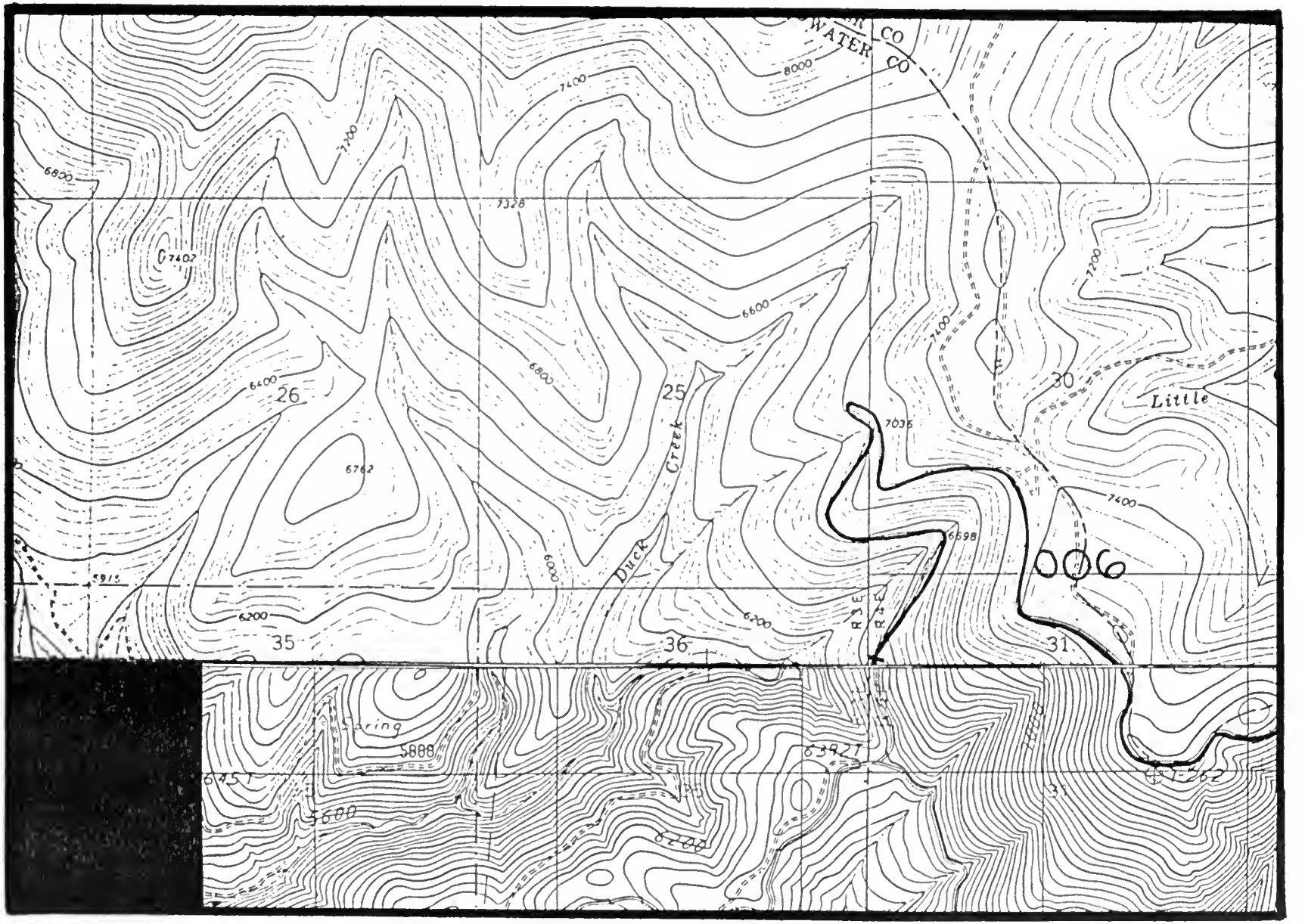
map continued on next page



Cirsium longistylum

Thompson Gulch/Gipsy Creek (006)

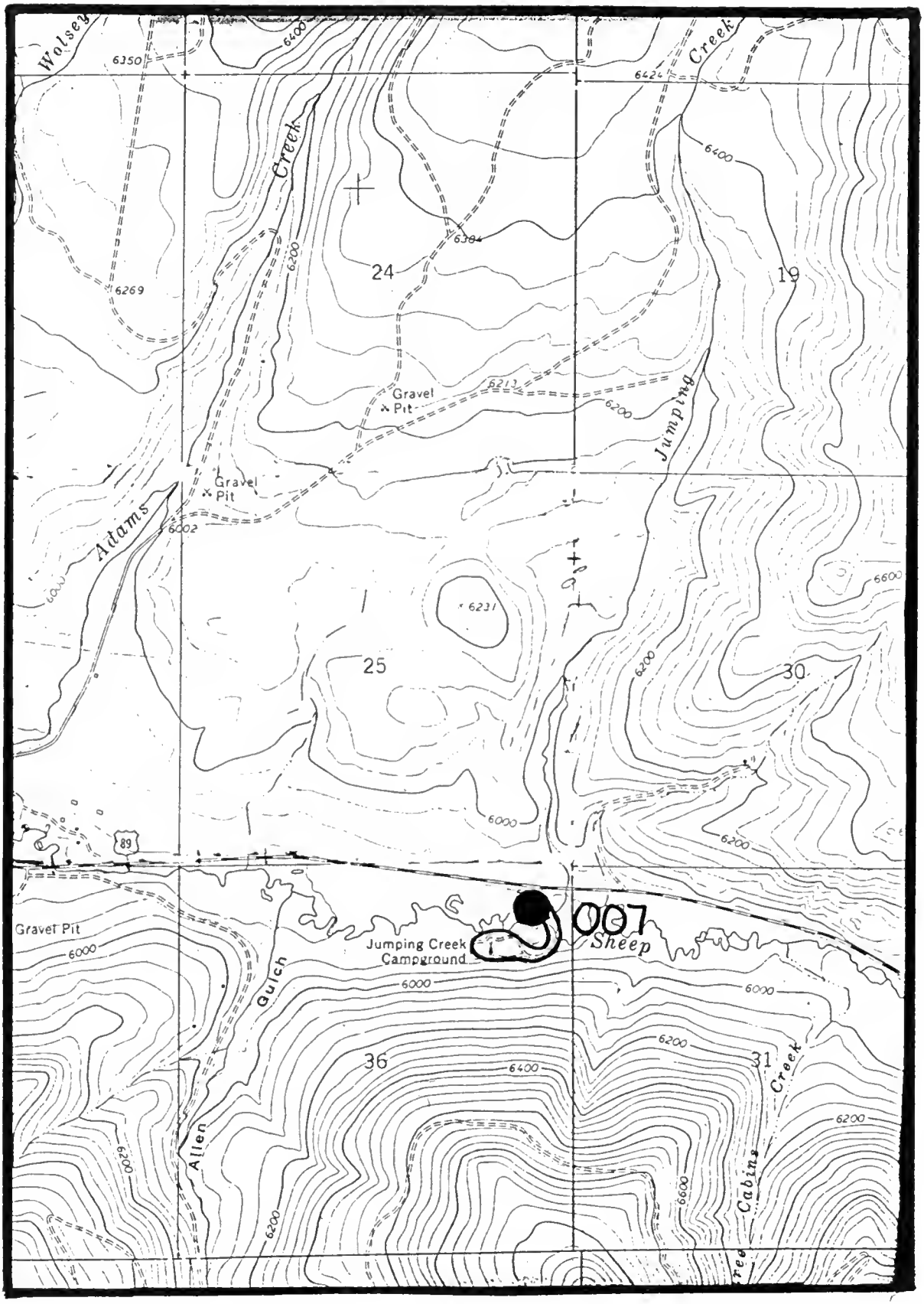
U.S.G.S. Gurnett Creek (bottom left), Boulder Baldy (top left), and Gipsy Lake (top right) Quadrangles (7.5')



Cirsium longistylum

Thompson Gulch/Gipsy Creek (006)

U.S.G.S. Gurnett Creek East (bottom) and Boulder Baldy (top) Quadrangles (7.5')

