

A TAXONOMIC ASSESSMENT AND MONITORING STUDY OF  
THE LONG-STYLED THISTLE (Cirsium longistylum)

A Section 6 study  
conducted by the Montana Natural Heritage Program  
for Region 4, U.S. Fish and Wildlife Service

by  
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## OVERVIEW

Cirsium longistylum, long-styled thistle, is endemic to a few mountain ranges in central Montana (Figure 1). The species is placed in Category 2 by the U.S. Fish and Wildlife Service (U.S. Department of Interior 1990). It was initially ranked by the Montana Natural Heritage Program as G2S2 (Shelly 1990), now ranked G3S3 (Achuff 1991). It was initially listed as Sensitive by Region 1 of the U.S. Forest Service (U.S. Department of Agriculture 1988), but was dropped due to abundance (Roe 1992).

A status report on Cirsium longistylum was prepared for the U.S. Fish and Wildlife Service, based on survey work and compilation of available information (Schassberger 1991). The primary conservation concerns identified in this report were the rarity and possible threats to the species. Threats to the species included seed damage by an exotic weevil brought to this country to control the noxious, introduced weed, Carduus nutans. Hybridization with other Cirsium species was speculated as threatening the genetic integrity of the species.

This report represents the interim results of two studies contributing toward clarification and resolution of taxonomic questions, and assessment of population trends.

A high amount of morphological variation within Cirsium longistylum populations has been observed by many collectors. Moore and Frankton (1963) in their original description suggested that C. longistylum might be a hybrid or of hybrid origin. In the first study, an intensive collecting effort was conducted in August 1992 by the Montana Natural Heritage Program as part of a Section 6 study to provide more conclusive data about the variation and potential hybridization that might be occurring in populations of C. longistylum. The magnitude of variation within and between populations was characterized by collecting five specimens representative of the most common morphological variants within 15 reported populations from across the range of C. longistylum.

The results from this study indicate that C. longistylum is indeed a "good" species, and that hybridization with C. hookerianum is present at varying levels in most if not all populations. An approach is proposed to answer the question of whether this hybridization threatens the genetic integrity of C. longistylum.

The second study represents continuation of a monitoring project involving three populations of Cirsium longistylum in the Little Belt Mountains initiated by the Montana Natural Heritage Program in 1990 (Schassberger 1991) with funding from the U.S. Forest Service. The purpose of the study was to provide more detailed

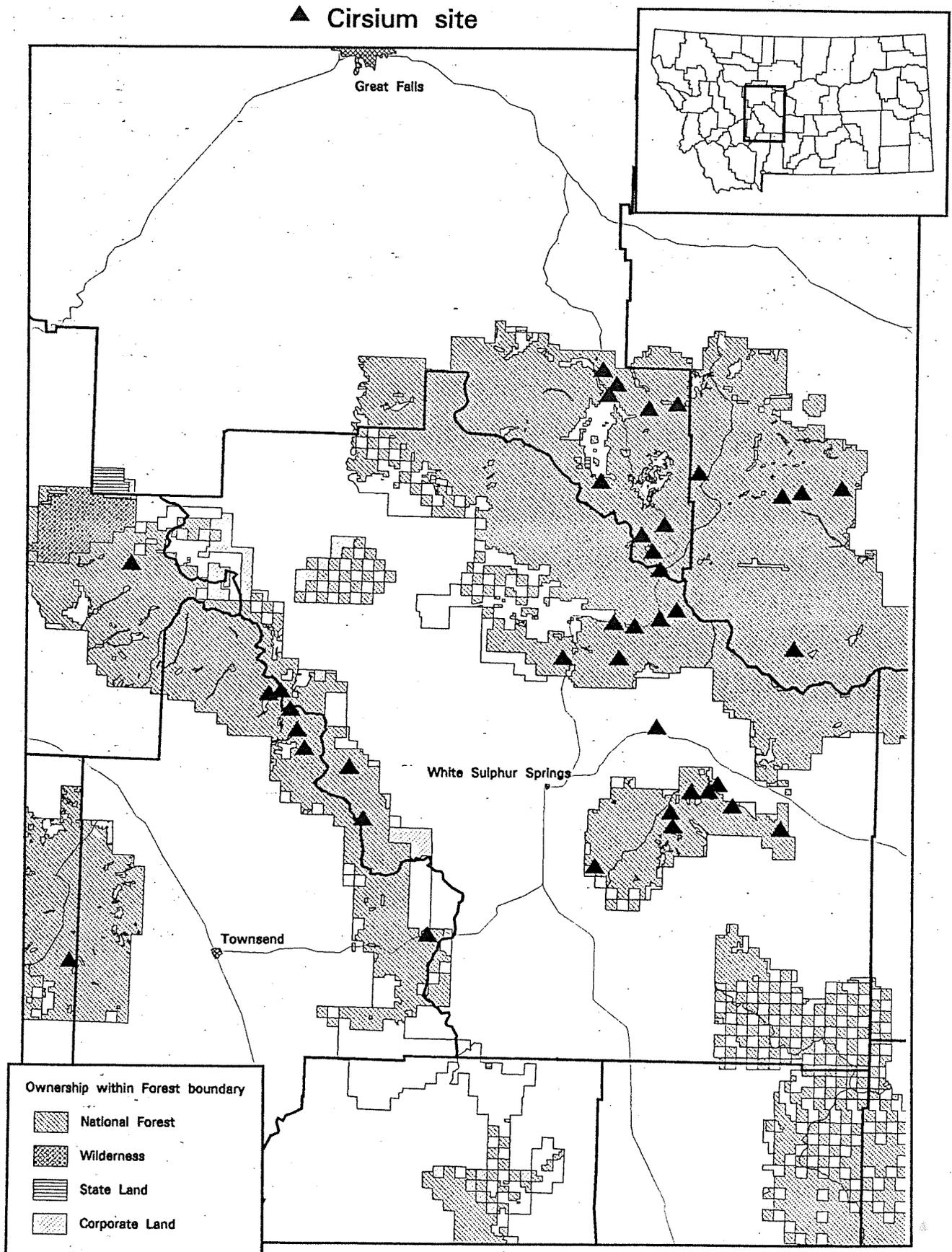
data on the life history and population dynamics of C. longistylum. The third year of this study was funded as a Section 6 project by the U.S. Fish and Wildlife Service.

The results from this study are represented in data on density and size class distributions for populations at Kings Hill (high density population) and Russian Creek (low density population). It was learned that C. longistylum is not present apart from hybrids at the Neihart study site. Preliminary analysis indicates population growth at the high density site and population decline at the low density site. A more detailed monitoring design is needed to determine critical life history stages of the species, and to evaluate the potential impacts posed by weevil infestation and hybridization. Additional population sites may also be needed.

Incidental to this work and related studies, new information on geographic range was collected. Since 1990 status report work the species has been found at many new locations within the Little Belt Mountains, and with recent range extensions in the Big Belt, Castle and Elkhorn Mountains that represent new county records. It is represented in the database by forty-one records in six counties (Cascade, Meagher, Judith Basin, Jefferson, Broadwater, and Lewis and Clark). Entry of a record from Jefferson County and a new county record from Wheatland County are in progress.

With the data at hand, we propose further taxonomic investigation into the potential threat posed by hybridization between Cirsium longistylum and C. hookerianum, and more detailed monitoring studies for better understanding of population trends.

# Occurrences of *Cirsium longistylum* in Montana



Scale = 1:775,000

**TAXONOMIC STATUS OF CIRSIUM LONGISTYLUM**

## INTRODUCTION

Cirsium longistylum was first collected on Long Baldy in the Little Belt Mountains of Montana in 1896. The species was described by Moore and Frankton in 1963 as part of their cytotaxonomic study of some species in the genus in the western United States. Moore and Frankton cited two other specimens also from the Little Belt Mountains. With the interest in the conservation of the species by the U.S. Fish and Wildlife Service (USDI 1990), the Montana Natural Heritage Program (Lesica and Shelly 1991), and the Region 1 Office of the U.S. Forest Service (USDA 1988), the species was collected more often, and observed more critically. More recently the species has been dropped from the Region 1 list of the U.S. Forest Service, a status disparity between federal agencies.

In 1983 the species was located in the Big Belt Mountains to the west (see Appendix 3, Element Occurrence Record (EOR) #6), and in 1991 in the Castle Mountains to the south (EOR #21, see Appendix 3). It was noticed that populations often contained quite a bit of morphological variation. Moore and Frankton (1963) had also noted the morphological variation, and suggested that the species might be a hybrid or of hybrid origin. In 1990 and 1991 specimens were collected and sent to Dr. Arthur Cronquist of the New York Botanical Garden, a noted expert in the family, for identification (Cronquist 1991 and 1992). After review of material collected in 1991, Cronquist pronounced C. longistylum a "good species of limited distribution in Montana" (Cronquist 1992). He also noted that "it probably hybridizes with C. hookerianum and possibly C. scariosum Nutt." and that "hybrids are best identified in the field" (Cronquist 1992).

Although the question of whether or not Cirsium longistylum was a "good" species was answered, the origin of the morphological variation was still speculative. Was it due to hybridization, and if so, with what species and what effect might there be on the genetic integrity of C. longistylum? This study was an initial attempt to resolve these issues.

## MATERIALS AND METHODS

In August 1992 Cirsium longistylum populations were sampled at 15 sites in the Little Belt, Big Belt, and Castle Mountains (EOR nos. 2, 3, 5, 7, 8, 10, 11, 12, 18, 19, 20, 21, 26, and 29 in Appendix 1; see Appendix 2 for maps of the populations and exact sampling sites). Five specimens (rarely less) representing the morphological variation of Cirsium at each site were collected, excluding exotic species such as C. arvense or C. vulgare. At 11 of the 15 sites observations were made as to the approximate amount of each morphological type within a particular sample size (usually 25-100 plants). The specimens were subsequently examined along with other C. longistylum collections, and identified as to species or hybrid intermediate (see Appendix 3). Morphological distinctions between C. longistylum and C. hookerianum hinge on bract characteristics (Moore and Frankton 1963, Dorn 1984). The nature and range of bract differences were enumerated in early stages of the sampling.

## RESULTS

Through extensive survey, sampling, and examination, three basic morphological types were found. The Cirsium longistylum type has involucre bracts which are apically widened and lacerate, erose, or occasionally undulate on the broad hyaline margins (Figure 2). The C. hookerianum type has involucre bracts which are continually tapering and not widened at the apex, and have entire or sometimes ciliate margins (Figure 3). The intermediate group has involucre bracts which are not widened at the apex but have lacerate, erose, or undulate narrow hyaline margins. This group has the most morphological variability in the degree of apex width and the amount of lacerations on the margins. This is reflected in the specimen annotations (Appendix 3) where truly intermediate conditions (apically non-widened but lacerate or erose-margined bracts, see Figure 4) are represented by + (i.e., C. longistylum + C. hookerianum). Specimens which appear to possess unequal proportions of characteristics of both species are represented by arrows in the direction of influence. Specimens which appeared to be C. longistylum but also showed some influence from C. hookerianum (bracts with highly lacerate or erose margins but only slightly widened apically, see Figure 5) were annotated as C. longistylum > C. hookerianum. Contrarily specimens which appeared to be C. hookerianum but also showed some influence from C. longistylum (bracts not apically widened but slightly lacerate or erose on the margin, see Figure 6) were annotated as C. hookerianum > C. longistylum. One rather strange specimen was collected at the Kings Hill site. This plant possessed lacerate, apically non-widened, purplish involucre bracts covered with a dense mat of arachnoid hairs (Figure 7). This specimen may represent hybridization of C. longistylum with another Cirsium species besides C. hookerianum.

In the 15 sites sampled Cirsium longistylum was present at 12, C. hookerianum was present at 14, none of which were made up entirely of typical C. longistylum individuals. Hybrid intermediates were present at all sites (Table 1). Cirsium hookerianum was not observed within the sample taken at the Spring Gulch site, and C. longistylum was not observed within the samples from Moose Park, Bear Gulch Spring, and Dewey Creek Spring sites. However the presence of hybrid intermediates at these sites suggests that the species occurred or occurs in the immediate vicinity. Of the 11 sites quantitatively sampled, C. longistylum was most common or equally as common at six of the sites while C. hookerianum was most common at three sites (see Table 1). Intermediates were most common or equally as common at four sites.

Figure 2. Cirsium longistylum. Note the apically widened, lacerate involucrel bracts with broad, hyaline margins.



Figure 3. Cirsium hookerianum. Note the continually tapering, apically non-widened involucre bracts with entire margins.



Figure 4. Cirsium longistylum + C. hookerianum. Note the apically non-widened involucral bracts with lacerate or erose margins.



Figure 5. Cirsium longistylum > C. hookerianum. Note the apically slightly widened involucral bracts with highly lacerate or erose margins.



Figure 6. Cirsium hookerianum > C. longistylum. Note the apically non-widened involucrel bracts with slightly lacerate or erose margins.

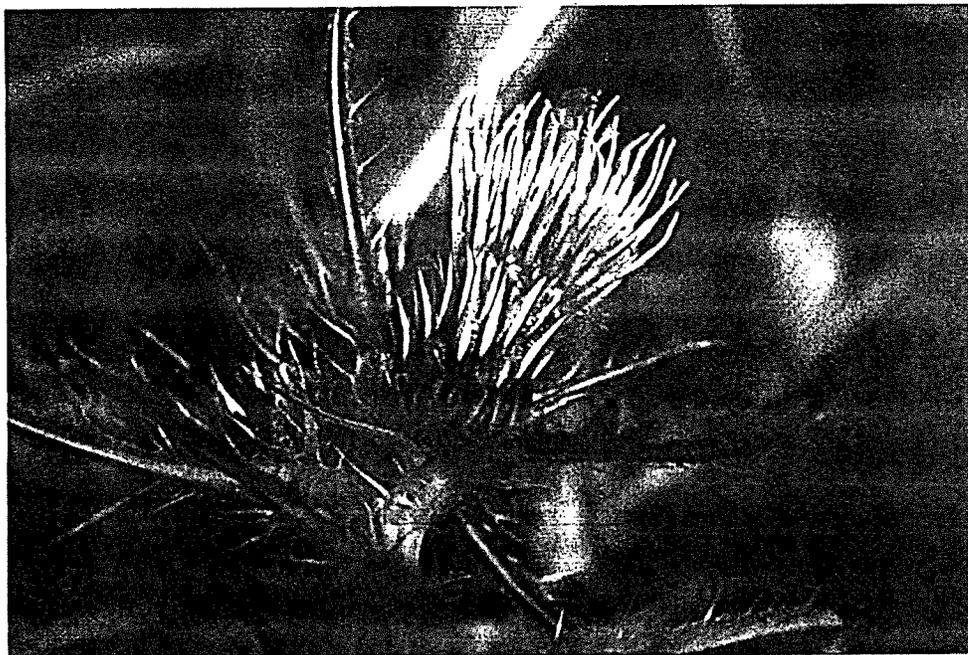


Figure 7. Cirsium longistylum + C. ?

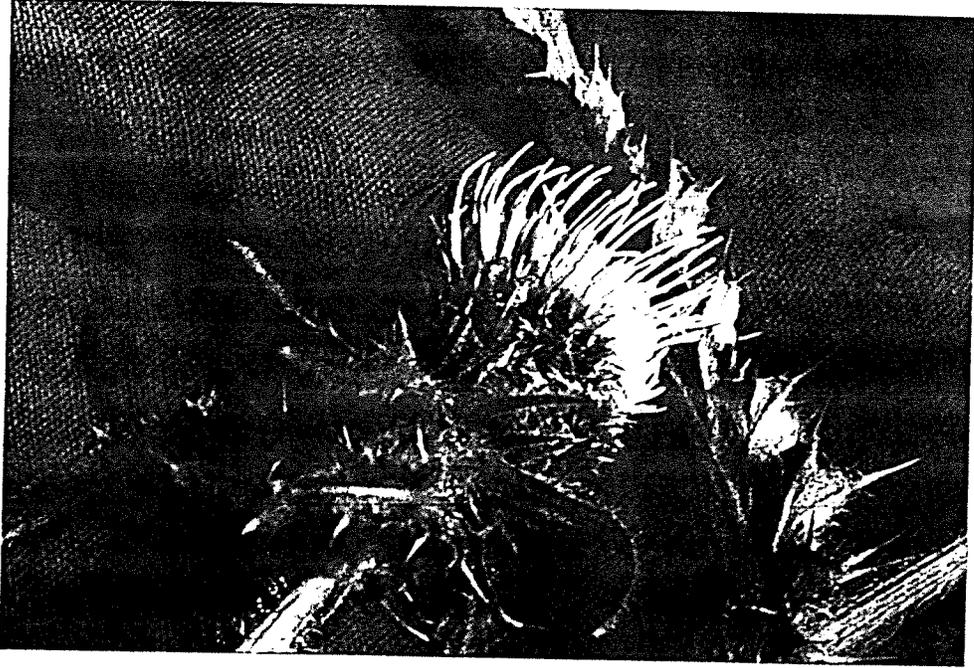


Table 1. Presence/absence and percent of sample size of Cirsium longistylum, C. hookerianum, and their intermediates at various sites in Montana.

| Site Name<br>(Sample Size)                         | <u>Cirsium longistylum</u><br>present<br>(%<br>widened & fringed 1 ) | Intermediates (% non-<br>widened & fringed 2 ) | <u>Cirsium hookerianum</u><br>present (% non-widened<br>& non-fringed 3 ) |
|--|--|--|---|
| Jumping Creek (ca. 25)                             | yes (75)   | yes (15)                                       | yes (10)  |
| Forest Green (ca. 25)                              | yes (<15)  | yes (ca. 75)                                   | yes (<10)   |
| - S Fork Deadman Creek<br>(ca. 100) <sup>100</sup> | yes (90)   | yes (10)                                       | yes (<1)  |
| ✓ Kings Hill (ca. 150) h                           | yes (50)   | yes (50)                                       | yes (<1)  |
| - Moose Park (ca. 100) h                           | <sup>except in road row</sup><br>not observed (0)                    | yes (50)                                       | yes (50)  |
| ✓ Neihart (ca. 100)                                | yes (<1)   | yes (20)                                       | yes (80)  |
| Bender Creek Trail (18)                            | yes (17)   | yes (6)  | yes (78)  |
| - Hay Coulee (ca. 25)                              | yes (70)   | yes (10)                                       | yes (20)  |
| ? Skunk Gulch (ca. 25)                             | yes (80)   | yes (10)                                       | yes (10)  |
| ✓ Russian Creek (ca. 25)                           | yes (80)   | yes (15)                                       | yes (5)   |
| Pasture Gulch (ca. 25)                             | yes (40)   | yes (40)                                       | yes (20)  |
| Thornquist Gulch (*)                               | yes (*)  | yes (*)  | yes (*)   |
| Bear Gulch Spring (*)                              | no (*)   | yes (*)  | yes (*)   |
| Spring Gulch (*)                                   | yes (*)  | yes (*)  | no (*)  |
| Dewey Creek Spring (*)                             | no (*)   | yes (*)  | yes (*)   |

\* Population not sampled as to percent composition of species and/or intermediates

1 May include C. longistylum > C. hookerianum and C. longistylum ↔ C. hookerianum

2 May include C. longistylum > C. hookerianum, C. longistylum ↔ C. hookerianum, and C. hookerianum > C. longistylum

3 May include C. hookerianum > C. longistylum

## DISCUSSION

Cirsium longistylum is a well-defined species which occurs within the range of several other species of Cirsium, and apparently hybridizes with C. hookerianum when the two are sympatric. Although no pure populations of C. longistylum were located during this study (the Spring Gulch population sample did not contain C. hookerianum but intermediates betray its former or nearby presence), they may have existed in the past or may be in extremely isolated, roadless locations. Cirsium hookerianum does exist in pure populations at least outside the range of C. longistylum.

The specimens positively identified in this study as C. longistylum are quite distinct with their apically widened, lacerate involucre bracts, from the positively identified C. hookerianum specimens with their continuously tapered, apically non-widened, entire-margined involucre bracts. The presence of numerous intermediates, with a truly intermediate blend of characters or the tendency toward one species or the other, suggests a hybrid swarm with multi-generational hybrids.

Cirsium hookerianum is a widespread species occurring across much of the northwestern United States and southwestern Canada while C. longistylum is endemic to west-central Montana (Figure 1). The distribution of C. longistylum may be the result of geographical isolation and speciation. The Little Belt Mountains escaped glaciation during the ice ages because they were too low to catch the quantities of snow which large glaciers require (Alt and Hyndman 1986). Is it possible that these two species have only been brought into contact with each other since settlement through the numerous roads which now cross their territories. The literature provides inadequate basis for interpreting distribution patterns relative to historic distribution. Is C. longistylum expanding its range via the roadways, or is C. hookerianum using these arteries to invade the habitat of C. longistylum? Is this current mingling threatening the genetic integrity of C. longistylum in the populations sampled during this study (and possibly others)? In the 11 populations quantitatively sampled, C. longistylum was more common or as common as the morphological intermediates in seven, C. hookerianum was more common or as common as the morphological intermediates in three, and the morphological intermediates were most common in one (Table 1). However the hybridization levels between species at a given site appear to be dynamic. For example C. longistylum was collected at the Forest Green site (EOR #3) in 1953. Thirty years later Ramstetter could find "no plants which could conclusively be identified as C. longistylum." Almost ten years later during this study approximately 15% of 25 plants sampled were identifiable as C. longistylum, C. longistylum > C. hookerianum, or C. longistylum + C. hookerianum (i.e., lacerate involucre bracts which were slightly to broadly

widened apically). Is this the result of investigator bias as to the identifying characters of C. longistylum? Were the collectors in slightly different locations? Assuming collectors were in agreement on location and identification, at least two other explanations are possible. Perhaps C. longistylum is resurfacing after a hybridization event, or has recently invaded a former site. It is possible that C. longistylum is able to withstand hybridization with C. hookerianum, but it may be equally likely that such hybridization is a recent phenomenon, possibly leading to the ultimate genetic swamping of C. longistylum.

### CONCLUSIONS

On morphological grounds Cirsium longistylum appears to be a unique and distinct species which hybridizes with C. hookerianum to produce swarms of morphologically variable individuals. The impact on the genetic integrity of C. longistylum needs to be determined. The following studies are needed to determine the appropriate status for C. longistylum.

First, genetic identity of each species as well as hybrids and backcrosses needs to be profiled electrophoretically to confirm the results of the morphological study implicating hybridization.

Second, monitoring is needed to determine the long-term stability of the unhybridized C. longistylum component of populations. The high incidence of hybridization among populations (present in 100% of the C. longistylum populations sampled) represents a potential threat of genetic swamping in successive generations. The presence and amount of hybridization and introgression between C. longistylum and C. hookerianum needs to be tracked through time and multiple generations.

Third, other threats to C. longistylum such as reduced fecundity due to weevil infestations or unnatural disturbance promoting hybridization with C. hookerianum should be studied.

It is recommended that monitoring design be modified in 1993 to meet the aforementioned study needs by permanently tracking individual plants in an appropriate monitoring framework. Study sites should include the existing C. longistylum monitoring sites, and additional sites should be considered. It is also recommended that visits made to any new or revisited C. longistylum population sites include estimates of the population composition by the morphological categories identified in this report.

## MONITORING STUDY OF CIRSIUM LONGISTYLUM

### INTRODUCTION

Cirsium longistylum reproduces both asexually by biennial offsets from a perennial rhizome (Moore and Frankton 1963), and sexually by seeds. Observations of populations indicate a range of different size classes, from single whorl rosettes to larger multiple whorl rosettes to flowering and fruiting adults. Such size classes may relate to life history stages. The species appears to be a short-lived perennial which takes several years to flower.

In 1990 three permanent monitoring plots were established on the Lewis and Clark National Forest to provide more detailed data on the life history and population dynamics of the rare species, Cirsium longistylum. In 1992 specimens from one of these sites Neihart, were identified as C. hookerianum. Data presented in the taxonomic assessment portion of this report indicate that the population is almost entirely composed of C. hookerianum, with few individuals even showing introgression with C. longistylum. Readings were taken again in 1992 for comparative purposes. Data on density, size class demographics, recruitment, and mortality have now been compiled for a three-year period. However results from the three populations are mixed, and no well-established trends are yet apparent.

