Biogeography of the Genus *Carex* in the Columbia River Basin

A report to the U.S. Forest Service
Eastside Ecosystems Management Project
Walla Walla, Washington

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PREFACE

The following report was prepared by either University scientists through cooperative agreement, project science staff, or contractors as part of the ongoing efforts of the Interior Columbia Basin Ecosystem Management Project, co-managed by the U.S. Forest Service and the Bureau of Land Management. It was prepared for the express purpose of compiling information, reviewing available literature, researching topics related to ecosystems within the Interior Columbia Basin, or exploring relationships among biophysical and economic/social resources.

This report has been reviewed by agency scientists as part of the ongoing ecosystem project. The report may be cited within the primary products produced by the project or it may have served its purposes by furthering our understanding of complex resource issues within the Basin. This report may become the basis for scientific journal articles or technical reports by the USDA Forest Service or USDI Bureau of Land Management. The attached report has not been through all the steps appropriate to final publishing as either a scientific journal article or a technical report.

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Introduction

This report summarizes the biogeography of the genus *Carex* (sedges *sensu stricto*) within the study area of the Eastside Ecosystems Management Project (EEMP). The members of the genus are herbaceous graminoids in the family Cyperaceae. Biogeographical data provided in this report are provided for use in long-term modeling and planning efforts conducted by the Forest Service. Both common and rare taxa are evaluated. A second report prepared by Newhouse et al. (1995) summarizes ecological information about the genus within the EEMP area.

The study area is defined as the Columbia River Basin south of Canada, and east of the crest of the Cascade Mountains, and also includes small portions of the Great Basin in southern Oregon and northeastern Nevada, and of the Klamath River Basin in southern Oregon. The EEMP area includes lands in seven states: Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Appendix 1 shows the boundaries of the 102 counties that have lands within the project area. Some of the peripheral counties are only partially contained within the EEMP area.

Methodology

Data collection.

Carex distribution data were gathered from nine regional herbaria through comprehensive on-site inventories, from databases supplied by three of the herbaria, and from the taxonomic literature. Specimens on loan from other herbaria also were viewed during the on-site visits. The herbaria from which specimen data are cited are listed in Table 1. In addition, distribution data were collected from other literature sources including regional floras, state natural heritage programs, plant checklists of national parks and national forests and other botanical literature sources for the region.

Table 1. Herbaria from which *Carex* distribution data were obtained.

[1] = Referenced in taxonomic literature
[2] = Computer database or manual list of collections
[3] = On site inventory of *Carex* collections

Herbarium	Acronym	Institution and Location
Liberty Hyde Bailey Hortorium[1]	BH	Cornell University, Ithaca, New York
Intermountain Experiment Station[2]	BOIS	Forest Service, Boise, Idaho
Dept. of Botany[1]	CAS	California Academy of Sciences
Harold M. Tucker Herbarium[2]	CIC	College of Idaho, Caldwell, Idaho
Wiegand Herbarium[1]	CU	Cornell University, Ithaca, New York
Vascular Plant Herbarium[1]	DAO	Biosystematics Research Inst., Ontario, Canada

Herbarium	Acronym	Institution and Location
Dudley Herbarium of Stanford Univ.[1]	DS	California Academy of Sciences
Fremont National Forest Herbarium[2]	FNLO	Forest Service, Lakeview, Oregon
Gray Herbarium[1]	GH	Harvard University, Cambridge, Massachusetts
Dept. of Biology[1]	HSC	Humboldt State University, Arcata, California
Dept. of Biological Sciences[3]	ID	University of Idaho, Moscow, Idaho
Jepson Herbarium[1]	JEPS	University of California, Berkeley, California
Royal Botanic Gardens[1]	K	Kew, England
Catholic University of America[1]	LCU	Washington, D.C.
Herbarium of the Univ. of Michigan[1]	MICH	Ann Arbor, Michigan
Missouri Botanical Garden[1]	MO	St. Louis, Missouri
Botany Department[3]	MONTU	University of Montana, Missoula, Montana
Intermountain Experiment Station[3]	MRC	Forest Service, Missoula, Montana
New York Botanical Garden[1]	NY	Bronx, New York
Combined Herbaria Oregon State Univ.[2]	ORE, OSC, WILLU	Corvallis, Oregon
Herbarium of Pomona College[1]	POM	Rancho Santa Ana Botanic Garden, Claremont, California
Rocky Mountain Herbarium[2,3]	RM	University of Wyoming, Laramie, Wyoming
Dept. of Botany[1]	UBC	University of British Columbia, Vancouver, British Columbia, Canada
Dept. of Botany[1]	UC	University of California, Berkeley, California
United States National Herbarium[1]	US	Smithsonian Institution, Washington, D.C.
U.S. Forest Service Herbarium[3]	USFS	University of Wyoming, Laramie, Wyoming
Department of Biology[1]	WELC	Wellesley College, Wellesley, Massachusetts
Marion Ownbey Herbarium[3]	WS	Washington State University, Pullman, Washington
Department of Botany[3]	WTU	University of Washington, Seattle, Washington

During the on-site inventories, state and county occurrence data were recorded from herbarium specimen labels. More specific locality data was not consistently available on the labels. When county was not specified on the label, we attempted to ascertain the county from which the specimen was collected using any other locality information provided. For cases in which only a portion of a county is within the EEMP boundary (e.g., Deer Lodge Co., MT) we attempted to determine whether the specimen had been collected from within

the study area. If not, or if exact location could not be determined, locality data for the specimen was not recorded. Herbarium identifications were not comprehensively verified, and species identifications were accepted as labelled and annotated. Some specimens that were obviously in error or radically disjunct were examined more closely and annotated when appropriate. However, it was not possible to verify all specimens of disjunct taxa.

The distribution data were databased and each observation of each species-county combination was coded for its source: herbarium specimen or literature citation. Herbarium specimens cited in the taxonomic literature were coded as herbarium records. All other literature records were coded as such.

Mapping.

County dot maps were generated from the county distribution dataset. These maps are contained in Appendix 2. Herbarium records were mapped as a filled circle and literature records as an open circle. Herbarium records were given priority over literature records: if a county had both herbarium and literature records for a species, only the herbarium record (filled circle) was mapped.

Limitations.

The following limitations apply to the county distribution maps:

1) Only county level locality data are presented, because they are the most universally available both on herbarium specimens and in the literature. County dot maps should be considered an approximation of the true distribution of the species, especially in large counties with widely varying habitats. For example, in a large county such as Harney County, Oregon it is likely that some of the mapped species will occur only in a small portion of the county.

2) Not all herbaria within the region were inventoried, and as a result, some county occurrences may have been missed.

3) It was not practical to verify the identity of most of the herbarium specimens or the taxa referred to in the literature. For this reason some taxa may have been included that do not occur within the EEMP area, and others may have been excluded that do. Several dubious specimens of radically disjunct taxa were reexamined and found to be misidentified. Where appropriate, these were excluded from the species list. Table 2 contains a list of excluded species. Appendix 4 lists misidentifications of herbarium specimens that we have commonly encountered while annotating collections at Oregon State University.

4) A few records from complex groups were difficult to map, because of confusion between names, improper application of the type, or identification problems, (e.g., *C. podocarpa*, *C. paysonis*, and *C. spectabilis*; see the section on taxonomic problems).

5) It was not possible to field check disjuncts or rare taxa, nor to collect in under-collected counties.

6) It is likely that many counties have extant but undocumented *Carex* taxa. Counties near universities or containing national parks generally are better collected than more remote counties.

Table 2. Taxa excluded from the Columbia River Basin.

Excluded Carex Taxa	Original Report	County, State (Herbarium)	Reason Excluded
atratiformis	Davis 1952	Idaho	voucher never found
deflexa	Davis 1952	Idaho	voucher never found
emoryi	Davis 1952	Idaho	voucher never found
haydenii	Peck 1961	Oregon	colls = C. haydeniana
helleri	CWG 1993	Harney Co., OR (ORE, OSC)	colls = C. atrata var. erecta
laeviconica	Davis 1952	Idaho	voucher never found
mariposana	Hermann 1970 [Hitchcock & Muhlick 10824]	Custer Co., ID	R. Whitkus annot. to C. abrupta
nigra		Flathead Co., MT (ID)	colls = C. spectabilis (annot. Mastrogiuseppe 1994)
prairea	Davis 1952	Idaho	voucher never found
pseudocyperus		Flathead Co., MT (MONTU)	coll = C. retrorsa (annot. Lesica 1994)
richardsonii		Flathead Co., MT (MONTU)	coll = C. concinna (annot. Lesica 1994)
trichocarpa		Owyhee Co., ID (ID)	coll = C. sheldonii (annot. Mastrogiuseppe 1994)
umbellata		Ravalli Co., MT (WS)	coll = C. rossii (annot. Mastrogiuseppe 1994)
viridior	Abrams 1940	Okanogan Co., WA	coll = C. atrata vars. (Reznicek pers. comm.)

Taxa Included

159 *Carex* taxa were documented to occur within the study area (Appendix 3a). This was determined from on-site inventories of major regional herbaria, and from the taxonomic literature. Technical considerations for inclusion of taxa were discussed with taxonomic experts including Joy Mastrogiuseppe and Dr. Tony Reznicek. As a result, nomenclature from herbarium labels and names long familiar in the literature have been modernized in list of EEMP area taxa. A detailed synonymy (Appendix 3b) was prepared to facilitate interpretation of all names in regional manuals, including Abrams (1940), Peck (1961), Davis (1952), Hitchcock et al. (1969), Hermann (1970), Hitchcock and Cronquist (1973), Cronquist et al. (1977), Mason (1980), Welsh et al. (1987), Lackschewitz (1991), Dorn (1992), Hickman (1993), and Kartesz (1994a,b). Authors of the taxa are not given in this report, but may be found in standard references for the region or in Kartesz (1994a,b).

Because it was not practical to verify either the identity of most of the herbarium specimens nor the taxa referred to in the literature, some taxa may have been included that do not occur within the EEMP area, and others may have been excluded that do occur within the study area.

Taxonomy

The genus *Carex* comprises roughly 1000 species world-wide (Mabberley 1993), and is the largest genus of vascular plants in North America. The majority of species are well-marked and discrete, though in a group of this size, taxonomic difficulties are to be expected. Relatively few problems are encountered in distinguishing purported taxa (Standley 1992b, p.229), but there will always be disagreement over the ranking of taxa (e.g., whether a particular taxon should be ranked at the varietal level vs. the species level). Hybrids occasionally occur (Cayoutte and Catling 1992), but in our experience, do not obscure the identities of the majority of populations.

Taxonomic problems.

This section contains a summary of *Carex* taxonomy problems in the study area. Roughly 40 percent of the species found in the EEMP area are included. Although this is a large proportion of the taxa, it is not an unusual "laundry list" of taxonomic problems in the genus in North America. For example, 25 percent of the *Carex* species in New England present taxonomic difficulties (Reznicek 1989). The genus in that region has been studied longer and is better known than it is in the EEMP area. In the west, the greater number of taxonomic problems encountered with the group is to be expected, given the shorter history of study.

Sectional nomenclature is currently under revision for the Flora of North America (Reznicek, pers. comm.). For utility, we have followed the generic divisions that are readily available in regional manuals (e.g., Abrams 1940).

Taxonomic problems are discussed by subgenus and section because most problems occur

among closely related taxa. Table 3 gives an alphabetical listing of *Carex* species with subgenus and section identified to facilitate locating a particular species. A full synonymy may be found in Appendix 3b. The only synonyms included are those that, because of recent literature reports, affected the mapping of taxa within the project area.

Table 3. Subgenus and section names for *Carex* taxa with taxonomic problems.

Species	Subgenus	Section
abrupta	Vignea	Ovales
aenea	Vignea	Ovales
albonigra	Eucarex	Atratae
angustata	Eucarex	Acutae
aquatilis	Eucarex	Acutae
atherodes	Eucarex	Paludosae
atrata	Eucarex	Atratae
atrosquama	Eucarex	Atratae
aurea	Eucarex	Bicolores
backii	Eucarex	Phyllostachys
bebbii	Vignea	Ovales
bigelowii	Eucarex	Acutae
bipartita	Vignea	Heleonastes
bolanderi	Vignea	Deweyanae
brainerdii	Eucarex	Montanae
brevior	Vignea	Ovales
brevipes	Eucarex	Montanae
breweri	Vignea	Inflatae
brunnescens	Vignea	Heleonastes
canescens	Vignea	Heleonastes
chalciolepis	Eucarex	Atratae
comosa	Eucarex	Pseudo-cyperae
constanceana	Vignea	Ovales
deflexa	Eucarex	Montanae
deweyana	Vignea	Deweyanae
echinata	Vignea	Stellulatae
elynoides	Eucarex	Filifoliae
exsiccata	Eucarex	Vesicariae
festivella	Vignea	Ovales
filifolia	Eucarex	Filifoliae
fissuricola	Eucarex	Ferrugineae
flava	Eucarex	Extensae
foenea	Vignea	See Arenariae
foetida	Vignea	Foetidae
fracta	Vignea	Ovales
garberi	Eucarex	Bicolores
haydeniana	Vignea	Ovales
heliophila	Eucarex	Montanae
heteroneura	Eucarex	Atratae
idahoa	Eucarex	Atratae
illota	Vignea	Ovales
incurviformis	Vignea	Foetidae
inops	Eucarex	Montanae
integra	Vignea	Stellulatae
jonesii	Vignea	Vulpinae
lanuginosa	Eucarex	Hirtae
lasiocarpa	Eucarex	Hirtae
leporina	Vignea	See Ovales
leptopoda	Vignea	Deweyanae
limnophila	Vignea	Ovales
luzulaifolia	Eucarex	Ferrugineae
luzulina	Eucarex	Ferrugineae
macloviana	Vignea	Ovales
microptera	Vignea	Ovales
multicaulis	Vignea	Ovales
muricata	Vignea	Stellulatae
nardina	Vignea	Nardinae
nervina	Vignea	Vulpinae
occidentalis	Vignea	Bracteosae
oederi	Eucarex	Extensae
ovalis	Vignea	Ovales
pachystachya	Vignea	Ovales
parryana	Eucarex	Atratae
paysonis	Eucarex	Atratae
pellita	Eucarex	Hirtae
pensylvanica	Eucarex	Montanae
praeceptorum	Eucarex	Heleonastes
preslii	Vignea	Ovales
rossii	Eucarex	Montanae
rostrata	Eucarex	Vesicariae
saxatilis	Eucarex	Extensae
scirpoidea	Eucarex	Scirpinae
scopulorum	Eucarex	Acutae
siccata	Vignea	Arenariae
straminiformis	Vignea	Ovales
subfusca	Vignea	Ovales
tincta	Vignea	Ovales
tracyi	Vignea	Ovales
tribuloides	Vignea	Ovales
utriculata	Eucarex	Vescariae
vernacula	Vignea	Foetidae
vesicaria	Eucarex	Vesicariae
viridula	Eucarex	Extensae

SUBGENUS EUCAREX

Section *Acutae*

Species in this complex are reciprocally misidentified with other members of the complex and occasionally with *C. amplifolia*, *C. spectabilis*, and *C. paysonis*. The problem is fueled in part by the erroneous belief that *C. aquatilis* is the most common species.