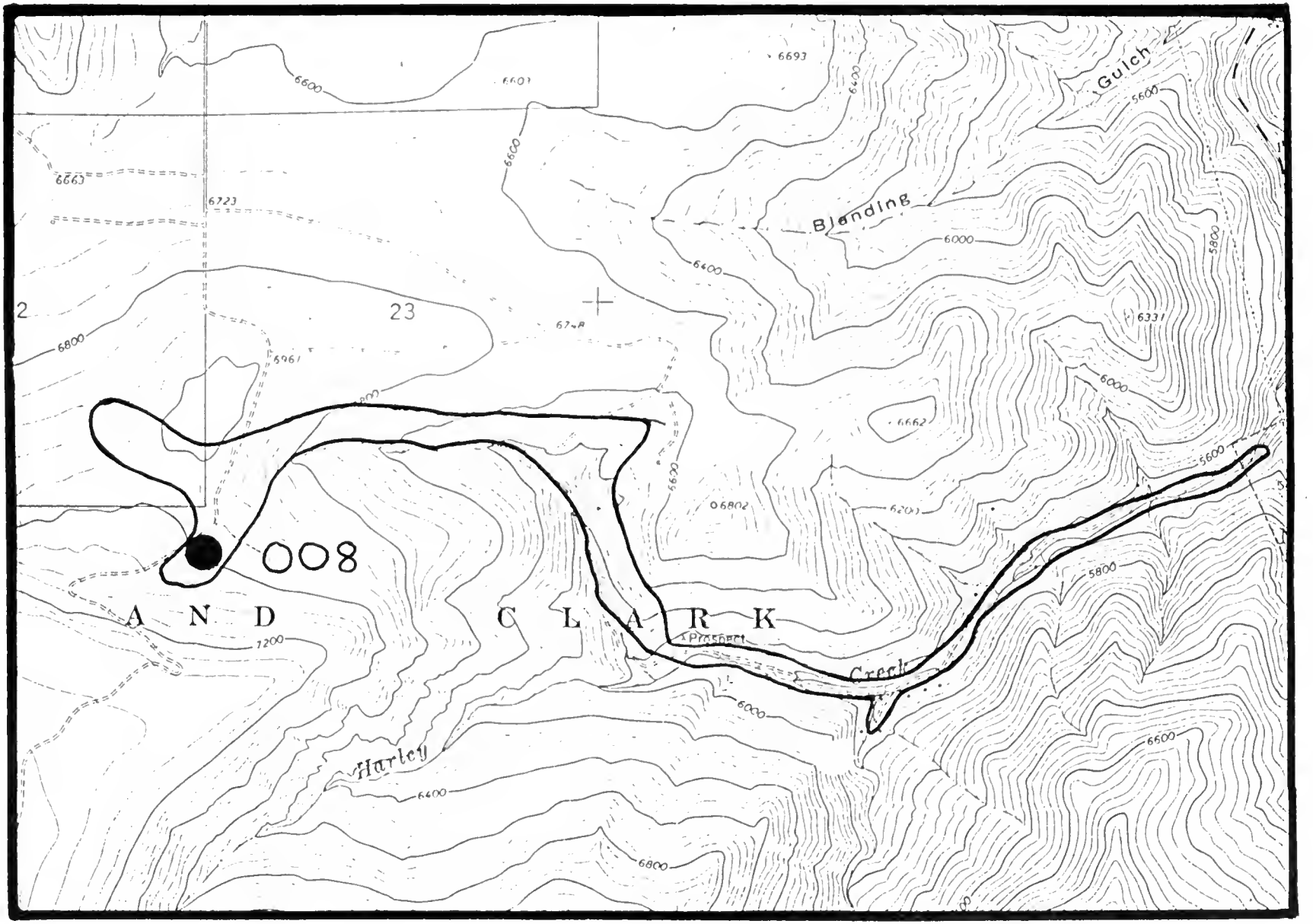


Cirsium longistylum

Jumping Creek Campground (007)

U.S.G.S. Moose Mountain Quadrangle (7.5')

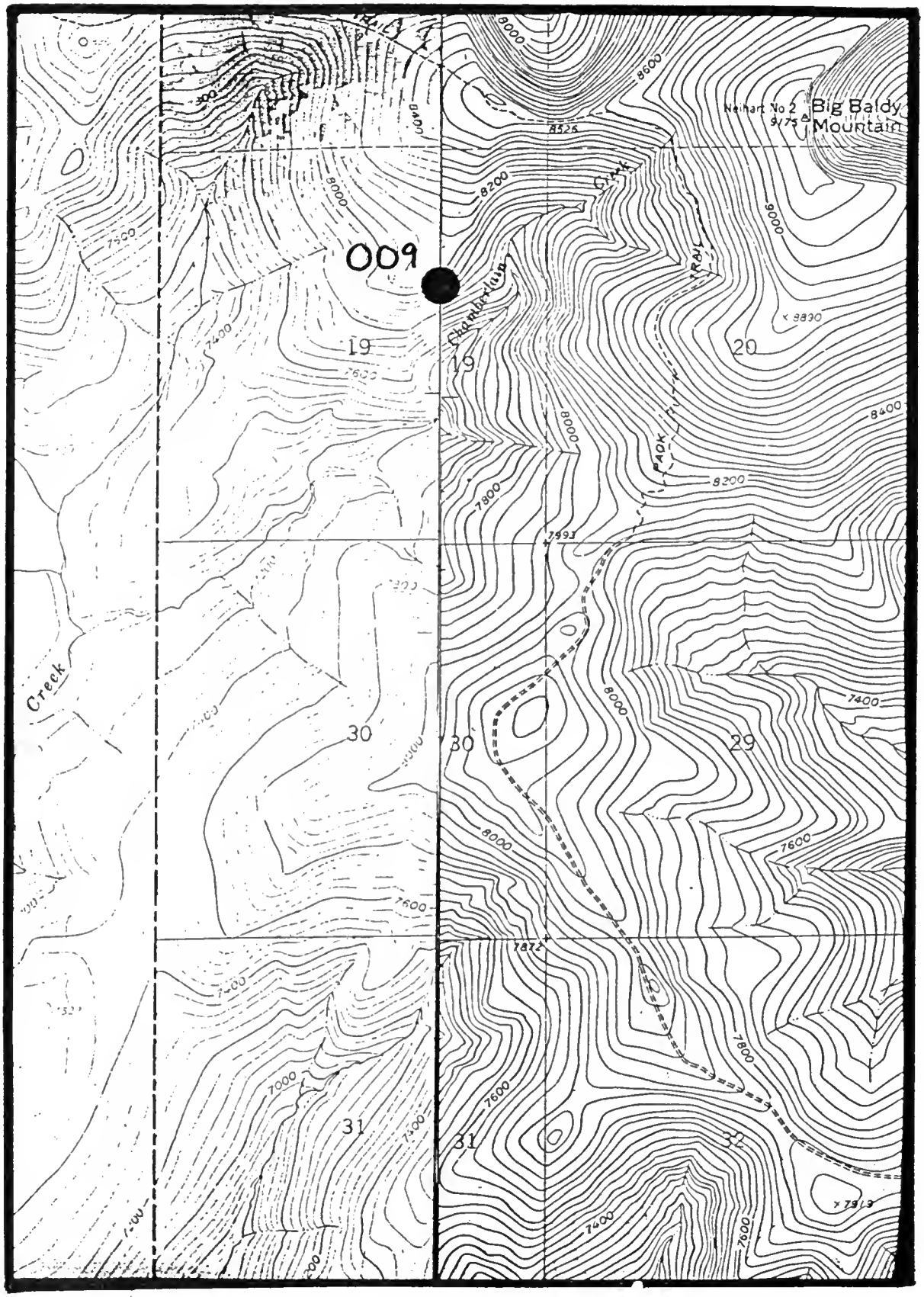
MONTANA



Cirsium longistylum

Neihart (008)

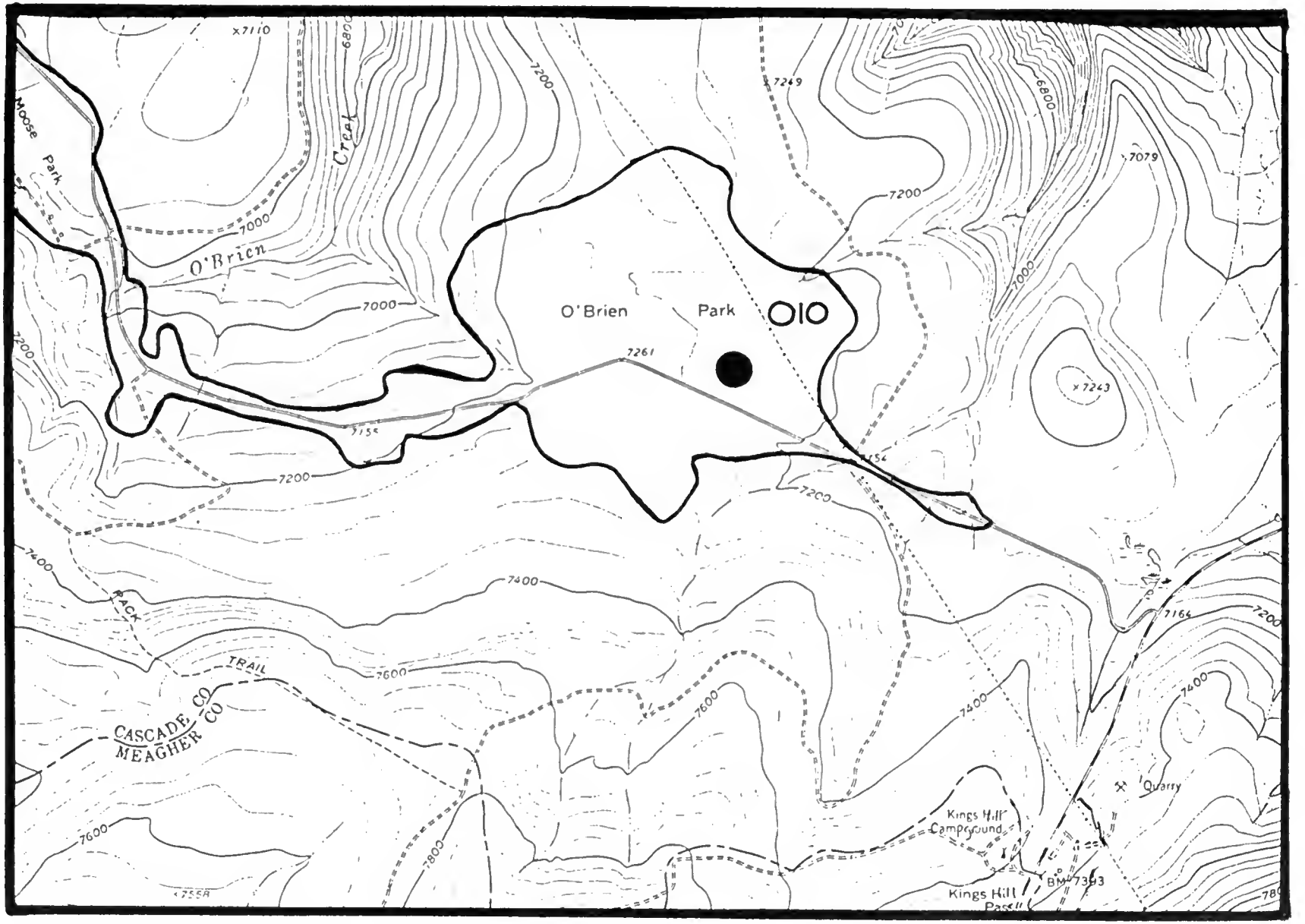
U.S.G.S. Belt Park Butte Quadrangle (7.5')