### MATERIALS AND METHODS

In late July 1990 three monitoring plots were established in the Little Belt Mountains of the Lewis and Clark National Forest (Figure 8; Schassberger and Achuff 1991). In Judith Basin County the Russian Creek plot is located at T11N R10E Sec. 11 SE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ . In Meagher County the Kings Hill plot is found at T12N R8E Sec. 2 SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ . In Cascade County the Neihart plot is set up at T14N R7E Sec. 27 NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ . At each site a piece of re-bar approximately four feet long and painted bright orange was driven into the center of the plot to a depth of two feet. Plot radii vary from 15 feet (4.57 meters) at the Kings Hill and Neihart sites to 37 feet (11.28 meters) at the Russian Creek site. Radius length was established in 1990 and was dependent on the density of plants at that point in time. The Russian Creek site originally had a radius of 39 feet, but as no plants were found beyond 37 feet, the plot radius was changed in 1991 (Roe 1992). Distance from the center stake to individual plants were recorded by hooking a measuring tape over the stake and holding it at about 6 inches from the top of the stake. The direction (in degrees) and distance (in feet and inches) from the stake to each plant was recorded, along with the size class, reproductive status, mortality, and other comments. Size classes were used to approximate age. They include the following:

Seedling = plant with cotyledons only  
 R = Rosette, non-flowering/fruited

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 = Plants which are flowering/fruited

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

Pb(x) = Plant with (x) number of buds (involucral bracts completely enclose flowers)

Dead = a dead stem from the previous year

Gone = Plants which were noted as dead in the previous year, and which had decomposed or disappeared by the current year. For example plants which flowered in 1989 were recorded as dead in 1990 (dead flowering stalks were still visible), and as gone in 1991 (when stalks and leaves had disappeared).

? = Rosettes or flowering plants which were recorded in a previous year but were not relocated the following year. Possible causes of disappearance were noted when evident.

- = Rosettes or flowering plants which were recorded in a previous year as not relocated or gone which were not relocated for the following year.

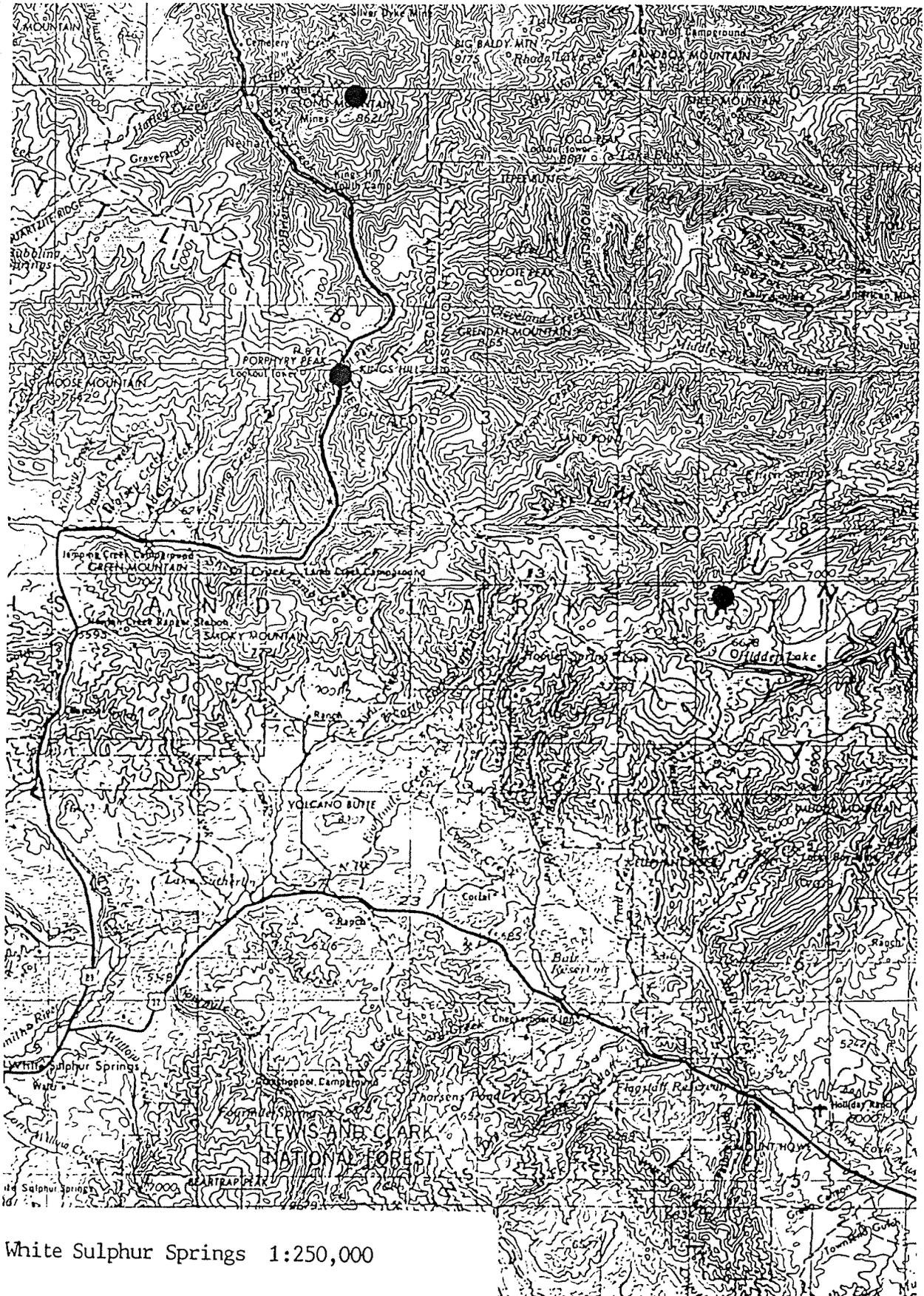
Grazed = Many of the rosettes, especially at the Neihart site, had been grazed. In order to check the effect of grazing on the ability of a plant to produce and store enough energy to flower, information on grazing was recorded as follows.

Grazed heavily = Plant significantly reduced in size, at least two leaves removed

Grazed = Plants with a leaf or portion of a leaf removed

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

Figure 8. Cirsium longistylum monitoring plots in the Little Belt Mountains, Lewis and Clark National Forest, Montana



White Sulphur Springs 1:250,000

## RESULTS

Density increased at the Kings Hill site, and decreased at both the Russian Creek and Neihart sites for the second year in a row (Table 2). Tables 3, 4, and 5 present life history data for each of the three sites. Kings Hill, the site with the most individuals, is primarily composed of small rosettes while the Russian Creek site has more medium rosettes. Number of flowering individuals increased from 1991 but is still well below 1990 levels. Large numbers of flowering individuals produce copious quantities of seed which germinate and cause a dramatic increase in the seedling and small rosette size class. Only one dead plant (flowering in 1991) was noted in 1992. Perhaps light snowfall of the 1991-1992 winter made such plants more accessible to herbivores. Numbers of plants not relocated increased at both Kings Hill and Russian Creek, and recruitment was lower at all sites. However this data may be erroneous (see Discussion section).

During the 1992 monitoring season it was noticed that the angles recorded for the locations of both plants and plot center stakes were off  $\pm 36^\circ$  west due to the use of a compass with declination set in the wrong direction. The demographic data tables (Appendices 4-6) have been adjusted for this factor. The angles and distances from the 1990 and 1991 data are listed in parenthesis after the those measured in 1992, or after a space if the 1990 and/or 1991 did not match with 1992 data. Demographic data tables run from  $360^\circ$  to  $1^\circ$ , with the farthest distance at a given angle being the first entry. The 1992 data is given priority, and 1990 and/or 1991 data which did not match are placed in a position equal to their angle plus  $36^\circ$ . Additionally all distances and angles were allowed a certain amount of investigator error. That is distances were considered to be the same if they were within plus or minus three inches, and for angles within plus or minus  $10^\circ$  (this was in addition to the correction factor of  $36^\circ$ ). Occasionally exceptions were made by a few additional inches or degrees. In one exceptional case at the Russian Creek site, a flowering plant was matched to a 1991 large rosette due to the distance, disregarding the angle. However in 1991 the angle could have been measured from the plant to the stake which, with the correction factor, would be a close correspondence to the 1992 measurement.

Table 2. Density of Cirsium longistylum

|               | 1990                  | 1991                  | 1992                  |
|---------------|-----------------------|-----------------------|-----------------------|
| SITE          | plants/m <sup>2</sup> | plants/m <sup>2</sup> | plants/m <sup>2</sup> |
| Kings Hill    | 1.72                  | 2.65                  | 2.94                  |
| Russian Creek | 0.27                  | 0.18                  | 0.13                  |
| Neihart       | 2.16                  | 1.60                  | 1.0                   |

Table 3. Life history data for Cirsium longistylum at the Kings Hill site

| SIZE CLASS                       | 1990     | 1991      | 1992      |
|----------------------------------|----------|-----------|-----------|
| small<br>(includes<br>seedlings) | 30 (27%) | 141 (81%) | 156 (81%) |
| medium                           | 37 (33%) | 24 (14%)  | 21 (11%)  |
| large                            | 14 (12%) | 9 (5%)    | 4 (2%)    |
| flowering                        | 32 (28%) | 0 (0%)    | 12 (6%)   |
| total living                     | 113      | 174       | 193       |
| dead                             | 0        | 31        | 1         |
| missing                          | -        | 41        | 56        |
| recruits                         | -        | 133       | 67        |

Table 4. Life history data for Cirsium longistylum at the Russian Creek site

| SIZE CLASS                       | 1990     | 1991     | 1992     |
|----------------------------------|----------|----------|----------|
| small<br>(includes<br>seedlings) | 26 (24%) | 24 (33%) | 12 (23%) |
| medium                           | 23 (21%) | 26 (36%) | 26 (49%) |
| large                            | 20 (19%) | 18 (25%) | 7 (13%)  |
| flowering                        | 38 (36%) | 4 (6%)   | 8 (15%)  |
| total living                     | 107      | 72       | 53       |
| dead                             | 0        | 34       | 0        |
| missing                          | -        | 23       | 30       |
| recruits                         | -        | 23       | 14       |

Table 5. Life history data for Cirsium hookerianum at the Neihart site

| SIZE CLASS                       | 1990     | 1991     | 1992     |
|----------------------------------|----------|----------|----------|
| small<br>(includes<br>seedlings) | 41 (29%) | 50 (47%) | 31 (44%) |
| medium                           | 54 (38%) | 38 (36%) | 27 (39%) |
| large                            | 23 (17%) | 17 (16%) | 10 (14%) |
| flowering                        | 24 (17%) | 0 (0%)   | 2 (3%)   |
| total living                     | 142      | 105      | 70       |
| dead                             | 0        | 20       | 0        |
| missing                          | -        | 61       | 58       |
| recruits                         | -        | 44       | 17       |

## DISCUSSION

In studies where the object is to identify individuals through time, circular plots are perhaps useful for species with low densities. For species with moderate to high densities and/or clumped distributions such as Cirsium longistylum or C. hookerianum, such plots are not practical. The amount of difference between a few degrees near the center of a circular plot is minute while the difficulty in accurately measuring the same angle from one year to the next is immense. Added to the above dilemma, the incorrectly measured angles in 1990 and 1991 as well as investigator error, make it extremely difficult, if not impossible, to be able to assign any certainty to the identifications of an individual from one season to the next. Thus although it may appear from the demographic data tables that individuals may remain in a size class for three years or advance through various rosette stages and flower in three years, such an interpretation is at best tenuous.

Population density is independent of the above problems, but the three years' worth data show contrasting trends between the Kings Hill and the Russian Creek sites (i.e, increasing at Kings Hill, decreasing at Russian Creek). The Kings Hill site has become increasingly dominated by small rosettes while the Russian Creek site is dominated by medium rosettes. Extensive burrowing activity was noted in 1990 field notes, possible explanation for the high levels of recruitment the following year. Trend may also be affected by density, hybridization intensity, and/or weevil infestation; all of which vary between the two sample sites.

## CONCLUSIONS

Preliminary analysis indicates population growth at the high density Kings Hill site and population decline at the low density Russian Creek site. Additional sampling are needed to determine long-term trend. A refinement in the monitoring methods is needed to determine critical life history stages of the species by tracking individuals through time. This calls for changing or modifying monitoring design in order to track individual plants. Populations with high, low and intermediate C. longistylum components, as identified in this report, should be added to monitoring sites. It would also be appropriate to consider weevil infestation levels and disturbance regime in selection of additional sites.

The feasibility of conducting genetic eletrophoretic research on the species will be pursued and monitoring work will continue in consultation with Lewis and Clark National Forest.

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- Schassberger, L.A., and P.L. Achuff. 1991. Status review of Cirsium longistylum. U.S. Forest Service - Region 1, Lewis and Clark National Forest. Montana Natural Heritage Program. Helena, Montana. 78 pp.
- Shelly, J.S. 1990. Plant species of special concern. Montana Natural Heritage Program, Helena, Montana. 20 pp.
- U.S. Department of Agriculture. 1988. Sensitive Plant Field Guide, Region 1. U.S. Forest Service, Northern Region: Range, Air, Watershed, and Ecology Unit, Missoula, Montana.
- U.S. Department of Interior. 1990. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50 CFR Part 17: 6184-6229.

APPENDIX I: ELEMENT OCCURRENCE RECORDS  
FOR CIRSIUM LONGISTYLUM

Element Occurrence Record  
Cirsium longistylum

Occurrence # 001

Survey site name: MONARCH SE

EO rank:

EO rank comments:

County: CASCADE

USGS quadrangle: MONARCH

Township: Range: Section: TRS comments:

015N 007E 14

|                    |            |               |        |
|--------------------|------------|---------------|--------|
| 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:

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.

Specimens:

SENN, FRANKTON & GILLETT. (5666). 1951. DAO. (HOLOTYPE).

Element Occurrence Record  
Cirsium longistylum

Occurrence # 002

Survey site name: KINGS HILL

EO rank: B

EO rank comments: VERY LARGE POPULATION IN A MIX OF  
 DISTURBED AND RELATIVELY UNDISTURBED  
 HABITATS; CA. 50% OF POPULATION IS  
 CIRSIUM LONGISTYLUM.

County: MEAGHER  
 CASCADE

USGS quadrangle: KINGS HILL

|           |        |          |   |
|-----------|--------|----------|---|
| Township: | Range: | Section: | TRS comments:                           |
| 012N      | 008E   | 03       | NE4NE4; 2 N2, SE4; 11 N2; 12 NW4, 1 NW4 |
| 013N      | 008W   | 34       | SE4, SW4                                |

|                    |            |               |             |
|--------------------|------------|---------------|-------------|
| Survey date:       | 1992-08-19 | Elevation:    | 7280 -      |
| First observation: | 1951       | Slope/aspect: | 0-25% / ALL |
| Last observation:  | 1992-08-19 | Size (acres): | 500         |

Location:

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

Element occurrence data:

1992: CA. 1500 PLANTS, 33% IN FLOWER, 50% PURE C. LONGISTYLUM, CONCENTRATED AROUND KINGS HILL. NONE IN CAMPGROUND, FEW ALONG ROAD OR IN SKI AREA. 1990: EXTENDED POPULATION BOUNDARIES, TENS OF THOUSANDS OF PLANTS. 1986: FREQUENT; 41 PLANTS STUDIED, WITH 32 HAVING FEATURES OF C. LONGISTYLUM, AND 9 HAVING FEATURES APPARENTLY INTERMEDIATE BETWEEN C. LONGISTYLUM AND C. HOOKERIANUM.

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:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

RAMSTETTER, J. (7). 1983. MONTU.  
 SENN, FRANKTON & GILLET (5670). 1951. DAO.  
 SCHASSBERGER, L. (396). 1990. MN.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 003

Survey site name: FOREST GREEN  
 EO rank: C  
 EO rank comments: MEDIUM-SIZED POPULATION IN AN UNGRAZED  
 MEADOW BETWEEN HIGHWAY AND DIRT ROAD;  
 FEWER THAN 10% OF POPULATION IS PURE C.  
 LONGISTYLUM.

County: MEAGHER

USGS quadrangle: KINGS HILL

Township: Range: Section: TRS comments:  
 012N 008E 32 SW4NE4, E2SE4NW4

Survey date: 1992-08-19 Elevation: 6028 -6040  
 First observation: 1953 Slope/aspect:  
 Last observation: 1992-08-19 Size (acres): 15

Location:

LITTLE BELT MOUNTAINS, CA. 16 MILES SOUTH OF NEIHART, NORTH SIDE OF  
 HIGHWAY JUST WEST OF FOREST GREEN.

Element occurrence data:

1992: CA. 100 PLANTS (50% JUVENILE). OF A 25-PLANT SAMPLE, FEWER THAN  
 10% DISPLAYED C. LONGISTYLUM CHARACTERS. 1983: UNKNOWN; FOREST GREEN  
 AREA WAS SEARCHED BY J. RAMSTETTER, BUT NO PLANTS WHICH COULD BE  
 CONCLUSIVELY IDENTIFIED AS C. LONGISTYLUM WERE FOUND.

General site description:

MEADOWS DOMINATED BY DESCHAMPSIA CAESPITOSA (?), WITH THLASPI ARVENSE,  
 CIRSIUM HOOKERIANUM AND C. VULGARE.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)  
 LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

OCCURRENCE IS LOCATED ON A PRIVATE INHOLDING WITHIN THE LEWIS & CLARK  
 NATIONAL FOREST.

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
 MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

SENN. (6207). 1953. DAO.  
 POOLE, J. M. (3154 a-e). 1992. MONT.

/

Element Occurrence Record  
Cirsium longistylum

Occurrence # 004

Survey site name: MONARCH

EO rank: D

EO rank comments: VERY SMALL POPULATION, ADJACENT TO ROAD.

County: CASCADE

USGS quadrangle: MONARCH

Township: Range: Section: TRS comments:  
015N 007E 03 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:

1992: NO CIRSIUM OF ANY SPECIES SEEN IN THE AREA. 1986: 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 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:

SITE REVISITED BY J. POOLE (MTNHP) IN 1992.

Information source:

SHELLY, J. S. 1986. [MTNHP FIELD SURVEYS IN LEWIS & CLARK, PONDERA, AND MEAGHER COUNTIES OF 22-24 JULY.]

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 005

Survey site name: BENDER CREEK TRAIL  
 EO rank: D  
 EO rank comments: DISTURBED AREA, ADJACENT TO ROAD AND  
 NUCLEAR MISSILE SILO. VERY SMALL  
 POPULATION; FEWER THAN 20% ARE C.  
 LONGISTYLUM.

County: CASCADE

USGS quadrangle: BARKER

Township: Range: Section: TRS comments:  
 015N 008E 23 NE4

Survey date: 1992-08-20 Elevation: 5360 -  
 First observation: 1983 Slope/aspect: LEVEL  
 Last observation: 1992-08-20 Size (acres): 5

Location:

LITTLE BELT MOUNTAINS. GO CA. 9.7 MILES EAST OF MONARCH ON FS RD #120  
 (DRY FORK BELT CREEK ROAD); POPULATION IS AT JUNCTION OF ROAD WITH  
 TRAIL #318 (BENDER CREEK TRAIL).

Element occurrence data:

1992: 23 PLANTS, 18 FLOWERING, 3 OF WHICH WERE C. LONGISTYLUM. LOW  
 REPRODUCTIVE RATE; FEW FLOWER HEADS. 1990: 10 PLANTS COUNTED. 1986: 20  
 PLANTS COUNTED; EVIDENCE OF POSSIBLE HYBRIDIZATION WITH CIRSIUM  
 HOOKERIANUM.

General site description:

IN GRASSY OPENINGS, ON ROADSIDE AND ALONG CREEK; WITH PINUS PONDEROSA,  
 P. CONTORTA, PSEUDOTSUGA MENZIESII, ACHILLEA MILLEFOLIUM, PHLEUM,  
 LINUM.

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY, LITTLE BELT AND CASTLE  
 MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

RAMSTETTER, J. (2). 1983. MONTU.  
 SHELLY, J. (1253b) AND W. PHILLIPS. 1986.  
 POOLE, J. M. (3159). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 006

Survey site name: DUCK CREEK PASS  
 EO rank: BC  
 EO rank comments: LARGE POPULATION, PRIMARILY ROADSIDE,  
 PROBABLY HYBRIDIZING WITH CIRSIUM  
 HOOKERIANUM.

County: MEAGHER  
 BROADWATER

USGS quadrangle: GIPSY LAKE  
 BOULDER BALDY  
 GURNETT CREEK EAST

|           |        |          |                    |
|-----------|--------|----------|--------------------|
| Township: | Range: | Section: | TRS comments:      |
| 009N      | 004E   | 32       | 27, 28, 33, 31, 30 |
| 009N      | 003E   | 25       | 36                 |

|                    |            |               |            |
|--------------------|------------|---------------|------------|
| Survey date:       | 1992-07-27 | Elevation:    | 6320 -7600 |
| First observation: | 1976       | Slope/aspect: |            |
| Last observation:  | 1992-10-02 | Size (acres): | 20         |

Location:

BIG BELT MOUNTAINS, DUCK CREEK PASS ROAD (FS RD #139), BEGINNING JUST WEST OF TURNOFF TO THOMPSON GULCH GUARD STATION, AND SCATTERED IN SUBPOPULATIONS ALONG ROAD FOR 6.4 MILES TO THE WEST.

Element occurrence data:

1992: 1000-5000 INDIVIDUALS, ALL IN FLOWER. 1983: SOME SUBPOPULATIONS HAVE >100 PLANTS; ANOTHER THISTLE, POSSIBLY C. HOOKERIANUM, OCCURS IN ALL AREAS, PROBABLY HYBRIDIZING.

General site description:

1992: OPEN GRASSLANDS WITH SCATTERED SHRUBS BETWEEN ROAD EDGE AND FOREST, WITH FESTUCA IDAHOENSIS, TRISETUM SP., POA PRATENSIS, BROMUS SP., PSEUDOTSUGA MENZIESII, AND PINUS CONTORTA. 1983 (RAMSTETTER): MOIST FIELDS AND ALONG ROADSIDE; WITH LUPINUS, SOLIDAGO.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

SOME DISTURBANCE CAUSED BY ROAD CONSTRUCTION AND MAINTENANCE.

Information source:

POOLE, J. 1992. [MTNHP FIELD SURVEYS TO ELKHORN AND BIG BELT MOUNTAINS, HELENA NATIONAL FOREST, JULY 12, 27-29, AUGUST 3-7, 14, 17, 26 AND 27.]

Specimens:

RAMSTETTER, J. (11, 13). 1983. MONTU.  
 DORN, R. D. (2783). 1976. MONTU.  
 LESICA, P. (5846). 1992.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 007

Survey site name: JUMPING CREEK CAMPGROUND  
EO rank: C  
EO rank comments: SMALL POPULATION IN CAMPGROUND;  
HYBRIDIZING WITH C. HOOKERIANUM.

County: MEAGHER

USGS quadrangle: MOOSE MOUNTAIN

Township: Range: Section: TRS comments:  
012N 007E 36 NE4

Survey date: 1992-08-19 Elevation: 5920 -  
First observation: 1983 Slope/aspect: 0-5% / -  
Last observation: 1992-08-19 Size (acres): 5

Location:  
JUMPING CREEK CAMPGROUND AND ACCESS ROAD, CA. 17.5 MILES SOUTH OF  
NEIHART OFF US HWY 89.

Element occurrence data:  
COMMON IN MOIST MEADOWS AND IN LIGHTLY-DISTURBED AREAS OF CAMPGROUND  
AND ACCESS ROAD. CA. 75 PLANTS IN 1992; AN ESTIMATED 75% ARE C.  
LONGISTYLUM.

General site description:  
MOIST MEADOWS INTERSPERSED AMONG SPRUCE WOODLAND ALONG SHEEP CREEK;  
WITH C. HOOKERIANUM, C. VULGARE AND PHLEUM PRATENSE.

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

Comments:

Information source:  
POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:  
RAMSTETTER, J. (9). 1983. MONTU.  
SCHASSBERGER, L. (398). 1990. MN.  
POOLE, J. M. (3153 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 008

Survey site name: NEIHART  
EO rank: D  
EO rank comments: LARGE POPULATION BUT ONLY 1% C.  
LONGISTYLUM; DISTURBED HABITAT.