C. aquatilis var. *dives* -- formerly called *C. sitchensis* but intergrades in the Cascades with typical *C. aquatilis* (Standley 1985).

C. bigelowii -- A tundra species, disjunct in Appalachian alpine areas. It was not included in the regional monograph (Standley 1985), and is easily confused with *C. scopulorum* in our mountains, or with *C. aquatilis* in the arctic. Two mostly immature collections from Lemhi Co., ID (*Mancuso 405 & 470*) may be *C. bigelowii* (Mastrogiuseppe pers. comm.). This population should be researched further. Additional EEMP county records (at RM) have not been verified.

C. scopulorum -- This montane species occasionally has three stigmas rather than two (Hitchcock et al. 1969), and therefore reciprocal misidentifications occur between it, *C. spectabilis* and *C. paysonis*. Likewise, *C. spectabilis* occasionally has two stigmas. The range of *C. scopulorum* as mapped in this report is probably unaffected.

Section *Atratae*

C. albonigra -- This taxon can be considered an alpine ecotype of *C. atrata* (Hitchcock et al. 1969).

C. atrata -- This circumboreal complex includes tundra and alpine populations that now are isolated from one another and are somewhat morphologically distinct. Reasonable arguments can be made for recognizing the components as subspecies and/or varieties of a single species or as two to several species with or without varieties (Hitchcock et al. 1969, Murray 1969, Mastrogiuseppe 1993). *Carex atrata s. str.* does not grow in the continental United States (D. Murray fide J. Mastrogiuseppe, pers. comm., *contra* A. Cronquist [Cronquist et al. 1977; Hitchcock et al. 1969]).

The type specimen of *C. viridior* (Abrams 1940) described from Okanogan Co., WA, but ignored in the synonymy of more recent works (Kartesz 1994a, Hitchcock et al. 1969, Hitchcock and Cronquist 1973), is a mixed collection of *C. atrata* var. *erecta* and *C. atrata* var. *atrosquama* (Mackenzie 1931-1935). The name has not been lectotypified, but will be a later synonym under any circumstance.

C. atrata var. *atrosquama* -- Murray (1969) recognizes this as *C. atrosquama* Mack.

C. atrata var. *chalciolepis* -- This variety is closest to *C. atrata* var. *erecta*, with intermediates in Utah (Cronquist et al. 1977). It is unexpected in our area.

C. atrata var. *erecta* -- This taxon can be considered to be *C. heteroneura* W. Boott, which has two varieties, *C. heteroneura* var. *heteroneura* and *C. heteroneura* var. *epapillosa* (Mackenzie) F. Herm. (Mastrogiuseppe 1993, and others). They are sympatric in the study area, and intergrades are present. The variation may be genetic or environmental. The two varieties of *C. heteroneura* can be recognized at the species level (Murray 1969).

C. idahoa -- This taxon, endemic to Idaho and Montana, can be called *C. parryana* ssp. *idahoa* (Murray 1969).

C. parryana -- This taxon can be split into three highly variable groups (Murray 1969). *C. parryana* ssp. *parryana* is widespread in our area. *C. parryana* ssp. *hallii* is similar to *C. parryana* ssp. *parryana* and intermediate forms occur. Ssp. *hallii* may reach the eastern edge of the study area; however, the two varieties could not be separated for mapping. Ssp. *idahoa* is treated as a full species here. Cronquist et al. (1977) did not treat any of these subspecies as distinct.

C. paysonis -- *Carex paysonis*, *C. spectabilis*, and *C. podocarpa* (which may be best considered a synonym of *C. spectabilis*) form an intergrading complex (Hitchcock et al. 1969). *C. paysonis* and *C. spectabilis* are often reciprocally misidentified.

C. spectabilis -- See *C. paysonis*.

Section *Bicolores*

C. aurea s.l. -- This taxon is the subject of current research and controversy (e.g. Katz et al. 1986), and needs more research. Five taxa can be recognized, *C. bicolor* of Europe, Alaska and British Columbia, and the American *C. aurea* s. str., *C. garberi*, *C. hassei* and *C. saliniformis* (Mastrogiuseppe 1993). Fleshy-fruited *C. aurea* s. str.is very difficult to distinguish in the herbarium from other taxa in the complex, which have drier perigynia. Reznicek (pers. comm.) believes *C. aurea* s. str. should remain discrete, and *C. garberi* should be lumped into *C. hassei*. Mastrogiuseppe (pers. comm.) believes *C. garberi* and *C. hassei* are morphologically and phenologically distinct from *C. aurea*, and that *C. garberi* appears to be more distinct from *C. aurea* than does *C. hassei*. Other botanists are of the opinion that *C. aurea*, *C. garberi* and *C. hassei* should be lumped with *C. bicolor* (Welsh et al. 1987). Some well-known splitters do not see well-marked distinctions among *C. aurea*, *C. garberi* and *C. hassei* (Weber 1976, p.376, and 1990). The Californian endemic, *C. saliniformis*, was maintained as a distinct species in the most recent treatment (Mastrogiuseppe 1993).

Section *Extensae*

C. flava -- A member of a controversial and variable complex in the Old World (e.g., Bruederle & Jensen 1991, Halkka et al. 1992). The only two taxa in the study area are quite distinct: *C. flava* and *C. viridula* (Bruederle & Jensen 1991; Crins and Ball 1989a & 1989b; Hitchcock et al. 1969).

C. viridula -- See *C. flava*. Six intraspecific taxa can be recognized, but only *C. v.* ssp. *viridula* var. *viridula* (if we wish to be pedantic) occurs in our area (Crins and Ball 1989b). The name *C. oederi* (Hitchcock et al. 1969) does not apply to any North American taxon (Reznicek, pers. comm.).

Section *Ferrugineae*

C. luzulina -- Reznicek (pers. comm.) reported that he is unable to distinguish reliably between var. *luzulina* and var. *ablata*. The Carex Working Group (1993) had similar difficulties in Oregon. Mastrogiuseppe (pers. comm.) said that the two varieties can be difficult to distinguish but that 70-80% of the time they are distinctive and not difficult to key. Dorn (1988) named a new Rocky Mountain endemic variety, *C. luzulina* var. *atropurpurea*. His 1992 key to var. *ablata* and var. *atropurpurea* was based on the same characters that have made it so hard to cleave var. *ablata* from var. *luzulina* in the Cascades. Moreover, his version of var. *ablata* (Dorn 1992, p.147) contradicts var. *ablata* descriptions from farther west (e.g., Mastrogiuseppe 1993). These murky waters need clarification.

Above varietal rank, *Carex luzulina* is easy to recognize, and collectively the distribution maps for *C. luzulina* varieties probably depict the range of the species accurately. However, the maps of var. *luzulina* and var. *ablata* should be considered suspect.

Carex fissuricola -- A segregate from *C. luzulina*, this taxon is recognized in California (Mastrogiuseppe 1993), but not by Hitchcock et al. (1969). *Carex fissuricola* occurs in Idaho (Mastrogiuseppe, pers. comm.); however, we mapped those specimens as *C. luzulina* for two reasons: 1) most herbarium specimens were not annotated and their identifications had not been reviewed, and 2) the status of this taxon remains controversial. The entire *C. luzulina* complex is in need of review.

C. luzulaifolia -- Yet another segregate from *C. luzulina*, at the robust extreme of a vegetative gradation from *C. luzulina* through *C. fissuricola* to *C. luzulaifolia*. However, *C. luzulaifolia* has a very distinctive and winged fruit.

Section *Filifoliae*

C. elynoides -- Similar to *C. filifolia* and difficult to distinguish from it; sometimes confused with *C. nardina* as well (Hitchcock et al. 1969).

C. filifolia -- Some botanists recognize two varieties of *C. filifolia* (e.g. Mastrogiuseppe 1993). The distinctions between the two varieties do not appear to hold in our area (B. Wilson, pers. obs.), and Cronquist (1977) cites a specimen from Lake County, Oregon that combines characters of the two varieties. The range of the more southern *C. filifolia* var. *erostrata* overlaps with that of the more widespread *C. filifolia* var. *filifolia* in the Great Basin in the southwestern portion of the EEMP area. Only minor features separate *Carex filifolia* from *C. nardina*.

Section *Hirtae*

C. lasiocarpa -- The taxonomic distinctions between *C. lasiocarpa* and *C. pellita* (see below) involve vegetative characters and habitat differences that result in reciprocal misidentifications. The morphological differences coincide with differences in allozyme frequency and chromosome number (McClintock and Waterway 1994), supporting a concept of two close but distinct species.

C. pellita -- This species is familiar to botanists as *C. lanuginosa*. However, the type of *C. lanuginosa* Michx. is actually an immature *C. lasiocarpa*, making *C. lanuginosa* a synonym of *C. lasiocarpa* and requiring the use of the next legal name in line: *C. pellita* (A. A. Reznicek, pers. comm.). Those are the rules.

Section *Montanae*

C. brainerdii -- Reciprocally misidentified with *C. rossii* s. l., these species are hard to identify on the herbarium sheet but distinct in the field.

C. inops -- We followed Crins and Ball (1983) in calling our most western taxon *C. inops* ssp. *inops*. It is often called *C. pensylvanica* var. *vespertina*, (e.g., Hitchcock et al. 1969). The distinctions between the *C. inops* subspecies, *C. pensylvanica*, and *C. leucorum* are weak. Specimens of the high plains subspecies (*C. inops* ssp. *heliophila*) were reported from westernmost Wyoming and Montana (Dorn 1992, Lackschewitz 1991).

C. pensylvanica -- See *C. inops*.

C. rossii -- The often-dominant species recognized as *C. rossii* by Hitchcock et al. (1969) includes two forms, *C. rossii* and what can be recognized as *C. brevipes* (= *C. deflexa* var. *boottii*) of the Sierra-Cascade axis (Hitchcock et al. 1969). The entire *C. deflexa* complex needs research (A. A. Reznicek pers. comm.).

Section *Phyllostachys*

C. backii -- Pacific Northwest plants can be considered conspecific with eastern *C. backii* (Hitchcock et al. 1969). Alternatively, western plants can be considered a distinct variety or even species, *C. saximontana* (Catling, Reznicek, & Crins 1993).

C. saximontana -- See *C. backii*.

Section *Scirpinae*

C. scirpoidea -- Taxonomic problems with the varieties exist. *Carex scirpoidea* var. *stenochlaena* can be considered a synonym of var. *scirpoidea* (Kartesz 1994a,b). The species is also close to the Klamath Mountains endemic *Carex gigas* (including *C. scabriuscula*).

Section *Vesicariae*

C. rostrata -- A circumboreal plant rare in the study area in northwestern Montana and northeastern Washington (Reznicek and Catling 1985). Can be considered conspecific with *C. utriculata* (as in Hitchcock et al. 1969, Cronquist et al. 1977, but not Mastrogiuseppe 1993). See *C. utriculata*.

C. saxatilis -- This complex is sometimes divided into three or more taxa in North America, but the variation is largely clinal, and recognition of a single species is appropriate (Ford and Ball 1992).

C. utriculata -- Circumboreal plants with papillae on the leaves are *C. rostrata*. A strictly North American form (*C. utriculata*) lacks papillae but is otherwise very similar (Reznicek pers. comm.). In addition, *C. rostrata* has perigynia that differ in shape somewhat from those of *C. utriculata*, the foliage has a bluish waxy color, and the habitat is more specialized. If the two forms are considered conspecific, the non-papillate form is often called *C. rostrata* var. *utriculata*; however, this name is invalid (Hitchcock et al. 1969). Virtually all the *Carex* literature is now confused in the application of these names. In the Pacific Northwest *C. utriculata* is a common wetland species, whereas the boreal *C. rostrata* is a rare plant of peatlands.

C. vesicaria var. *major* -- sometimes called *C. exsiccata*. This species is primarily found west of the Cascade crest, but occasionally occurs east of, but near the Cascades. Sometimes reciprocally misidentified with *C. retrorsa*, but closer to *C. utriculata*. Typical var. *vesicaria* grades into var. *major* in the Cascades.

SUBGENUS VIGNEA

Section *Arenariae*

C. siccata -- There has apparently been nomenclatural confusion with *C. foenea* which is a member of the Section Ovales (A. A. Reznicek pers. comm.). *Carex siccata* was called *C. foenea* in Hermann (1970), and Voss (1970).

Section *Bracteosae*

C. occidentalis -- Closely related and similar to allopatric *C. tumulicola* (Cronquist et al. 1977), this species sometimes confused with immature *C. vallicola*.

Section *Deweyanae*

C. deweyana -- A variable species. Attempts to name the variants of *Carex deweyana* (e.g., Calder & Taylor 1968) are controversial. Some authors recognize three taxa: *C. deweyana* (northeastern U.S.), and *C. leptopoda* and *C. bolanderi* (western U.S.). According to R. Naczi (pers. comm.) the western taxa are purported to be sympatric but separated by habitat, but his studies are not completed. Mastrogiuseppe (1993) recognized *C. bolanderi* and *C. deweyana* ssp. *leptopoda* in California. She believes that it might be appropriate to reduce *C. bolanderi* to a subspecies of *C. deweyana* because she has seen many intermediate plants (pers. comm.). She did not use this combination in the California flora because it has not been published at the rank of subspecies. As varieties these taxa are *C. deweyana* var. *bolanderi* and *C. deweyana* var. *leptopoda*. Hitchcock & Cronquist (1973) recognized all western plants as *C. deweyana* var. *leptopoda*, as has been done in this report. Most collections have not been critically examined, and thus are mapped as one entity.

Section *Foetidae*

C. foetida -- See *C. vernacula*.

C. incurviformis var. *danaensis* -- Minor differences separate this from the typical variety (Stacey 1939, Hermann 1955). Although some authors treat all the *C. incurviformis* taxa as synonyms under the circum-arctic C. maritima (Hulten 1968), we followed Mastrogiuseppe (1993) and Kartesz (1994a,b) and distinguished the two varieties of *C. incurviformis*.

C. vernacula -- Minor differences separate *C. foetida* s.str. (of Europe) and *C. vernacula* (= *C. foetida* var. *vernacula* of western U.S.).

Section *Heleonastes*

The taxonomy and keys separating *C. bipartita, C. brunnescens, C. canescens*, and *C. praeceptorum* need revision (Hitchcock et al. 1969).

C. bipartita -- The name *C. bipartita* will probably yield to *C. lachenalii* in the treatment of the genus in the Flora North America (Reznicek, pers. comm.).

C. brunnescens -- Many false reports of this species occur based on *C. laeviculmis* (B. Wilson, pers. obs.). In the past, *C. laeviculmis* has been put in this section or in the Stellulatae, but it is now placed in the Deweyanae and is not as similar to *C.*

brunnescens as sometimes stated (e.g., Hitchcock et al. 1969).