Cirsium longistylum — Long Baldy (009)

U.S.G.S. Neihart (left) and Yogo Peak (right) Quadrangles (7.5')

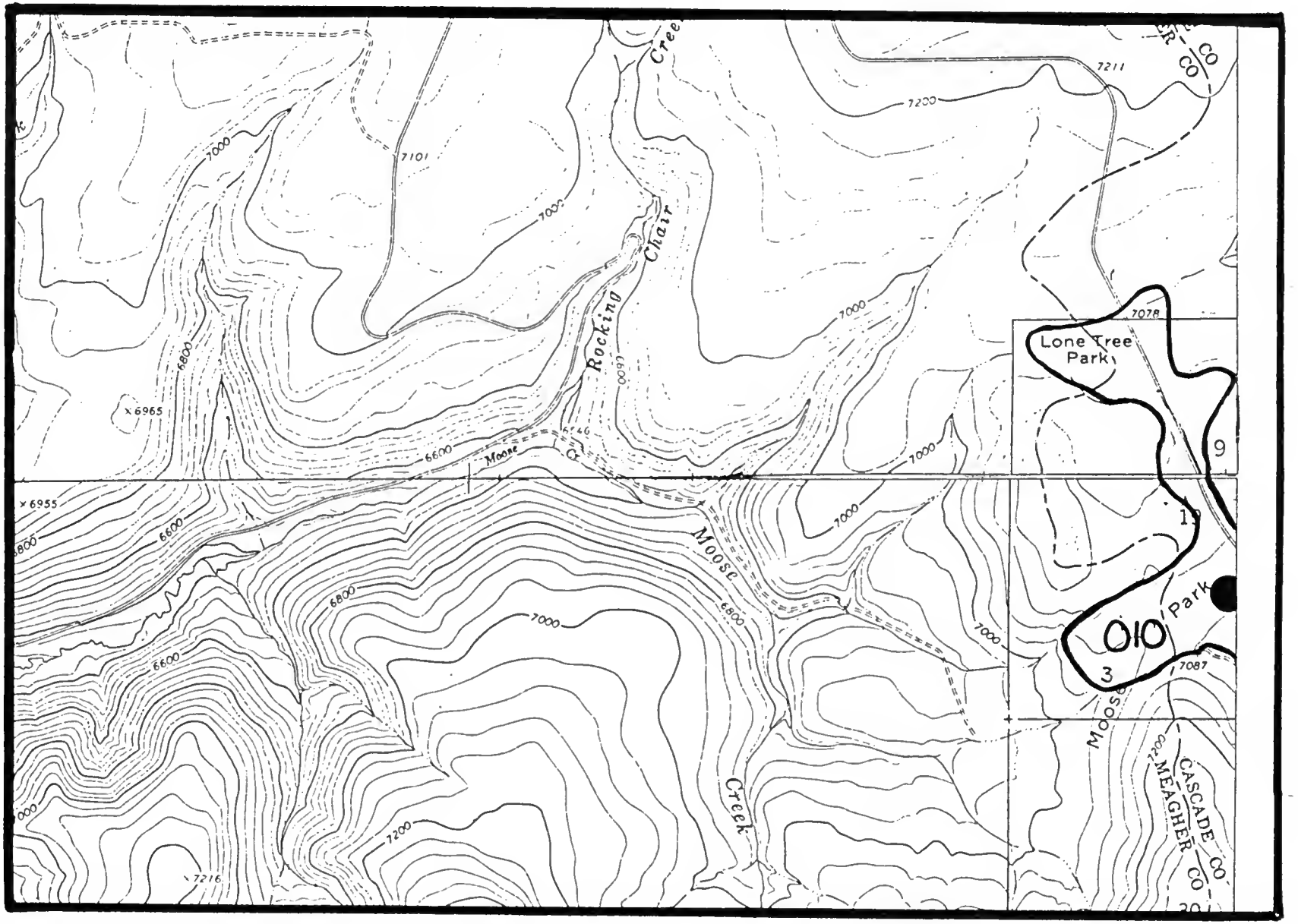
map continued on next page



Cirsium longistylum

O'Brien Park (010)

U.S.G.S. Kings Hill Quadrangle (7.5')