County: CASCADE

USGS quadrangle: BELT PARK BUTTE

Township: Range: Section: TRS comments:  
014N 007E 07 22, 23, 24, 25, 26  
014N 008E 19 30

Survey date: 1992-08-19 Elevation: 5440 -7040  
First observation: 1983 Slope/aspect: 0-20% / ALL  
Last observation: 1992-08-19 Size (acres): 160

Location:  
JUST NORTH OF NEIHART, ALONG FS RD #834 THAT EXTENDS WEST UP HARLEY  
CREEK AND NORTH TO UPLAND MEADOWS.

Element occurrence data:  
1992: CA. 1,000 INDIVIDUALS, 50% IN FLOWER. 1% OF MEADOW POPULATION  
WAS C. LONGISTYLUM. 1990: 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:  
SCHASSBERGER SPECIMEN (403) TENTATIVELY ANNOTATED BY CRONQUIST AS C.  
HOOKERIANUM, 1991; PREVIOUSLY ANNOTATED C. LONGISTYLUM, G. OWNBEY,  
1990.

Information source:  
POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:  
RAMSTETTER, J. (3). 1983. MONTU.  
SCHASSBERGER, L. (403). 1990. NY.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 009

Survey site name: LONG BALDY

EO rank:

EO rank comments:

County: JUDITH BASIN

USGS quadrangle: YOGO PEAK  
NEIHART

Township: Range: Section: TRS comments:  
014N 009E 19

|                              |                   |
|------------------------------|-------------------|
| 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:

SPECIMEN LABEL INDICATES THAT 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 CIRSIIUM SPECIES OF THE WESTERN U.S. CAN.J. BOT. 41:1553

Specimens:

FLODMAN (880). 1896. NY.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 010

Survey site name: O'BRIEN CREEK *Moose Park*  
 EO rank: C  
 EO rank comments: VERY LARGE POPULATION IN MIX OF  
 DISTURBED AND UNDISTURBED HABITAT; EXACT  
 PERCENTAGE OF CIRSIUM LONGISTYLUM  
 UNKNOWN.

County: CASCADE  
 MEAGHER

USGS quadrangle: KINGS HILL  
 MOOSE MOUNTAIN  
 BELT PARK BUTTE

Township: Range: Section: TRS comments:  
 013N 008E 28 NW4; 29 NE4, CENTER; 30 NE4; 19 SW4, SE4, NE4

Survey date: 1992-08-19 Elevation: 7200 -  
 First observation: 1990 Slope/aspect: 0-15% / VARIOUS  
 Last observation: 1992-08-19 Size (acres): 800

Location:

LITTLE BELT MOUNTAINS, WEST OF KINGS HILL ALONG FS RD #839 FROM  
 O'BRIEN PARK TO LONE TREE PARK.

Element occurrence data:

1992: OVER 3,000 INDIVIDUALS IN MOOSE PARK, BUT NO CIRSIUM  
 LONGISTYLUM; C. LONGISTYLUM FOUND ALONG ROADS. 1990: 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:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
 MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

SCHASSBERGER, L. (401). 1990. TENTATIVE ID BY G. OWNBEY.  
 POOLE, J. M. (3157 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 011

Survey site name: SOUTH FORK DEADMAN CREEK  
EO rank: AB  
EO rank comments: 1992: LARGE POPULATION, PARTIALLY IN  
DISTURBED AREAS; CA. 90% OF POPULATION  
IS C. LONGISTYLUM.

County: MEAGHER  
JUDITH BASIN

USGS quadrangle: KINGS HILL  
SAND POINT

Township: Range: Section: TRS comments:  
012N 008E 24 S2, NW4; 25 NE4  
012N 009E 19 S2; 20 SW4; 30 NE4; 29 N2

Survey date: 1992-08-19 Elevation: 6520 -8170  
First observation: 1986 Slope/aspect: 0-10% / ALL  
Last observation: 1992-08-19 Size (acres): 600

Location:  
LITTLE BELT MOUNTAINS, SOUTH FORK DEADMAN CREEK DRAINAGE. TAKE FS RD  
#837 CA. 1 MILE FROM US HWY 89 UP INTO SPUR PARK; POPULATION IS ALONG  
ROAD AND ON ADJACENT, LIGHTLY-DISTURBED SLOPES.

Element occurrence data:  
1992: CA. 700 PLANTS, 70% IN FLOWER; CA. 90% PURE C. LONGISTYLUM.  
1990: FREQUENT; SEVERAL TENS OF THOUSANDS OF PLANTS. 1986: OF 19  
PLANTS STUDIED, 3 DISPLAYED FEATURES SUGGESTING HYBRID CONTACT WITH C.  
HOOKERIANUM.

General site description:  
AT LOWER ELEVATIONS: PINUS CONTORTA FOREST ON NORTHEAST-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:  
SIGHT RECORD ONLY IN 1986.

Information source:  
POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:  
SCHASSBERGER, L. (399). 1990. MN.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 012

Survey site name: HAY COULEE  
EO rank: B  
EO rank comments: LARGE POPULATION IN FAIRLY UNDISTURBED  
SITE, WITH CA. 60% C. LONGISTYLUM.

County: JUDITH BASIN

USGS quadrangle: WOODHURST MOUNTAIN

Township: Range: Section: TRS comments:  
014N 011E 29 SE4SW4NE4, SE4NE4, N2N2NW4, NE4NW4SW4; 28 W2N;  
21 SE4, SE4NW4, SW4SW4

Survey date: 1992-08-20 Elevation: 5440 -6180  
First observation: 1990 Slope/aspect: LEVEL / EAST  
Last observation: 1992-08-20 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:

1992: GRAZING LIGHT. 1990: HEAVILY-GRAZED MEADOW; PART OF SITE WAS  
BURNED IN THE SAGE CREEK FIRE OF 1990.

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

POOLE, J. M. (3160). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 013

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

County: CASCADE

USGS quadrangle: NEIHART

Township: Range: Section: TRS comments:  
 013N 008E 15 N2

Survey date: 1986-07-24 Elevation: 6080 -  
 First observation: 1986 Slope/aspect:  
 Last observation: 1992-08-19 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:

1992: ONLY CA. 50 PLANTS WERE SEEN SCATTERED ALONG CREEK AND HIGHWAY FOR TWO MILES EITHER SIDE OF MANY PINES CAMPGROUND. 1986: 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. SITE REVISITED IN 1992 BY J. M. POOLE, MTNHP.

Information source:

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

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 014

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: Section: TRS comments:  
015N 007E 12 W2; 11 NE4

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.]

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 015

Survey site name: SERVOSS MOUNTAIN

EO rank:

EO rank comments:

County: CASCADE

USGS quadrangle: BARKER

Township: Range: Section: TRS comments:

015N 008E 21 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.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 016

Survey site name: LAKE SUTHERLIN

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: VOLCANO BUTTE

Township: Range: Section: TRS comments:

010N 008E 15

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. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF MONTANA, MISSOULA, MT 59812.

Specimens:

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

Element Occurrence Record  
Cirsium longistylum

Occurrence # 017

Survey site name: UPPER BEAR GULCH

EO rank:

EO rank comments:

County: JUDITH BASIN

USGS quadrangle: BANDBOX MOUNTAIN

Township: Range: Section: TRS comments:  
 014N 010E 26 SW4SW4; 27 SE4SE4; 35 NW4NW4

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:

Information source:

SCHASSBERGER, L. A. 1990. [FIELD SURVEYS AND MONITORING OF 23-27 AND  
 30-31 JULY AND 6-10 AUGUST IN THE LITTLE BELT MOUNTAINS (CIRSIIUM  
 LONGISTYLUM, GOODYERA REPENS)].

Specimens:

SCHASSBERGER, L. (412). 1990. MN. TENTATIVELY VERIFIED BY G. OWNBEY.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 018

Survey site name: SKUNK GULCH

EO rank:

EO rank comments:

County: JUDITH BASIN

USGS quadrangle: BANDBOX MOUNTAIN

Township: Range: Section: TRS comments:

014N 010E 33 NW4, SE4

Survey date:

Elevation: 6280 -

First observation: 1990

Slope/aspect:

Last observation: 1992-08-20

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:

SITE REVISITED IN 1992 BY J. M. POOLE (MTNHP).

Information source:

SCHASSBERGER, L. A. 1990. [FIELD SURVEYS AND MONITORING OF 23-27 AND 30-31 JULY AND 6-10 AUGUST IN THE LITTLE BELT MOUNTAINS (CIRSIMUM LONGISTYLUM, GOODYERA REPENS)].

Specimens:

SCHASSBERGER, L. (412). 1990. MN. TENTATIVE ID BY G. OWNBEY.

POOLE, J. M. (3161 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 019

Survey site name: THORNQUIST GULCH  
EO rank: CD  
EO rank comments: SMALL POPULATION ALONG ROAD AND GULCH  
SUFFERING HEAVY GRAZING PRESSURE.

County: MEAGHER

USGS quadrangle: COXCOMBE BUTTE

Township: Range: Section: TRS comments:  
011N 007E 17 NW4

Survey date: 1992-08-18 Elevation: 5800 -  
First observation: 1990 Slope/aspect: 0-5% / -  
Last observation: 1992-08-18 Size (acres): 30

Location:

LITTLE BELT MOUNTAINS. FROM WHITE SULPHUR SPRINGS TAKE US HWY 89 NORTH  
CA. 15 MILES, THEN FS RD #831 NORTH CA. 0.5 MILE. POPULATION EXTENDS  
0.5-1.0 MILE ALONG THORNQUIST GULCH.

Element occurrence data:

1992: CA. 50 PLANTS (50% IN FLOWER, 50% VEGETATIVE). 1990: CA. 50  
PLANTS.

General site description:

NEAR JEEP ROAD, ALONG STREAM; MESIC WOODLAND WITH SMALL MEADOW  
OPENINGS.

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:

SCHASSBERGER, L. (397). 1990. NY. TENTATIVE ID BY A. CRONQUIST.  
POOLE, J. M. (3152 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 020

Survey site name: RUSSIAN FLAT <sup>Creek</sup>  
EO rank: B

EO rank comments: LARGE POPULATION (CA. 80% CIRSIUM LONGISTYLUM) IN SOMEWHAT DISTURBED HABITAT.

County: JUDITH BASIN

USGS quadrangle: RUSSIAN FLAT

Township: Range: Section: TRS comments:  
011N 010E 11 NW4; 10 NW4SE4, NE4; 12 SW4; 9 N2

Survey date: 1992-08-20 Elevation: 6350 -6640  
First observation: 1990 Slope/aspect: 0-5% / NORTHEAST  
Last observation: 1992-08-28 Size (acres): 86

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 AND TO THE WEST 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:  
POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:  
POOLE, J. M. (3162 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 021

Survey site name: PASTURE GULCH  
EO rank: D  
EO rank comments: SMALL, DWINDLING POPULATION IN A  
CLEARCUT (40% CIRSIUM LONGISTYLUM).

County: MEAGHER

USGS quadrangle: GROVELAND  
MOUNT HOWE

Township: Range: Section: TRS comments:  
009N 010E 34 W2

Survey date: 1992-08-20 Elevation: 5560 -5640  
First observation: 1991 Slope/aspect: 5-20% / WEST, NORTHWEST  
Last observation: 1992-08-20 Size (acres): 5

Location:  
TAKE US HWY 12 CA. 5 MILES EAST OF CHECKERBOARD, THEN GO SOUTH ON FS  
RD #694 CA. 4 MILES INTO PASTURE GULCH.

Element occurrence data:  
1992: 50 PLANTS, ONLY 3 JUVENILES, REPRODUCTION LOW. 1991: 50-100  
PLANTS SCATTERED ALONG ROAD AND IN RECENTLY LOGGED AREAS; 10%  
FLOWERING, WITH THE REST IN BUD.

General site description:  
OPEN, PARTIALLY LOGGED SLOPES AND TOESLOPES OF ROAD-CUTS; WITH  
PSUEDOTSUGA MENZIESII, SYMPHORICARPOS ALBUS, ROSA SPP., ARNICA  
CORDIFOLIA, CYNOGLOSSUM OFFICINALE AND CARDUUS NUTANS.

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

Comments:  
CATTLE GRAZING HEAVY IN AREA...

Information source:  
POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO LITTLE BELT AND CASTLE  
MOUNTAINS, LEWIS AND CLARK NATIONAL FOREST, AUGUST 18-20.]

Specimens:  
FIELD, D. (910707-1). 1991.  
POOLE, J. M. (3163 a-e). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 022

Survey site name: CARL CREEK  
 EO rank: D  
 EO rank comments: VERY SMALL POPULATION, DISTURBED  
 HABITAT.

County: BROADWATER

USGS quadrangle: BATTLE MOUNTAIN

Township: Range: Section: TRS comments:  
 007N 005E 20 NE4

Survey date: 1992-07-14 Elevation: 5440 -5480  
 First observation: 1992-07-14 Slope/aspect: 0-5% / SOUTH,  
 SOUTHEAST.  
 Last observation: 1992-07-14 Size (acres):

Location:

BIG BELT MOUNTAINS, ALONG CARL CREEK TRAIL, JUST SOUTH OF TRAILHEAD  
 OFF HIGHWAY 12.

Element occurrence data:

7 PLANTS TOTAL, 1 COLLECTED. IN EARLY FLOWERING; WEEVILS PRESENT.

General site description:

IN ABANDONED ROADBED (NORTH END) AND SEMI-INTACT MEADOW (SOUTH END) OF  
 PARTIALLY-OPEN VALLEY BOTTOM SEGMENT ALONG CARL CREEK. ASSOCIATED  
 SPECIES (NORTH END): PHLEUM PRATENSE, SYMPHORICARPOS ALBUS, CIRSIUM  
 VULGARIS, GERANIUM VISCOSSISIMUM, BROMUS INERMIS; SOUTH END: GALIUM  
 BOREALE, FESTUCA IDAHOENSIS, SENECIO SPP., AND ACHILLEA MILLEFOLIUM.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

VALLEY BOTTOM WAS FORMER ROADBED; HIGH NUMBER OF EXOTICS OUTSIDE OF  
 ROADBED MAY REFLECT GRAZING HISTORY.

Information source:

HEIDEL, B. 1992. [MTNHP FIELD SURVEY TO CARL CREEK OF 14 JULY.]

Specimens:

HEIDEL, B. (796). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 023

Survey site name: ATLANTA RIDGE  
 EO rank: A  
 EO rank comments: LARGE POPULATION IN INTACT HABITAT.

County: MEAGHER

USGS quadrangle: BOULDER BALDY

Township: Range: Section: TRS comments:  
 009N 004E 06 S2NW4, N2SW4; 5 NW4SW4

Survey date: 1992-07-15 Elevation: 6400 -7440  
 First observation: 1992-07-15 Slope/aspect: 0-10% / EAST, SOUTH  
 Last observation: 1992-07-15 Size (acres): 40

Location:

BIG BELT MOUNTAINS, ON ATLANTA RIDGE ABOVE ATLANTA CREEK, WEST OF ATLANTA ROAD (FS RD #575), UPPER END OF RIDGE. ALSO ALONG ATLANTA CREEK AND DIVERSION CHANNEL IN FEWER NUMBERS.

Element occurrence data:

250-400 PLANTS IN PEAK FLOWERING, THE MAJORITY AT WEST END IN MEADOW SETTING. WEEVILS PRESENT.

General site description:

MOST NUMEROUS IN TRANSITION BETWEEN FESTUCA SCABRELLA HABITAT TYPE AND DESCHAMPسيا CESPITOSA-OENTHONIA PARRYI HT, ASSOCIATED WITH IRIS MISSOURIENSIS, AGROPYRON CANINUM, EQUISETUM ARVENSE, GALIUM BOREALE, POTENTILLA GRACILIS, OXYTROPIS SERICEA; INTO OPEN PINUS CONTORTA. ALSO ALONG SPARSELY VEGETATED DIVERSION CHANNEL BANKS, AND WIDELY SCATTERED ALONG ATLANTA RIDGE ABOVE MEADOW SPECIES LIKE HERACLEUM LANATUM AND MERTENSIA OBLONGIFOLIA.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

REPRESENTS LARGEST AND MOST NATURAL OCCURRENCE OF CIRSIUM LONGISTYLUM ON HELENA NATIONAL FOREST. TEN SPECIMENS COLLECTED BY B. HEIDEL FOR MORPHOMETRIC STUDY (NOT SUITED FOR HERBARIUM).

Information source:

HEIDEL, B. 1992. [MTNHP FIELD SURVEY TO ATLANTIC RIDGE OF 15 JULY.]

Specimens:

HEIDEL, B. (820). 1992.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 024

Survey site name: CEMENT GULCH

EO rank:

EO rank comments:

County: BROADWATER

USGS quadrangle: WHITES CITY

Township: Range: Section: TRS comments:

010N 003E 7 SE4NE4

Survey date:

Elevation: 6000 -

First observation: 1992-08-05

Slope/aspect:

Last observation: 1992-08-05

Size (acres):

Location:

BIG BELT MOUNTAINS; TAKE COUNTY RTE. #287 UP CONFEDERATE AND CEMENT GULCHES TO NEAR READY CASH GULCH.

Element occurrence data:

General site description:

ROADSIDE; WITH POA PRATENSIS AND CARDUUS NUTANS.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

Information source:

LESICA, P. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF MONTANA,  
MISSOULA, MT 59812.

Specimens:

LESICA, P. (5834). 1992. MONTU.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 025

Survey site name: HOGBACK MOUNTAIN

EO rank:

EO rank comments:

County: LEWIS AND CLARK

USGS quadrangle: HOGBACK MOUNTAIN

Township: Range: Section: TRS comments:

012N 001W 3 NE4SE4

Survey date:

Elevation: 7800 -

First observation: 1992

Slope/aspect:

Last observation: 1992

Size (acres):

Location:

BIG BELT MOUNTAINS, FELLFIELD ON TOP OF HOGBACK MOUNTIAN.

Element occurrence data:

General site description:

FELLFIELD, GRAVELLY LIMESTONE-DERIVED SOIL, WITH POTENTILLA OVINA AND  
POA INTERIOR.

Land owner/manager:

HELENA NATIONAL FOREST, HELENA RANGER DISTRICT

Comments:

Information source:

LESICA, P. 1992. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF MONTANA,  
MISSOULA, MT 59812.

Specimens:

LESICA, P. (5855). 1992. MONTU.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 026

Survey site name: BEAR GULCH SPRING  
 EO rank: D  
 EO rank comments: 1 PLANT MIXED WITH ANOTHER SPECIES AND  
 POSSIBLE HYBRIDS; PASTURE NEAR ROAD.

County: JEFFERSON

USGS quadrangle: CROW CREEK FALLS

Township: Range: Section: TRS comments:  
 006N 002W 1 NW4SE4NW4

Survey date: 1992-08-26 Elevation: 6920 -  
 First observation: 1992-08-26 Slope/aspect: 10% / EAST  
 Last observation: 1992-08-26 Size (acres): 1

Location:

ELKHORN MOUNTAINS, 2.3 AIR MILES SOUTH OF CROW CREEK FALLS; TAKE CROW  
 CREEK ROAD (FS RD #424) BEYOND CAMPGROUND TO TRAIL 110 (TO POE PARK),  
 GO LEFT, STAYING ON MAIN ROAD FOR CA. 1 MILE TO CORRAL AND SPRING.

Element occurrence data:

IN 1992 ONLY 1 PLANT, IN FRUIT, WITH CIRSIUM LONGISTYLUM CHARACTERS  
 WAS OBSERVED AMONG A POPULATION OF CA. 100 PLANTS OF CIRSIUM  
 HOOKERIANUM AND POSSIBLE HYBRIDS AND BACK CROSSES.

General site description:

OPEN GRASSLAND SURROUNDED BY FOREST; GRAZED PASTURE BY ROAD WITH  
 FENCED SPRING AND UPPER SPRING RUN; NEARBY MESIC MEADOW AROUND  
 DRAINAGE; WITH PHLEUM PRATENSE, POTENTILLA SP., ANTENNARIA SP., AND  
 CAREX SPP.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO ELKHORN AND BIG BELT  
 MOUNTAINS IN THE HELENA NATIONAL FOREST OF JULY 12, 27-29 AND AUG.  
 3-7, 14, 17, 26.]

Specimens:

POOLE, J. M. (3164). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 027

Survey site name: CONFEDERATE GULCH

EO rank:

EO rank comments:

County: BROADWATER

USGS quadrangle: DIAMOND CITY

Township: Range: Section: TRS comments:

010N 003E 20 NE4

Survey date:

Elevation: 5220 -

First observation: 1992-08-05

Slope/aspect:

Last observation: 1992-08-05

Size (acres):

Location:

BIG BELT MOUNTAINS, ALONG CONFEDERATE GULCH JUST ABOVE CEMENT GULCH.

Element occurrence data:

General site description:

DISTURBED AREA; WITH PHLEUM PRATENSE AND ELYMUS GLAUCUS.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

Information source:

LESICA, P. DIVISION OF BIOLOGICAL SCIENCES, UNIVERSITY OF MONTANA,  
MISSOULA, MT. 59812.

Specimens:

LESICA, P. (5833). 1992. MONTU.

Element Occurrence Record  
Cirsium longistylum

53

Occurrence # 028

Survey site name: BOULDER CREEK  
EO rank: CD  
EO rank comments: SMALL POPULATION.

County: BROADWATER

USGS quadrangle: BOULDER BALDY  
DIAMOND CITY

Township: Range: Section: TRS comments:  
010N 003E 28 S2SW4; 29 S2SE4

Survey date: 1992-08-11 Elevation: 6920 -7020  
First observation: 1992-08-11 Slope/aspect: 20-40% / SOUTH  
Last observation: 1992-08-11 Size (acres):

Location:

BIG BELT MOUNTAINS, RIDGELINE ABOVE BOULDER CREEK, ACCESSIBLE FROM FS  
RD #4171 TO LOGGING ROAD TO FS TRAIL #142, WHICH CUTS OVER THE RIDGE.

Element occurrence data:

20-40 PLANTS WIDELY SCATTERED ACROSS EXPOSED SLOPE. VERY LATE  
FLOWERING AND FRUITING STAGES.

General site description:

OPEN UPPER SOUTH-FACING RIDGELINE ABOVE BOULDER CREEK IN AGROPYRON  
SPICATUM HABITAT TYPE WITH PAST GRAZING HISTORY LIKELY. UNUSUALLY  
HEAVY LITTER BUILDUP. ASSOCIATED SPECIES: FESTUCA IDAHOENSIS, MONARDA  
FISTULOSA.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

FIVE SPECIMENS COLLECTED FOR MORPHOMETRIC STUDY.

Information source:

HEIDEL, B. 1992. [MTNHP FIELD SURVEYS TO BOULDER CREEK AND BOULDER  
LAKES OF 11 AUGUST.]

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 029

Survey site name: SPRINGS GULCH  
 EO rank: BC  
 EO rank comments: SMALL POPULATION IN DISTURBED SITE, ONLY  
 10% WAS CIRSIUM LONGISTYLUM.

County: BROADWATER

USGS quadrangle: WHITES CITY

Township: Range: Section: TRS comments:  
 010N 002E 3 NW4NW4NW4

Survey date: 1992-08-27 Elevation: 6640 -6840  
 First observation: 1992-08-27 Slope/aspect: 50% / SOUTHWEST  
 Last observation: 1992-08-27 Size (acres): 10

Location:

BIG BELT MOUNTAINS, HEAD OF SPRINGS GULCH ON SOUTH SLOPES OF BILK MOUNTAIN, 0.3 AIR MILES SOUTHWEST OF THE EASTERN PEAK OF BILK MOUNTAIN; END OF SPRINGS GULCH ROAD (FS RD #1020).

Element occurrence data:

IN 1992 THERE WERE CA. 50 PLANTS (10% WERE CIRSIUM LONGISTYLUM, 20% WERE C. HOOKERIANUM, AND THE REST WERE HYBRIDS; N=25). IN FRUIT WITH FEW SEEDS POSSIBLY DUE TO EARLIER DROUGHTS.

General site description:

MEADOW WITH VARIOUS GRASSES AND SEDGES SURROUNDED BY PSEUDOTSUGA MENZIESII FOREST; NUMEROUS INTRODUCED SPECIES SUCH AS CARDUUS NUTANS AND CIRSIUM VULGARE ALONG ROAD EDGE; SEDGE MEADOW DOWNSLOPE MAY BE MORE "NATURAL."