Section *Inflatae*

C. breweri -- Although the morphological extremes of the two varieties (*C. breweri* var. *breweri* and *C. breweri* var. *paddoensis*) are distinct, they overlap in our area. Classifying intermediates is difficult. See discussion in Hitchcock et al. (1969).

Section *Multiflorae*

C. densa -- This species is found west of the Cascade Range, closely resembles *C. vulpinoidea*, and might be considered a variety of that species (Hitchcock et al. 1969). Some *C. densa* specimens collected east of the Cascades have been checked and are *C. vulpinoidea* (Mastrogiuseppe, pers. comm.) The remaining eastside *C. densa* collections also should be checked.

Section *Nardinae*

C. nardina -- This taxon is similar to and reciprocally misidentified with *C. elynoides* (Hitchcock et al. 1969) and *C. filifolia* (B. Wilson, pers. obs.). The distinctions between these three taxa are weak. Varieties of *C. filifolia* are sometimes elevated to species rank (Cronquist et al. 1977), further confusing the situation. Mixed collections of *C. nardina* and *C. filifolia* from an alpine site in the Wallowa Mountains (specimen at OSC) may indicate this would be a valuable population to study for further definition of this complex.

Section *Ovales*

Virtually all the members of this section can be reciprocally misidentified with all the other members, and probably are. In addition, these species are reciprocally misidentified with *C. hoodii*, *C. jonesii*, *C. nervina*, *C. neurophora*, *C. tumulicola*, *C. vernacula*, and occasionally with less similar species. This is the most difficult group in *Carex*. Recent research has only attacked a small portion of the problems (e.g., Whitkus 1981; 1988a,b; 1991; 1992; Whitkus & Packer 1984).

Only taxa involved in taxonomic controversy are discussed below. However, even the taxonomically distinct species (*C. feta, C. fracta, C. phaeocephala, C. scoparia, C. straminiformis*, and *C. sychnocephala*) are often misidentified. Extreme caution should be used in interpreting distribution maps of all species in this group, because herbarium identifications were not verified.

C. abrupta -- A member of the difficult *C. macloviana* complex (see below). A segregate of controversial taxonomic status from *C. pachystachya*. According to R. Whitkus *C. abrupta* is most easily confused with *C. mariposana* due to the similarity of the perigynium (Mastrogiuseppe, pers. comm.).

C. aenea -- The name *C. aenea* will probably yield to *C. foenea* in the treatment of the genus for the Flora North America (Reznicek, pers. comm.). Also see C. *praticola*.

C. arapahoensis -- Considered unworthy of recognition by the US Fish and Wildlife Service (3B candidate). Dorn (1992) lumps it in *C. macloviana*. *C. arapahoensis* is accepted as a species by Cronquist et al. (1977) and Welsh (1987), following Hermann (1970 p.184).

C. athrostachya -- Very similar to *C. unilateralis*, with possible intermediates.

C. bebbii -- Part of a complex that includes *C. tenera*, with which it is sometimes confused. See discussion in Hitchcock et al. (1969). Recently studied by Zager (1991).

C. brevior -- In the northwest portion of our area, but frequently reported elsewhere (usually based on *C. straminiformis*). *C. brevior* is more closely related to *C. bebbii* (see above) and *C. tenera*.

C. constanceana -- Hitchcock et al. (1969) lumped this with *C. petasata*. Mastrogiuseppe (pers. comm.) is considering restoring it to species rank for the Flora of North America (in prep.). Named by Stacey in 1938 and similar to the Californian endemic *C. davyi* (Mastrogiuseppe 1993 and pers. comm.).

C. crawfordii -- A slender-fruited species confused with immature specimens of numerous Ovales species. Mature plants are distinctive, though most similar to *C. scoparia* (Hermann 1970, Hitchcock et al. 1969).

C. ebenea -- A member of the difficult *C. macloviana* complex (see below). Similar to *C. microptera* (Hitchcock et al. 1969).

C. egglestonii -- Closest to *C. straminiformis* and *C. xerantica* (Cronquist et al. 1977).

C. haydeniana -- A member of the difficult *C. macloviana* complex (see below). An alpine form similar to and perhaps conspecific with *C. microptera* (Hitchcock et al. 1969). However, Mastrogiuseppe (pers. comm.) considers *C. haydeniana* to be distinct from *C. microptera*.

C. illota -- See *C. integra*.

C. integra -- Although this taxon may have originated as a hybrid involving *C. illota* (Hitchcock et al. 1969), it is distinct from its parent species.

C. leporina -- The Linnaean type does not belong in the section *Ovales*, according to A. A. Reznicek (pers. comm.). The local species called *C. leporina* (or *C. tracyi*) is *C. ovalis* (see below).

C. macloviana -- Originally described from the Falkland Islands, this species is superficially similar to virtually all the project area species in section *Ovales* with the spikes crowded into a single dense head. Broadly defined, this species could include the entire subsection Festivae (as it occurs in our area) except *C. illota*, *C. integra*, and *C. proposita*. (That is, *C. macloviana* could include *C. abrupta, C. arapahoensis, C. ebenea, C. haydeniana, C. mariposana, C. pachystachya, C. preslii, C. stenoptila*, and *C. subfusca*; Hitchcock et al. 1969). The status of *C. macloviana* is under review at this time, as is the taxonomic status of the entire complex (A. C. Yen at WTU; see also Whitkus & Packer 1984, Whitkus 1988, 1991, 1992). When recognizing all the segregate species, most authors have considered *C. macloviana* s. str. to be limited to high latitudes, north of the EEMP boundaries.

C. mariposana -- A rare member of the difficult *C. macloviana* complex (see above). We could find no specimen of this taxon collected in our region. Hermann (1970) reported *C. mariposana* from Custer Co., Idaho. Mastrogiuseppe notes it is similar to *C. abrupta*. Whitkus (1988) cites a *C. abrupta* specimen from Custer Co., Idaho, but no *C. mariposana* specimen from anywhere in Idaho; presumably the "*C. mariposana*" specimen was a misidentified *C. abrupta* (Mastrogiuseppe pers. comm.).

C. microptera -- A common member of the difficult *C. macloviana* complex (see above). Specimens of many other species are misidentified as *C. microptera*, but that does not change the mapped range of this widespread species. Dorn (1988, 1992) continues to recognize *C. limnophila*, as a variety of *C. microptera*. Most botanists lump it with *C. microptera*, following Whitkus and Packer (1984). Older works (e.g., Peck 1961, Ireland 1968) recognized *C. festivella*, which Whitkus and Packer (1984) also sank into *C. microptera*.

C. microptera var. *crassinerva* -- This taxon is now lumped into *C. microptera*, even by Kartesz (1994a,b) and the US Fish and Wildlife Service (3B candidate).

C. microptera var. *limnophila* -- This taxon is now lumped into *C. microptera* (Whitkus and Packer 1984, followed by Kartesz 1994a,b); only Dorn (1992) disagrees.

C. ovalis -- An Old World weedy species (Hitchcock et al. 1969) that can be considered conspecific with the New World *C. tracyi*, although this interpretation remains controversial on nomenclatural and ecological grounds (Reznicek, pers. comm.). A careful review combining morphological and chemical evidence is needed. (Long known, incorrectly, as *C. leporina*.)

C. pachystachya -- A common member of the difficult *C. macloviana* complex (see above), this widespread taxon is a receptacle for misidentifications. It can be considered *C. macloviana* subsp. *pachystachya* (Hulten 1968).

C. praticola -- This taxon resembles such diverse *Ovales* sedges as *C. aenea, C. leporinella, C. ovalis, C. petasata,* and *C. phaeocephala* (Cronquist et al.

1977).

C. preslii -- A member of the difficult *C. macloviana* complex (see above). Most similar to *C. pachystachya* (Hulten 1968).

C. stenoptila -- A member of the difficult C. macloviana complex (see above). It apparently hybridizes with *C. microptera* (Hermann 1970).

C. subfusca -- A member of the difficult *C. macloviana* complex (see above). Similar to *C. pachystachya* (Hitchcock et al. 1969).

C. tenera -- A member of a largely sympatric complex of similar taxa that reaches the project area in NW Montana (Hitchcock et al. 1969). Available keys make it surprisingly easy to misidentify other *Ovales* as *C. tenera*. See *C. bebbii*.

C. tincta -- Reported recently from three counties in Montana (Heidel 1994), including the fringe of the EEMP area, this taxon is otherwise believed to be a rare midwestern and eastern species. Gleason and Cronquist (1991) suggest it is a hybrid between *C. normalis* and *C. foenea*. B. Wilson and J. Mastrogiuseppe, following many authors, feel strongly that whatever *C. tincta* is, it is not found in the western U.S.

C. tribuloides -- An eastern species that reaches Minnesota and Nebraska (Gleason & Cronquist 1991; Reznicek 1993), *C. tribuloides* is not listed as occurring within our range by Hitchcock et al. (1969) or Hermann (1970). *Carex bebbii* was originally described as *C. tribuloides* var. *bebbii* (Cronquist et al. 1977).

C. unilateralis -- Closely related to *C. athrostachya*.

Section *Stellulatae*

C. echinata -- All North American citations of *C. muricata*, an Old World taxon, refer to *C. echinata* (Reznicek and Ball 1980, contra Hitchcock et al. 1969). This taxon is often confused with the much less common *C. interior*.

Section *Vulpinae*

C. jonesii -- There are three species in this complex: *C. jonesii, C. neurophora*, and *C. nervina*. Mastrogiuseppe (1993, and pers. comm.) and Cronquist et al. (1977) feel that *C. jonesii* and *C. nervina* are close but distinct species, despite intergradation between the two.

Misidentifications.

Misidentified *Carex* specimens are often encountered in herbaria. As noted in the above discussion, certain species in particular are consistently misidentified as another species, or

as one of a small group of species. Appendix 4 lists some common identification errors. Experienced caricologists might chuckle at some of the misidentifications noted in Appendix 4. They are based on our experience with collections at the Oregon State University herbaria. These misidentifications indicate areas of potential uncertainty in the species distribution maps which are based on collections for which the species identifications were not critically examined and verified. In addition, several of the radically disjunct records are suspicious and their identifications should be checked. These include *Carex conjuncta*, *C. macloviana* (Klickitat County, Washington), *C. tincta* and *C. tribuloides* (Reznicek, pers. comm.).

Distribution

Centers of diversity.

County distribution maps for the *Carex* taxa within the EEMP area are contained in Appendix 2. The distributions of most *Carex* taxa in the project area generally correlate with mountain ranges, because *Carex* is primarily a boreal and montane genus of cool, mesic to wet habitats. Most of the relatively few taxa found in the arid lowlands are associated with wetter habitats. A small number of taxa such as *Carex geyeri* and *C. rossii* are common and widespread in dry to mesic habitats at nearly all elevations.

Total numbers of taxa in each county are summarized in Appendix 5. Table 4 outlines important centers of *Carex* diversity within the project area.

Table 4. Centers of *Carex* diversity.

State(s)	Geographic Area
western Montana; northern and central Idaho	Rocky Mountains along the west slope of the continental divide; Bitterroot Range. The highest county totals for the entire EEMP area are in western Montana in Flathead County (84), Ravalli County (84), Missoula County (81).
western Wyoming	Bitterroot Range; Teton Range; Wyoming Range; Wind River Range
northeastern Oregon	Wallowa Mountains, Blue Mountains
central Washington; central Oregon	East slope of the Cascade Range throughout the EEMP area. The highest *Carex* diversity along the east slope of the Cascades occurs in Klamath County (77) in southern Oregon, and in Okanogan County (71) and Chelan County (69) in northern Washington.
southeastern Oregon; northeastern Nevada	Isolated high mountain ranges in the Great Basin, such as Steens Mountain in Harney County, Oregon and the Jarbridge Mountains in Elko County, Nevada.

Distribution of rare taxa

Of the 159 *Carex* taxa found within the EEMP area, 81 have federal, state, or natural heritage program status in at least some portion of the project area (Appendix 6). Total numbers of rare taxa are summarized by county in Appendix 5. Note that the totals on this map include **all** taxa that are considered rare somewhere in the EEMP area. The count of rare species for a particular county often includes taxa that are not rare in that county, but that are rare elsewhere in the study area.

While some of the species mapped as rare may be relatively common in some portions of the EEMP area, the populations in these areas may become important source populations for replacement of others that go locally extinct. We recognize that it is important to preserve peripheral populations (Hunter and Hutchinson 1994, Lesica and Allendorf, in press).

Many of the rare taxa reach their range limits within the EEMP area but have secure populations elsewhere in their ranges. Not surprisingly, concentrations of rare taxa correlate closely with areas of high diversity in montane to alpine habitats (see Table 4).

There are no federally listed endangered or threatened *Carex* taxa within the EEMP area. One federal candidate (C2), *Carex lenticularis* var. *dolia*, has been documented from Glacier National Park in Flathead County, Montana. This taxon occurs primarily in Canada and Alaska. Hermann (1964) discovered one Flathead County population and named it *C.*

plectocarpa (now a synonym). This population declined radically over the next few years (Hermann 1970). The Montana Natural Heritage Program has documented two populations in Glacier National Park near Logan Pass, all in the same area where Hermann discovered his plants (Lesica 1988). Development of tourist facilities, heavy visitor use, and official and unauthorized hiking trails threaten plants in some of the locations.

Several other *Carex* taxa found in the EEMP area have been considered for Federal listing as threatened or endangered. All of these have been rejected from the active candidate lists (C1 or C2), and are now placed in one of three inactive categories (see Table 5).

Table 5. *Carex* taxa rejected as federal candidates for listing as threatened or endangered.

Taxon	Category	Reason for Rejection
Carex aboriginum	3A	Extinct taxon
C. arapahoensis	3B	Taxonomic problems
C. microptera var. *crassinerva*	3B	Taxonomic problems
C. idahoa	3C	Too common
C. whitneyi	3C	Too common

The Montana Natural Heritage Program (MNHP) is considering recommending to the U.S. Fish and Wildlife Service that *Carex idahoa* be reinstated as a C2 federal candidate. *Carex idahoa* has been documented in Idaho and Montana. The MNHP considers this taxon to be *Carex parryana* ssp. *idahoa*. In Idaho the taxon is known only from historical populations in Bannock, Bonneville and Clark counties (CDC 1994). No extant populations have been documented from Idaho, although recent surveys for the species apparently have not been conducted and are needed (Moseley and Lesica, pers. comm.). There are 14 known extant populations in Montana where the taxon is ranked by the Montana Natural Heritage Program (MNHP) as S2, threatened or endangered in the state (Lesica and Shelley 1991). According to the MNHP, the Montana populations are very close to, but just outside of the EEMP boundary (Heidel, pers. comm.) in Silver Bow and Beaverhead counties. They are located on Bureau of Land Management, Forest Service, and private lands. Population sizes are small, and some are grazed. The grazed populations appear to be in decline (Heidel, pers. comm.). Hermann (1970) reports that the plant is very palatable to livestock and is a decreaser under grazing.