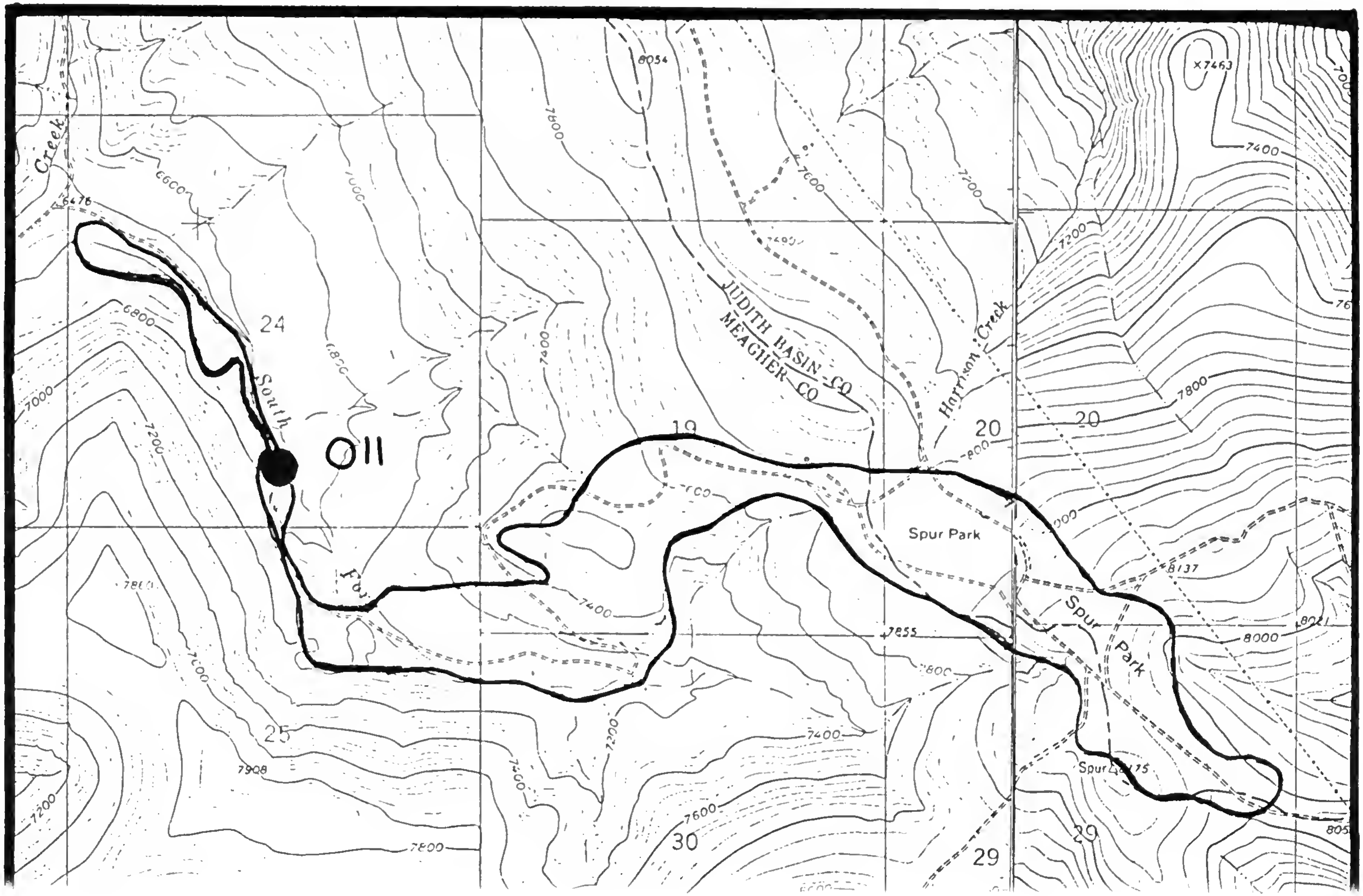


Cirsium longistylum

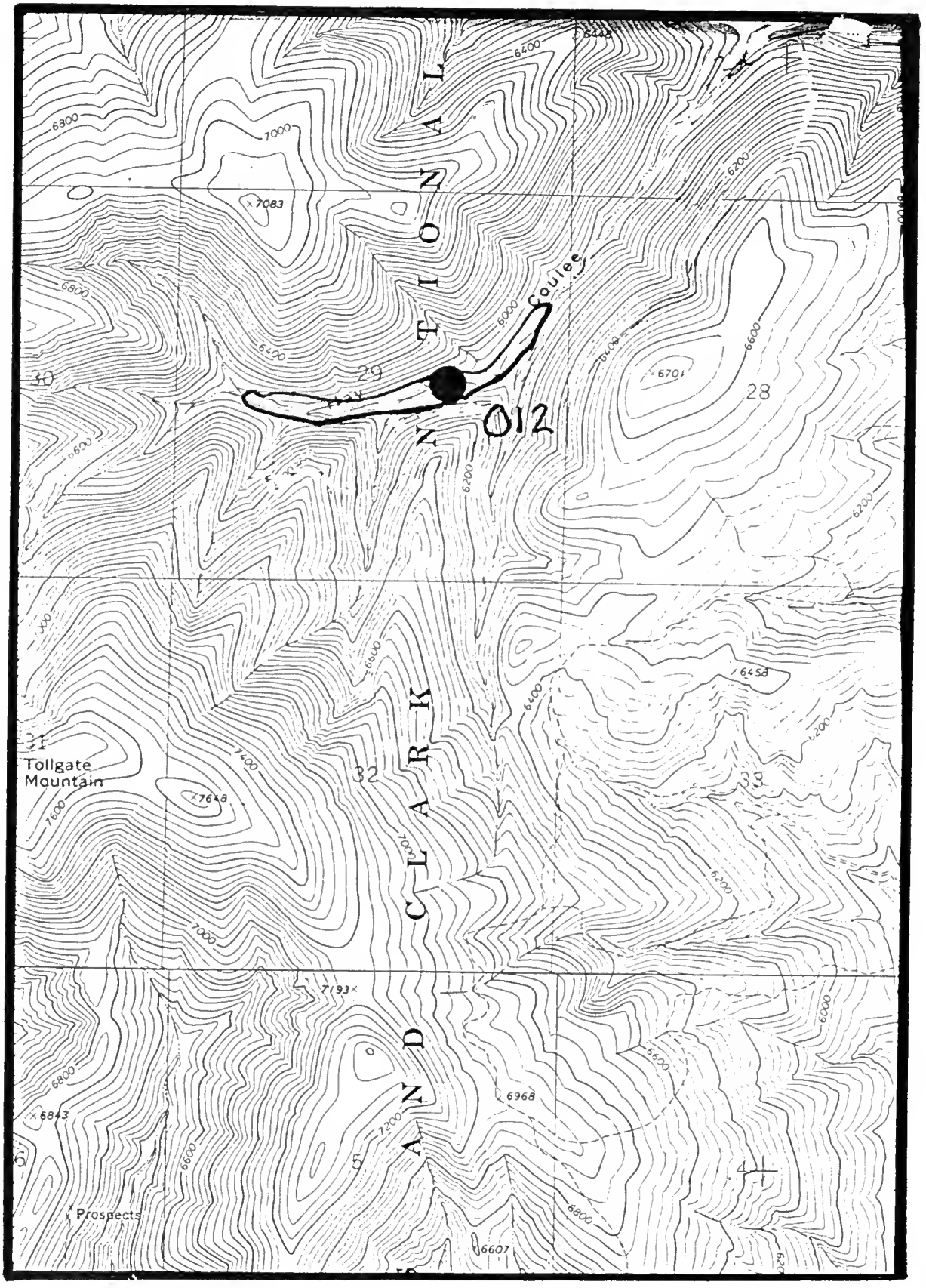
O'Brien Park (010) cont.

U.S.G.S. Belt Park Butte (top) and Moose Mountain (bottom) Quadrangles (7.5')

MONTANA

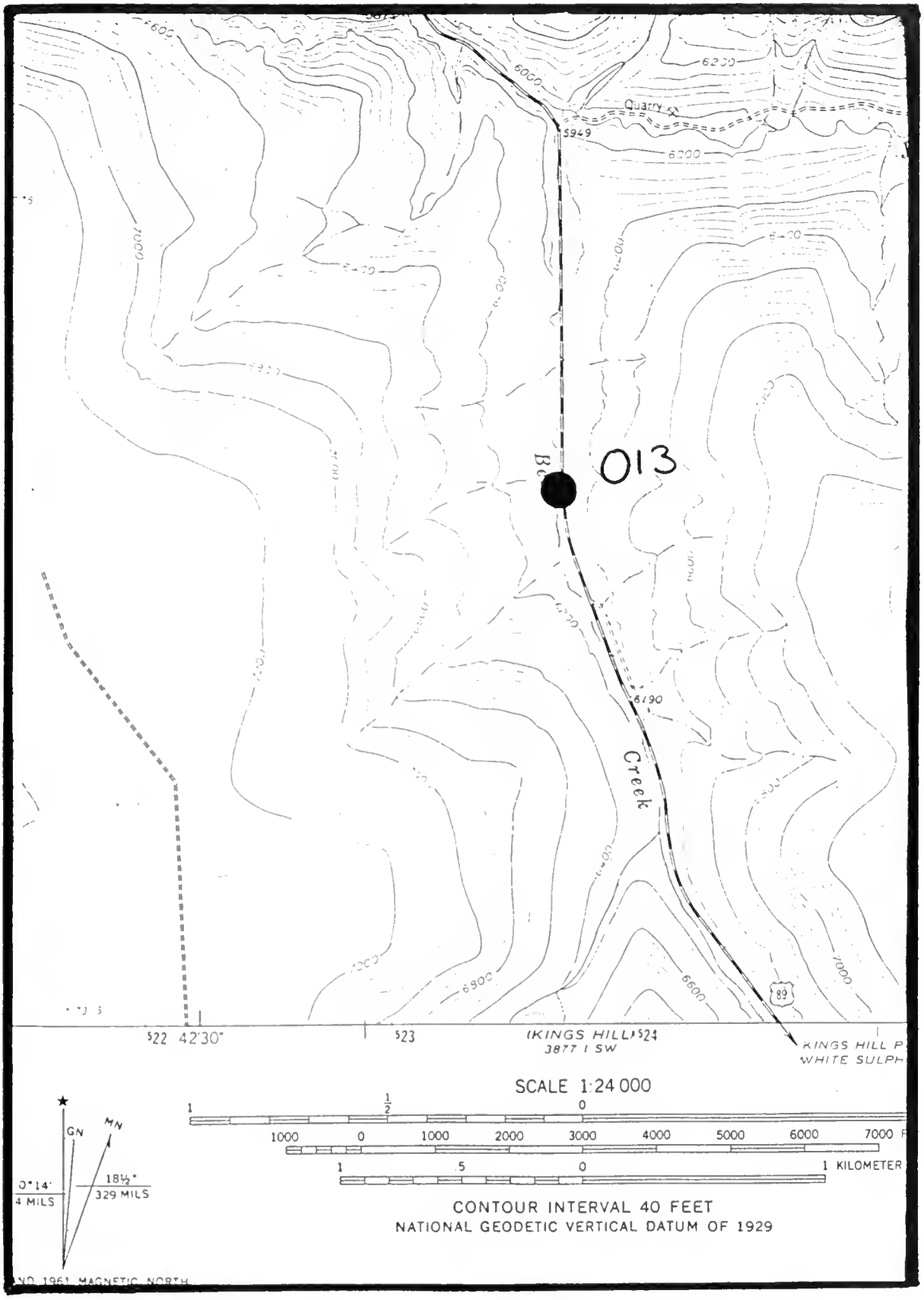


Creek
South
Fo
011
24
25
19
20
20
29
29
30
Spur Park
Spur Park
Spur
JUDITH BASIN CO
MEAGHER CO
Harrison Creek
x7463
8054
7908
7855
8137
8000
8021
7400
7800
7200
7600
6600
6800
7000
6476