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO ELKHORN AND BIG BELT MOUNTAINS IN HELENA NATIONAL FOREST OF JULY 12, 27-29 AND AUG. 3-7, 14, 17, 26, 27.]

Specimens:

POOLE, J. (3165). 1992. MONT.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 030

Survey site name: LONG GULCH/PRIEST GULCH RIDGE  
EO rank: AB  
EO rank comments: LARGE POPULATION IN RELATIVELY  
UNDISTUBED HABITAT, BUT NOT ALL OF THE  
POPULATION IS CIRSIUM LONGISTYLUM.

County: MEAGHER  
BROADWATER

USGS quadrangle: WHITES CITY

| Township: | Range: | Section: | TRS comments:                  |
|-----------|--------|----------|--------------------------------|
| 011N      | 003E   | 31       | SW4SW4, W2NW4SW4, W2SW4NW4     |
| 011N      | 002E   | 36       | SE4NE4, NE4NE4, NW4NE4; 25 SE4 |
| 010N      | 002E   | 1        | E2NE4NE4, NW4NE4NE4            |

|                    |            |               |                 |
|--------------------|------------|---------------|-----------------|
| Survey date:       | 1992-08-05 | Elevation:    | 6440 -6693      |
| First observation: | 1992-08-05 | Slope/aspect: | 5-15% / VARIOUS |
| Last observation:  | 1992-08-05 | Size (acres): | 100             |

Location:

BIG BELT MOUNTAINS, 2.7 AIR MILES EAST OF EAST SUMMIT OF BILK MOUNTAIN, RIDGE AT THE HEAD OF LONG AND PRIEST GULCHES; CA. 0.3 - 2.1 MILES NORTH OF FS RD #4161 (LAST 0.2 MILES NORTH ON NORTH SPLIT) FROM JUNCTION WITH FS RD #587 (WHITES GULCH ROAD) WHICH IS CA. 4 MILES NORTHEAST OF WHITES CITY.

Element occurrence data:

IN 1992 CA. 500 INDIVIDUALS OBSERVED (BUT NOT ALL THE POPULATION IS CIRSIUM LONGISTYLUM.)

General site description:

ROUGH FESCUE MEADOW AT CREST OF BIG BELT MOUNTAINS DIVIDE; SILTY MOIST SOILS. WITH POA PRATENSIS, POTENTILLA GRACILIS, SMILACINA STELLATA, BROMUS CARINATUS, FESTUCA IDAHOENSIS, STIPA RICHARDSONII, PERIDERIDEA GAIRDNERI, FRAGARIA VIRGINIANA, GEUM TRIFLORUM, DANTHONIA INTERMEDIA, GALIUM BOREALE, GERANIUM VISCOSUM, ETC.

Land owner/manager:

HELENA NATIONAL FOREST, TOWNSEND RANGER DISTRICT

Comments:

ECODATA PLOT #92JPO01.

Information source:

POOLE, J. M. 1992. [MTNHP FIELD SURVEY TO ELKHORN AND BIG BELT MOUNTAINS IN THE HELENA NATIONAL FOREST OF JULY 12, 27-29, AUG. 3-7, 14, 17, 26, 27.]

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 031

Survey site name: BROOKS CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: CHECKERBOARD

Township: Range: Section: TRS comments:  
009N 009E 16 NE4

Survey date:

Elevation: 5960 -6040

First observation: 1992-07-14

Slope/aspect:

Last observation: 1992-07-14

Size (acres):

Location:

FROM JUNCTION WITH US HWY 12 AT CHECKERBOARD, FOLLOW FS RD 581 UP  
BROOKS CREEK CA. 3 MILES. TAKE LEFT FORK CA. 0.3 MILE TO SITE.

Element occurrence data:

FLOWERING. NO OTHER WHITE-FLOWERED THISTLES IN VICINITY.

General site description:

FOREST/GRASSLAND ECOTONE, WITH PSEUDOTSUGA MENZIESII, FESTUCA  
SCABRELLA, ARTEMISIA TRIDENTATA.

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

FIELD, D. (43). 1992. IR.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 032

Survey site name: WEST FORK FLAGSTAFF CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: CHECKERBOARD

Township: Range: Section: TRS comments:

009N 009E 23 NE4

Survey date:

Elevation: 5400 -

First observation: 1992-07-28

Slope/aspect:

Last observation: 1992-07-28

Size (acres):

Location:

FROM JUNCTION WITH US HWY 12 CA. 3 MILES SOUTHEAST OF CHECKERBOARD,  
FOLLOW FS RD 1043 CA. 3.5 MILES TO SITE.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 033

Survey site name: BROOKS CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: CHECKERBOARD

Township: Range: Section: TRS comments:

009N 009E 10

Survey date:

Elevation: 5680 -

First observation: 1992-07-10

Slope/aspect:

Last observation: 1992-07-10

Size (acres):

Location:

FROM JUNCTION WITH US HWY 12 AT CHECKERBOARD, FOLLOW FS RD 581 UP  
BROOKS CREEK CA. 2 MILES. SITE IS ALONG ROAD JUST INSIDE FOREST  
SERVICE BOUNDARY.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

FIELD, D. (44). 1992. IR.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 034

Survey site name: WEST FORK CHECKERBOARD CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: FOURMILE SPRING

Township: Range: Section: TRS comments:  
009N 009E 17 NW4NW4

|                               |                       |
|-------------------------------|-----------------------|
| Survey date:                  | Elevation: 6350 -6440 |
| First observation: 1992-07-15 | Slope/aspect:         |
| Last observation: 1992-07-15  | Size (acres):         |

Location:

FROM CHECKERBOARD, FOLLOW FS RD 581 UP BROOKS CREEK CA. 5 MILES. SITE IS ALONG THE SOUTH SIDE OF THE ROAD BESIDE AN UNNAMED TRIBUTARY.

Element occurrence data:  
NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 035

Survey site name: WEST FORK CHECKERBOARD CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: FOURMILE SPRING

Township: Range: Section: TRS comments:

009N 008E 24 25 NW4; 26 E2

Survey date:

Elevation: 6000 -6440

First observation: 1992-07-21

Slope/aspect:

Last observation: 1992-07-21

Size (acres):

Location:

GO CA. 4 MILES SOUTHEAST OF RICHARDSON CREEK CAMPGROUND ON FS RD 211.  
SITE RUNS ALONG WEST FORK OF CHECKERBOARD CREEK TO THE SOUTHWEST AND  
NORTHEAST.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT  
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 036

Survey site name: EAST FORK CHECKERBOARD CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: FOURMILE SPRING

Township: Range: Section: TRS comments:

009N 008E 36

Survey date:

Elevation: 6800 -6840

First observation: 1992-09-15

Slope/aspect:

Last observation: 1992-09-15

Size (acres):

Location:

FOLLOW FS RD 211 CA. 6 MILES SOUTHEAST FROM RICHARDSON CREEK  
CAMPGROUND. SITE IS ALONG THE EAST FORK OF CHECKERBOARD CREEK TO THE  
NORTH OF THE ROAD.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, MUSSELSHELL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 037

Survey site name: WEST FORK COTTONWOOD CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: MANGER PARK

Township: Range: Section: TRS comments:  
 008N 007E 23 NE4; 14 SE4

|                               |                       |
|-------------------------------|-----------------------|
| Survey date:                  | Elevation: 6280 -6600 |
| First observation: 1992-07-22 | Slope/aspect:         |
| Last observation: 1992-07-22  | Size (acres):         |

Location:

CA. 7 MILES SOUTH OF WHITE SULPHUR SPRINGS, TAKE ROAD TO EAST UP COTTONWOOD CREEK. FOLLOW ROAD TO END ALMOST TO NATIONAL FOREST BOUNDARY. FOLLOW CREEK NORTH AND TAKE EAST FORK; SITE BEGINS AT FORK AND EXTENDS CA. 0.5 MILE UPSTREAM.

Element occurrence data:

3 SUBPOPULATIONS MAPPED.

General site description:

VALLEY BOTTOM MEADOW, WITH PHLEUM PRATENSE, GERANIUM RICHARDSONII, RUBUS IDAEUS, RIBES SETOSUM, ALNUS INCANA, ANGELICA ARGUTA, OSMORHIZA OCCIDENTALIS, CALAMAGROSTIS CANADENSIS, MERTENSIA CILIATA, VERATRUM VIRIDE, SENEIO TRIANGULARIS, AND CIRSIUM HOOKERIANUM IN CLOSE PROXIMITY.

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

FIELD, D. (40, 42). 1992. IR.

Element Occurrence Record  
Cirsium longistylum

Occurrence # 038

Survey site name: NEWLAN CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: CHARCOAL GULCH

Township: Range: Section: TRS comments:

011N 008E 18 NW4

Survey date:

Elevation: 6200 -6240

First observation: 1992-08-18

Slope/aspect:

Last observation: 1992-08-18

Size (acres):

Location:

TAKE FS RD 830 OFF US HWY 89 JUST SOUTH OF NEWLAN CREEK GUARD STATION.  
FOLLOW THE ROAD CA. 4 MILES UP NEWLAN CREEK. SITE IS TO THE NORTH OF  
ROAD ALONG UNNAMED TRIBUTARY.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 039

Survey site name: SHEEP CREEK

EO rank:

EO rank comments:

County: MEAGHER

USGS quadrangle: KINGS HILL

Township: Range: Section: TRS comments:  
012N 008E 27 SE4; 26 SW4

Survey date: Elevation: 6200 -6440  
First observation: 1992-08-19 Slope/aspect:  
Last observation: 1992-08-19 Size (acres):

Location:

FOLLOW US HWY 89 NORTHEAST FROM FOREST GREEN CA. 2 MILES. TAKE ROAD TO  
RIGHT TO QUARRY CA. 0.25 MILE. SITE IS ALONG UNNAMED TRIBUTARY OF  
SHEEP CREEK.

Element occurrence data:  
NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET  
NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 040

Survey site name: O'BRIEN CREEK

EO rank:

EO rank comments:

County: CASCADE

USGS quadrangle: NEIHART

Township: Range: Section: TRS comments:  
013N 008E 17 SW4

Survey date:

Elevation: 6600 -

First observation: 1992-08-12

Slope/aspect:

Last observation: 1992-08-12

Size (acres):

Location:

FROM NEIHART RESERVOIR, FOLLOW POWERLINE CORRIDOR SOUTH CA. 2 MILES TO SOUTHEAST TURN. SITE IS ON MAIN CREEK PARALLEL TO SOUTHEASTERLY RUN OF POWERLINE.

Element occurrence data:

NO DATA AVAILABLE.

General site description:

Land owner/manager:

LEWIS & CLARK NATIONAL FOREST, KINGS HILL RANGER DISTRICT

Comments:

AREA NOT COMPLETELY SURVEYED.

Information source:

FIELD, DANA. LEWIS & CLARK NATIONAL FOREST. 1101 15TH STREET NORTHEAST, GREAT FALLS, MT 59403.

Specimens:

Element Occurrence Record  
Cirsium longistylum

Occurrence # 041

Survey site name: OKA BUTTE  
EO rank:  
EO rank comments:

County: JUDITH BASIN

USGS quadrangle: JUDITH GAP

Township: Range: Section: TRS comments:  
011N 015E 17

|                               |                       |
|-------------------------------|-----------------------|
| Survey date:                  | Elevation: 5640 -5760 |
| First observation: 1988-06-24 | Slope/aspect:         |
| Last observation: 1988-06-24  | Size (acres):         |

Location:

TAKE COUNTY ROAD WHICH PASSES RODEO GROUNDS NORTH OUT OF JUDITH GAP. MAKE LEFT TURN AT COUNTY LINE, GO NORTH CA. 1.5 MILES, THEN TURN WEST FOR CA. 1.7 MILES TO DIRT ROAD. GO CA. 1 MILE, TURN RIGHT. GO CA. 2 MILES TO SITE ON EITHER SIDE OF ROAD.

Element occurrence data:  
FLOWERING.

General site description:  
UNKNOWN.

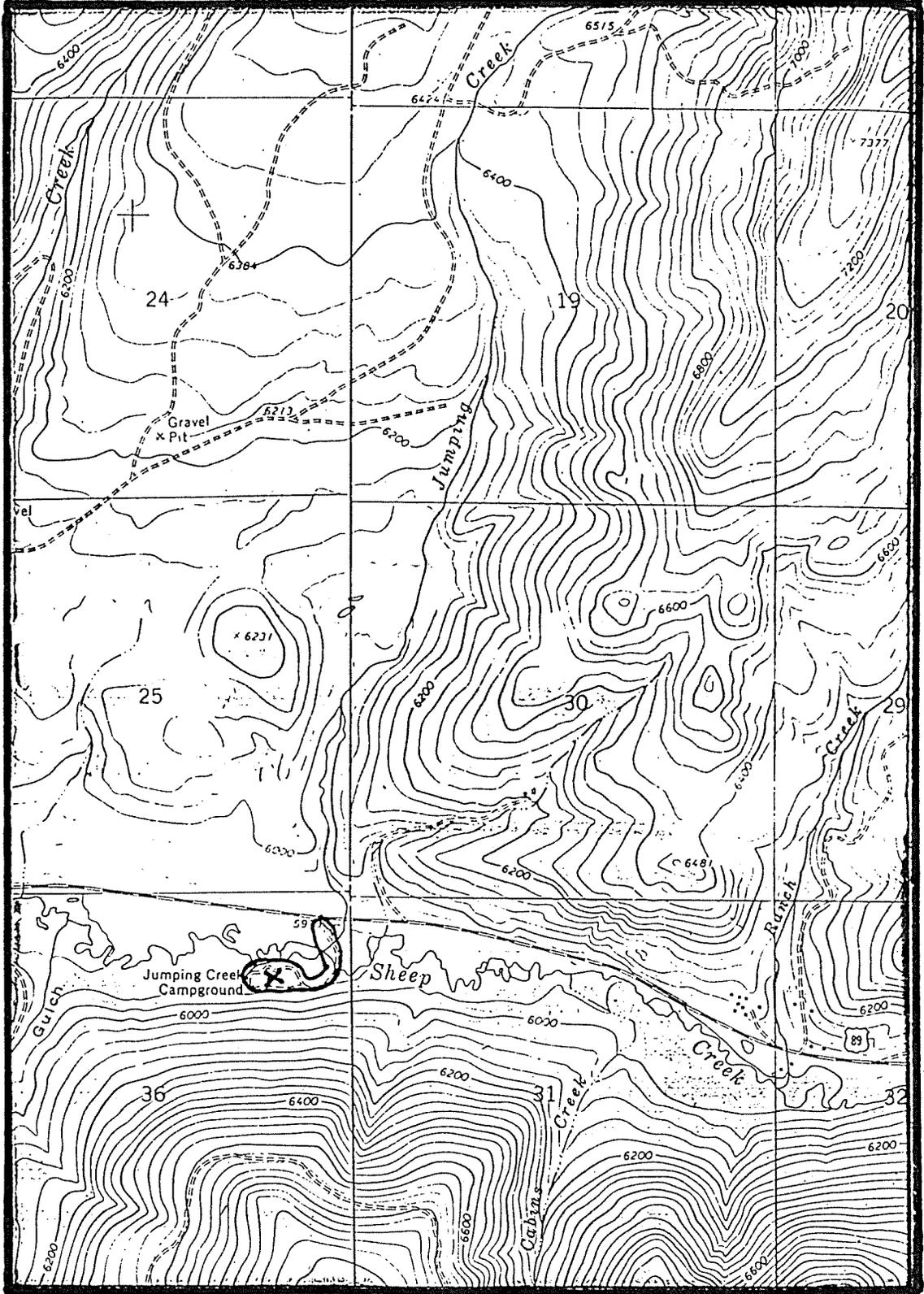
Land owner/manager:  
LEWIS & CLARK NATIONAL FOREST, JUDITH RANGER DISTRICT

Comments:  
PERMISSION REQUIRED TO CROSS PRIVATE LAND FOR ACCESS TO NATIONAL FOREST.

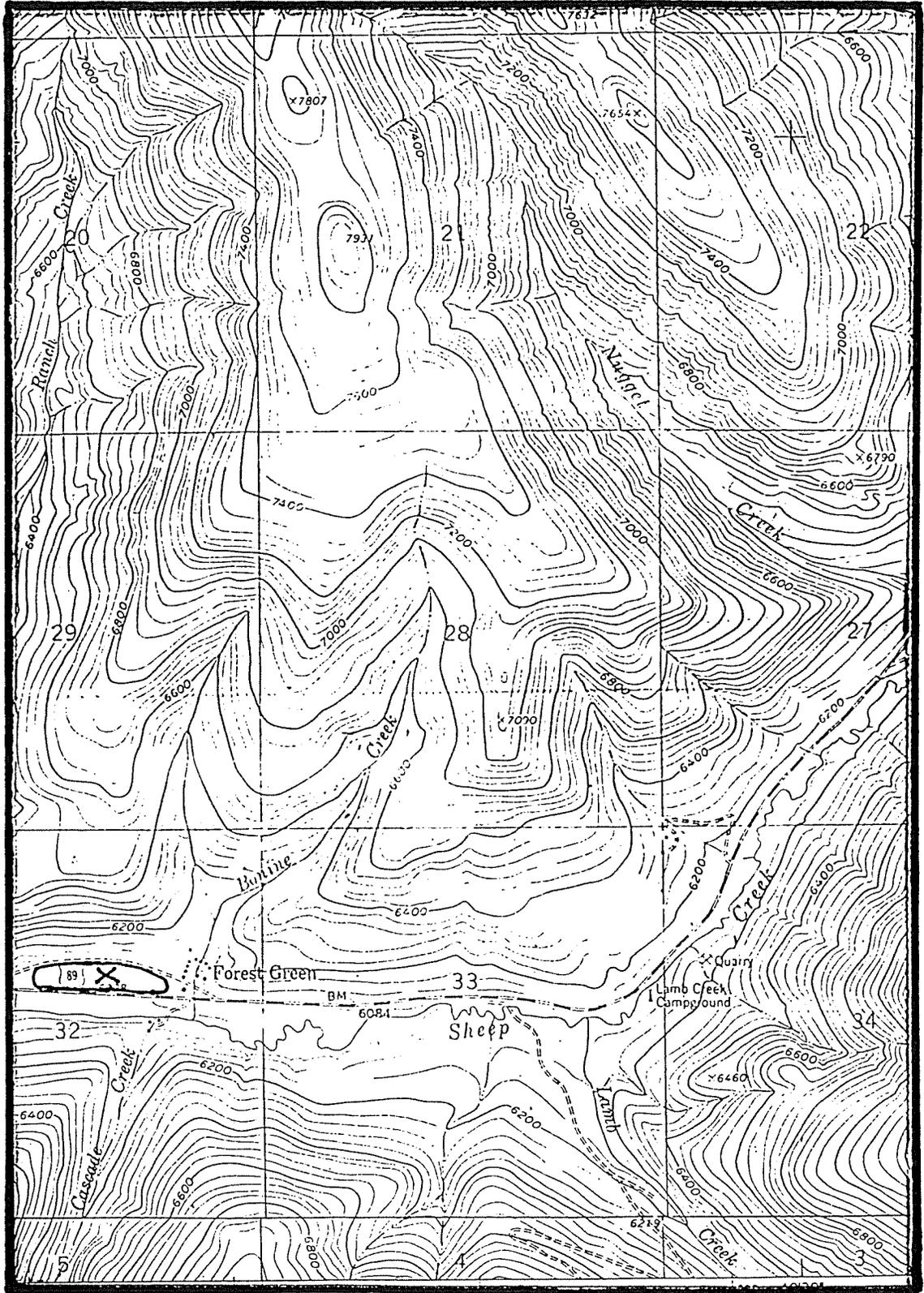
Information source:  
PHILLIPS, H. WAYNE. LEWIS AND CLARK NATIONAL FOREST, P.O. BOX 871, GREAT FALLS, MT 59403.

Specimens:

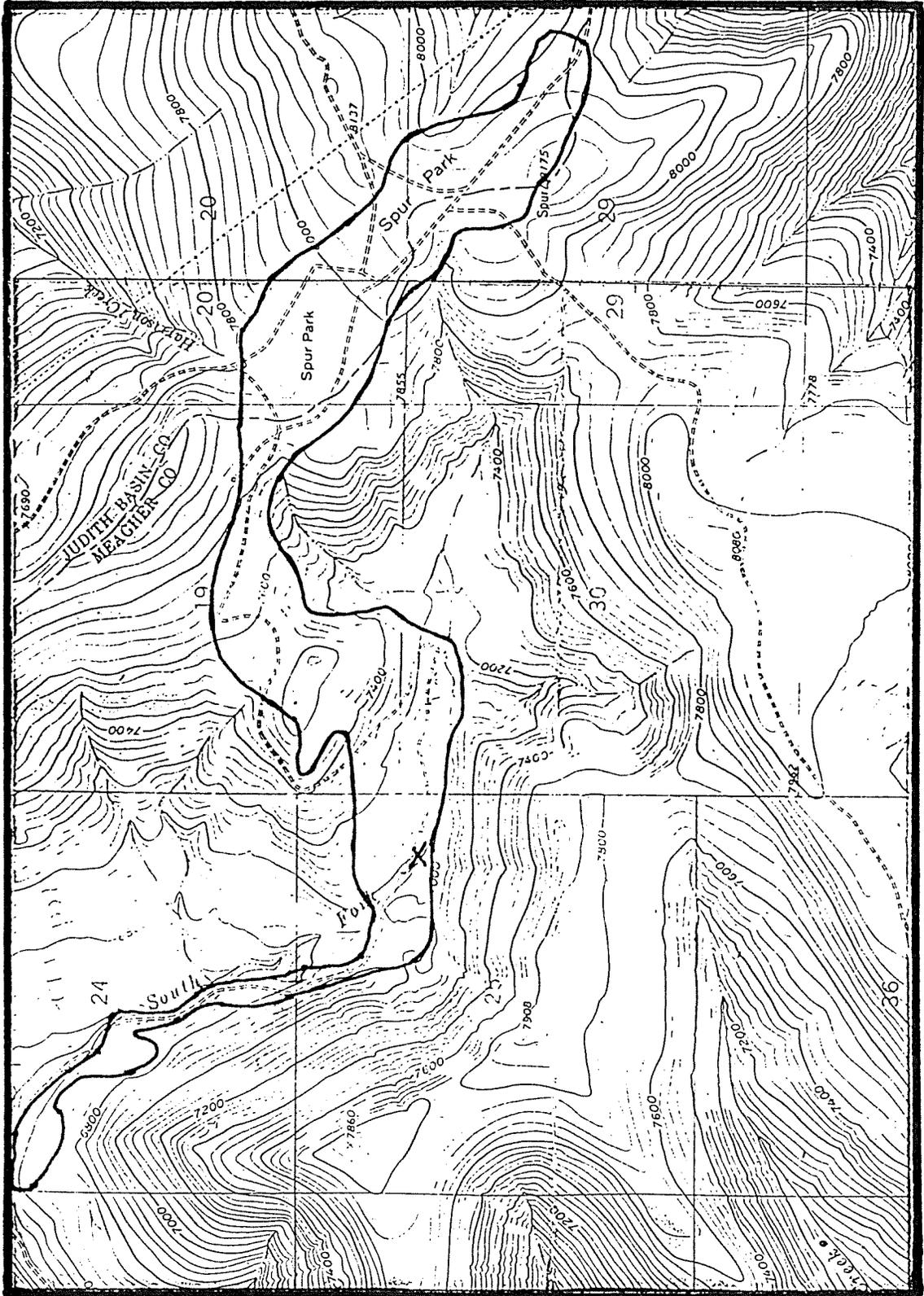
APPENDIX II: MAPS OF SAMPLE SITES



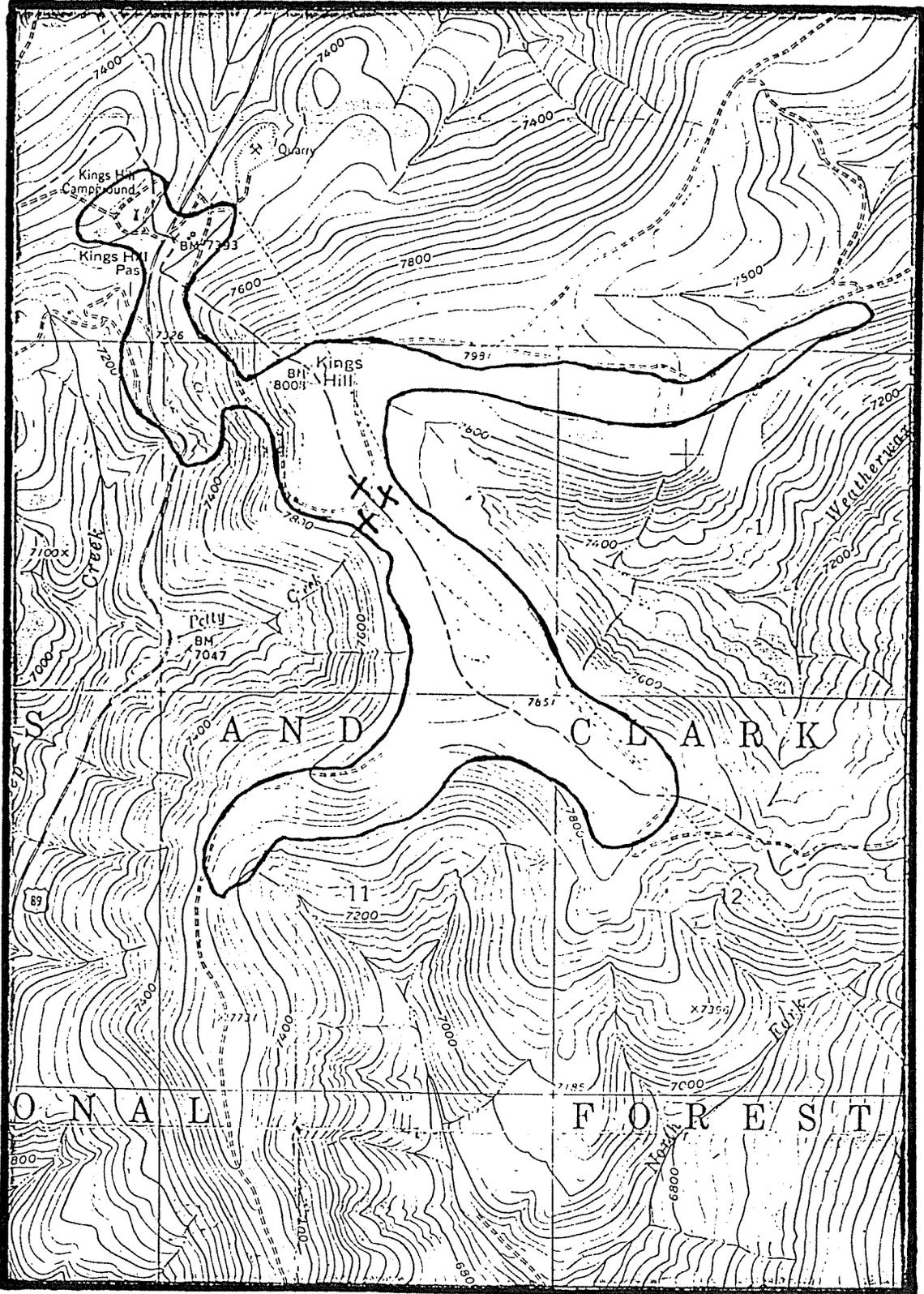
JUMPING CREEK SAMPLE SITE



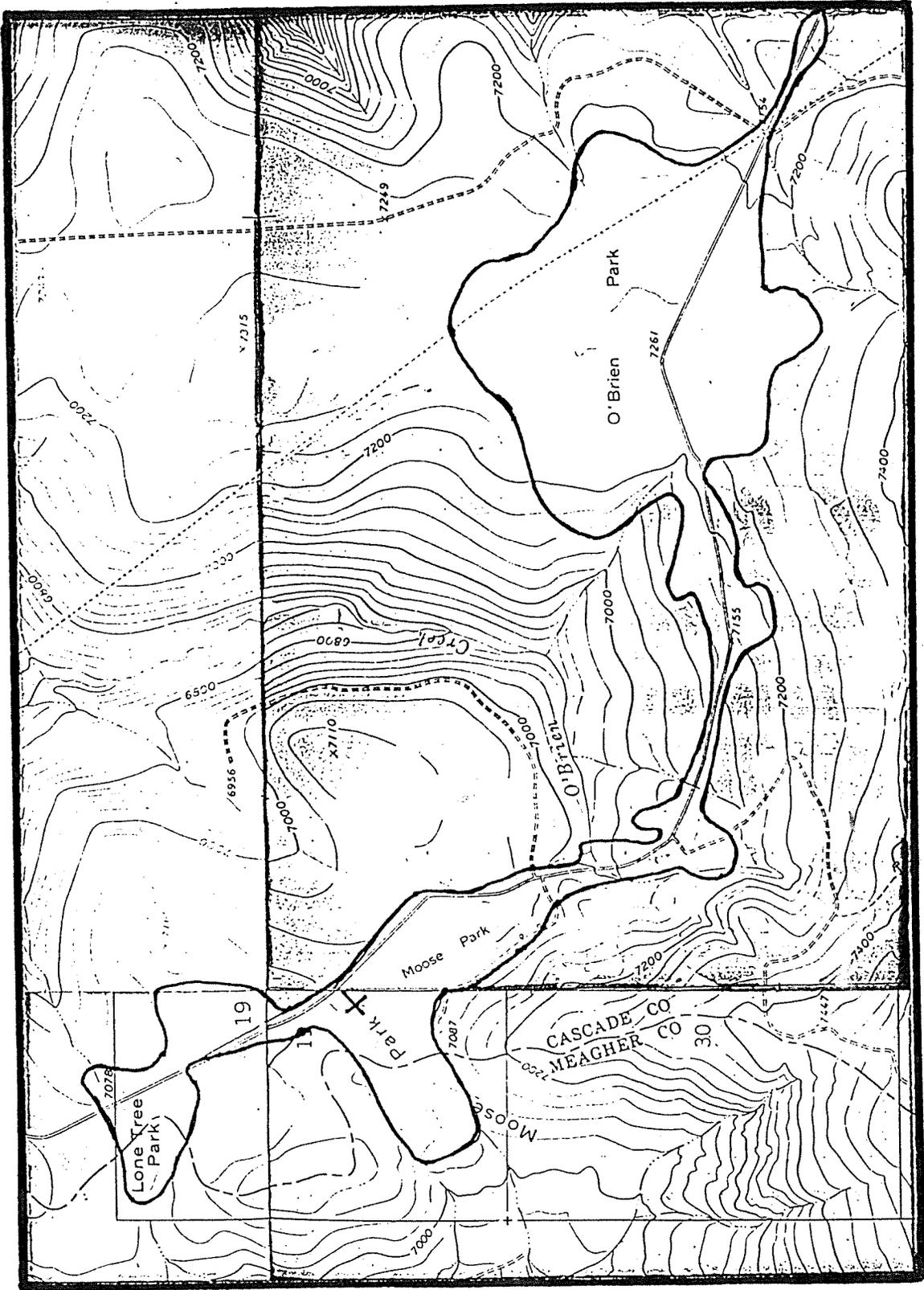
FOREST GREEN SAMPLE SITE



SOUTH FORK OF DEADMAN CREEK SAMPLE SITE

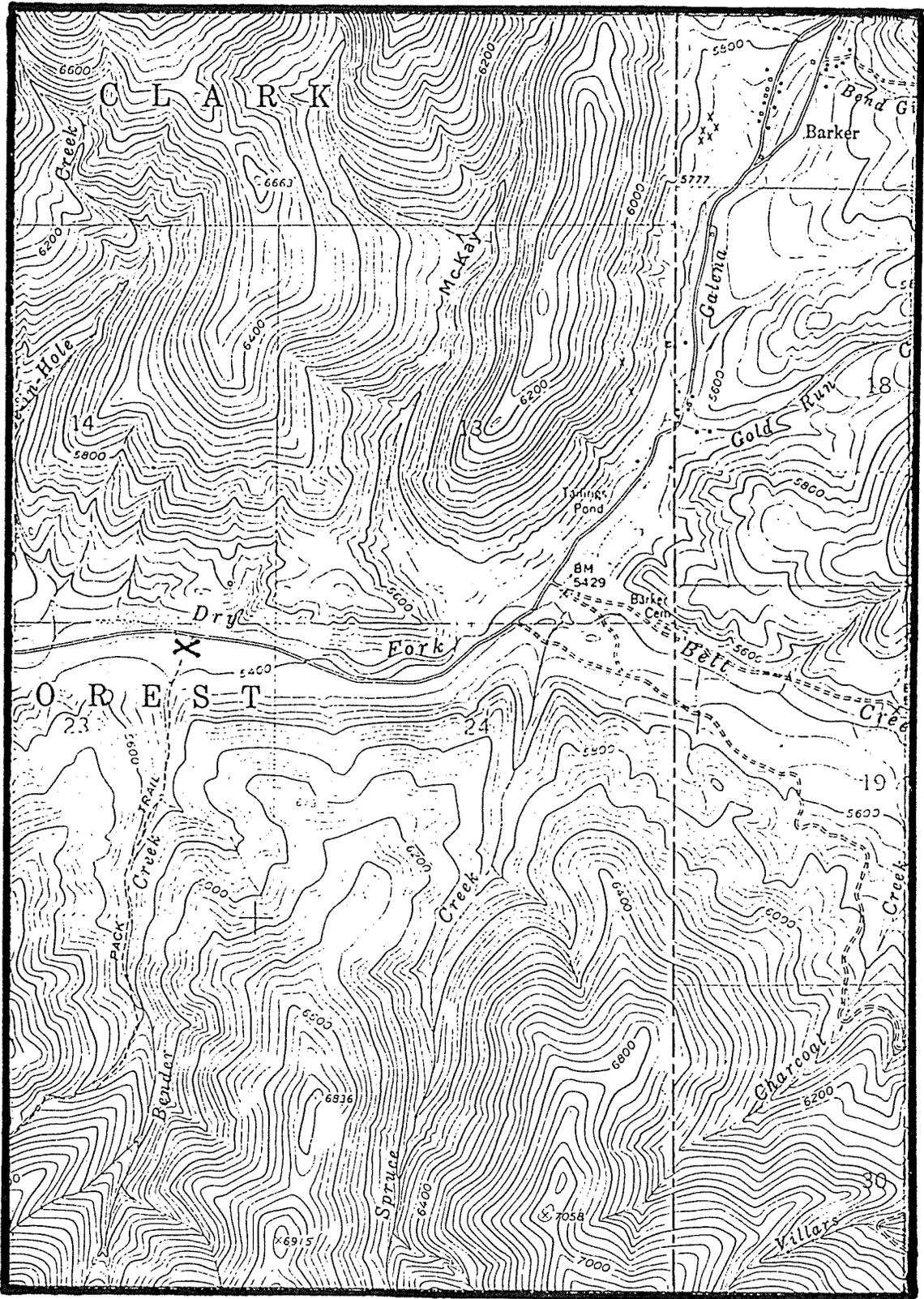


KINGS HILL SAMPLE SITE

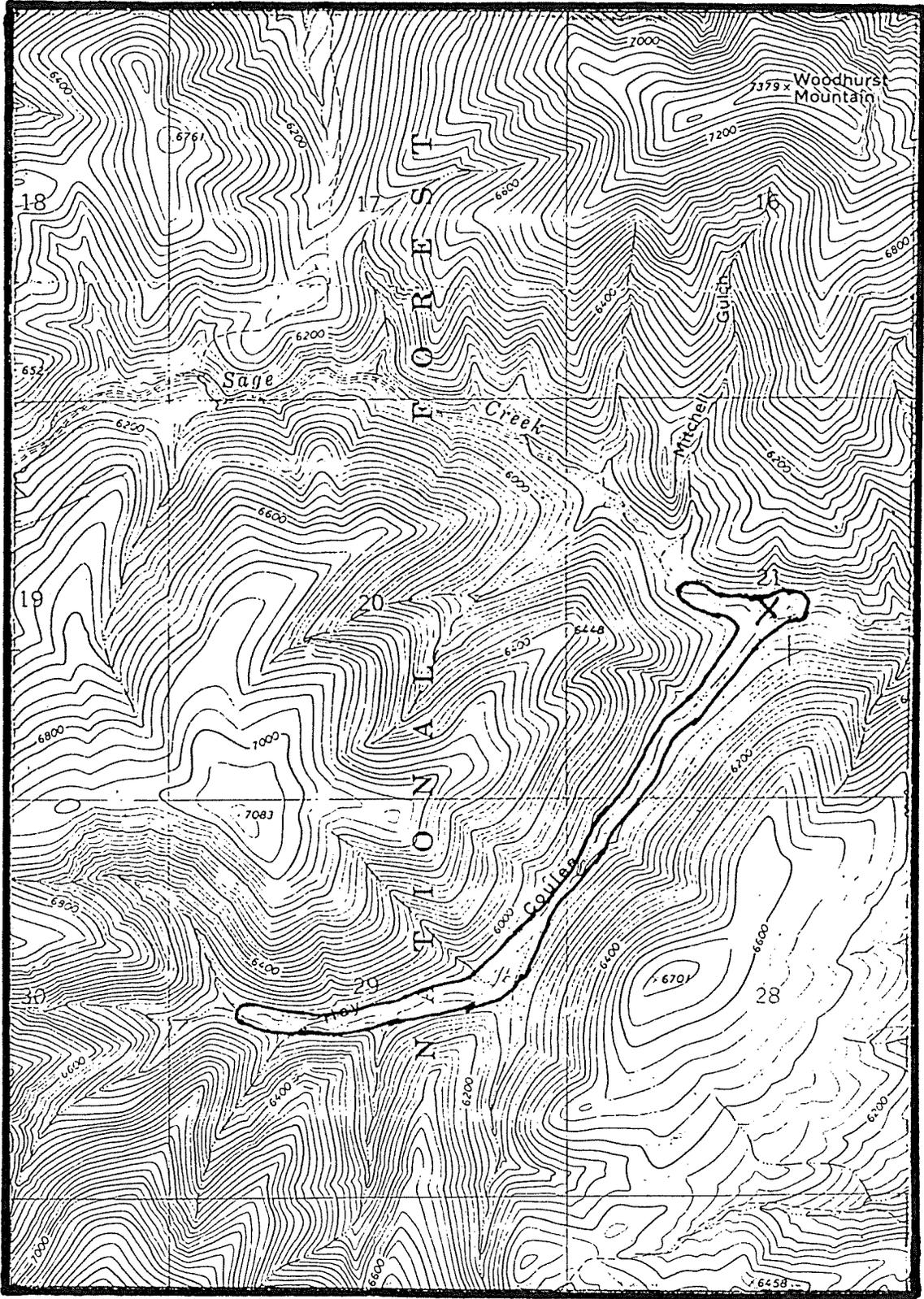


MOOSE PARK SAMPLE SITE

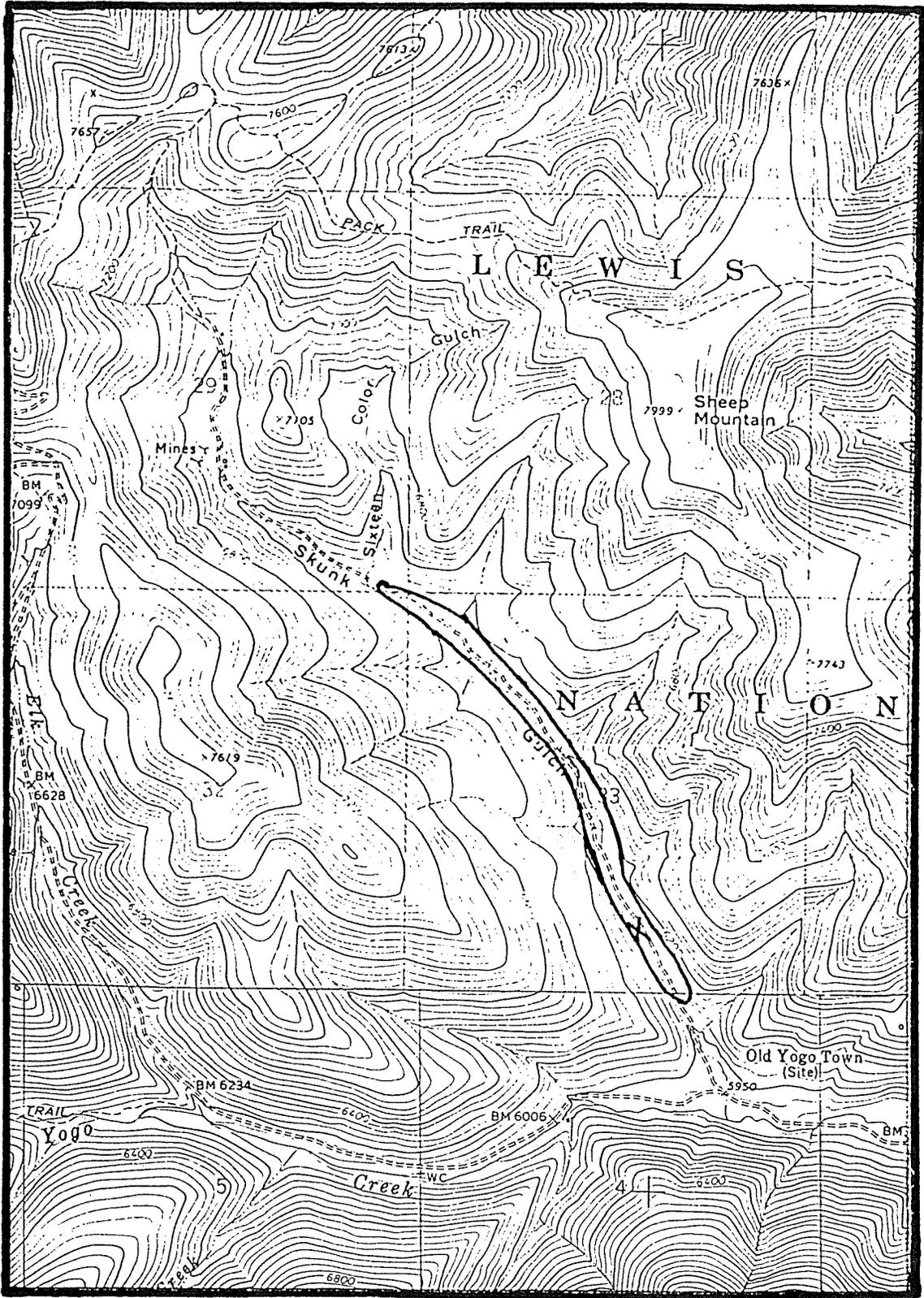




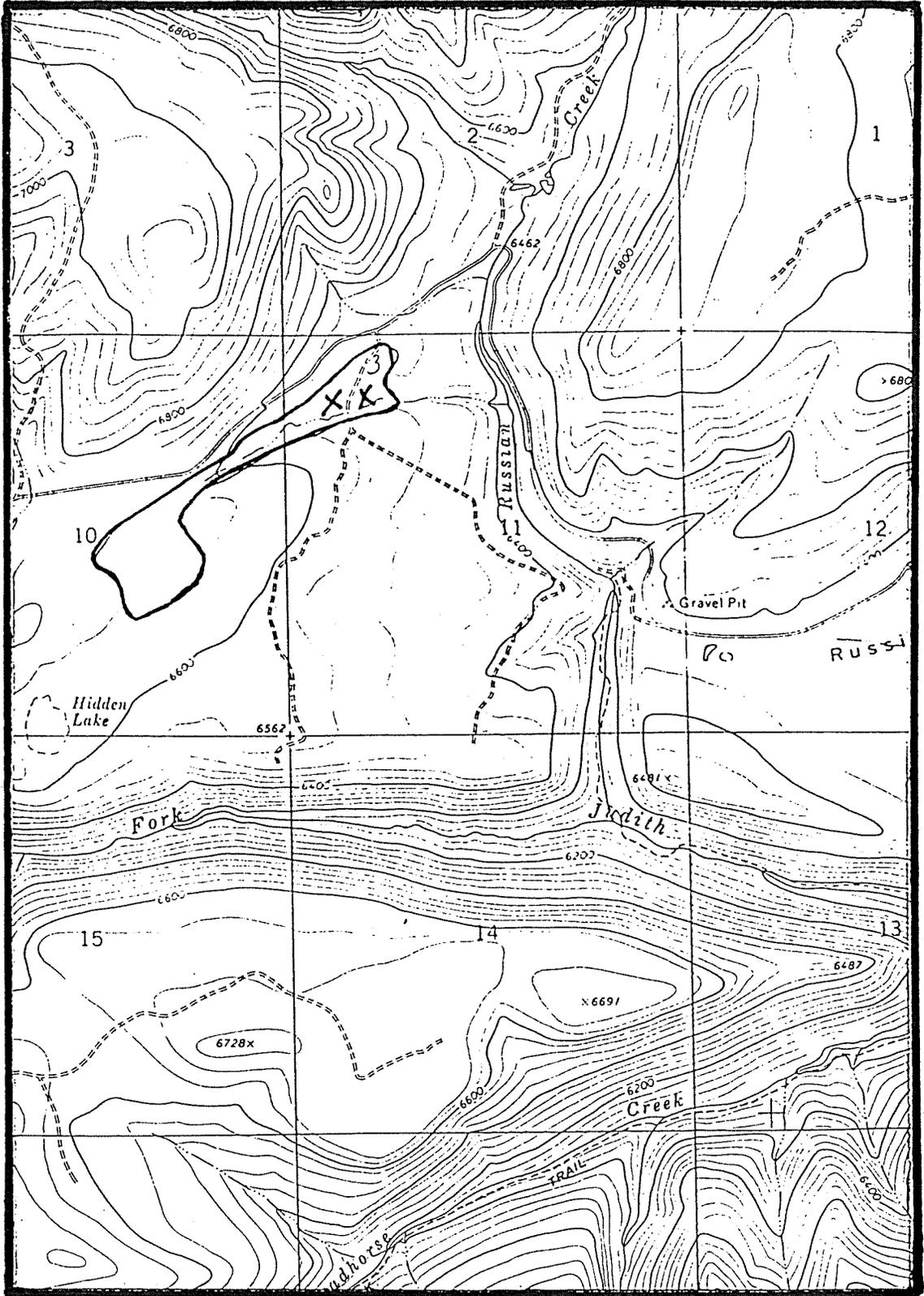
BENDER CREEK SITE



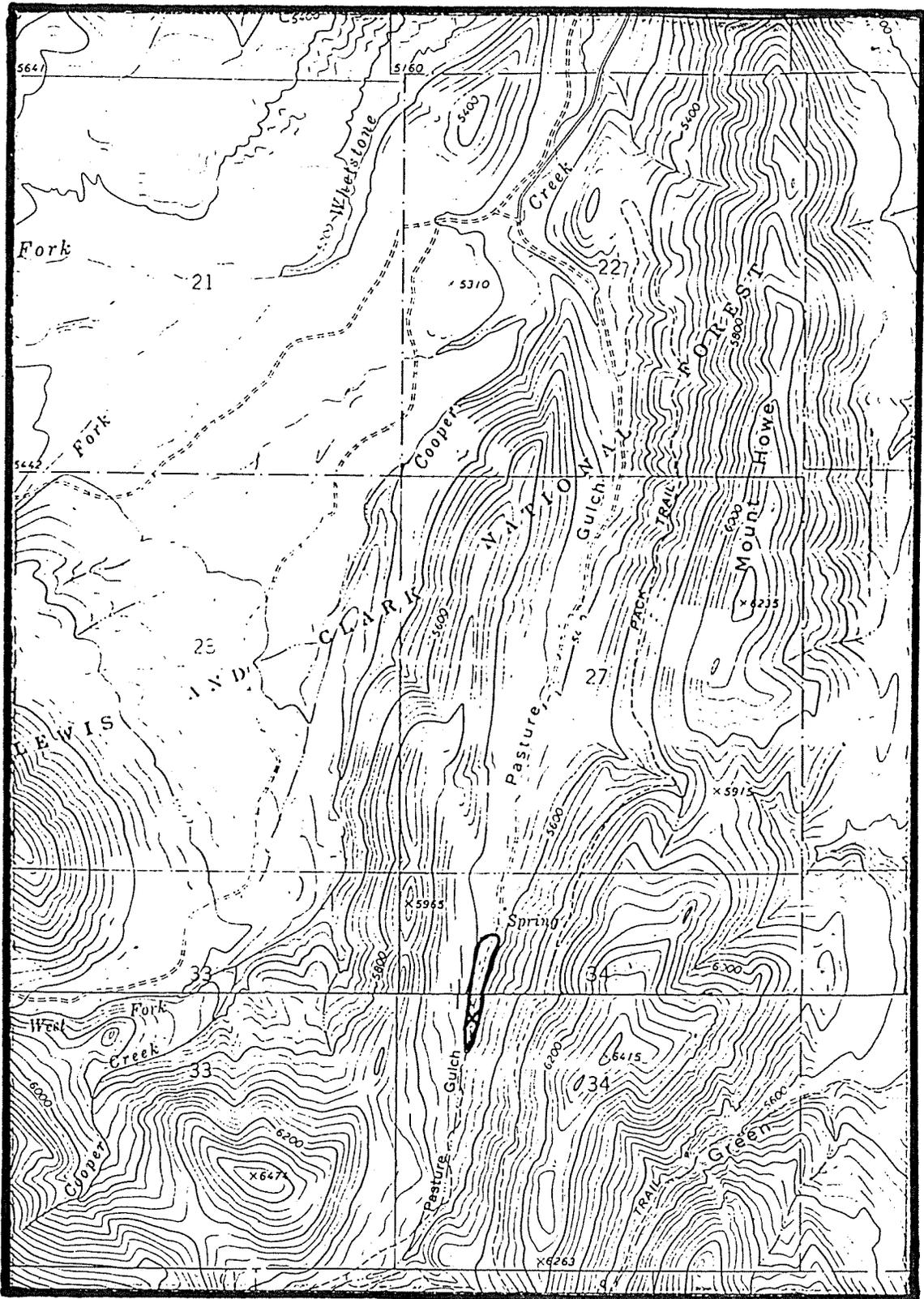
HAY COULEE SAMPLE SITE



SKUNK GULCH SAMPLE SITE

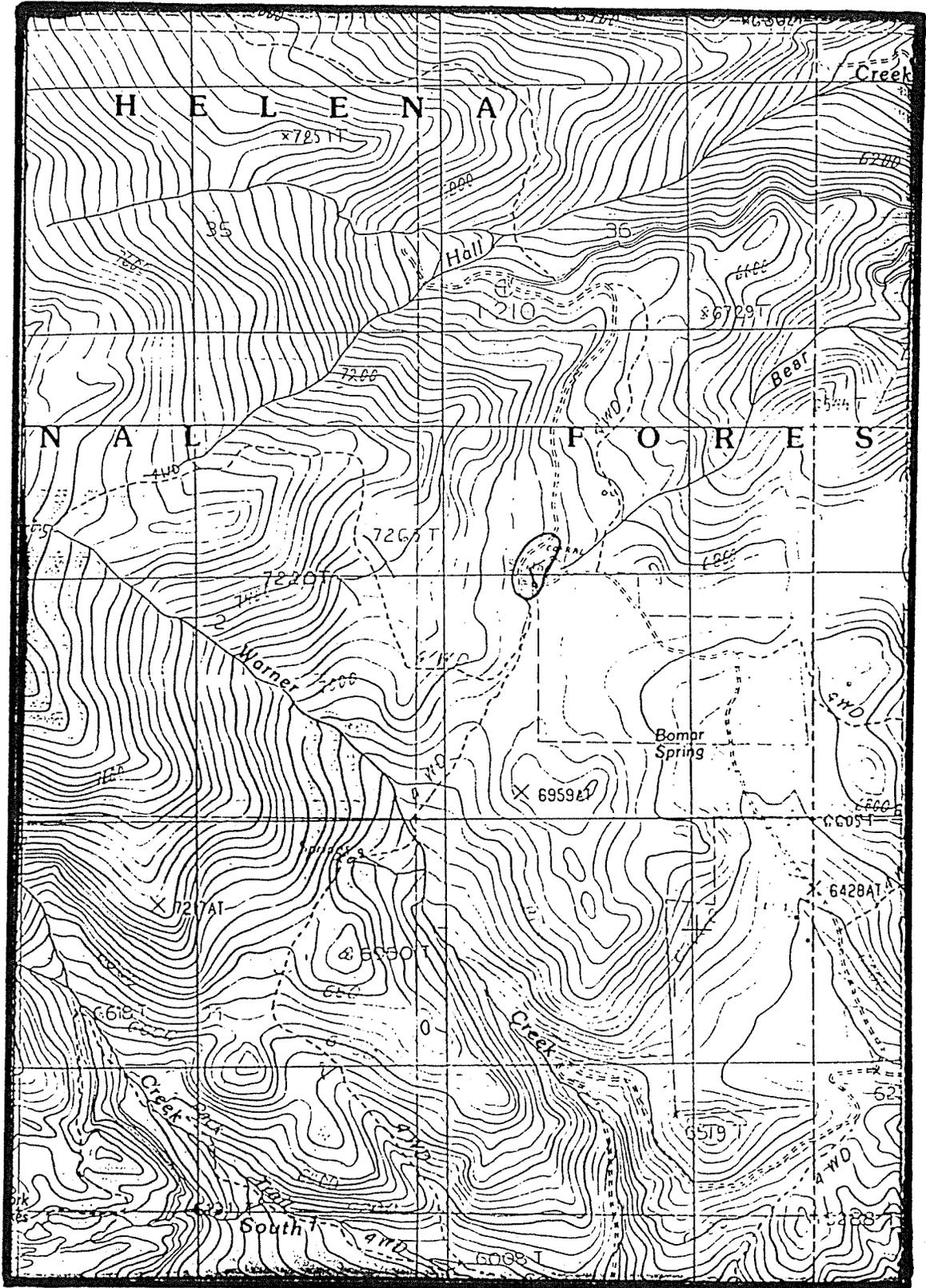


RUSSIAN CREEK SAMPLE SITE

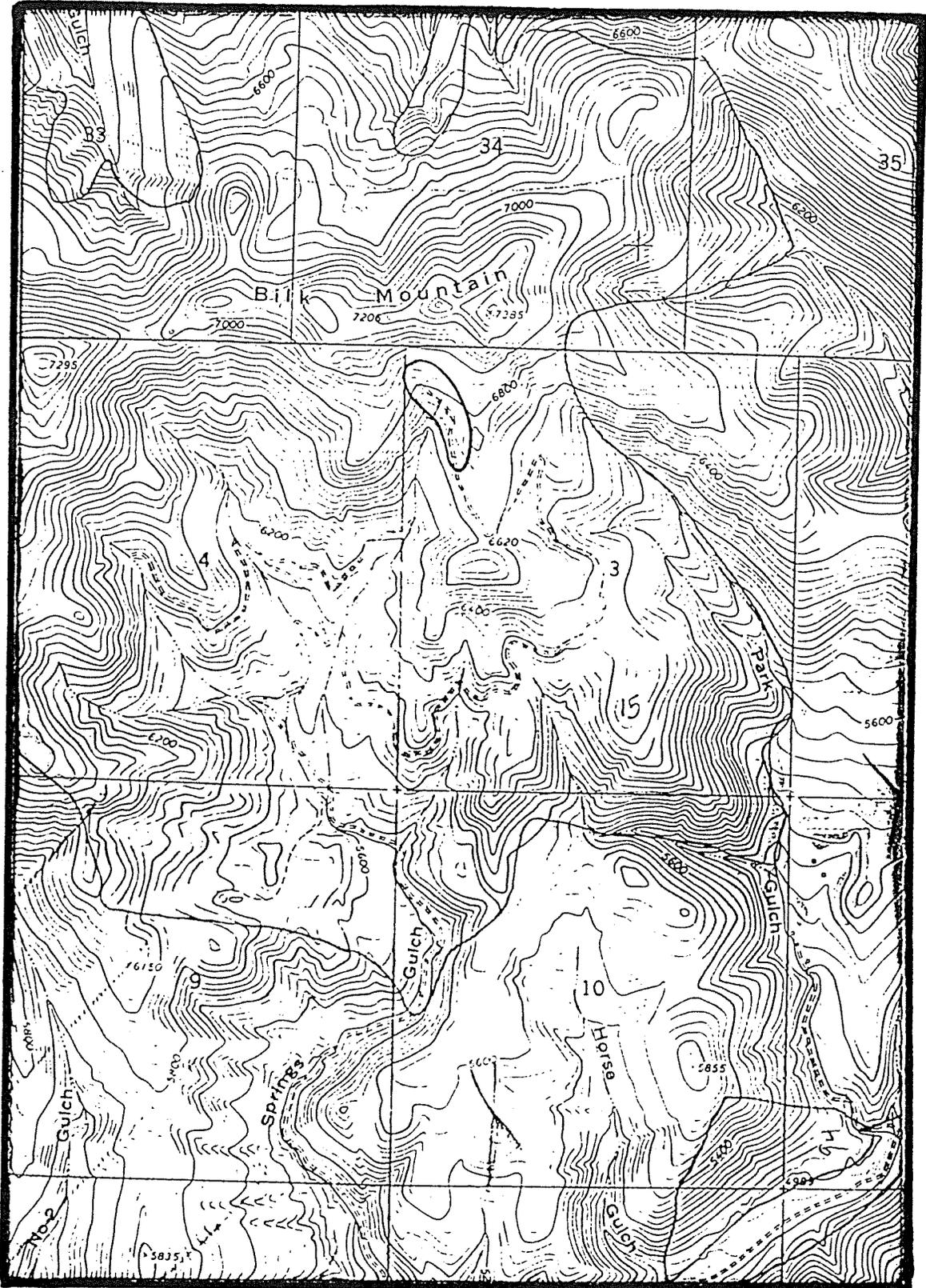


PASTURE GULCH SAMPLE SITE





BEAR GULCH SPRING SAMPLE SITE



SPRING GULCH SAMPLE SITE



Cirsium longistylum Moore & Frankton > Cirsium hookerianum Nutt.

- Field 43 - Meagher Co.: Castle Mountains, Brooks Creek (T9N R9E Sec. 16 NE $\frac{1}{4}$ ); 15 July 1992 (mixed collection)
- Field 44 - Meagher Co.: Castle Mountains, ca. 1.5 miles southwest of Checkerboard (T9N R9E Sec. 10); 10 July 1992
- Heidel 796A - Meagher Co.: Big Belt Mountains, Atlantic Ridge (T9N R4W Sec. 6 NW); 15 July 1992
- Heidel 796C - Meagher Co.: Big Belt Mountains, Atlantic Ridge (T9N R4W Sec. 6 NW); 15 July 1992
- Heidel 796D - Meagher Co.: Big Belt Mountains, Atlantic Ridge (T9N R4W Sec. 6 NW); 15 July 1992
- Heidel 796F - Broadwater Co.: Big Belt Mountains, Boulder Lakes (T10N R3E Sec. 28 SW); 11 August 1992
- Heidel 796G - Broadwater Co.: Big Belt Mountains, Boulder Lakes (T10N R3E Sec. 28 SW); 11 August 1992
- Lesica 5834 - Broadwater Co.: Big Belt Mountains, Cement Gulch (T10N R3E Sec. 7); 5 August 1992
- Lesica 5836 - Broadwater Co.: Big Belt Mountains, south of Mount Edith (T8N R4E Sec. 25 SW $\frac{1}{4}$ ); 6 August 1992 (mixed collection)
- Poole 3156a - Meagher Co.: Little Belt Mountains, Kings Hill (T12N R8E Sec. 2 W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  and E $\frac{1}{2}$ NW $\frac{1}{4}$ ); 19 August 1992
- Poole 3160a - Judith Basin Co.: Little Belt Mountains, Hay Coulee (T14N R11E Sec. 21 NE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3160c - Judith Basin Co.: Little Belt Mountains, Hay Coulee (T14N R11E Sec. 21 NE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3160d - Judith Basin Co.: Little Belt Mountains, Hay Coulee (T14N R11E Sec. 21 NE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3160e - Judith Basin Co.: Little Belt Mountains, Hay Coulee (T14N R11E Sec. 21 NE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3161a - Judith Basin Co.: Little Belt Mountains, Skunk Gulch (T14N R10E Sec. 33 NW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3161b - Judith Basin Co.: Little Belt Mountains, Skunk Gulch (T14N R10E Sec. 33 NW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3163e - Meagher Co.: Castle Mountains, Pasture Gulch (T9N R10E Sec. 34 NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 20 August 1992
- Poole 3165a - Broadwater Co.: Big Belt Mountains, Spring Gulch (T10N R2E Sec. 3 NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 27 August 1992
- Poole 3165e - Broadwater Co.: Big Belt Mountains, Spring Gulch (T10N R2E Sec. 3 NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 27 August 1992

Cirsium longistylum Moore & Frankton + Cirsium hookerianum Nutt.

- Field 40 - Meagher Co.: Castle Mountains, West Fork of Cottonwood Creek (T8N R7E Sec. 23 NE $\frac{1}{4}$ ); 22 July 1992 (mixed collection)
- Field 42 - Meagher Co.: Castle Mountains, West Fork of Cottonwood Creek (T8N R7E Sec. 23 NE $\frac{1}{4}$ ); 22 July 1992
- Heidel 796B - Meagher Co.: Big Belt Mountains, Atlantic Ridge (T9N R4E Sec. 6 NW); 15 July 1992
- Poole 3152b - Meagher Co.: Little Belt Mountains, Thornquist Gulch (T11N R7E Sec. 17 NW $\frac{1}{4}$ ); 18 August 1992
- Poole 3152d - Meagher Co.: Little Belt Mountains, Thornquist Gulch (T11N R7E Sec. 17 NW $\frac{1}{4}$ ); 18 August 1992

- Poole 3153b - Meagher Co.: Little Belt Mountains, Jumping Creek (T12N R7E Sec. 36 NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3153e - Meagher Co.: Little Belt Mountains, Jumping Creek (T12N R7E Sec. 36 NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3154d - Meagher Co.: Little Belt Mountains, Forest Green (T12N R8E Sec. 32 SW $\frac{1}{4}$ NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3156c - Meagher Co.: Little Belt Mountains, Kings Hill (T12N R8E Sec. 2 W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  and E $\frac{1}{2}$ NW $\frac{1}{4}$ ); 19 August 1992
- Poole 3158b - Cascade Co.: Little Belt Mountains, Neihart (T14N R7E Sec. 26 W $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ , Sec. 27 E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3158e - Cascade Co.: Little Belt Mountains, Neihart (T14N R7E Sec. 26 W $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ , Sec. 27 E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3159e - Cascade Co.: Little Belt Mountains, Bender Creek (T15N R8E Sec. 23 N $\frac{1}{2}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3161d - Judith Basin Co.: Little Belt Mountains, Skunk Gulch (T14N R10E Sec. 33 NW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3162b - Judith Basin Co.: Little Belt Mountains, Russian Creek (T11N R10E Sec. 11 NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 20 August 1992
- Poole 3162c - Judith Basin Co.: Little Belt Mountains, Russian Creek (T11N R10E Sec. 11 NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 20 August 1992
- Poole 3163a - Meagher Co.: Castle Mountains, Pasture Gulch (T9N R10E Sec. 34 NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 20 August 1992