Endemism

Regional endemics are noted in Appendix 6. Three narrowly endemic taxa were documented within the EEMP study area: *Carex aboriginum* (presumed extinct), *Carex idahoa* (extant in Montana, historical records in Idaho), and *Carex luzulina* var. *atropurpurea* (extant in Idaho, Montana and Wyoming). *Carex constanceana*, a species not recognized by Hitchcock et al.

(1969), would be a fourth endemic if accepted in the *Carex* treatment of the upcoming Flora of North America. At present, the author of that portion of the *Carex* treatment for the Flora of North America believes it is probably valid taxon (Mastrogiuseppe, pers. comm.). It is known only from a series of collections made by Suksdorf circa 1909-1915 on Mt. Adams in Yakima County, Washington.

There is no documented overlap of the ranges of these narrow endemics within the EEMP area, although the ranges of *Carex idahoa* and *Carex luzulina* var. *atropurpurea* approach each other in western Montana and near the Idaho-Wyoming boundary. Except for this rather loose concentration of two regional endemics in the Rocky Mountains, there are no centers of endemism for *Carex* within the study area. Presumably this is due to Pleistocene glaciation throughout the mountainous habitat of most species in the genus. The entire flora still is adjusting to deglaciation and the subsequent hypsithermal period (Habeck 1988).

A larger study area would show endemism in a broader sense in western North America associated with barriers created by north-south running mountain ranges. Isolated gene pools to the east and west have lead to speciation and distinct vegetation patterns (Barbour and Christensen 1993). The members of the genus *Carex* have diversified on the opposite sides of the crest of the Rocky Mountains; however, some taxa are disputed (e.g., eastern and western representatives of *Carex backii, C. deweyana, C. inops*). Cleaner examples of east-west taxon pairs exist, but in all cases the western species are not confined to the EEMP study area (e.g., *Carex polymorpha* of the northeastern US, and *C. californica* of Idaho, western Oregon and adjacent California). The Cascade Mountains also isolated gene pools, now represented by pairs of similar taxa comprised of endemics to the west and more widespread analog taxa to the east (e.g., *Carex tumulicola/vallicola, C. densa/vulpinoidea, C. echinata* vars., *C. lenticularis* vars., and *C. aquatilis* vars.). These floristic patterns are discussed in Barbour and Billings (1988).

A contrasting distribution pattern of northwestern endemics also occurs in the region, represented by taxa distributed primarily west of the Cascades, but with disjunct, possibly relictual, populations within the EEMP area. Examples include *Carex hendersonii, C. californica, C. vesicaria* var. *major, C. nudata,* and *C. tumulicola* (see Detling 1968). The mountainous areas of central and northern Idaho are important centers for disjunct populations of these taxa. In addition, several other widespread species occur within the EEMP area as disjuncts. Appendix 7 summarizes the occurrence of disjunct taxa within the EEMP area.

Some rare western endemics occur within the study area but are not restricted to it. These include *Carex proposita* of California, Washington and Idaho, and *Carex incurviformis* var. *danaensis* of California, Colorado and Wyoming (Mastrogiuseppe 1993). The distributions of these taxa suggest relictual populations in a post-hypsithermal environment. Mastrogiuseppe (1993) reported a number of other sedges that are endemic to southwestern Oregon, adjacent Nevada and/or California (e.g., *Carex barbarea, C. brainerdii, C. gigas, C. gynodynama, C. mendocinensis, C. nervina, C. serratodens, C. whitneyi*). Several of these Klamath region taxa (i.e. *Carex brainerdii* and *C. whitneyi*) barely enter the southwest

corner of the EEMP area.

There are many California endemics (e.g., *Carex albida, C. congdonii, C. davyi, C. hirtissima, C. lemmonii, C. schottii, C. tahoensis, C. tiogana, C. tompkinsii*; Mastrogiuseppe 1993). California endemics have been discussed by Smith and Sawyer (1988), Kruckeburg and Rabinowitz (1985), and Stebbins and Major (1965). California's high level of endemism suggests that it may have served as a refugium from Pleistocene glaciation. Some post-glacial recolonization northward into the EEMP area by *Carex* may have originated from this southern genetic resource. This underscores the need for regional planning to consider importance of links between habitats and genetic pools on EEMP lands with those of neighboring regions when modeling for climate change or the effects of management activities. In the face of climatic warming, present *Carex* habitats within the EEMP area may become important as cool climate refugia, and the high elevation north-south mountain ranges may provide migration routes for more southern taxa (Grabherr et al. 1994).

Whether "endemic" is defined narrowly (sensu Ratti et al. 1991) or broadly, it is clear that federal lands within the EEMP area, especially Forest Service lands, are critical repositories of habitats for *Carex* taxa because they contain the greatest areas of cool climate, high elevation habitats. These areas likely will be important refugia for members of this mostly boreal and montane group of plants with continued climatic warming. *Carex* habitats within the EEMP area will be important not only for the taxa currently documented to exist there, but also for some that occur in neighboring regions to the south.

Introduced taxa

Carex ovalis is the only non-native sedge currently found within the EEMP area. It occurs in a scattered distribution in Oregon, central Washington, and northern and central Idaho. *Carex ovalis* is common west of the Cascade Range, and is likely to continue to expand its range within the EEMP. *Carex* taxa that have been introduced in the Columbia River Basin outside the EEMP area are in Table 6. Except for *Carex ovalis*, none of the known introduced taxa have persisted. In the eastern U.S. some European *Carex* have persisted as for decades but have shown no tendency to aggressively spread (e.g., *Carex caryophyllea*, see Standley 1992). *Carex praegracilis*, a native species found in the EEMP area, has become a widespread weed on salted roadsides in eastern North America (Reznicek et al. 1976, Brunton and Catling 1982, Cusick 1984, Reznicek and Catling 1987, Reznicek and Oldham 1993).

Table 6. Introduced *Carex* taxa in the Columbia River Basin.

Species	Native To	East or West of Cascades	Status	Notes
C. arenaria	Coastal Europe	West (Multnomah Co., OR)	Historical records, no known extant populations in EEMP study area	Unlikely to spread into EEMP area
C. hirta	Europe	West (Multnomah Co., OR)	Historical records, no known extant populations in EEMP study area	Unlikely to spread into EEMP area
C. kobomugi	Eastern Asia	West (Multnomah Co., OR; Mastrogiuseppe pers. comm.)	Historical records, no known extant populations in EEMP study area (Standley 1983)	Unlikely to spread into EEMP area
C. ovalis (C. leporina)	Europe	East and West	Common west of Cascades, widely scattered east of Cascades	Likely to continue to slowly expand range and population in EEMP area
C. pumila	Eurasia	West (Multnomah Co., OR)	Historical records, no known extant populations in EEMP study area	Unlikely to spread into EEMP area

Important lands

Table 7 shows public and tribal lands in the counties of the EEMP area which have the highest diversity of *Carex* taxa. Included are lands that were identified by natural heritage program databases as known sites of rare, threatened or endangered *Carex* taxa. One to four counties within each state, except Utah, were selected to provide broad geographic representation of the EEMP area. Elko County, Nevada was included despite its somewhat lower diversity because it contains isolated high mountain ranges which function as 'islands' surrounded by the arid Great Basin lowlands. Harney County, Oregon exhibits similar characteristics. The high elevation habitats in these ranges may become important refugia for lower elevation taxa if climatic warming progresses. However, because of isolation from similar habitats elsewhere in the region, some taxa currently found at higher elevations in these mountains may be at risk of local extinction with climate warming.

Table 7. Public and tribal lands in counties with high *Carex* diversity.

DOD = Department of Defense; NF = National Forest; NM = National Monument; NP = National Park; NRA = National Recreation Area; NWR = National Wildlife Refuge; RD = Ranger District

State	County	Total Taxa	Rare Taxa	Public Lands
ID	Bonner	59	28	1. Kaniksu NF (e.g., Priest Lake RD, Bonners Ferry RD, Sandpoint RD) 2. Coeur d'Alene NF
ID	Custer	73	35	1. Challis NF 2. Sawtooth National Forest (e.g., Sawtooth National Recreational Area)
ID	Idaho	69	31	1. Nez Perce NF (e.g., Selway RD, Selway Recreation River Corridor) 2. Clearwater NF (e.g., Lochsa RD, Lochsa RNA, Lochsa Recreational River Corridor, North Fork RD, Aquarius RNA, Pierce RD) 3. Bitterroot NF 4. Nez Perce Indian Reservation 5. Hells Canyon NRA
ID	Lemhi	64	28	1. Salmon NF 2. Challis NF (e.g., Yankee Fork RD) 3. Beaverhead NF 4. Targhee NF (e.g., Island Park RD)
MT	Flathead	84	43	1. Glacier NP 2. Flathead NF (e.g., Swan Lake RD, Swan Lake proposed RNA, Hungry Horse RD, Tally Lake RD, Spotted Bear RD) 3. Kootenai NF 4. Lolo NF
MT	Missoula	81	32	1. Lolo NF (e.g., Missoula RD) 2. Bitterroot NF 3. Flathead NF (see above)
MT	Ravalli	84	38	1. Bitterroot NF (e.g., Selway-Bitterroot Wilderness, Stevensville RD, Darby RD, W. Fork RD) 2. Lolo NF
NV	Elko	41	16	1. Humboldt NF
OR	Deschutes	53	14	1. Deschutes NF (e.g., Newberry Crater NM)
OR	Harney	52	22	1. Ochoco NF 2. Malheur NF 3. Malheur NWR 4. Burns District BLM (e.g., Andrews RA, Steens Mt. Recreation Area)

State	County	Total Taxa	Rare Taxa	Public Lands
OR	Klamath	77	28	1. Winema NF 2. Fremont NF 3. Rogue River NF 4. Crater Lake NP 5. Klamath NWR
OR	Wallowa	71	34	1. Umatilla NF (e.g., Wenaha-Tucannon Wilderness) 2. Wallowa-Whitman NF (e.g., Hells Canyon NRA, Eagle Cap RD, Eagle Cap Wilderness)
WA	Chelan	69	26	1. Wenatchee NF 2. Lake Chelan NRA 3. North Cascades NP
WA	Klickitat	60	22	1. Gifford Pinchot NF 2. Columbia River Gorge National Scenic Area 3. Horsethief Lake State Recreation Area
WA	Okanogon	71	36	1. Yakima Indian Reservation 2. Okanogon NF 3. Conboy Lake NWR 4. Colville Indian Reservation
WA	Yakima	63	22	1. Snoqualmie NF 2. Yakima Indian Reservation 3. Gifford Pinchot NF 4. Toppenish NWR 5. Yakima Firing Range, DOD
WY	Sublette	64	27	1. Bridger-Teton NF
WY	Teton	77	35	1. Bridger-Teton NF 2. Targhee NF 3. Yellowstone NP 4. Grand Teton NP 5. National Elk Refuge

Federal lands, especially Forest Service lands, are crucial repositories of *Carex* diversity because they contain large tracts of higher elevation habitats as well as many special habitats such as bogs and wet meadows. Migration of taxa in response to climate change or other unforseen environmental change will certainly occur elevationally and latitudinally. The major north-south running mountain ranges of the EEMP area provide routes along which northern species may recede and southern species may advance northward.

Large tracts of private lands generally occur only at lower elevations in the region and, therefore, may be less important for providing critical habitats or links between centers of diversity and endemism. No important private ownerships were identified; however, little information is available that could indicate which private lands provide the links that may be important for maintaining diversity. Certainly any lands containing extensive wetlands

and/or riparian corridors should be considered important in the maintenance of a taxonomic group comprising mostly wetland plants.

Issues for Analysis

Issues for analysis in the Eastside Assessment process for the biogeography of the genus *Carex* are summarized in Table 8. Other issues for analysis are outlined in the report on *Carex* ecology (Newhouse et al. 1995).

Table 8. Issues for analysis concerning the biogeography of the genus *Carex*.

Issue	Implications
Global climate change	1. Mountain ranges in the EEMP area will serve as northerly migration routes, both for taxa currently present, and for taxa from more southerly regions. 2. Cool, high elevation habitats will provide refugia for *Carex* taxa. 3. Some taxa of isolated habitats, or which are unable to migrate rapidly enough may become locally extinct.
Management impacts (grazing, forest harvesting, mining, recreation)	1. Distribution of taxa has been, and will continue to be, changed by alterations in habitats resulting from management activities, especially grazing. Rare taxa may be particularly susceptible. For example, *Carex lenticularis* var. *dolia* may be threatened by tourist development and hikers in high meadows; and *Carex idahoa* appears to decline when grazed. 2. Management for maintenance of links between habitats, as well as protection of critical habitats (e.g., peatlands, high elevation meadows, wetlands) could reduce impacts.
Interaction of management activities and climatic warming.	1. If atmospheric warming continues, the resilience of systems that have been stressed by management activities may be exhausted. Habitats could lose the ability to buffer the effects of the climatic changes. (E.g., a harvested dry forest habitat could experience much higher extremes of temperature and drought stress than a similar unharvested habitat. 2. Management activities that alter habitats could cut off suitable routes of migration for some taxa.
Uncertainty	1. The true distribution of *Carex* taxa in the EEMP is only approximated by herbaria records and literature reports. 2. The rate and impacts of climatic warming are unknown. 3. The taxonomic status of some taxa is uncertain and could affect management decisions. (E.g., *Carex luzulina* var. *atropurpurea*)

Research Needs and Unknowns

Research needs regarding the biogeography of *Carex* taxa within the EEMP area include the following topics:

1. Taxonomic problems. See the section on taxonomic problems for a detailed discussion of research needs for *Carex* taxa in the EEMP area. Resolution of taxonomic problems could affect the mapped distribution of some taxa and, particularly with rare taxa, could affect management decisions. Taxonomic research should be coordinated with non-government scientists.

2. Inventory, monitoring and demographic studies of rare species to determine extent of ranges, population trends and effects of both management activities and broad scale environmental changes such as atmospheric warming. These activities should include comparison with taxa that are not currently rare.

3. Effects of climate change on species distribution. This could include modeling species migration patterns, extinction rates and changes in habitat characteristics and availability.