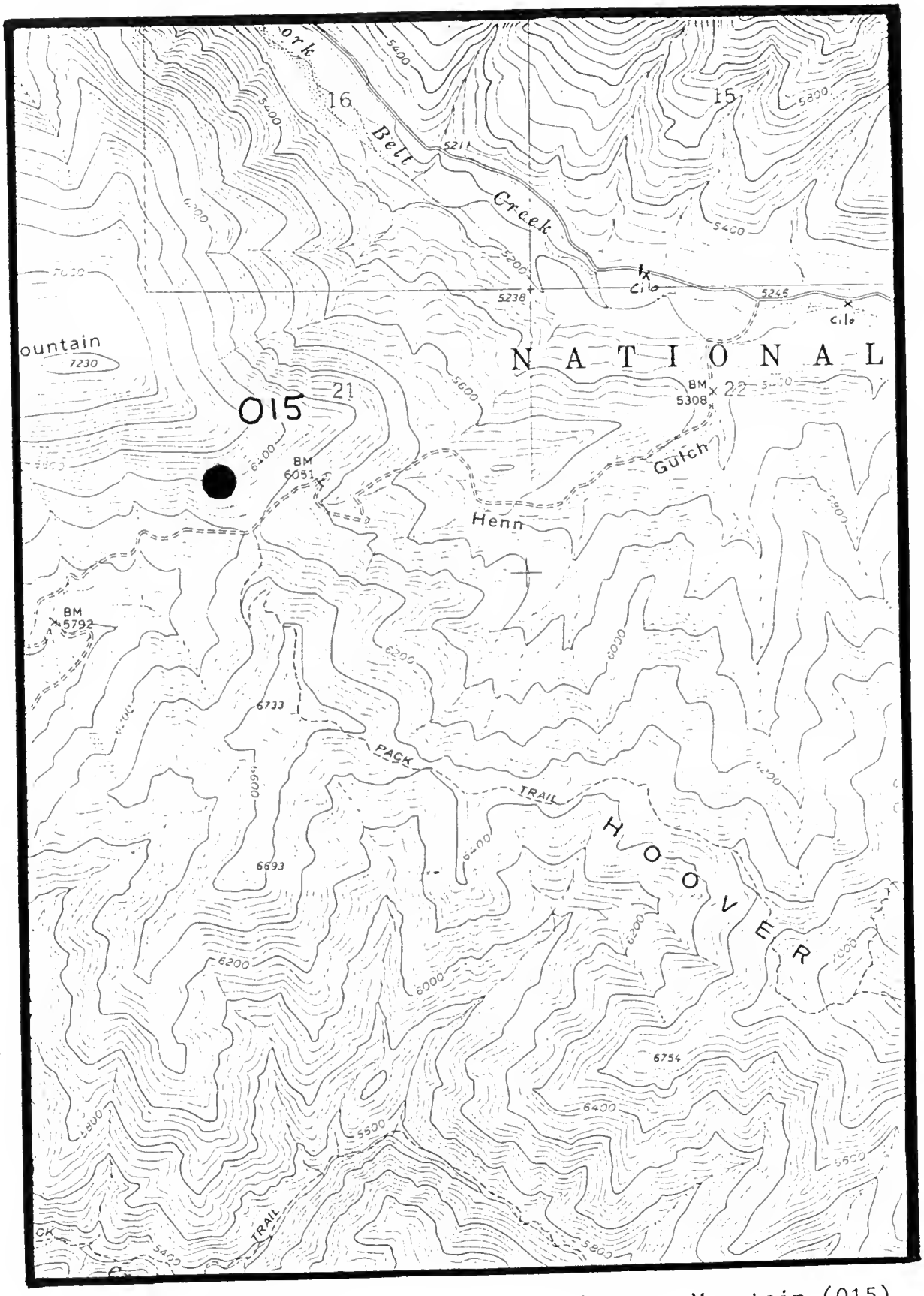
Cirsium longistylum Hay Coulee (012)

U.S.G.S. Woodhurst Mountain Quadrangle (7.5')



Cirsium longistylum Belt Creek (013)

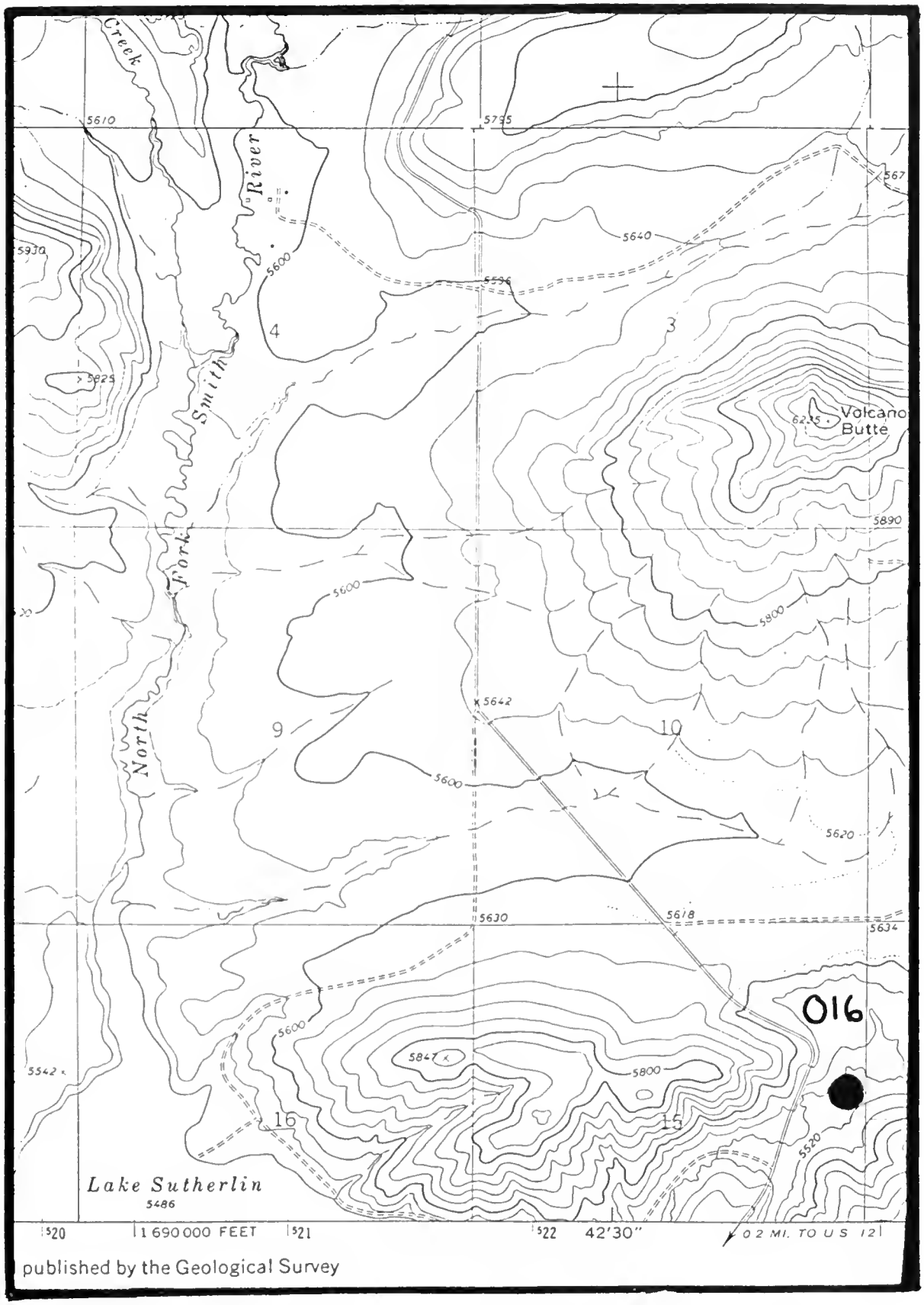
U.S.G.S. Neihart Quadrangle (7.5')