- Poole 3164 - Jefferson Co.: Elkhorn Mountains, Bear Gulch Spring (T6N R2W Sec. 1 NW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ); 26 August 1992 (mixed collection)
- Poole 3165b - Broadwater Co.: Big Belt Mountains, Spring Gulch (T10N, R2E, Section 3, NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 27 August 1992
- Poole 3165d - Broadwater Co.: Big Belt Mountains, Spring Gulch (T10N R2E Sec. 3 NW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 27 August 1992

Cirsium hookerianum Nutt. > Cirsium longistylum Moore & Frankton

- Field 40 - Meagher Co.: Castle Mountains, West Fork of Cottonwood Creek (T8N R7E Sec. 23 NE $\frac{1}{4}$ ); 22 July 1992 (mixed collection)
- Field 41 - Meagher Co.: Castle Mountains, West Fork of Cottonwood Creek (T8N R7E Sec. 23 NE $\frac{1}{4}$ ); 22 July 1992
- Lesica 5835 - Meagher Co.: Big Belt Mountains, Long Gulch (T11N R3E Sec. 31 SW $\frac{1}{4}$ ); 5 August 1992 (mixed collection)
- Lesica 5836 - Broadwater Co.: Big Belt Mountains, south of Mount Edith (T8N R4E Sec. 25 SW $\frac{1}{4}$ ); 6 August 1992 (mixed collection)
- Poole 3152e - Meagher Co.: Little Belt Mountains, Thornquist Gulch (T11N R7E Sec. 17 NW $\frac{1}{4}$ ); 18 August 1992
- Poole 3153a - Meagher Co.: Little Belt Mountains, Jumping Creek (T12N R7E Sec. 36 NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3153c - Meagher Co.: Little Belt Mountains, Jumping Creek (T12N R7E Sec. 36 NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3156b - Meagher Co.: Little Belt Mountains, Kings Hill (T12N R8E Sec. 2 W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  and E $\frac{1}{2}$ NW $\frac{1}{4}$ ); 19 August 1992
- Poole 3157a - Cascade Co.: Little Belt Mountains, Moose Park (T13N R8E Sec. 19 NW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 19 August 1992
- Poole 3157b - Cascade Co.: Little Belt Mountains, Moose Park (T13N R8E Sec. 19 NW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 19 August 1992

- Poole 3157c - Cascade Co.: Little Belt Mountains, Moose Park  
(T13N R8E Sec. 19 NW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 19 August 1992
- Poole 3157d - Cascade Co.: Little Belt Mountains, Moose Park  
(T13N R8E Sec. 19 NW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 19 August 1992
- Poole 3157e - Cascade Co.: Little Belt Mountains, Moose Park  
(T13N R8E Sec. 19 NW $\frac{1}{4}$ SE $\frac{1}{4}$ ); 19 August 1992
- Poole 3158a - Cascade Co.: Little Belt Mountains, Neihart (T14N  
R7E Sec. 26 W $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ , Sec. 27 E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3158c - Cascade Co.: Little Belt Mountains, Neihart (T14N  
R7E Sec. 26 W $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ , Sec. 27 E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3159b - Cascade Co.: Little Belt Mountains, Bender Creek  
(T15N R8E Sec. 23 N $\frac{1}{2}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3159c - Cascade Co.: Little Belt Mountains, Bender Creek  
(T15N R8E Sec. 23 N $\frac{1}{2}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3159d - Cascade Co.: Little Belt Mountains, Bender Creek  
(T15N R8E Sec. 23 N $\frac{1}{2}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3160b - Judith Basin Co.: Little Belt Mountains, Hay Coulee  
(T14N R11E Sec. 21 NE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 20 August 1992
- Poole 3163b - Meagher Co.: Castle Mountains, Pasture Gulch (T9N  
R10E Sec. 34 NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ ); 20 August 1992
- Poole 3164 - Jefferson Co.: Elkhorn Mountains, Bear Gulch Spring  
(T6N R2W Sec. 1 NW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ); 26 August 1992 (mixed  
collection)
- Poole 3166b - Jefferson Co.: Elkhorn Mountains, Dewey Creek (T7N  
R2W Sec. 26 SE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 26 August 1992

Cirsium hookerianum Nutt.

- Field 39 - Meagher Co.: Castle Mountains, West Fork of Cottonwood  
Creek (T8N R7E Sec. 23 NE $\frac{1}{4}$ ); 22 July 1992
- Lesica 5835 - Meagher Co.: Big Belt Mountains, Long Gulch (T11N  
R3E Sec. 31 SW $\frac{1}{4}$ ); 5 August 1992 (mixed collection)
- Poole 3152c - Meagher Co.: Little Belt Mountains, Thornquist  
Gulch (T11N R7E Sec. 17 NW $\frac{1}{4}$ ); 18 August 1992
- Poole 3153d - Meagher Co.: Little Belt Mountains, Jumping Creek  
(T12N R7E Sec. 36 NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3154e - Meagher Co.: Little Belt Mountains, Forest Green  
(T12N R8E Sec. 32 SW $\frac{1}{4}$ NE $\frac{1}{4}$ ); 19 August 1992
- Poole 3158d - Cascade Co.: Little Belt Mountains, Neihart (T14N  
R7E Sec. 26 W $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ , Section 27, E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3159a - Cascade Co.: Little Belt Mountains, Bender Creek  
(T15N R8E Sec. 23 N $\frac{1}{2}$ NE $\frac{1}{4}$ ); 20 August 1992
- Poole 3164 - Jefferson Co.: Elkhorn Mountains, Bear Gulch Spring  
(T6N R2W Sec. 1 NW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ); 26 August 1992 (mixed  
collection)
- Poole 3166a - Jefferson Co.: Elkhorn Mountains, Dewey Creek (T7N  
R2W Sec. 26 SE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 26 August 1992
- Poole 3166c - Jefferson Co.: Elkhorn Mountains, Dewey Creek (T7N  
R2W Sec. 26 SE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 26 August 1992
- Poole 3166d - Jefferson Co.: Elkhorn Mountains, Dewey Creek (T7N  
R2W Sec. 26 SE $\frac{1}{4}$ SE $\frac{1}{4}$ ); 26 August 1992

Cirsium longistylum Moore and Frankton + Cirsium ?

Poole 3156d - Meagher Co.: Little Belt Mountains, Kings Hill  
(T12N R8E Sec. 2 W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  and E $\frac{1}{4}$ NW $\frac{1}{4}$ ); 19 August 1992

Cirsium longistylum Moore and Frankton + Cirsium ?