4. Documentation of distribution of *Carex* taxa in the study area, especially in under-collected regions.

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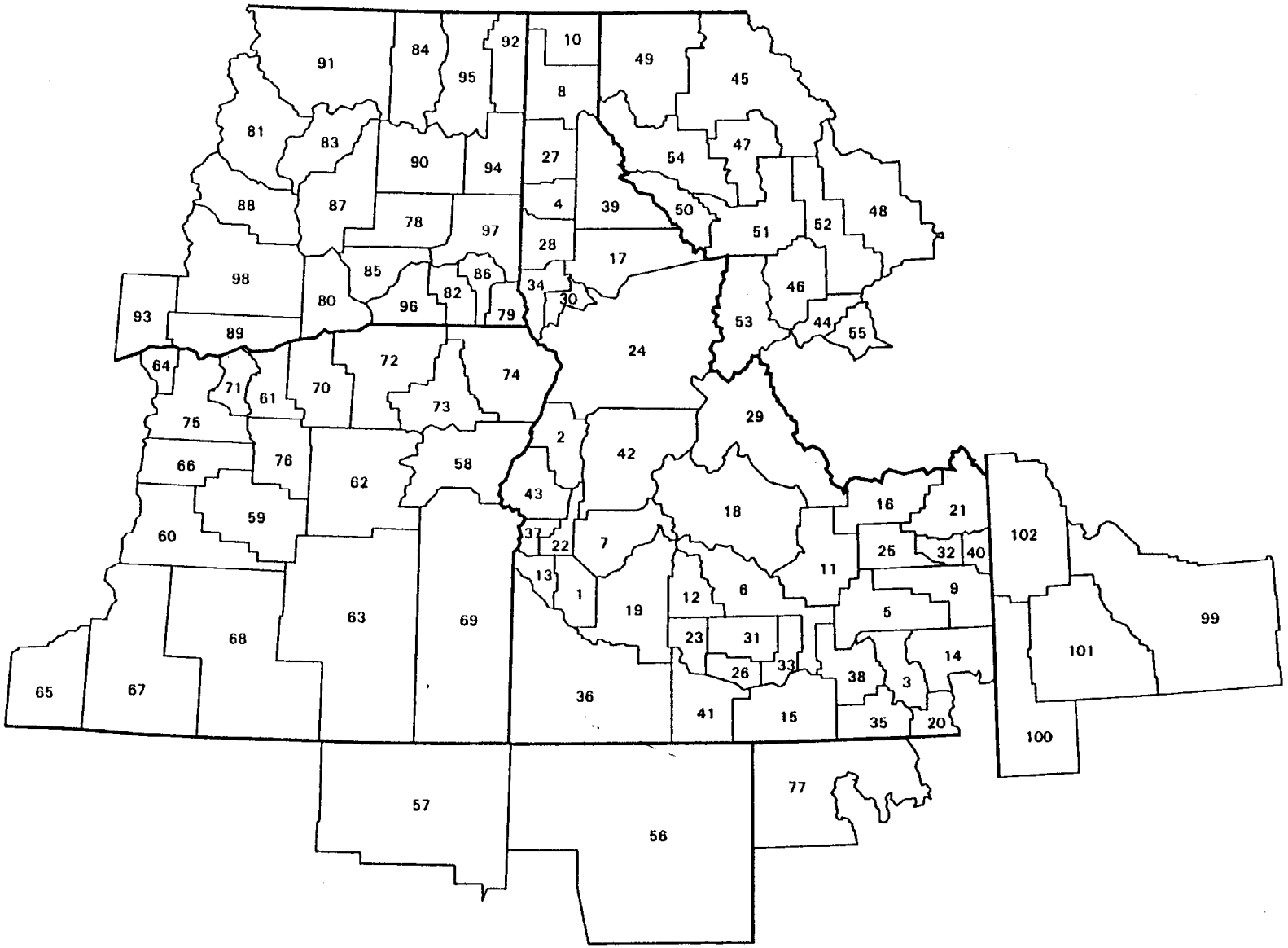
Appendix 1. Key to counties in the study area.

County #	County	County #	County	County #	County
	Idaho	47	Lake	86	Garfield
1	Ada	48	Lewis & Clark	87	Grant
2	Adams	49	Lincoln	88	Kittitas
3	Bannock	50	Mineral	89	Klickitat
4	Benewah	51	Missoula	90	Lincoln
5	Bingham	52	Powell	91	Okanogan
6	Blaine	53	Ravalli	92	Pend Oreille
7	Boise	54	Sanders	93	Skamania
8	Bonner	55	Silver Bow	94	Spokane
9	Bonneville			95	Stevens
10	Boundary		**Nevada**	96	Walla Walla
11	Butte	56	Elko	97	Whitman
12	Camas	57	Humboldt	98	Yakima
13	Canyon				
14	Caribou		**Oregon**		**Wyoming**
15	Cassia	58	Baker	99	Fremont
16	Clark	59	Crook	100	Lincoln
17	Clearwater	60	Deschutes	101	Sublette
18	Custer	61	Gilliam	102	Teton
19	Elmore	62	Grant		
20	Franklin	63	Harney		
21	Fremont	64	Hood River		
22	Gem	65	Jackson		
23	Gooding	66	Jefferson		
24	Idaho	67	Klamath		
25	Jefferson	68	Lake		
26	Jerome	69	Malheur		
27	Kootenai	70	Morrow		
28	Latah	71	Sherman		
29	Lemhi	72	Umatilla		
30	Lewis	73	Union		
31	Lincoln	74	Wallowa		
32	Madison	75	Wasco		
33	Minidoka	76	Wheeler		
34	Nez Perce				
35	Oneida		**Utah**		
36	Owyhee	77	Box Elder		
37	Payette				
38	Power				
39	Shoshone		**Washington**		
40	Teton	78	Adams		
41	Twin Falls	79	Asotin		
42	Valley	80	Benton		
43	Washington	81	Chelan		
		82	Columbia		
	Montana	83	Douglas		
44	Deer Lodge	84	Ferry		
45	Flathead	85	Franklin		
46	Granite				

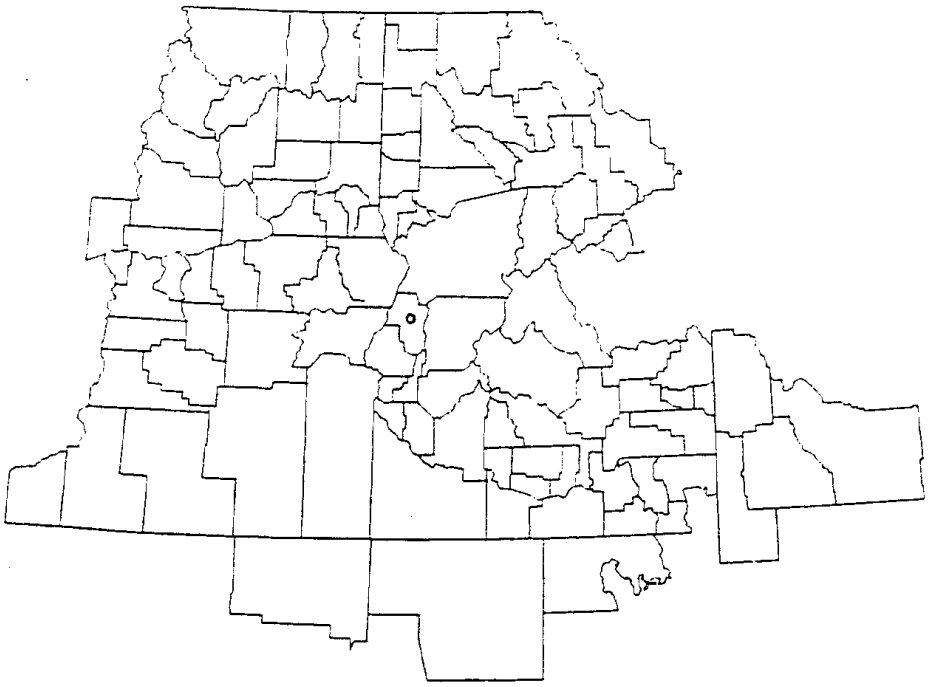
Counties in the EEMP Area

Numbers correspond to county names in the key to county codes on the preceding page



Appendix 2. Distribution maps for *Carex* taxa in the study area.

● = occurrence based on an herbarium voucher
○ = occurrence based on a literature citation



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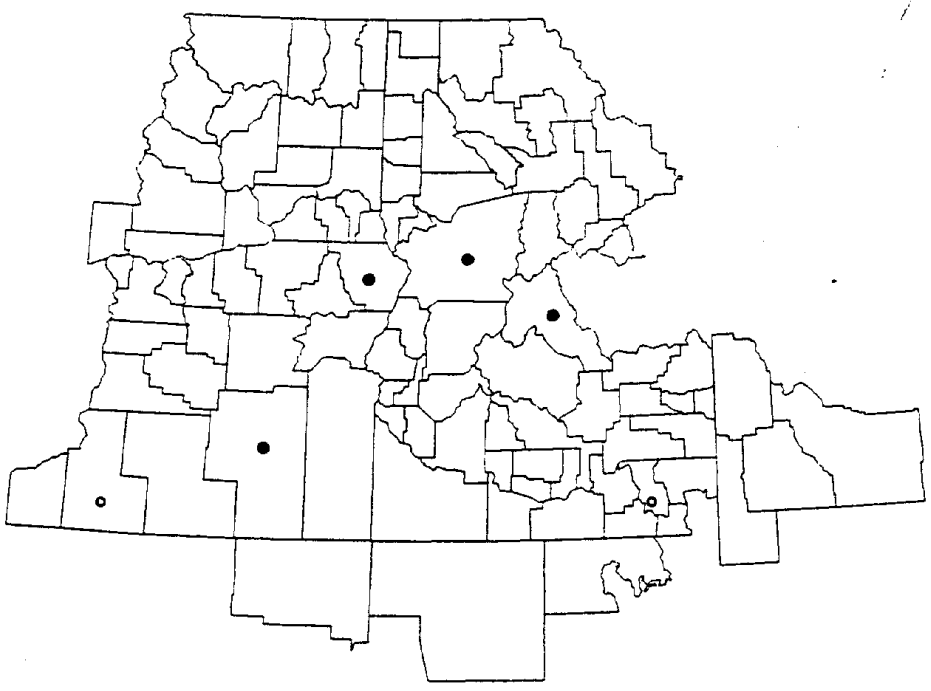

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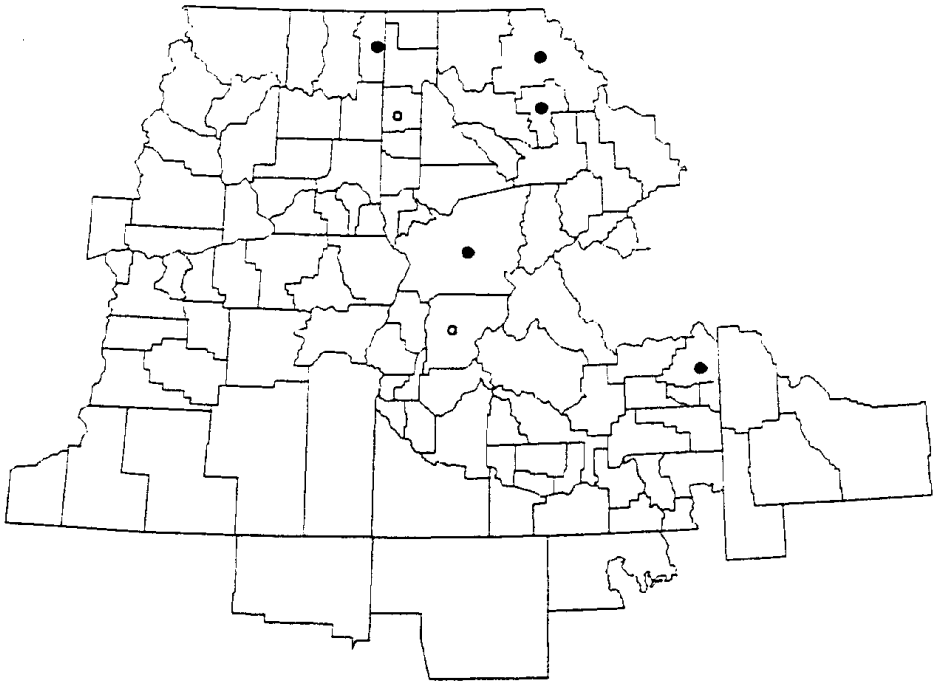

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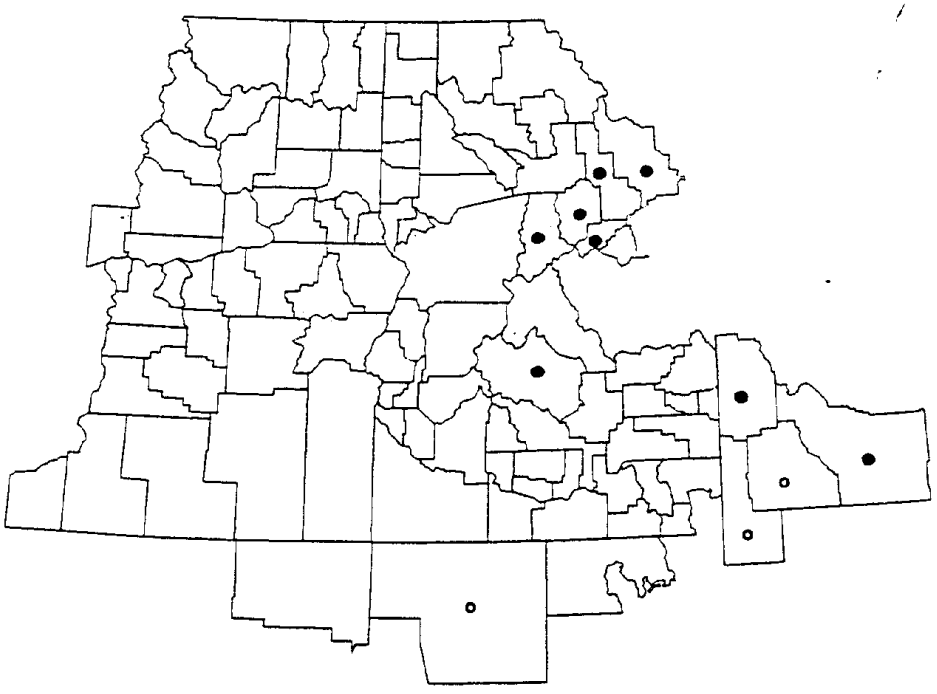

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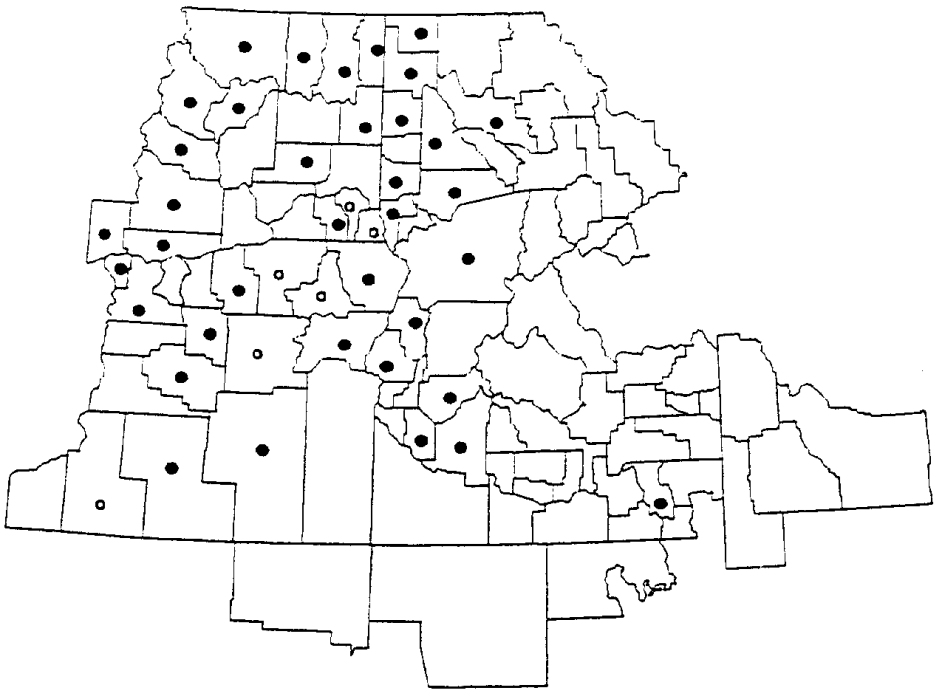