Cirsium longistylum

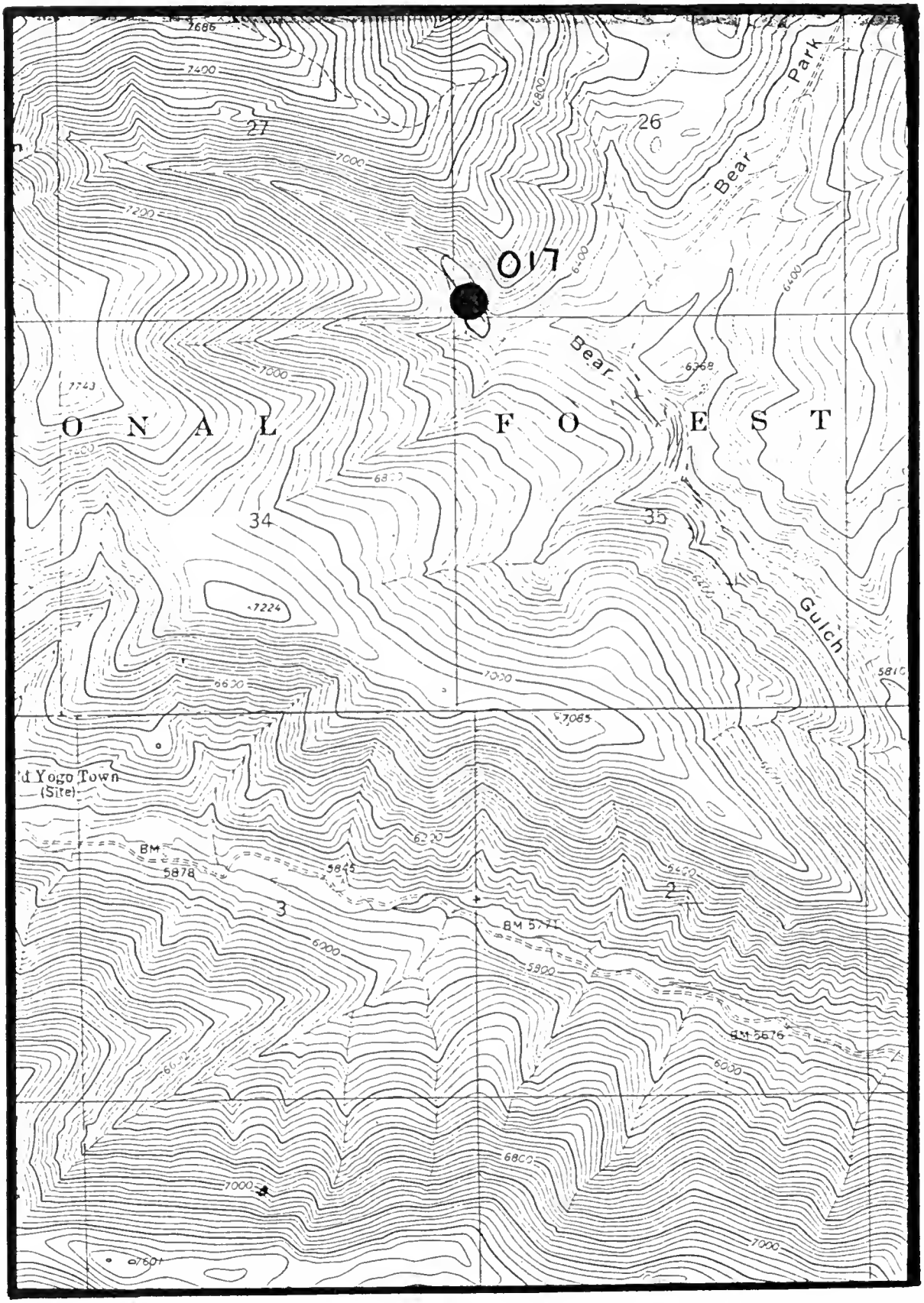
Servoss Mountain (015)

U.S.G.S. Barker Quadrangle (7.5')



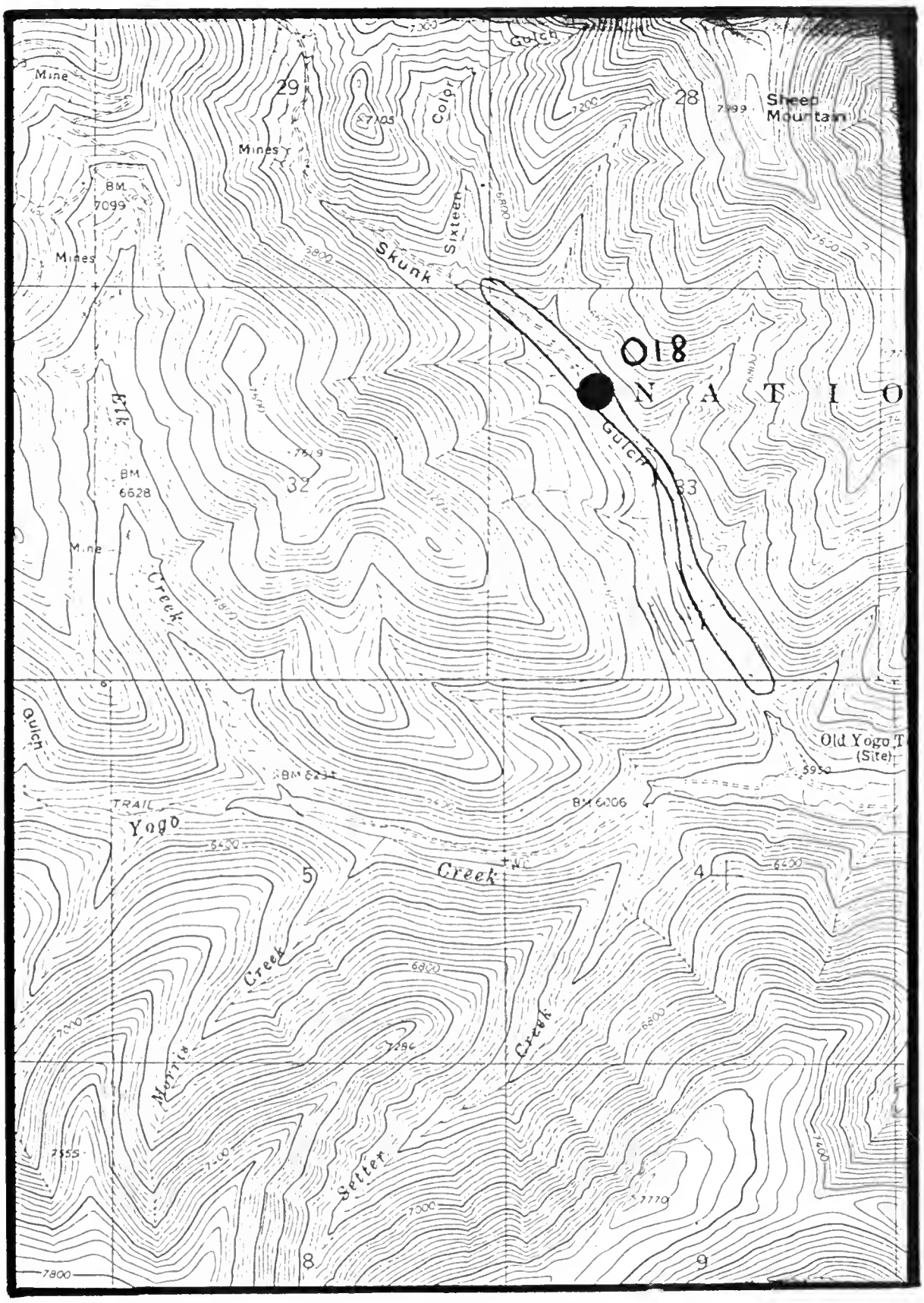
Cirsium longistylum — Lake Sutherlin (016)

U.S.G.S. Volcano Butte Quadrangle (7.5')



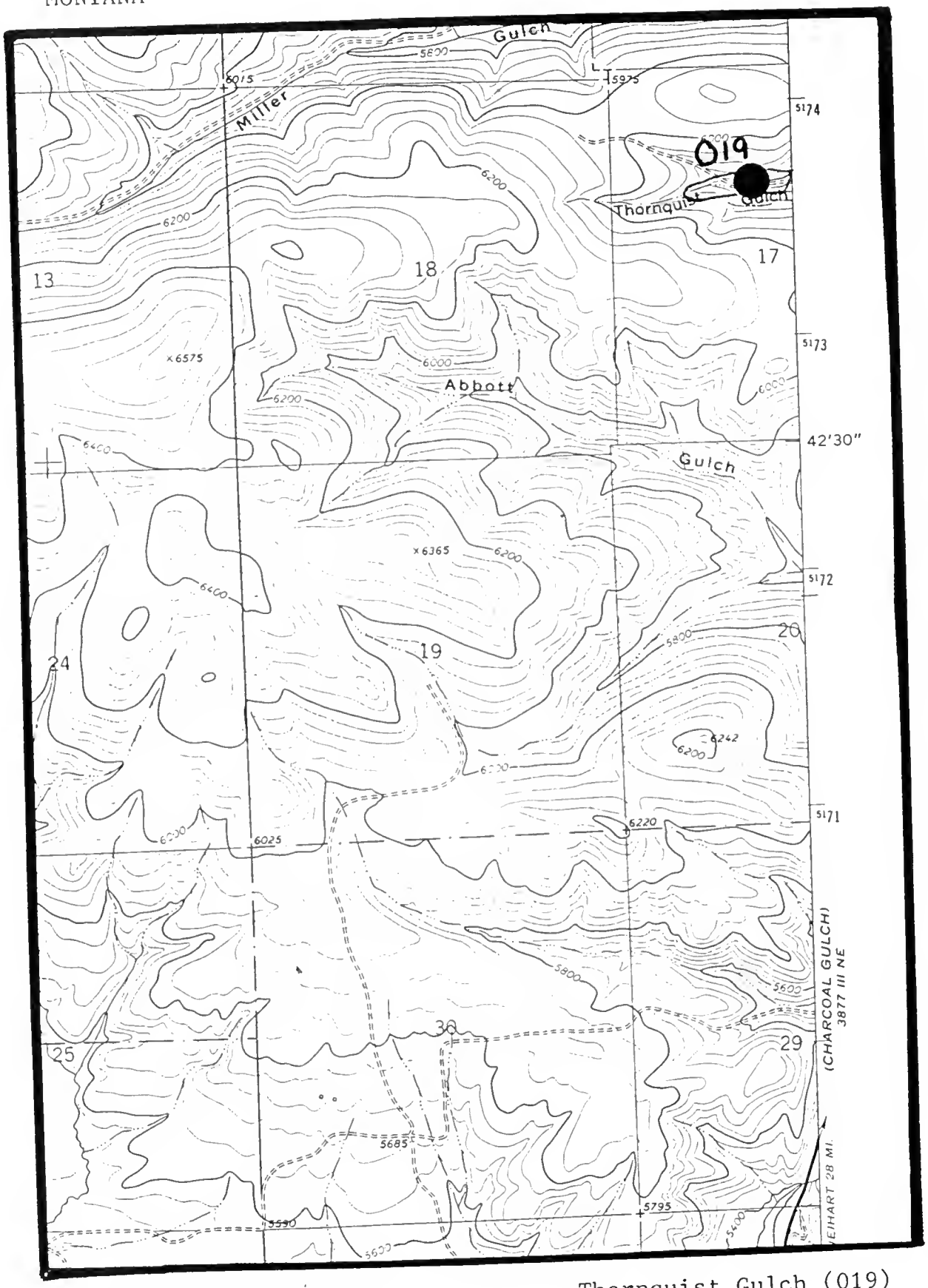
Cirsium longistylum Upper Bear Gulch (017)