Poole 3156d - Meagher Co.: Little Belt Mountains, Kings Hill  
(T12N R8E Sec. 2 W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$  and E $\frac{1}{4}$ NW $\frac{1}{4}$ ); 19 August 1992

## APPENDIX IV: MONITORING DATA FOR KINGS HILL

|  |   |              | 1990/07/30    | 1991/08/02 | 1992/07/20      |
|--|---|--------------|---------------|------------|-----------------|
| Direction from<br>center stake<br>(in degrees) | Distance from<br>stake<br>(in feet in inches) |              | Plant         | Plant      | Plant           |
| (306)  | (8')  | (10")        |               | Rm         | ?               |
| (306)  | (5')  | (9")         | Rs            | Rm         | ?               |
| (306)  | (4')  | (2")         | Ph2b3h3b1h2b2 | Dead       | Gone            |
| (296)  | (7')  | (2")         | Ph7b5         | Dead       | Gone            |
| (286)  | (3')  | (5.5")       |               | Rs         | ?               |
| 313 (274)                                      | 14'(14')                                      | 1"(2.5")     |               | Rs         | Rs              |
| (272)  | (13')   | (9")         | RL            | RL         | ?               |
| (270)  | (13')   | (8")         | Ph1b5b1       | Dead       | Gone            |
| 304  | 14'   |              |               |            | Rs              |
| (267)  | (13')   | (1")         | Rm            | Rm         | ?               |
| 303  | 11'   | 9.5"         |               |            | Rs              |
| 302 (275)                                      | 13'(13')                                      | 11"(11")     | Rs            | Rm         | Rs              |
| 302  | 12'   | 2"           |               |            | Rm              |
| (265)  | (12')   | (7")         | Rm            | Rm         | ?               |
| 299 (269)                                      | 12'(12')                                      | 0"(0")       | Rm            | Rm         | Pb4             |
| 299  | 9'  | 6"           |               |            | Rs              |
| 298 (264)                                      | 12'(12')                                      | 2"(2")       |               | Rs         | Rm              |
| 298 (265)                                      | 11'(11')                                      | 11"(11")     | Rm            | Rm         | Pb2             |
| 296 (260)                                      | 9'(9')  | 5"(6")       | Rm            | Rm         | Rm              |
| (260)  | (13')   | (3")         | Ph1b2         | Dead       | Gone            |
| 296  | 7'  | 11"          |               |            | Rs              |
| 294 (260)                                      | 13'(13')                                      | 8.5"(10")    | Rs            | Rs         | Rs              |
| 294 (260)                                      | 13'(13')                                      | 8.5"(10")    |               | Rs         | Rs              |
| 294 (260)                                      | 13'(13')                                      | 8.5"(10")    |               | Rs         | Rs              |
| 294 (260)                                      | 12'(12')                                      | 10"(10")     | Rm            | Rm         | Rs              |
| 294 (263)                                      | 12'(12')                                      | 10"(10.5")   |               | Rs         | Rs              |
| 292 (255)                                      | 8'(8')  | 5"(6")       | Ph1b14b10     | Dead       | Dead            |
| 292  | 6'  | 4.5"         |               |            | Rs              |
| 292  | 6'  | 3.5"         |               |            | Rs              |
| (255)  | (8')  | (3")         |               | Rs         | ?               |
| 290 (257)                                      | 8'(8')  | 9"(9")       | RL            | RL         | Rs center eaten |
| 290 (256)                                      | 8'(8')  | 9"(10.5")    |               | Rs         | Rs center eaten |
| 288 (255)                                      | 11'(11')                                      | 0"(2")       | RL            | RL         | Ph10b22         |
| 288  | 6'  | 8"           |               |            | Rs              |
| 287  | 9'  | 0"           |               |            | Rs              |
| 287 (249)                                      | 8'(8')  | 4.5"(3")     |               | Rs         | seedling        |
| 287 (249)                                      | 8'(8')  | 3"(2.5")     |               | Rs         | seedling        |
| 287 (249)                                      | 8'(8')  | 2"(0")       |               | Rs         | seedling        |
| 286 (248)                                      | 8'(8')  | 2"(2")       | Rs            | Rs         | seedling        |
| 286 (248)                                      | 8'(8')  | 2"(2")       |               | Rs         | seedling        |
| 286 (248)                                      | 8'(8')  | 0"(0.5")     |               | Rs         | seedling        |
| 286 (253)                                      | 7'(7')  | 11"(9")      |               | Rs         | Rs              |
| 286 (253)                                      | 7'(7')  | 10"(9")      |               | Rs         | Rs              |
| 286 (253)                                      | 7'(7')  | 10"(9")      |               | Rs         | Rs              |
| 286 (251)                                      | 7'(7')  | 10"(8")      |               | Rs         | Rs              |
| (249)  | (7')  | (8")         | Ph7b15        | Dead       | Gone            |
| 286 (246)                                      | 7'(7')  | 7"(8.5")     |               | Rs         | seedling        |
| 286 (246)                                      | 7'(7')  | 6"(8.5")     |               | Rs         | seedling        |
| 285 (248)                                      | 7'(7')  | 11.5"(11.5") |               | Rs         | seedling        |
| 285  | 6'  | 5"           |               |            | Rs              |
| 285  | 6'  | 3"           |               |            | Rs              |
| 285  | 6'  | 3"           |               |            | Rs              |
| 285  | 6'  | 3"           |               |            | seedlings       |
| (248)  | (8')  | (1.5")       |               | Rs         | ?               |
| (248)  | (8')  | (0.5")       |               | Rs         | ?               |
| 284 (255)                                      | 7'(8')  | 11"(1")      |               | Rs         | Rs              |
| (248)  | (7')  | (10")        |               | Rs         | ?               |
| (248)  | (7')  | (10")        |               | Rs         | ?               |
| (248)  | (7')  | (10")        |               | Rs         | ?               |
| (248)  | (7')  | (10")        |               | Rs         | ?               |
| (248)  | (7')  | (10")        |               | Rs         | ?               |

|           |          |            |    |                |                         |
|-----------|----------|------------|----|----------------|-------------------------|
| (248)     | (7')     | (10")      |    | Rs             | ?                       |
| 284 (251) | 7'(7')   | 6"(5.5")   |    | Rs             | Rs                      |
| 284 (246) | 7'(7')   | 6"(7.5")   |    | Rs             | Rs                      |
| (248)     | (7')     | (3")       |    | Rs             | ?                       |
| 284       | 5'       | 7"         |    |                | Rs                      |
| 284       | 5'       | 7"         |    |                | seedling                |
| (247)     | (7')     | (11.5")    |    | Rs             | ?                       |
| (247)     | (7')     | (11.5")    |    | Rs             | ?                       |
| (247)     | (7')     | (11.5")    |    | Rs             | ?                       |
| (247)     | (7')     | (11.5")    |    | Rs             | ?                       |
| (247)     | (7')     | (10")      |    | Rs             | ?                       |
| 283 (251) | 7'(7')   | 4"(4")     |    | Rs             | Rs                      |
| 283 (251) | 7'(7')   | 4"(4")     |    | Rs             | Rs                      |
| 282 (251) | 7'(7')   | 7.5"(7")   |    | Rs             | Rs                      |
| 282 (250) | 7'(7')   | 7.5"(9")   |    | Rs             | Rs                      |
| (246)     | (7')     | (9")       |    | Rs             | ?                       |
| (246)     | (7')     | (8.5")     |    | Rs             | ?                       |
| (246)     | (7')     | (7.5")     |    | Rs             | ?                       |
| (246)     | (7')     | (7")       |    | Rs             | ?                       |
| (246)     | (7')     | (2")       |    | Rs             | ?                       |
| 282       | 6'       | 9"         |    |                | Rs                      |
| (245)     | (13')    | (10")      | Rs | Dead           | Gone                    |
| (245)     | (11')    | (4")       | Rs | ?              | -                       |
| 280 (247) | 7'(7')   | 4"(4.5")   |    | Rs             | Rs                      |
| 280 (246) | 7'(7')   | 4"(5")     |    | Rs             | Rs                      |
| 280 (246) | 7'(7')   | 4"(2")     |    | Rs             | Rs                      |
| 279 (245) | 14'(13') | 0"(10")    | Rs | Rm             | Pb4b3b2b3b1b1b2b4b4b1b2 |
| 279 (248) | 7'(7')   | 6"(7")     |    | Rs             | seedling                |
| 279 (248) | 7'(7')   | 6"(7")     |    | Rs             | seedling                |
| 279 (248) | 7'(7')   | 6"(6.5")   |    | Rs             | seedling                |
| 279 (248) | 7'(7')   | 6"(4")     |    | Rs             | seedling                |
| 279 (248) | 7'(7')   | 6"(4")     |    | Rs             | seedling                |
| 279 (247) | 7'(7')   | 6"(8")     |    | Rs             | seedling                |
| 279 (247) | 7'(7')   | 6"(8")     |    | Rs             | seedling                |
| 279 (247) | 7'(7')   | 6"(6")     |    | Rs             | seedling                |
| (242)     | (7')     | (2")       |    | Rs             | ?                       |
| 277 (245) | 14'(14') | 7"(7")     | Rs | Rm grazed      | Ph1b4                   |
| 277       | 6'       | 10"        |    |                | Rs                      |
| 276 (244) | 13'(13') | 3.5"(4")   |    | Rs             | Ph1b13                  |
| 276 (242) | 6'(6')   | 9"(7.5")   |    | Rs             | Rs                      |
| 275       | 11'      | 11"        |    |                | Rs                      |
| 275 (246) | 6'(7')   | 11"(1")    |    | Rs             | Rs                      |
| 275 (242) | 6'(7')   | 11"(1")    |    | Rs             | Rs                      |
| (239)     | (7')     | (11")      | Rm | ?              | -                       |
| (239)     | (7')     | (1")       | Rm | ?              | -                       |
| 275       | 6'       | 7"         |    |                | seedling                |
| 274 (248) | 7'(7')   | 11"(11")   |    | Rs             | seedling                |
| 274 (242) | 6'(6')   | 4"(5")     |    | Rs             | Rs                      |
| 273       | 6'       | 4"         |    |                | Rs                      |
| 273       | 6'       | 1"         |    |                | Rs                      |
| (236)     | (14')    | (3")       | Rs | ? rodent nest? | -                       |
| 272 (239) | 8'(8')   | 10.5"(10") | Rm | ?              | seedling                |
| 272 (233) | 8'(9')   | 10.5"(1")  |    | Rs             | seedling                |
| (235)     | (14')    | (3")       | Rs | ? rodent nest? | -                       |
| (235)     | (13')    | (8")       | Rs | ? " "          | -                       |
| (235)     | (12')    | (11")      | Rs | ? rodent mound | -                       |
| 271 (233) | 9'(9')   | 6"(4")     |    | Rs             | Rs                      |
| 271 (246) | 7'(7')   | 6.5"(7.5") |    | Rs             | Rm                      |
| (234)     | (8')     | (4")       |    | Rs             | ?                       |
| 270       | 4'       | 6"         |    |                | seedling                |
| 269 (237) | 10'(10') | 3"(6")     |    | Rs             | Rl                      |
| 269       | 4'       | 3"         |    |                | seedling                |
| 269       | 4'       | 3"         |    |                | seedling                |
| 266 (235) | 9'(9')   | 8"(6")     | Rm | ? rodent mound | Rl                      |
| 266 (233) | 9'(9')   | 8"(9")     |    | Rs             | Rl                      |
| (230)     | (9')     | (0.5")     |    | Rs             | ?                       |
| 265 (239) | 3'(3')   | 10"(10")   | Rm | ?              | -                       |
| 264 (221) | 11'(11') | 2"(4.5")   |    | Rs             | seedling                |
| 264 (216) | 10'(10') | 6"(6")     | Rs | Rs             | Rm                      |
| 264       | 10'      | 3.5"       |    |                | Rs                      |
| 264 (230) | 8'(9')   | 11"(1.5")  |    | Rs             | Rs                      |
| 264 (222) | 8'(7')   | 0"(11")    |    | Rs             | seedling                |

|           |          |           |         |                |          |
|-----------|----------|-----------|---------|----------------|----------|
| 264 (220) | 8'(8')   | 0"(0")    |         | Rs             | seedling |
| 264       | 6'       | 10"       |         |                | seedling |
| 264       | 6'       | 7"        |         |                | seedling |
| (227)     | (12')    | (10")     | Ph10b26 | Dead           | Gone     |
| 263 (235) | 11'(11') | 1"(0")    | Rs      | ? rodent mound | Rs       |
| 263 (233) | 11'(11') | 1"(0.5")  |         | Rs             | Rs       |
| (226)     | (14')    | (6")      | Ph1b7   | ?              | -        |
| (226)     | (8')     | (7")      | Rs      | ?              | -        |
| 262       | 6'       | 0"        |         |                | Rs       |
| 261       | 7'       | 6"        |         |                | Rm       |
| 260       | 6'       | 10"       |         |                | seedling |
| 260       | 4'       | 10"       |         |                | seedling |
| 259       | 7'       | 6"        |         |                | Rm       |
| (222)     | (13')    | (2")      | Ph3b9   | Dead           | Gone     |
| (222)     | (12')    | (11")     | Ph1b3   | Dead           | Gone     |
| (222)     | (11')    | (9")      | Ph1b8   | Dead           | Gone     |
| (222)     | (10')    | (8")      | Ph1b5   | ?              | -        |
| 258       | 6        | 11"       |         |                | seedling |
| 257 (221) | 12'(12') | 0"(2")    |         | Rs             | seedling |
| 257 (221) | 11'(12') | 11"(2")   |         | Rs             | seedling |
| 257       | 8'       | 6"        |         |                | seedling |
| (221)     | (7')     | (11")     |         | Rs             | ?        |
| 256 (221) | 12'(12') | 3"(2")    |         | Rs             | seedling |
| 256 (222) | 11'(11') | 9"(9")    | Rs      | ?              | seedling |
| 256       | 6'       | 4"        |         |                | Rm       |
| (219)     | (12')    | (3")      | Ph1b4   | Dead           | Gone     |
| (219)     | (11')    | (8")      | Rm      | ?              | -        |
| 255 (221) | 8'(8')   | 6"(8")    | Rs      | Rs             | Rm       |
| (219)     | (3')     | (8")      | Ph1b5   | ?              | -        |
| 254 (221) | 9'(9')   | 4"(5")    | Rs      | ?              | Rs       |
| 254 (222) | 8'(8')   | 6"(5")    |         | Rs             | Rm       |
| 252       | 10'      | 1"        |         |                | Rs       |
| 252 (221) | 6'(6')   | 6"(6")    |         | Rs             | Rm       |
| 251       | 10'      | 3"        |         |                | Rs       |
| 251       | 5'       | 10"       |         |                | seedling |
| 251       | 5'       | 6"        |         |                | seedling |
| 250 (207) | 12'(12') | 7"(7")    | Rm      | ?              | Rl       |
| 249 (211) | 12'(12') | 4"(6")    | Rm      | Rm             | Pb7      |
| 249 (208) | 12'(12') | 4"(4")    | Rl      | Rl             | Ph1b9    |
| 248 (211) | 12'(12') | 9"(9")    | Rm      | Rl             | Pb5h4    |
| 247 (218) | 13'(13') | 10"(8")   |         | Rl             | Ph1b14   |
| (211)     | (12')    | (0")      | Ph1b8   | Dead           | Gone     |
| 246       | 15'      | 0"        |         |                | Rl       |
| 246 (218) | 14'(14') | 5"(4")    |         | Rs             | Rm       |
| 246 (203) | 14'(14') | 5"(5")    | Rm      | Rs             | Rm       |
| (210)     | (13')    | (8")      | Ph5b24  | Dead           | Gone     |
| 246 (210) | 12'(12') | 0"(3")    | Rl      | Rl             | Pb2b2    |
| 246 (212) | 11'(11') | 7"(8")    |         | Rm             | Rm       |
| 246 (219) | 10'(11') | 11"(1")   | Rm      | ?              | seedling |
| 246 (208) | 10'(10') | 9"(10.5") |         | Rs             | seedling |
| 246 (208) | 9'(9')   | 11"(9")   | Rs      | Rs             | Rs       |
| 246 (209) | 9'(9')   | 2.5"(2")  |         | Rs             | Rs       |
| 246 (208) | 9'(9')   | 1"(3")    |         | Rs             | Rs       |
| 246 (208) | 8'(9')   | 10"(1")   |         | Rs             | Rs       |
| 244 (204) | 13'(13') | 7"(9")    | Rm      | ?              | Rs       |
| (208)     | (13')    | (0")      | Rs      | Rm             | ?        |
| (208)     | (11')    | (2")      |         | Rs             | ?        |
| (208)     | (10')    | (9")      | Rl      | ?              | -        |
| (208)     | (10')    | (9")      | Rl      | ?              | -        |
| 244 (208) | 10'(10') | 4"(6")    |         | Rs             | seedling |
| 244 (208) | 10'(10') | 4"(5")    |         | Rs             | seedling |
| 244 (208) | 10'(10') | 4"(2")    |         | Rs             | seedling |
| 244       | 10'      | 4"        |         |                | seedling |
| (208)     | (9')     | (8")      | Rs      | Rs             | ?        |
| (208)     | (9')     | (2")      |         | Rs             | ?        |
| (208)     | (9')     | (2")      |         | Rs             | ?        |
| (208)     | (9')     | (2")      |         | Rs             | ?        |
| 244 (208) | 8'(8')   | 9"(11")   |         | Rs             | Rm       |
| (208)     | (8')     | (6")      | Ph1b4   | Dead           | Gone     |
| 244       | 7'       | 4"        |         |                | Rs       |
| (207)     | (13')    | (5")      | Ph1b7   | Dead           | Gone     |
| (207)     | (8')     | (7")      | Ph1b2   | ?              | -        |

|           |          |          |           |                  |          |
|-----------|----------|----------|-----------|------------------|----------|
| 242 (208) | 9'(9')   | 6.5"(4") |           | Rs               | Rs       |
| 242 (209) | 9'(9')   | 4"(5")   |           | Rs               | seedling |
| 242 (208) | 9'(9')   | 4"(6.5") |           | Rs               | seedling |
| 241       | 10'      | 7"       |           |                  | seedling |
| 241       | 10'      | 7"       |           |                  | seedling |
| 241 (208) | 10'(10') | 4"(6")   |           | Rs               | Rs       |
| 241 (208) | 10'(10') | 4"(6")   |           | Rs               | Rs       |
| 241 (209) | 9'(9')   | 5"(5")   |           | Rs               | seedling |
| (204)     | (13')    | (4")     | RI        | RI               | ?        |
| (204)     | (12')    | (0")     | Pb4       | Dead             | Gone     |
| (204)     | (9')     | (10")    | Rm        | ?                | -        |
| 240 (208) | 8'(9')   | 10"(2")  |           | Rs               | Rs       |
| 240 (208) | 8'(9')   | 10"(2")  |           | Rs               | Rs       |
| 240 (208) | 8'(9')   | 10"(1")  |           | Rs               | Rs       |
| 240 (208) | 8'(9')   | 10"(1")  |           | Rs               | Rs       |
| 240 (208) | 8'(9')   | 10"(0")  | Rs        | Rs rodent mounds | Rs       |
| 240 (208) | 8'(8')   | 10"(11") |           | Rs               | Rs       |
| (204)     | (6')     | (1")     | Rm        | ?                | -        |
| (203)     | (11')    | (11")    | Ph1b8     | Dead             | Gone     |
| (203)     | (6')     | (7")     | Rs        | Rm               | ?        |
| (203)     | (3')     | (8")     | Rm        | Dead             | Gone     |
| 238       | 10'      | 4"       |           |                  | seedling |
| 237 (200) | 13'(12') | 0"(10")  | Rm        | RI               | Pb10     |
| 234 (197) | 6'(7')   | 11"(2")  | Rs        | Rm               | Rs       |
| 233 (201) | 12'(12') | 8"(11")  |           | Rs               | Rs       |
| 233 (201) | 12'(12') | 6"(10")  |           | Rs               | Rs       |
| 233       | 8'       | 3"       |           |                  | Rs       |
| 232       | 5'       | 5"       |           |                  | Rs       |
| 232       | 4'       | 7"       |           |                  | seedling |
| (195)     | (14')    | (10")    |           | Rs               | ?        |
| (195)     | (14')    | (10")    |           | Rs               | ?        |
| (195)     | (13')    | (6")     | Rm        | ? rodent mounds  | -        |
| (194)     | (13')    | (11")    |           | Rs               | ?        |
| (193)     | (14')    | (4")     | RI        | ?                | -        |
| (193)     | (9')     | (10")    | Rs        | Rs               | ?        |
| 228 (195) | 14'(14') | 9"(10")  |           | Rs               | Rs       |
| 228 (195) | 14'(14') | 7"(9")   |           | Rs               | Rs       |
| 228 (195) | 14'(14') | 5"(7")   | Rm        | ? rodent mounds  | Rs       |
| 228       | 10'      | 3"       |           |                  | Rs       |
| 224 (195) | 14'(14') | 5"(6")   | Rs        | ? rodent mounds  | seedling |
| 224 (195) | 14'(14') | 3"(2")   | Rm        | ? " "            | seedling |
| 224       | 8        | 7"       |           |                  | Rs       |
| 224       | 5'       | 6"       |           |                  | Rs       |
| (185)     | (5')     | (10")    |           | Rs               | ?        |
| (184)     | (14')    | (8")     | Ph4b12    | Dead             | Gone     |
| (182)     | (12')    | (8")     |           | Rs               | ?        |
| 218       | 12'      | 5"       |           |                  | Rs       |
| (182)     | (11')    | (3")     |           | Rs               | ?        |
| (181)     | (12')    | (7.5")   |           | Rs               | ?        |
| (181)     | (12')    | (5.5")   |           | Rs               | ?        |
| 216       | 12'      | 4"       |           |                  | Rs       |
| 216       | 12'      | 2"       |           |                  | Rs       |
| 216       | 10'      | 11"      |           |                  | Rs       |
| (177)     | (10')    | (0")     | Ph5b4     | ?                | -        |
| 208 (175) | 12'(13') | 10"(0")  | Rm        | Rm               | Rm       |
| (167)     | (7')     | (10")    | RI        | ?                | -        |
| 202       | 13'      | 4"       |           |                  | Rs       |
| 200       | 14'      | 10"      |           |                  | seedling |
| 200 (159) | 14'(14') | 9"(8")   |           | Rs               | Rs       |
| 200 (159) | 14'(13') | 1"(10")  |           | Rs               | Rs       |
| 200 (165) | 13'(13') | 6"(7.5") |           | Rs               | Rs       |
| (163)     | (11')    | (7")     |           | Rs               | ?        |
| 198       | 14'      | 6"       |           |                  | seedling |
| (162)     | (12')    | (5")     | Ph3b3h4b2 | Dead             | Gone     |
| (162)     | (11')    | (10")    | Rm        | Rm               | ?        |
| (159)     | (11')    | (5")     |           | Rs               | ?        |
| (155)     | (14')    | (7")     | RI        | Dead             | Gone     |
| (155)     | (13')    | (8")     | Rm        | Rm               | ?        |
| (155)     | (12')    | (4")     | Rm        | ?                | -        |
| 188 (150) | 2'(3')   | 11"(2")  | Rs        | Rs               | Rm       |
| (150)     | (3')     | (1")     |           | Rs               | ?        |
| (150)     | (3')     | (1")     |           | Rs               | ?        |

|          |       |          |         |        |               |          |
|----------|-------|----------|---------|--------|---------------|----------|
|          | (150) | (3')     | (0")    | Rs     | Rs            | ?        |
| 180      |       | 5'       | 10"     |        |               | Rm       |
| 178      |       | 6'       | 8"      |        |               | Rs       |
|          | (142) | (5')     | (8")    | Ph5b4  | Dead          | Gone     |
| 177      |       | 6'       | 5"      |        |               | Rs       |
|          | (139) | (8')     | (7")    | Rl     | Dead          | Gone     |
|          | (130) | (12')    | (5")    |        | Rs            | ?        |
|          | (128) | (13')    | (10")   | Ph6b10 | Dead          | Gone     |
| 148      |       | 5'       | 7"      |        |               | seedling |
| 142      |       | 6'       | 3"      |        |               | Rs       |
| 142      |       | 6'       | 3"      |        |               | Rs       |
| 142      |       | 5'       | 10.5"   |        |               | Rs       |
| 141      |       | 10'      | 0"      |        |               | Rs       |
|          | (104) | (6')     | (1")    | Ph1b17 | Dead          | Gone     |
|          | (98)  | (5')     | (3")    | Rm     | ?             | -        |
|          | (66)  | (13')    | (2")    |        | Rs            | ?        |
|          | (45)  | (12')    | (5")    | Ph1b5  | ?             | -        |
|          | (40)  | (5')     | (5")    | Rl     | Dead          | Gone     |
| 56 (21)  |       | 14'(14') | 4"(4")  | Rm     | Rm            | Rm       |
|          | (5)   | (14')    | (11")   | Rl     | ?             | -        |
|          | (5)   | (13')    | (8")    | Pb5    | Dead          | Gone     |
|          | (5)   | (11')    | (11")   | Rm     | ?             | -        |
| 40 (7)   |       | 12'(12') | 2"(0")  |        | Rs            | Rs       |
|          | (3)   | (9')     | (7")    | Rm     | ? rodent hole | -        |
|          | (3)   | (9')     | (7")    | Rm     | ?             | -        |
|          | (2)   | (12')    | (2")    | Rm     | ?             | -        |
| 38 (10)  |       | 12'(11') | 1"(10") |        | Rs            | Rs       |
| 36 (8)   |       | 12'(11') | 2"(10") |        | Rs            | Rm       |
| 34 (5)   |       | 13'(13') | 8"(6")  | Rs     | Rm            | Rm       |
|          | (357) | (7')     |         | Pb9    | Dead          | Gone     |
| 32 (3)   |       | 13'(13') | 9"(8")  | Rs     | Rm            | Rs       |
| 32       |       | 13'      | 1"      |        |               | seedling |
| 32 (2)   |       | 12'(12') | 5"(2")  | Rm     | Rm            | Rs       |
| 31 (359) |       | 11'(10') | 2"(10") | Rm     | Rm grazed     | Rm       |
|          | (345) | (8')     |         | Ph1b5  | Dead          | Gone     |
|          | (337) | (10')    | (10")   | Ph1b9  | Dead          | Gone     |