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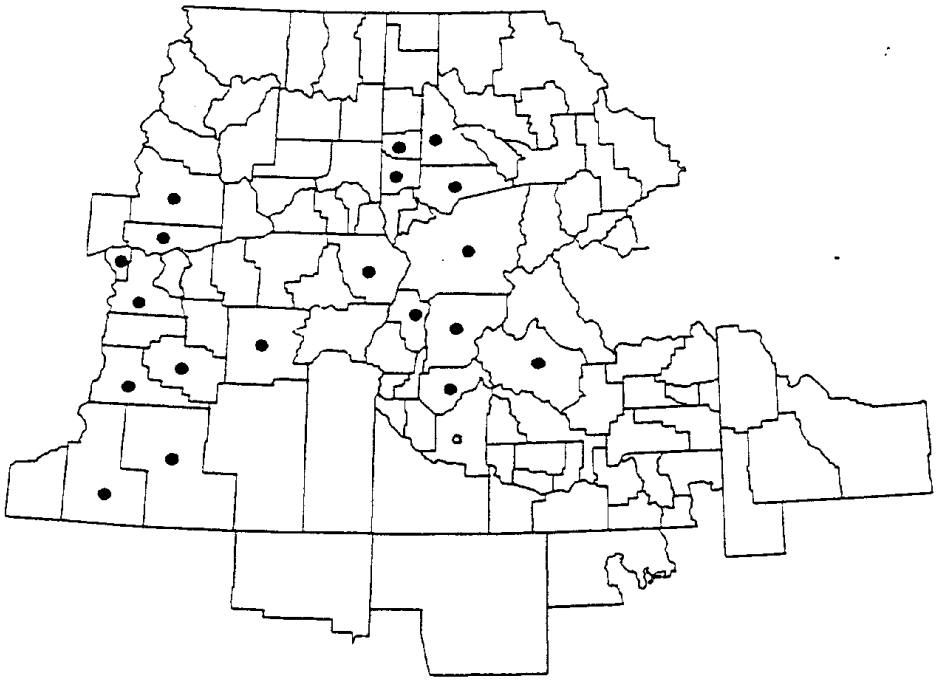

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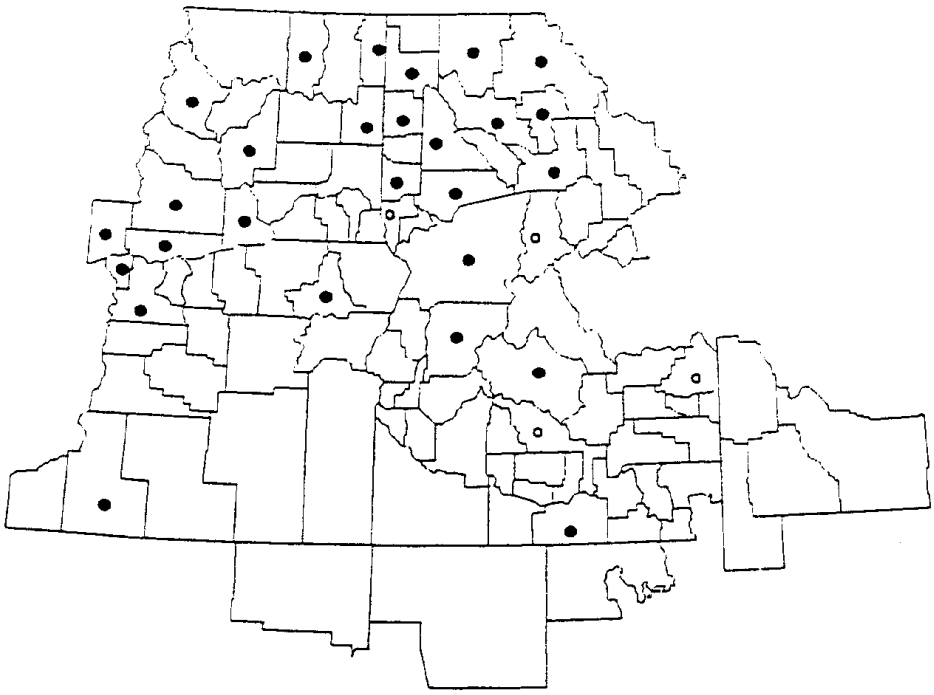

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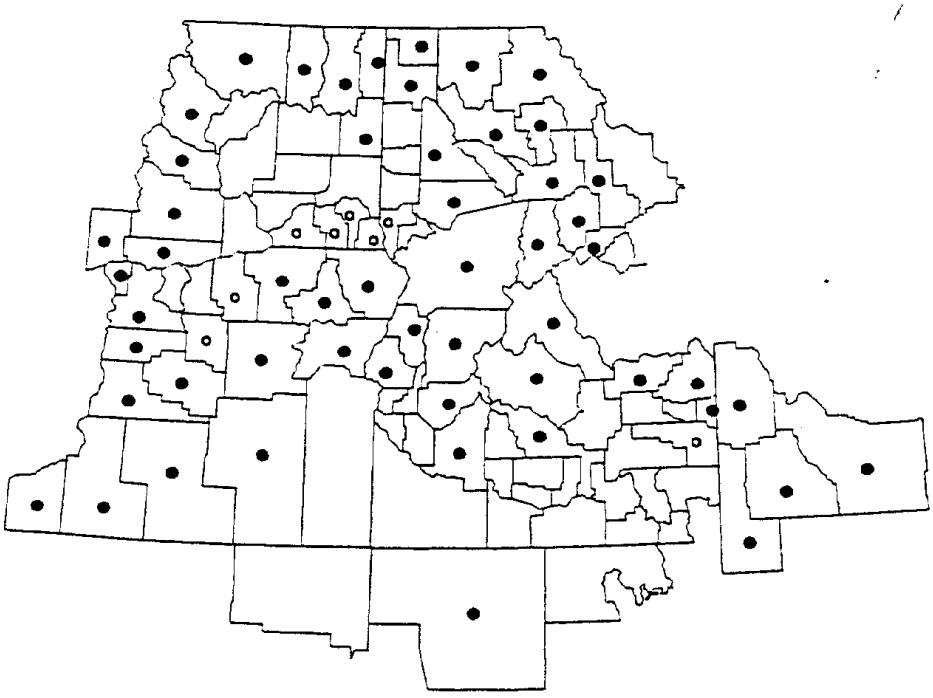

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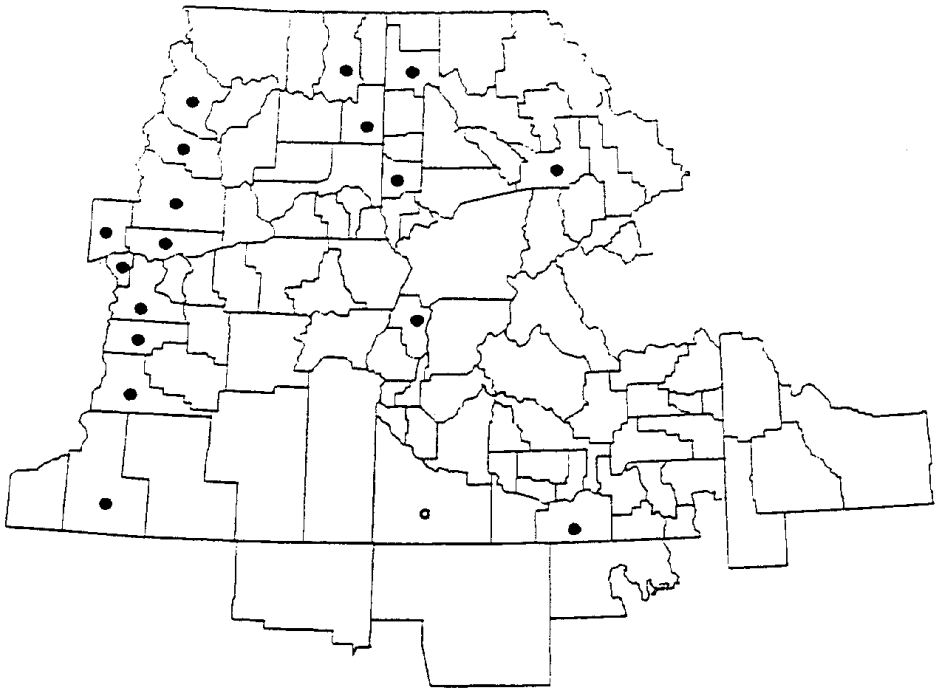

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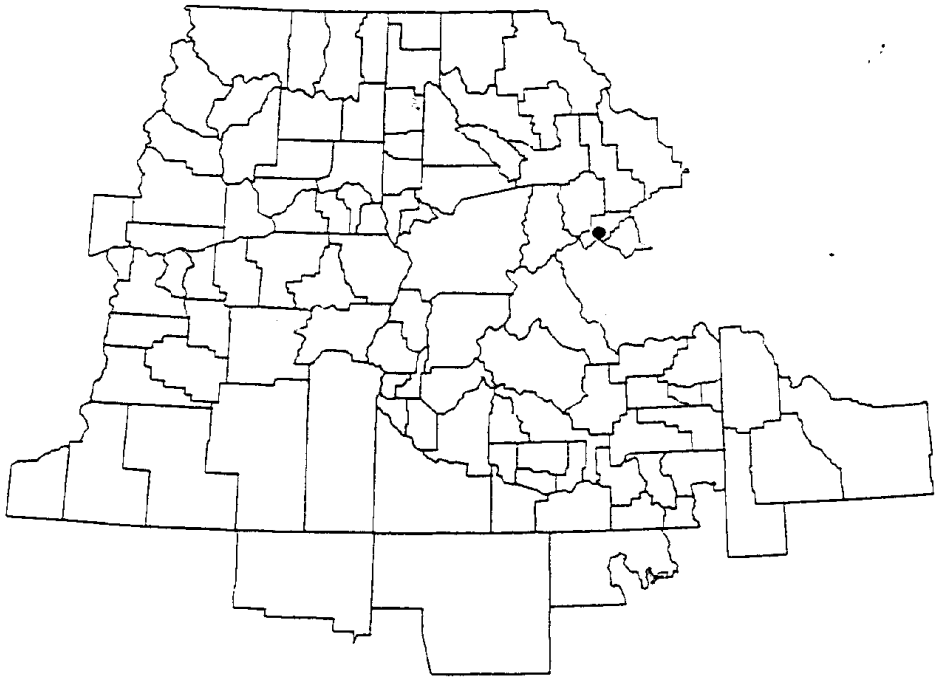

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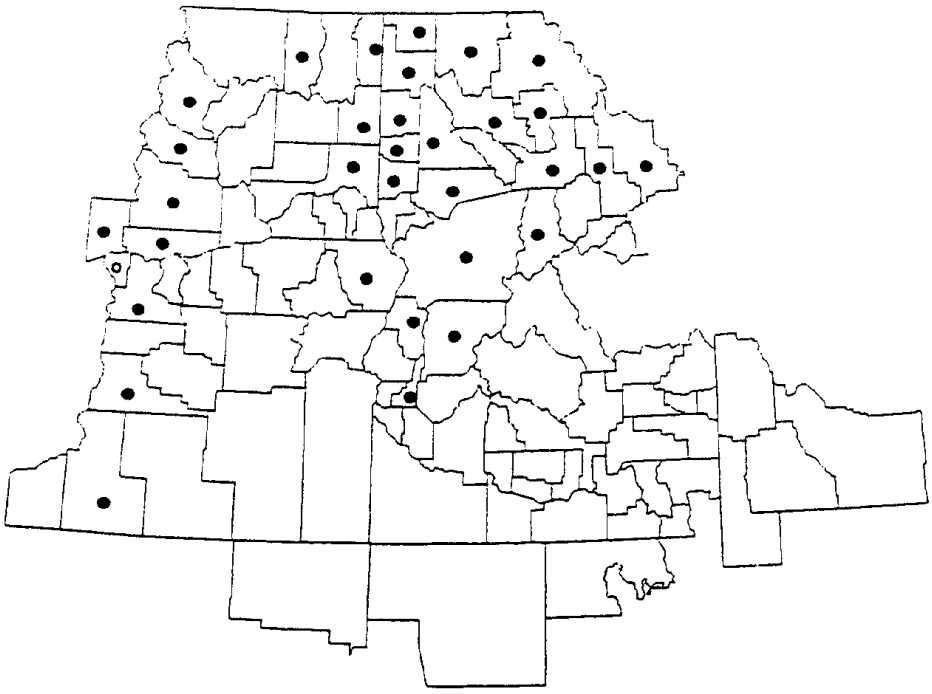

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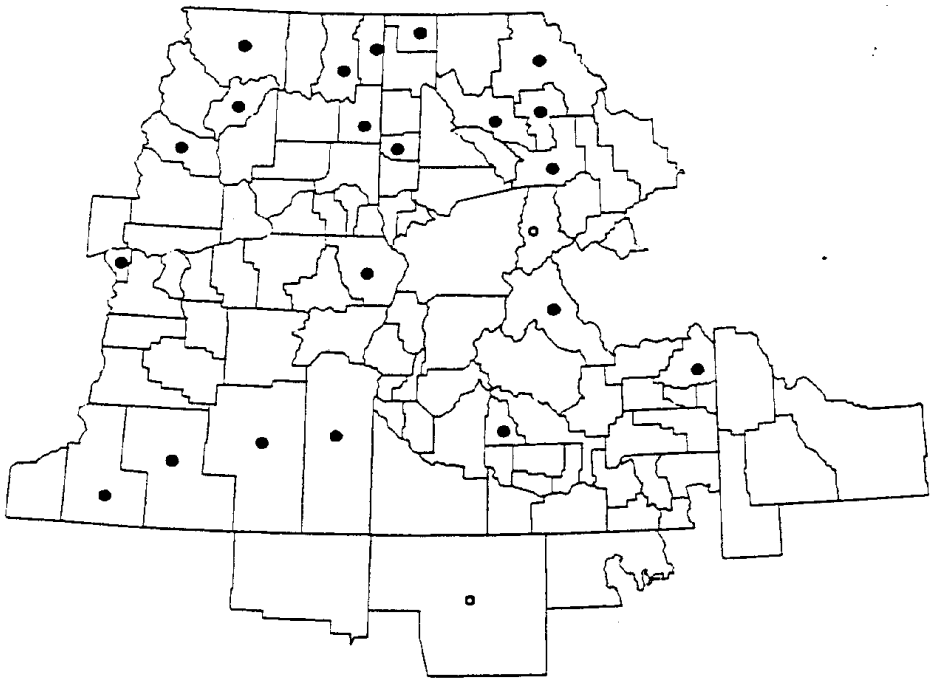