U.S.G.S. Bandbox Mountain Quadrangle (7.5')



Cirsium longistylum Skunk Gulch (018)

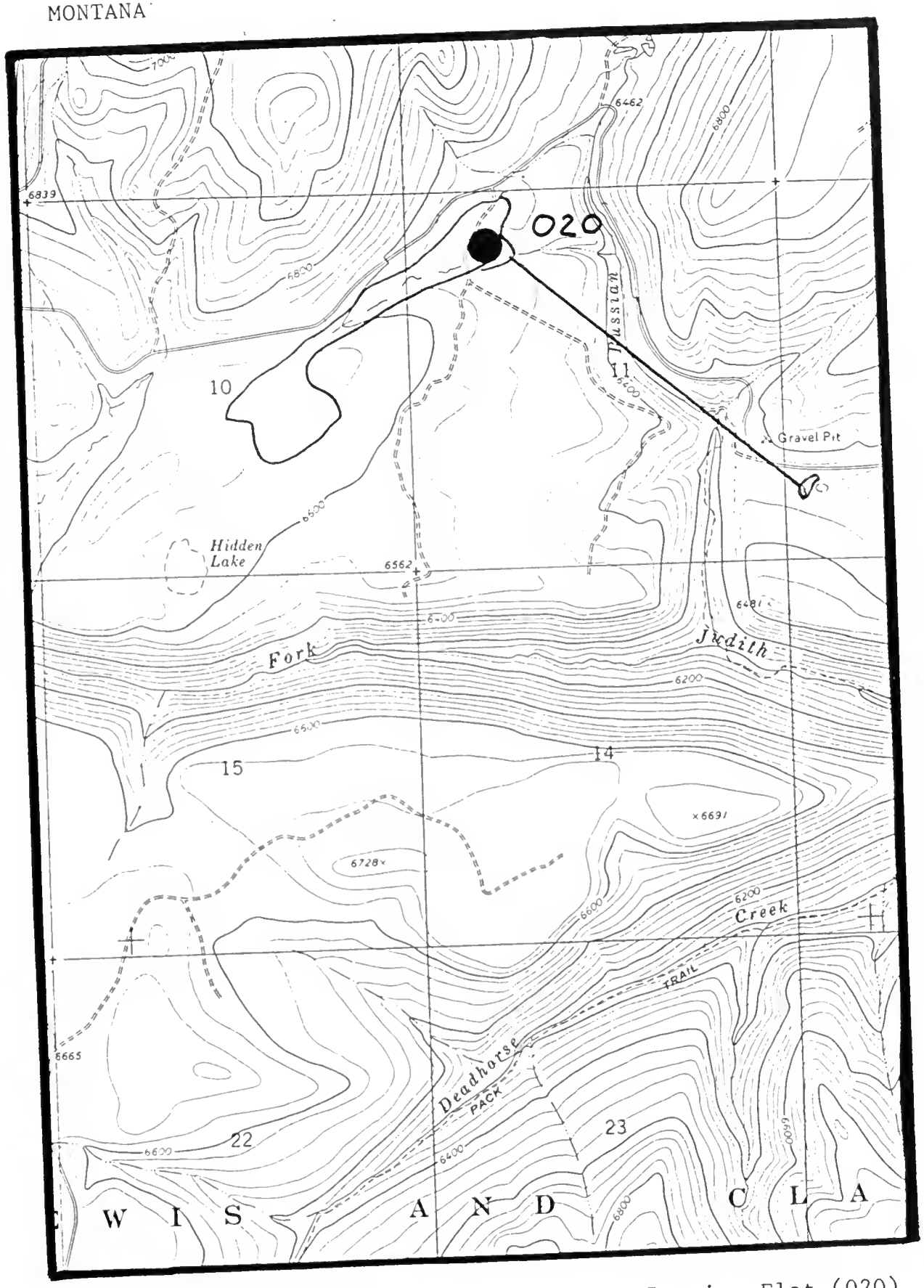
U.S.G.S. Bandbox Mountain Quadrangle (7.5')



Cirsium longistylum

Thornquist Gulch (019)

U.S.G.S. Coxcombe Butte Quadrangle (7.5')



Cirsium longistylum

Russian Flat (020)

U.S.G.S. Russian Flat Quadrangle (7.5')

V. PHOTOGRAPHS

A. Cirsium longistylum - flower.

B. Cirsium longistylum in fruit.

C. Cirsium longistylum - habit (South Fork Deadman Creek (011).

D. Cirsium longistylum - habitat - monitoring plot, (Neihart (008).

VI. DEMOGRAPHIC MONITORING DATA

R = Rosette
Rs = small rosette, 1 whorl of basal leaves
Rm = medium rosette, 2 whorls of basal leaves
Rl = large rosette, > 2 whorls of basal leaves

P = Plant that has bolted.

Ph(x)= Plant with (x) number of open, flowering heads
Pb(x)= Plant with (x) number of closed heads (involucral bracts completely enclosed flowers)

Dead - a dead stem from the previous year

* Ph(x)b(x)h(x)b(x) indicates a plant with more than one flowering stem per rosette

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Lower Russian Creek (plot radius = 39')

24 July 1990

Direction from center stake (in degrees)	Distance from stake (in feet in inches)		Plant
357	18'	5.5"	Rs
350	14'	0.5"	Rm
339	14'	10"	Ph4b2
339	7'	10.5"	Rl
338	29'	6"	Rm
336	17'	3"	Ph9b6
336	12'	4.5"	Rm
328	24'	10"	Rl
312	25'	9"	Rm
312	7'		Rm
311	19	4.5"	Ph3
311	8'	10.5"	Ph5b5
307	35'	9.5"	Rl
289	14'	7.5"	Rm
288	6'	3.5"	Rl
285	3'	11.5"	Rm
285	29'	3"	Rl
281	29'	5.5"	Rl
272	22'	6.5"	Dead
272	30'	3.5"	Rs
264	36'		Ph15b30
264	18'	4"	Ph8b12
264	17'	5"	Ph9b9
263	24'	0.5"	Rs
256	22'	8.5"	Ph16b15
256	11'	3"	Rm
256	13'	9"	Ph5b4
256	13'	11"	Rm
256	11'	11"	Rs
255	13'	1.5"	Rs
255	16'	5"	Rm
254	20'		Rs
253	19'	10"	Rs
253	19'	7"	Rs
253	23'	4.5"	Ph2b3
252	12'	1"	Ph7b5
251	11'	3"	Rl
248	18'	8"	Rs
246	19'	6"	Rs
246	19'	2"	Rs
243	18'	1.5"	Rs
242	19'	0.5"	Rs

242	21'	5"	Rm
242	29'		Ph9b3h1b4
238	28'	4"	Ph5b10
238	16'	6.5"	Ph7b4
238	17'	6"	Rs
238	3'		Ph9b16
236	21'	8"	Rs
233	16'	9.5"	Rm
232	16'	4.5"	Dead
231	8'	1"	Rl
223	11'	5.5"	Rl
210	8'	6"	Rm
210	12'	9"	Ph6b4
207	10'	7"	Rl
192	16"	1"	Ph5b2
189	17'	8.5"	Rs
186	28'	7"	Rs
185	29'	4"	Rm
185	36'	8"	Rs
174	28'	1"	Rm
172	37'		Rs
172	32'	10"	Rm
170	11'	8"	Ph8b9
169	15'		Dead
167	34'	4.5"	Rs
167	17'	5"	Rm
166	35'	8.5"	Rm
165	23'	9"	Rl
162	35'	9.5"	Rs
160	30'	6.5"	Rs
158	33'	9"	Rs
151	37'		Rs
151	29'		Ph12b5
150	18'	9.5"	Rl
150	32'	7"	Ph8b5
143	20'	9"	Rs
143	17'	5.5"	Rl
143	25'	5"	Ph9b4h5b2
141	24'	7.5"	Rm
140	29'	7"	Ph11b12
140	32'	1"	Rl
139	17'	10"	Ph7b5
129	14'	3"	Rm
119	15'	7"	Ph7b6
116	31'	2"	Ph15b7
113	13'	5"	Rl
97	35'		Dead
72	7'	1"	Ph7b13
67	29'		Ph23b11
63	31'	6"	Rl
62	22'	10"	Rl
60	18'	4.5'	Ph6b6
60	4'	10.5"	Rm
53	33'	5"	Ph11b6
52	25'	4"	Rm
52	24'	6"	Ph16b6
52	17'	8"	Rl
51	30'	11"	Rl
47	36'	9"	Ph6b6
45	31'	3"	Ph4b5
45	33'	5.5"	Rl
45	36'	5.5"	Ph9b7
45	34'	10"	Ph9b7
36	8'	3"	Rs
32	29'	3"	Ph4b1h1b2h3b2h4b3h4b2
32	36'	10"	Ph12b5
18	28'	2.5"	Rm
17	27'	2"	Ph6b3