## APPENDIX V: MONITORING DATA FOR RUSSIAN CREEK

|  |   |          | 1990/07/24 | 1991/08/01 | 1992/07/21 |
|--|---|----------|------------|------------|------------|
| Direction from<br>center stake<br>(in degrees) | Distance from<br>stake<br>(in feet in inches) |          | Plant      | Plant      | Plant      |
| (312)  | (25')   | (9")     | Rm         | Rm         | ?          |
| 348 (312)                                      | 6'(7')  | 11"(0")  | Rm         | Rm         | Rs         |
| (311)  | (22')   | (4.5")   |            | Rs         | ?          |
| (311)  | (19)  | (4.5")   | Ph3        | Dead       | Gone       |
| (311)  | (8')  | (10.5")  | Ph5b5      | Dead       | Gone       |
| (307)  | (35')   | (9.5")   | Rl         | Ph2b10     | ?          |
| 328  | 12'   | 11"      |            |            | Rs         |
| 326  | 13'   | 1"       |            |            | Rs         |
| 326 (279)                                      | 6'(6')  | 6"(11")  |            | Rm         | Ph2b11     |
| 326 (288)                                      | 6'(6')  | 3"(3.5") | Rl         | Rl         | Ph1b5      |
| 324 (289)                                      | 14'(14')                                      | 4"(7.5") | Rm         | Rm         | Rm         |
| (285)  | (29')   | (3")     | Rl         | Ph7b5      | ?          |
| (281)  | (29')   | (5.5")   | Rl         | ?          | -          |
| (279)  | (5')  | (4")     |            | Rs         | ?          |
| 312  | 21'   | 10.5"    |            |            | Rm         |
| 308 (272)                                      | 30'(30')                                      | 3"(3.5") | Rs         | Rm         | Rm         |
| (272)  | (22')   | (6.5")   | Dead       | Gone       | -          |
| (264)  | (36')   | (0")     | Ph15b30    | Dead       | Gone       |
| (264)  | (18')   | (4")     | Ph8b12     | Dead       | Gone       |
| (264)  | (17')   | (5")     | Ph9b9      | Dead       | Gone       |
| (263)  | (24')   | (0.5")   | Rs         | ?          | -          |
| (259)  | (13')   | (5")     |            | Rs         | ?          |
| 294 (258)                                      | 15'(15')                                      | 9"(9.5") |            | Rl         | Rm         |
| 294 (259)                                      | 11'(11')                                      | 10"(10") |            | Rs         | Rm         |
| (256)  | (22')   | (8.5")   | Ph16b15    | ?          | -          |
| (256)  | (13')   | (11")    | Rm         | Rm         | ?          |
| (256)  | (13')   | (9")     | Ph5b4      | Dead       | Gone       |
| 292  | 13'   | 0"       |            |            | Rs         |
| (256)  | (11')   | (11")    | Rs         | Rl         | ?          |
| (256)  | (11')   | (3")     | Rm         | ?          | -          |
| (255)  | (13')   | (1.5")   | Rs         | ?          | -          |
| (254)  | (20')   | (0")     | Rs         | ?          | -          |
| 290 (255)                                      | 16'(16')                                      | 3"(5")   | Rm         | Rm         | Rs         |
| (253)  | (23')   | (4.5")   | Ph2b3      | ?          | -          |
| (253)  | (22')   | (2.5")   |            | Rl         | ?          |
| (253)  | (19')   | (10")    | Rs         | ?          | -          |
| (253)  | (19')   | (7")     | Rs         | ?          | -          |
| (252)  | (12')   | (1")     | Ph7b5      | Dead       | Gone       |
| (251)  | (11')   | (3")     | Rl         | Dead       | Gone       |
| 284 (248)                                      | 18'(18')                                      | 8"(8")   | Rs         | Rm         | Rs         |
| 283 (245)                                      | 16'(17')                                      | 11"(0")  |            | Rm         | Rm         |
| 283 (248)                                      | 11'(11')                                      | 6"(8")   |            | Rm         | Rm         |
| 282 (246)                                      | 19'(19')                                      | 4"(6")   | Rs         | Rm         | Rm         |
| (246)  | (19')   | (2")     | Rs         | Rm         | ?          |
| (244)  | (17')   | (1.5")   |            | Rs         | ?          |
| 279 (246)                                      | 12'(12')                                      | 5"(3")   |            | Rl         | Ph8b8      |
| (242)  | (29')   | (0")     | Ph9b3h1b4  | ?          | -          |
| (242)  | (21')   | (5")     | Rm         | Rm         | ?          |
| (242)  | (19')   | (0.5")   | Rs         | Rs         | ?          |
| 278 (243)                                      | 18'(18')                                      | 0"(1.5") | Rs         | Rl         | Rm         |
| (238)  | (28')   | (4")     | Ph5b10     | Dead       | Gone       |
| (238)  | (17')   | (6")     | Rs         | ?          | -          |
| (238)  | (16')   | (6.5")   | Ph7b4      | Dead       | Gone       |
| (238)  | (3')  | (0")     | Ph9b16     | Dead       | Gone       |
| (236)  | (21')   | (8")     | Rs         | Rm         | ?          |
| (232)  | (16')   | (4.5")   | Dead       | Gone       | -          |
| 265  | 16'   | 5"       |            |            | Rs         |
| 264 (233)                                      | 16'(16')                                      | 9"(9.5") | Rm         | Rl moldy   | Rl         |
| 261 (231)                                      | 8'(8')  | 1"(1")   | Rl         | Rl         | Ph4b26     |
| (223)  | (11')   | (5.5")   | Rl         | ?          | -          |
| (222)  | (11')   | (8")     |            | Rs         | ?          |
| (220)  | (11')   | (3")     |            | Rs         | ?          |
| (220)  | (11')   | (2")     |            | Rs         | ?          |

|           |          |           |                       |                                |                 |
|-----------|----------|-----------|-----------------------|--------------------------------|-----------------|
| 253 (207) | 10'(10') | 3"(7")    | Rl                    | ?                              | Ph1b2           |
| 247       | 17'      | 9"        |                       |                                | Rm              |
| 247       | 12'      | 11"       |                       |                                | Rm              |
| (210)     | (12')    | (9")      | Ph6b4                 | Dead                           | Gone            |
| (210)     | (8')     | (6")      | Rm                    | ?                              | -               |
| (207)     | (22')    | (0")      | Ph9b8                 | ?                              | -               |
| (192)     | (16")    | (1")      | Ph5b2                 | Dead                           | Gone            |
| (189)     | (17')    | (8.5")    | Rs                    | Rm                             | ?               |
| 222       | 31'      | 8"        |                       |                                | Rm              |
| 216 (185) | 29'(29') | 3"(4")    | Rm                    | Rl                             | Rm              |
| 215 (186) | 28'(28') | 5"(7")    | Rs                    | Rm                             | Rm              |
| 214 (185) | 36'(36') | 8"(8")    | Rs                    | ?                              | Rl              |
| (174)     | (28')    | (1")      | Rm                    | ?                              | -               |
| (172)     | (37')    | (0")      | Rs                    | Rs                             | ?               |
| (172)     | (32')    | (10")     | Rm                    | Rm                             | ?               |
| (170)     | (11')    | (8")      | Ph8b9                 | Dead                           | Gone            |
| 205       | 16'      | 6"        |                       |                                | Rs rodent mound |
| (169)     | (15')    | (0")      | Dead                  | Gone                           | -               |
| 205       | 14'      | 5"        |                       |                                | Rl              |
| 204       | 17'      | 10"       |                       |                                | Rm              |
| 204       | 16'      | 10"       |                       |                                | Rs              |
| (167)     | (34')    | (4.5")    | Rs                    | Rs                             | ?               |
| (167)     | (17')    | (5")      | Rm                    | Rs                             | ?               |
| (166)     | (35')    | (8.5")    | Rm                    | ?                              | -               |
| (165)     | (23')    | (9")      | Rl                    | Ph14b10 ants, aphids present ? | ?               |
| (162)     | (35')    | (9.5")    | Rs                    | Rs                             | ?               |
| 196 (162) | 25'(25') | 11"(11")  |                       |                                | Rm              |
| (158)     | (33')    | (9")      | Rs                    | Rs                             | ?               |
| 192 (141) | 24'(24') | 8"(7.5")  | Rm                    | Rm                             | Rm              |
| 192 (177) | 22'(21') | 2"(10.5") |                       |                                | Ph5b7           |
| 191 (160) | 30'(30') | 7"(6.5")  | Rs                    | Rs                             | Rm              |
| (151)     | (37')    | (0")      | Rs                    | ?                              | -               |
| (151)     | (29')    | (0")      | Ph12b5                | Dead                           | Gone            |
| (150)     | (32')    | (7")      | Ph8b5                 | Dead                           | Gone            |
| 186 (150) | 18'(18') | 11"(9.5") | Rl                    | Rl                             | Pb18            |
| (145)     | (34')    | (8")      |                       | Rs                             | ?               |
| (143)     | (25')    | (5")      | Ph9b4h5b2             | Dead                           | Gone            |
| (143)     | (20')    | (9")      | Rs                    | ?                              | -               |
| 178 (144) | 19'(19') | 10"(10")  |                       |                                | Rm              |
| 178 (143) | 17'(17') | 8"(5.5")  | Rl                    | Rl                             | Rl              |
| (140)     | (29')    | (7")      | Ph11b12               | Dead                           | Gone            |
| 177 (140) | 32'(32') | 3"(1")    | Rl                    | Rl mold                        | Rm              |
| (139)     | (17')    | (10")     | Ph7b5                 | Dead                           | Gone            |
| (129)     | (14')    | (3")      | Rm                    | Rm                             | ?               |
| 165 (130) | 11"(11") | 1"(0")    |                       |                                | Rs              |
| (119)     | (15')    | (7")      | Ph7b6                 | ?                              | -               |
| (116)     | (31')    | (2")      | Ph15b7                | Dead                           | Gone            |
| 147 (113) | 13'(13') | 6"(5")    | Rl                    | Rl                             | Rm              |
| (97)      | (35')    | (0")      | Dead                  | ?                              | -               |
| (72)      | (7')     | (1")      | Ph7b13                | Dead                           | Gone            |
| (70)      | (27')    | (4")      |                       | Dead plant                     | Gone            |
| (67)      | (29')    | (0")      | Ph23b11               | Dead                           | Gone            |
| 100 (285) | 3'(3')   | 9'(11.5") | Rm                    | Rl                             | Ph5b5           |
| (63)      | (31')    | (6")      | Rl                    | Rl                             | ?               |
| (62)      | (22')    | (10")     | Rl                    | Rm dead leaves at base ?       |                 |
| (60)      | (18')    | (4.5")    | Ph6b6                 | Dead                           | Gone            |
| 91 (60)   | 5'(4')   | 1"(10.5") | Rm                    | Rl                             | Rl              |
| (53)      | (33')    | (5")      | Ph11b6                | Dead                           | Gone            |
| (52)      | (24')    | (6")      | Ph16b6                | Dead                           | Gone            |
| (52)      | (17')    | (8")      | Rl                    | ?                              | -               |
| (51)      | (30')    | (11")     | Rl                    | Rm or Rl                       | ?               |
| 86 (52)   | 25'(25') | 6"(4")    | Rm                    | Rm                             | Rm              |
| (50)      | (15')    | (11")     |                       | Rs                             | ?               |
| (47)      | (36')    | (9")      | Ph6b6                 | Dead                           | Gone            |
| (45)      | (36')    | (5.5")    | Ph9b7                 | Dead                           | Gone            |
| (45)      | (34')    | (10")     | Ph9b7                 | Dead                           | Gone            |
| (45)      | (33')    | (5.5")    | Rl                    | Rm dead leaves at base ?       |                 |
| (45)      | (31')    | (3")      | Ph4b5                 | Dead                           | Gone            |
| 72        | 35'      | 6"        |                       |                                | Rm              |
| (36)      | (8')     | (3")      | Rs                    | Rs                             | ?               |
| (32)      | (36')    | (10")     | Ph12b5                | Dead                           | Gone            |
| (32)      | (29')    | (3")      | Ph4b1h1b2h3b2h4b3h4b2 | Dead                           | Gone            |

|          |          |            |       |                          |      |
|----------|----------|------------|-------|--------------------------|------|
| (23)     | (33')    | (5.5")     |       | Rs                       | ?    |
| 58 (23)  | 33'(33') | 10"(7.5")  |       | Rs                       | Rm   |
| (17)     | (27')    | (2")       | Ph6b3 | ?                        | -    |
| 51 (18)  | 28'(28') | 4"(2.5")   | Rm    | Rm                       | Rm   |
| (357)    | (18')    | (5.5")     | Rs    | ?                        | -    |
| 20 (345) | 5'(5')   | 10"(8.0")  |       | RL                       | RL   |
| 20       | 4'       | 3"         |       |                          | Rs   |
| 18 (339) | 7'(7')   | 10"(10.5") | RL    | RL dead leaves at base ? |      |
| 17 (338) | 29'(29') | 7"(6")     | Rm    | Rm                       | Rs   |
| (339)    | (14')    | (10")      | Ph4b2 | Dead                     | Gone |
| (336)    | (17')    | (3")       | Ph9b6 | Dead                     | Gone |
| (336)    | (12')    | (4.5")     | Rm    | Rm                       | ?    |
| 7 (350)  | 14'(14') | 0.5"(0.5") | Rm    | ?                        | Rm   |
| (328)    | (24')    | (10")      | RL    | Ph2b2                    | ?    |

## APPENDIX VI: MONITORING DATA FOR WEIHART

|  |   |          | 1990/07/31     | 1991/08/01            | 1992/07/21 |
|--|---|----------|----------------|-----------------------|------------|
| Direction from<br>center stake<br>(in degrees) | Distance from<br>stake<br>(in feet in inches) |          | Plant          | Plant                 | Plant      |
| 358 (320)                                      | 14' (14')                                     | 11" (8") | Rm             | Rm grazed             | Rs         |
| (318)  | (14')   | (7")     | Rm             | ?                     | -          |
| (314)  | (10')   | (5")     |                | Rs                    | ?          |
| 334  | 14'   | 5"       |                |                       | Rs         |
| (290)  | (4')  | (7")     | Pb4b2          | Dead                  | Gone       |
| (285)  | (13')   | (5")     | Rm             | Dead died in 91'      | Gone       |
| (284)  | (13')   | (2")     | Ph10           | Dead                  | Gone       |
| (284)  | (11')   | (7")     | Ph2b4h15b2h3b3 | Dead                  | Gone       |
| 318  | 12'   | 11"      |                |                       | Rs         |
| 318  | 12'   | 4"       |                |                       | Rs         |
| (279)  | (10')   | (10")    | Rm             | Rm grazed             | ?          |
| (268)  | (14')   | (4")     |                | Rs                    | ?          |
| (264)  | (12')   | (9")     | Rm             | Rm grazed             | ?          |
| 300 (279)                                      | 11' (11')                                     | 6" (6")  | Rm             | Rm grazed to 2 leaves | Rs         |
| (264)  | (11')   | (1")     | Rs             | Rm grazed             | ?          |
| 298 (255)                                      | 13' (13')                                     | 1" (2")  | Rm             | ?                     | Rm         |
| (260)  | (13')   | (3")     | Rm             | Dead                  | Gone       |
| (260)  | (10')   | (1")     | Rs             | Rs                    | ?          |
| 295 (255)                                      | 11' (11')                                     | 8" (4")  | Rm             | Rm grazed             | Rm         |
| 295  | 10'   | 7"       |                |                       | seedling   |
| 293 (252)                                      | 13' (13')                                     | 6" (9")  | RL             | RL                    | Rm         |
| 289  | 14'   | 0"       |                |                       | Rm         |
| 289  | 11'   | 11"      |                |                       | Rs         |
| (252)  | (13')   | (7")     | Ph7b2          | ?                     | -          |
| (252)  | (12')   | (7")     | RL             | ?                     | -          |
| (252)  | (11')   | (6")     | Ph9b3          | ?                     | -          |
| (251)  | (1')  | (9.5")   |                | Rs                    | ?          |
| (250)  | (12')   | (7")     | Rm             | ?                     | -          |
| (250)  | (12')   | (2")     | Rm             | ?                     | -          |
| (247)  | (12')   | (2")     | Rm             | ?                     | -          |
| 278 (246)                                      | 11' (11')                                     | 6" (4")  | Rs             | Rm grazed             | Rm         |
| 276  | 13'   | 3"       |                |                       | Rs         |
| 276 (250)                                      | 12' (12')                                     | 5" (5")  | RL             | ?                     | Rs         |
| 268 (232)                                      | 13' (13')                                     | 9" (7")  |                | Rs                    | Rs         |
| (220)  | (10')   | (10")    | Rs             | ?                     | -          |
| (219)  | (13')   | (9")     |                | Rm                    | ?          |
| 250 (219)                                      | 13' (13')                                     | 8" (7")  | Rm             | RL                    | Rm         |
| 250  | 12'   | 3"       |                |                       | Rs         |
| 248 (218)                                      | 11' (11')                                     | 5" (7")  |                | Rm                    | Rm         |
| 248 (210)                                      | 9' (9')                                       | 9" (9")  | Rs             | Rm grazed             | Rs         |
| 248 (210)                                      | 9' (9")                                       | 6" (6")  | Rs             | Rm "                  | Rs         |
| 247 (210)                                      | 10' (10')                                     | 1" (1")  | Rm             | Rm "                  | Rs         |
| (210)  | (2')  | (9")     | RL             | ?                     | -          |
| (210)  | (2')  | (9")     |                | Rs                    | ?          |
| (207)  | (9')  | (4")     | Rm             | Rs grazed             | ?          |
| (203)  | (2')  | (9")     | RL             | ?                     | -          |
| (201)  | (7')  | (5")     | Rm             | ?                     | -          |
| (201)  | (5')  | (7")     | Rm             | ?                     | -          |
| (201)  | (5')  | (7")     | Rm             | ?                     | -          |
| (201)  | (4')  | (7")     | Rm             | RL grazed             | ?          |
| (201)  | (2')  | (5")     | RL             | ?                     | -          |
| 236 (193)                                      | 4' (4')                                       | 3" (5")  | Rm             | Rm                    | Rm         |
| (188)  | (15')   | (0")     | Rs             | Rs grazed heavily     | ?          |
| (188)  | (14')   | (11")    | Rs             | ?                     | -          |
| (188)  | (14')   | (5")     |                | Rs                    | ?          |
| (193)  | (9')  | (7")     | Ph12b2         | Dead                  | Gone       |
| 222  | 12'   | 3"       |                |                       | Rs         |
| (181)  | (12')   | (0")     | Ph8b4          | Dead                  | Gone       |
| 213 (175)                                      | 14' (14')                                     | 9" (11") | Rm             | Rm grazed heavily     | Rm         |
| 212 (176)                                      | 7' (7')                                       | 3" (6")  |                | Rs                    | Rs         |
| (175)  | (14')   | (3")     | Rs             | ?                     | -          |
| 211 (175)                                      | 13' (14')                                     | 11" (0") |                | Rm grazed             | Rm         |
| (174)  | (13')   | (11")    | Rm             | ?                     | -          |

|          |          |            |        |                   |       |
|----------|----------|------------|--------|-------------------|-------|
| 46       | 13'      | 1"         |        |                   | Rm    |
| 45 (8)   | 6'(6')   | 8"(7")     | Rm     | RL                | RL    |
| 45 (8)   | 6'(6')   | 5"(3")     | Rm     | Rm                | RL    |
| 45 (2)   | 6'(6')   | 5"(5")     | Rm     | ?                 | RL    |
| (8)      | (8')     | (6")       | Rm     | Rs                | ?     |
| (8)      | (8')     | (0")       | Rs     | Rs                | ?     |
| (8)      | (7')     | (0")       | Rs     | ?                 | -     |
| (8)      | (6')     | (9")       | Rs     | Rs                | ?     |
| (8)      | (5')     | (11")      | Rs     | ?                 | -     |
| (6)      | (9')     | (6")       | Rm     | Rm grazed         | ?     |
| (5)      | (13')    | (9")       | Rm     | Rm grazed heavily | ?     |
| (5)      | (9')     | (9")       | Rm     | ?                 | -     |
| (5)      | (9')     | (4")       | Dead   | Gone              | -     |
| (5)      | (8')     | (2")       | Rm     | ?                 | -     |
| (3)      | (11')    | (3")       | RL     | RL                | ?     |
| (3)      | (11')    | (6")       | Rm     | ?                 | -     |
| (3)      | (10')    | (8")       | Rm     | ?                 | -     |
| (2)      | (11')    | (7")       | Rm     | ?                 | -     |
| (2)      | (10')    | (11")      | Ph15b3 | Dead              | Gone  |
| (2)      | (9')     | (5")       | Rm     | ?                 | -     |
| (2)      | (6')     | (11")      | Rm     | ?                 | -     |
| (2)      | (6')     | (11")      | Rm     | ?                 | -     |
| (1)      | (12')    | (7")       | Rm     | Rm                | ?     |
| (1)      | (10')    | (10")      | Rs     | Rm                | ?     |
| (1)      | (9')     | (8.5")     |        | Rs                | ?     |
| (1)      | (9')     | (4")       | RL     | RL                | ?     |
| (360)    | (10')    | (10")      | Rs     | ?                 | -     |
| (360)    | (8')     | (8")       |        | Rs                | ?     |
| (360)    | (8')     | (7")       |        | Rm grazed         | ?     |
| 36 (5)   | 8'(8')   | 6"(6")     | RL     | RL grazed heavily | RL    |
| 36 (6)   | 8'(8')   | 4"(2")     | Rm     | Rm                | Rs    |
| 36 (1)   | 9'(9')   | 6"(8")     |        | Rs                | Rs    |
| (359)    | (14')    | (8")       | Rs     | ?                 | -     |
| (359)    | (6')     | (1")       | Rm     | ?                 | -     |
| 32 (359) | 11'(11') | 7"(6")     |        | RL                | Rs    |
| 30 (352) | 12'(12') | 9"(9")     |        | Rs                | Rm    |
| 28       | 13'      | 0"         |        |                   | Rs    |
| (352)    | (10')    | (0.5")     |        | Rs                | ?     |
| (351)    | (12')    | (10")      |        | Rs                | ?     |
| (350)    | (9')     | (10")      |        | Rs                | ?     |
| 25 (349) | 10'(10') | 10"(11.5") |        | Rs                | Rm    |
| (349)    | (10')    | (0.5")     |        | Rs                | ?     |
| 25 (354) | 9'(9')   | 6"(5")     |        | RL                | RL    |
| 22       | 14'      | 11.5"      |        |                   | Rm    |
| (346)    | (13')    | (4.5")     |        | Rs                | ?     |
| 22       | 7'       | 1"         |        |                   | Rs    |
| 19       | 15'      | 0"         |        |                   | Rs    |
| (342)    | (7')     | (4")       | Ph8    | Dead              | Gone  |
| (341)    | (15')    | (0")       | Ph10b3 | Dead              | Gone  |
| (341)    | (6')     | (10")      | Rs     | ?                 | -     |
| 17 (342) | 6'(6')   | (6")       | Rs     | Rs                | Rs    |
| (340)    | (11')    | (2")       | Rm     | ?                 | -     |
| 15 (340) | 11'(11') | 4"(3")     | Rm     | Rm                | Rm    |
| (339)    | (5')     | (8")       | Ph5b2  | Dead              | Gone  |
| (339)    | (5')     | (7")       | Rs     | ?                 | -     |
| 14 (339) | 10'(10') | 9"(8")     | RL     | RL                | Rs    |
| 13 (335) | 6'(6')   | 11"(11")   | Rm     | Rm grazed         | Rs    |
| 12       | 6'       | 2"         |        |                   | Rs    |
| (335)    | (11')    | (2")       | Ph19b3 | Dead              | Gone  |
| (335)    | (8')     | (0")       | Rs     | ?                 | -     |
| (335)    | (6')     | (11")      |        | Rs grazed         | ?     |
| (335)    | (6')     | (11")      |        | Rs "              | ?     |
| 11       | 5'       | 0"         |        |                   | RL    |
| 10 (335) | 14'(14') | 5"(6")     | RL     | Rm                | Rm    |
| 10 (335) | 7'(7')   | 9"(8")     | Rm     | Rm grazed         | Rm    |
| 10 (340) | 7'(7')   | 4"(6")     | Rs     | ?                 | Rs    |
| 10 (335) | 7'(7')   | 1"(0")     | Rm     | Rm "              | Rs    |
| (330)    | (14')    | (4")       | Ph14b2 | Dead              | Gone  |
| (330)    | (8')     | (0")       | Dead   | Gone              | -     |
| (330)    | (5')     | (9")       | RL     | RL grazed         | ?     |
| 1 (329)  | 12'(12') | 6"(3")     | RL     | RL                | Ph7b5 |