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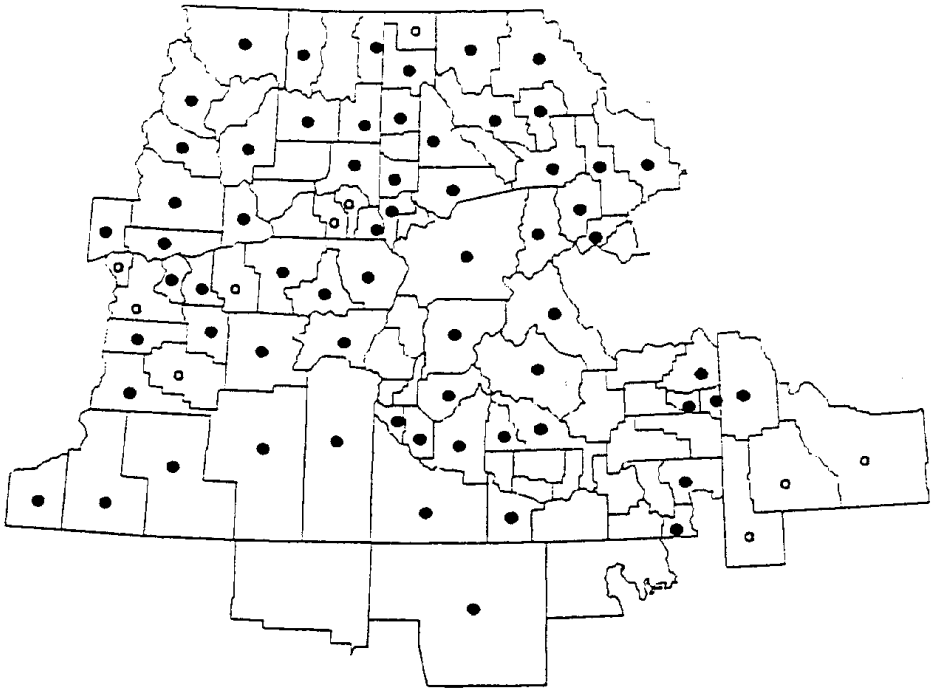

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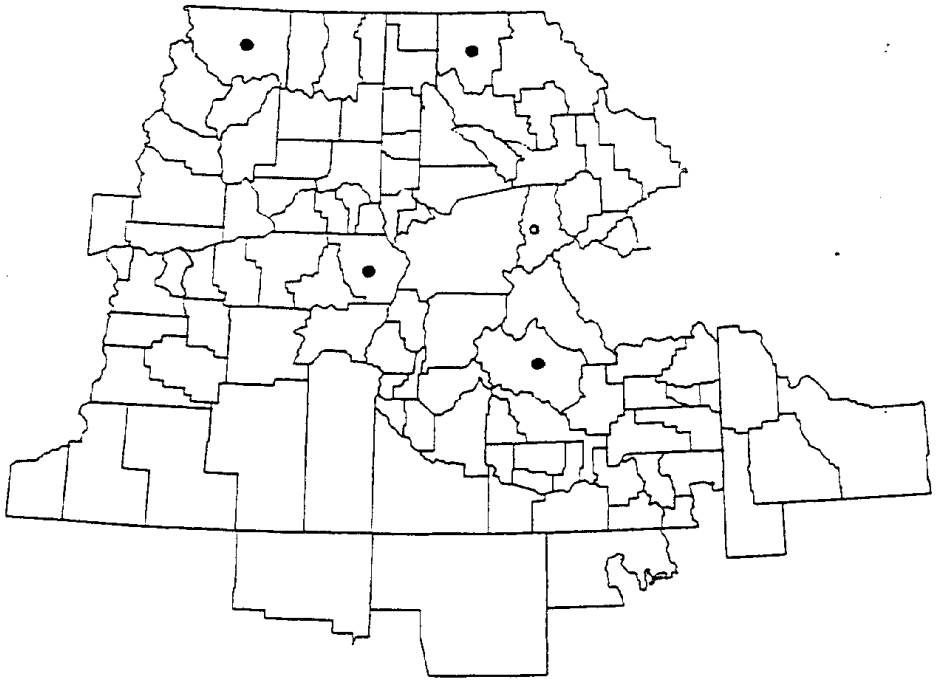

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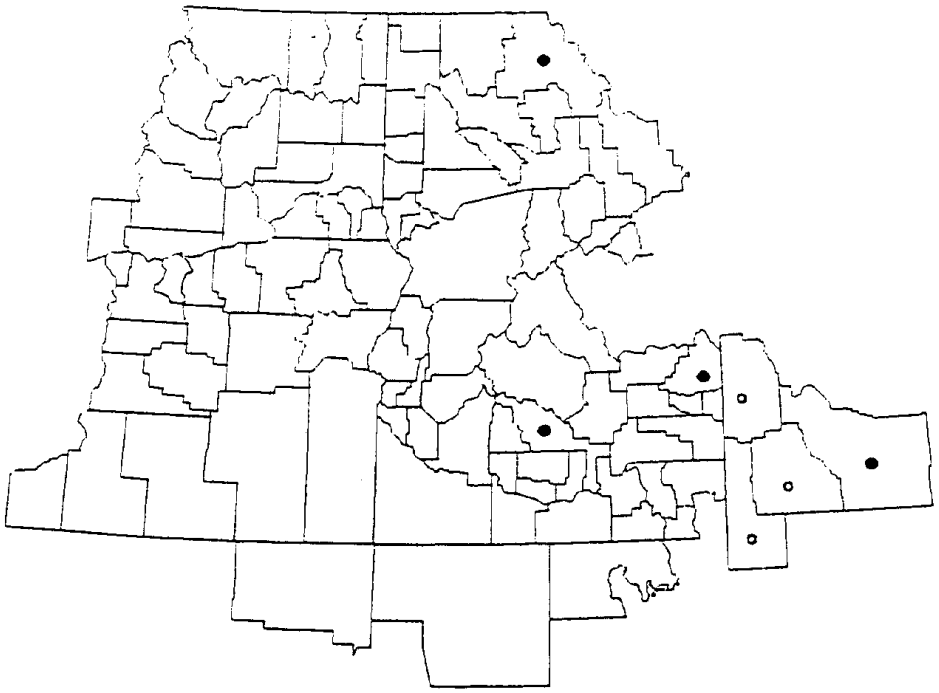
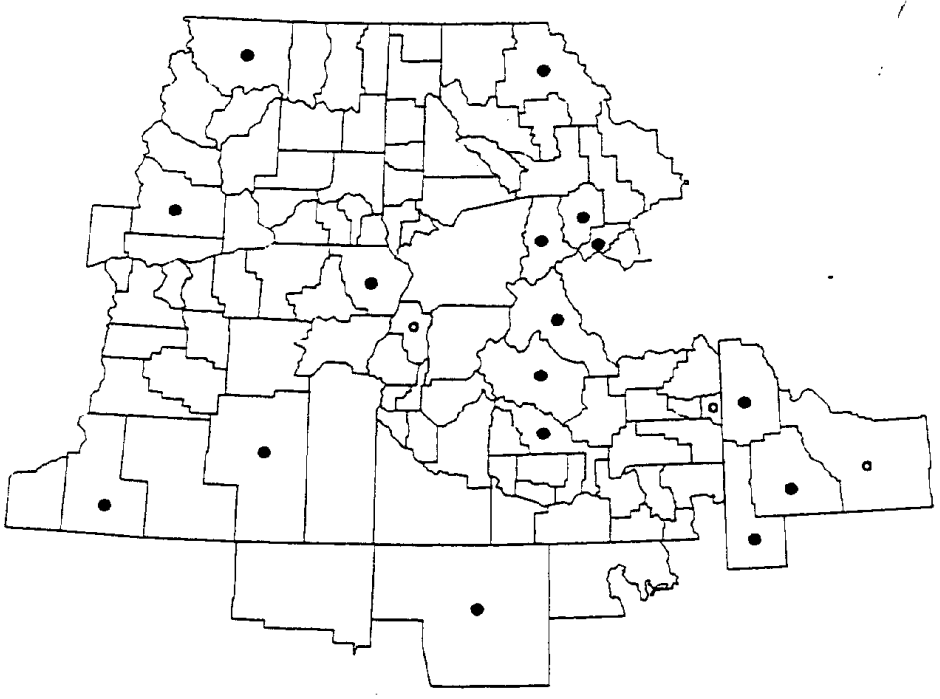


Carex atrata var. chalciolepis



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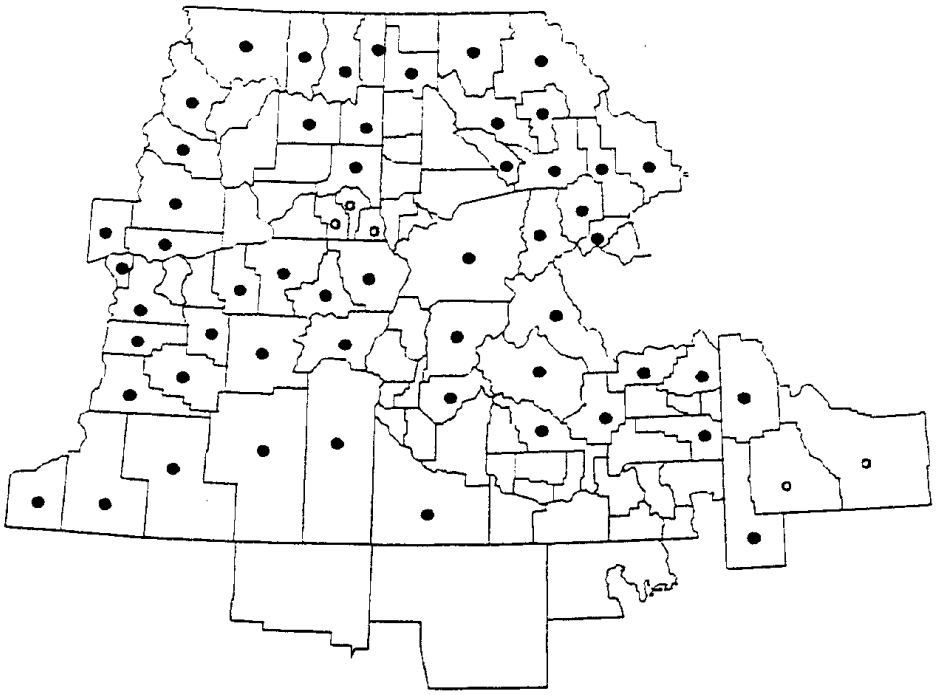
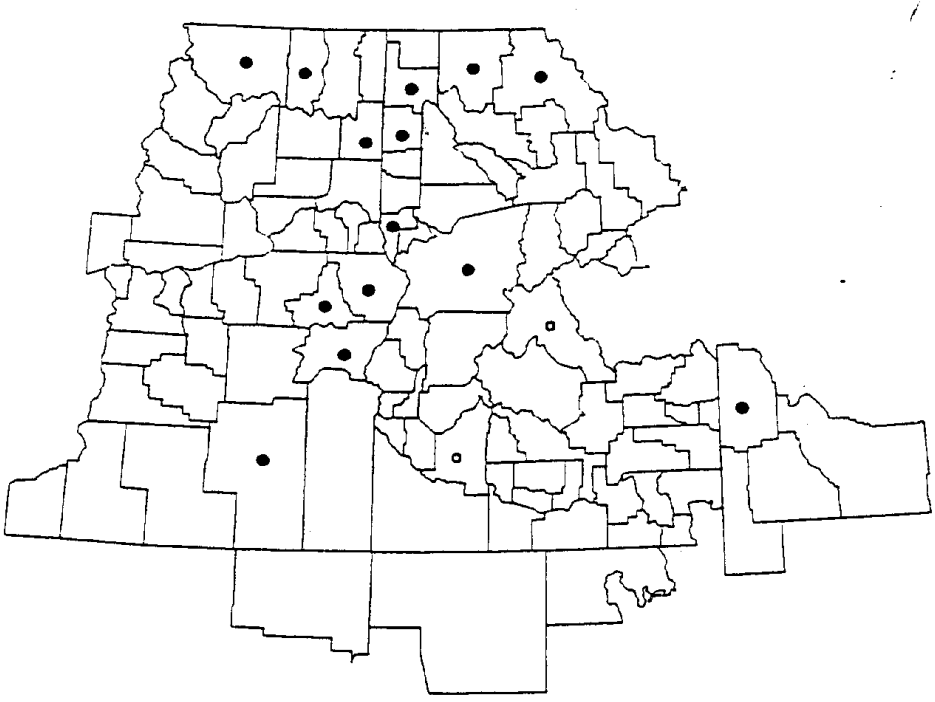
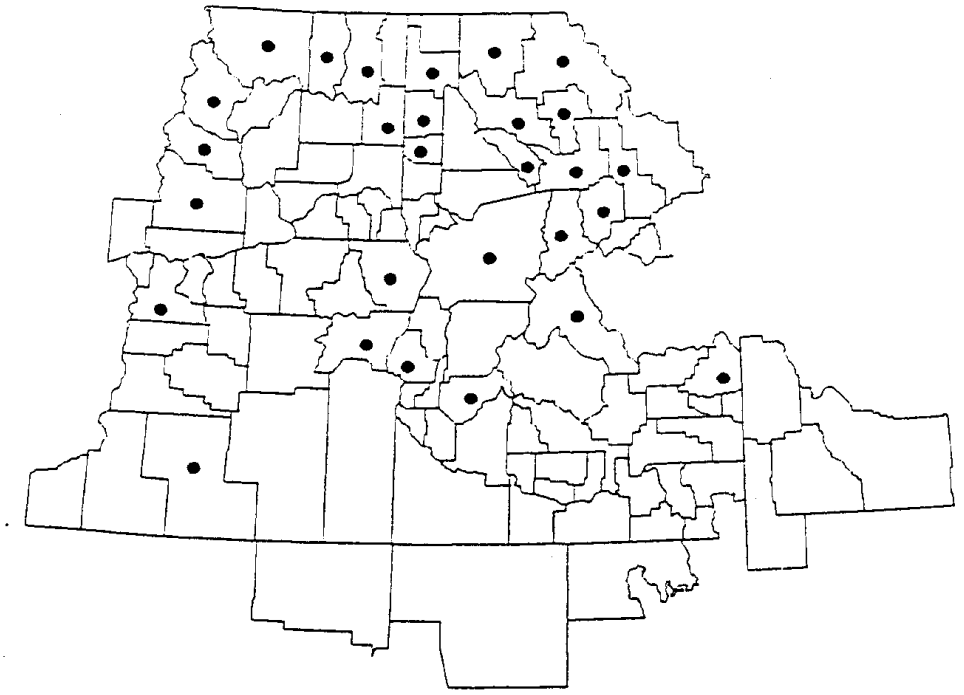