Kings Hill (plot radius = 15 ')

30 July 1990

Direction from center stake (in degrees)	Distance from stake (in feet in inches)		Plant
359	10'	10"	Rm
357	7'		Pb9
345	8'		Ph1b5
337	10'	10"	Ph1b9
306	5'	9"	Rs
306	4'	2"	Ph2b3h3b1h2b2
296	7'	2"	Ph7b5
275	13'	11"	Rs
272	13'	9"	Rl
270	13'	8"	Ph1b5b1
269	12'		Rm
267	13'	1"	Rm
265	11'	11"	Rm
265	12'	7"	Rm
260	9'	6"	Rm
260	13'	10"	Rs
260	12'	10"	Rm
260	13'	3"	Ph1b2
255	8'	6"	Ph1b14b10
255	11'	2"	Rl
249	7'	8"	Ph7b15
248	8'	2"	Rs
245	11'	4"	Rs
245	14'	7"	Rs
245	13'	10"	Rs
245	13'	10"	Rs
244	17'	5"	Rs
239	3'	10"	Rm
239	8'	10"	Rm
239	7'	1"	Rm
239	7'	11"	Rm
236	14'	3"	Rs
235	11'		Rs
235	9'	6"	Rm
235	14'	8"	Rs
235	12'	11"	Rs
235	13'	8"	Rs
227	12'	10"	Ph10b26
226	14'	6"	Ph1b7
226	8'	7"	Rs
222	11'	9"	Rs
222	12'	11"	Ph1b3
222	13'	2"	Ph3b9
222	10'	8"	Ph1b5
222	11'	9"	Ph1b8
221	9'	5"	Rs
221	8'	8"	Rs
219	11'	1"	Rm
219	12'	3"	Ph1b4
219	11'	8"	Rm
219	3'	8"	Ph1b5
216	10'	6"	Rs
211	12'		Ph1b8
211	12'	9"	Rm
211	12'	6"	Rm
210	13'	8"	Ph5b24
210	12'	3"	Rl
208	12'	4"	Rl
208	10'	9"	Rl
208	9'	9"	Rs
208	8'	6"	Ph1b4

208	10'	9"	Rl
208	9'	8"	Rs
208	13'		Rs
208	9'		Rs
207	12'	7"	Rm
207	13'	5"	Ph1b7
207	8'	7"	Ph1b2
204	6'	1"	Rm
204	9'	10"	Rm
204	13'	4"	Rl
204	12'		Pb4
204	13'	9"	Rm
203	6'	7"	Rs
203	14'	5"	Rm
203	3'	8"	Rm
203	11'	11"	Ph1b8
200	12'	10"	Rm
197	7'	2"	Rs
195	13'	6"	Rm
195	14'	7"	Rm
195	14'	2"	Rm
195	14'	6"	Rs
193	14'	4"	Rl
193	9'	10"	Rs
184	14'	8"	Ph4b12
177	10'		Ph5b4
175	13'		Rm
167	7'	10"	Rl
162	12'	5"	Ph3b3h4b2
162	11'	10"	Rm
155	12'	4"	Rm
155	14'	7"	Rl
155	13'	8"	Rm
150	3'	2"	Rs
150	3'		Rs
142	5'	8"	Ph5b4
139	8'	7"	Rl
128	13'	10"	Ph6b10
104	6'	1"	Ph1b17
98	5'	3"	Rm
45	12'	5"	Ph1b5
40	5'	5"	Rl
21	14'	4"	Rm
5	13'	6"	Rs
5	14'	11"	Rl
5	11'	11"	Rm
5	13'	8"	Pb5
3	9'	7"	Rm
3	13'	8"	Rs
3	9'	7"	Rm
2	12'	2"	Rm
2	12'	2"	Rm

Neihart (plot radius = 15 ')

31 July 1990

Direction from center stake (in degrees)	Distance from stake (in feet in inches)		Plant
360	10'	10"	Rs
359	14'	8"	Rs
359	6'	1"	Rm
342	7'	4"	Ph8
342	6'	6"	Rs
341	15'		Ph10b3
341	6'	10"	Rs
340	11'	3"	Rm
340	11'	2"	Rm
340	7'	6"	Rs
339	10'	8"	Rl
339	5'	8"	Ph5b2
339	5'	7"	Rs
335	14'	6"	Rl
335	11'	2"	Ph19b3
335	8'		Rs
335	7'	8"	Rm
335	7'		Rm
335	6'	11"	Rm
330	14'	4"	Ph14b2
330	8'		Dead
330	5'	9"	Rl
329	12'	3"	Rl
320	14'	8"	Rm
318	14'	7"	Rm
290	4'	7"	Pb4b2
285	13'	5"	Rm
284	13'	2"	Ph10
284	11'	7"	Ph2b4h15b2h3b3
279	11'	6"	Rm
279	10'	10"	Rm
264	12'	9"	Rm
264	11'	1"	Rs
260	13'	3"	Rm
260	10'	1"	Rs
255	13'	2"	Rm
255	11'	4"	Rm
252	13'	9"	Rl
252	13'	7"	Ph7b2
252	12'	7"	Rl
252	11'	6"	Ph9b3
250	12'	7"	Rm
250	12'	5"	Rl
250	12'	2"	Rm
247	12'	2"	Rm
246	11'	4"	Rs
220	10'	10"	Rs
219	13'	7"	Rm
210	10'	1"	Rm
210	9'	9"	Rs
210	9'	6"	Rs
210	2'	9"	Rl
207	9'	4"	Rm
203	2'	9"	Rl
201	7'	5"	Rm
201	5'	7"	Rm
201	5'	7"	Rm
201	4'	7"	Rm
201	2'	5"	Rl
193	9'	7"	Ph12b2
193	4'	5"	Rm

188	15'		Rs
188	14'	11"	Rs
181	12'		Ph8b4
177	15'	3"	Rs
176	15'	3"	Rs
175	14'	11"	Rm
175	14'	3"	Rs
174	13'	11"	Rm
168	12'	3"	Rs
168	12'	3"	Rs
162	14'	9"	Rs
162	14'	11"	Rs
157	11'	6"	Rs
142	13'	8"	Rl
142	10'	9"	Ph13b3
142	10'	8"	Rs
139	14'	3"	Rm
124	12'	10"	Ph17b5
124	7'	2"	Rm
124	3'	7"	Rl
115	14'	10"	Ph8b3
115	12'	4"	Rl
115	7'	1"	Rm
110	15'		Rl
107	4'	3"	Rl
107	2'	4"	Rl
102	8'	6"	Rl
92	6'	4"	Ph9b1
90	3'	9"	Ph5b1h5b4
90	4'		Ph8b2
79	7'		Rs
70	4'	10"	Ph1h1h1h1h1
55	14'	2"	Rs
55	6'	9"	Rm
51	13'	8"	Rl
51	10'	6"	Rs
50	10'	5"	Rl
48	13'	8"	Ph14b6
48	11'	4"	Ph6b6
47	13'	9"	Ph3b2
47	5'	4"	Dead
44	12'	6"	Rs
43	13'	2"	Rs
43	12'	11"	Rs
43	6'	11"	Rs
32	12'	4"	Rs
32	12'	4"	Rs
32	11'	10"	Rs
30	12'	3"	Rm
31	12'	1"	Rm
31	5'	5"	Rm
27	12'	7"	Rm
27	12'	9"	Rm
23	14'	9"	Rs
23	14'	9"	Rs
20	11'	4"	Rl
19	12'	3"	Rs
19	6'	6"	Rm
16	7'		Ph11b1
16	10'	1"	Rm
8	8'	6"	Rm
8	8'		Rs
8	7'		Rs
8	7'		Rs
8	6'	9"	Rs
8	6'	7"	Rm
8	6'	3"	Rm
8	5'	11"	Rs
6	9'	6"	Rm

6	8'	2"	Rm
5	9'	9"	Rm
5	9'	4"	Dead
5	8'	6"	Rl
5	8'	2"	Rm
5	13'	9"	Rm
3	11'	3"	Rl
3	11'	6"	Rm
3	10'	8"	Rm
2	11'	7"	Rm
2	10'	11"	Ph15b3
2	9'	5"	Rm
2	6'	11"	Rm
2	6'	11"	Rm
2	6'	5"	Rm