Carex aurea



Carex backii



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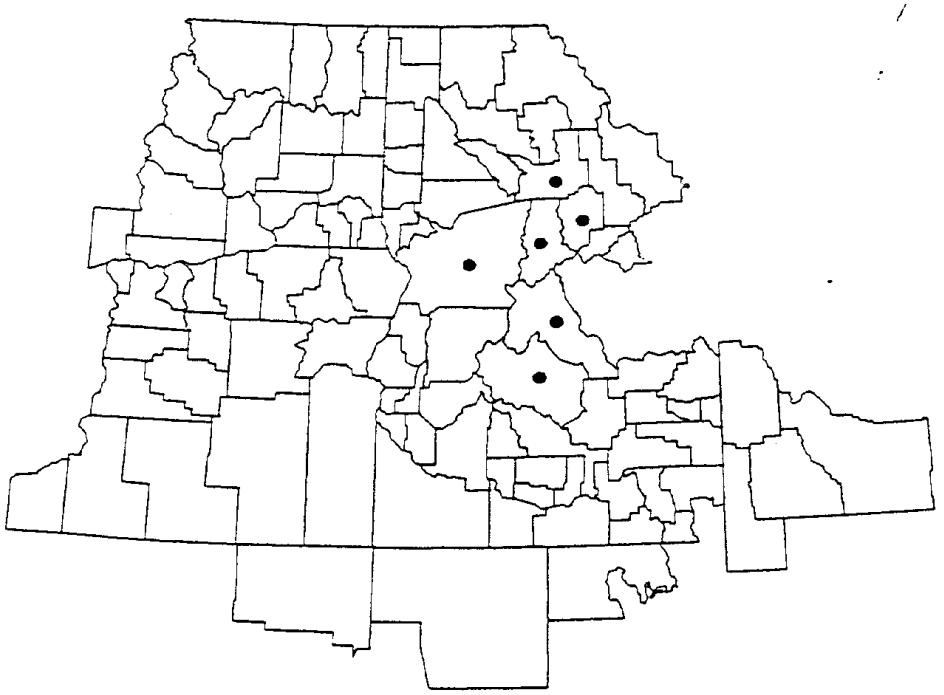

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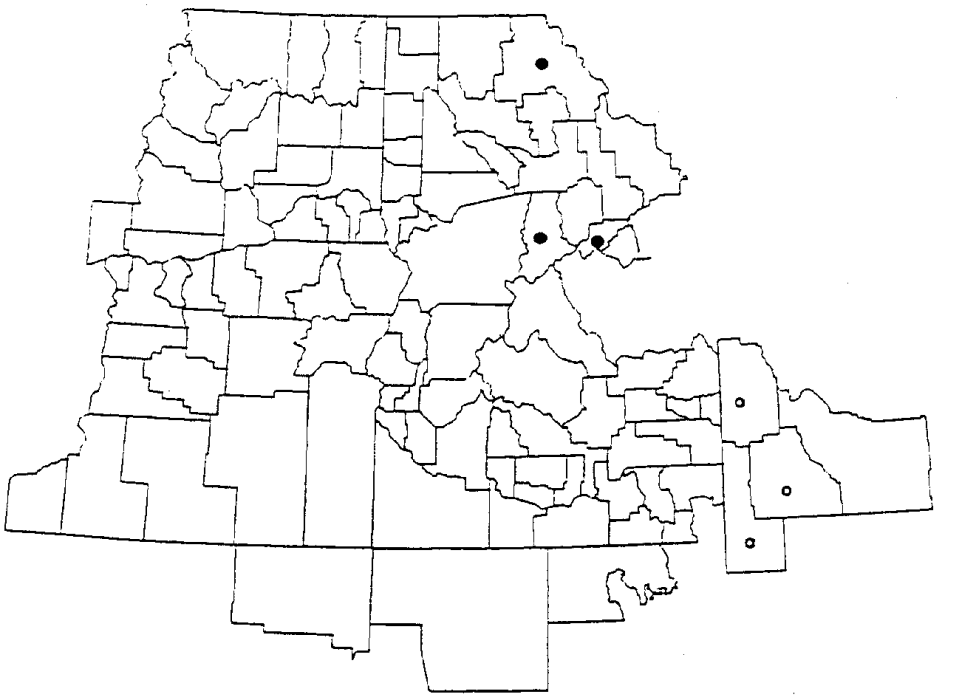

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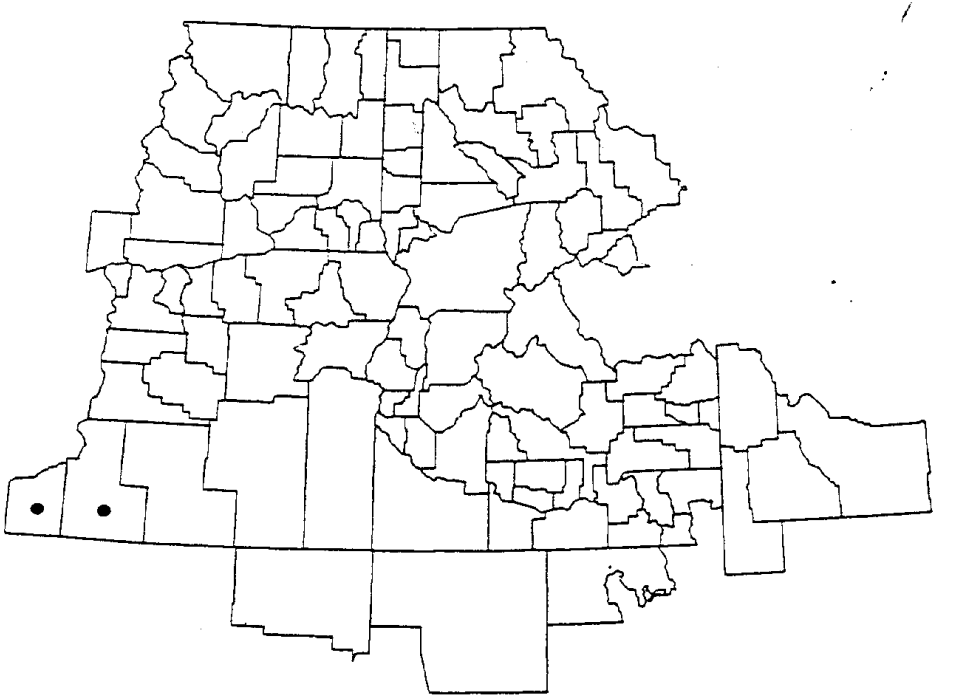

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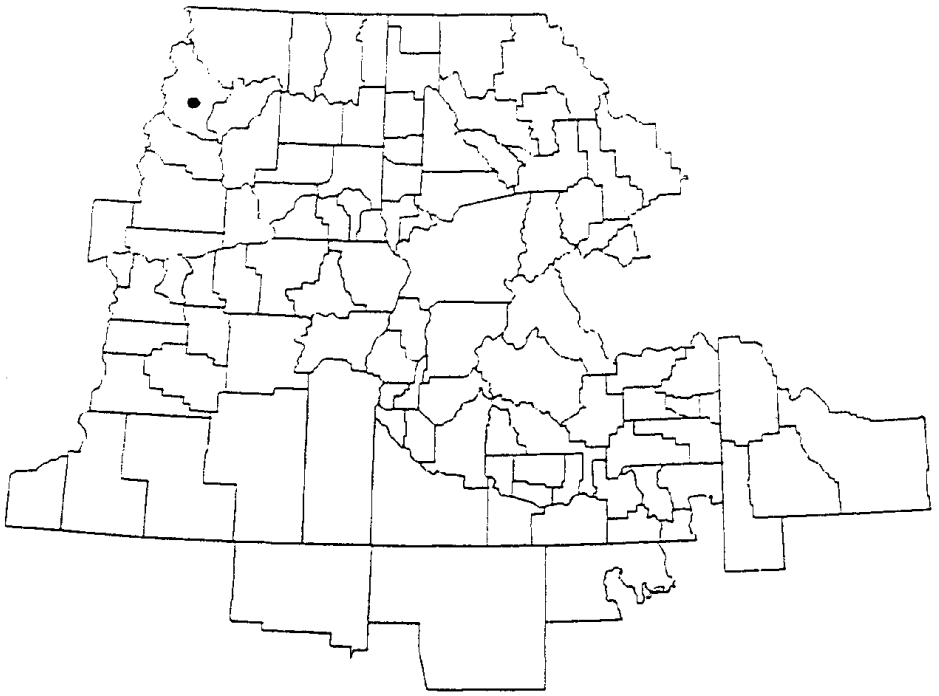

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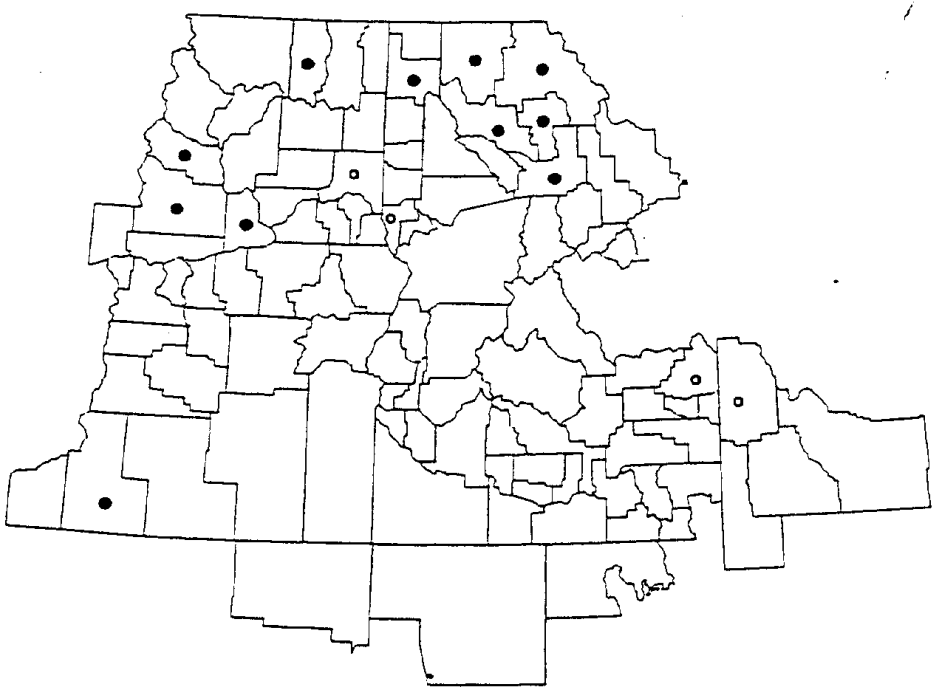

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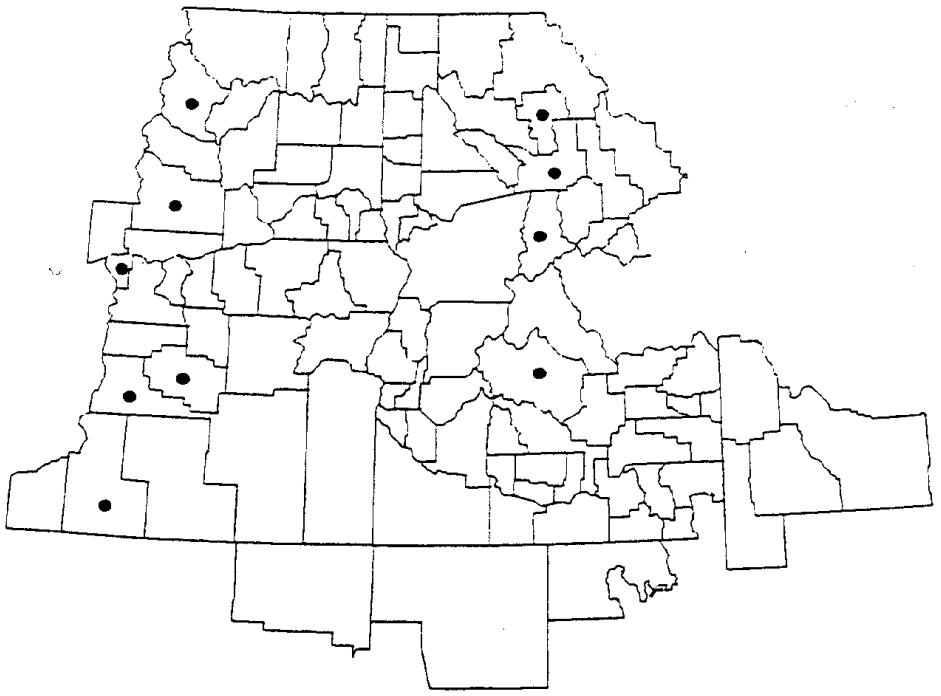
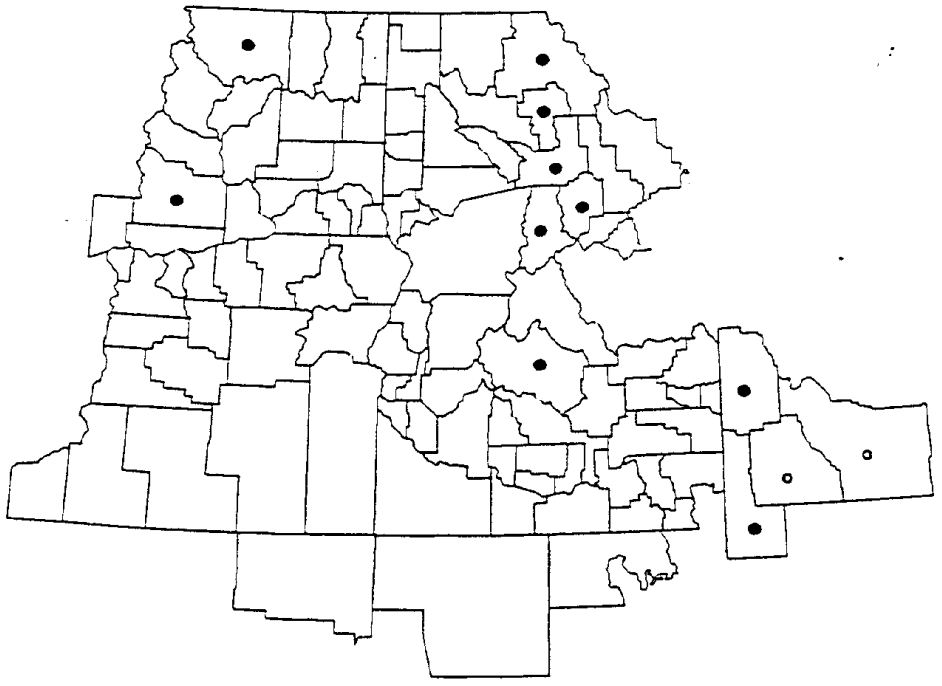
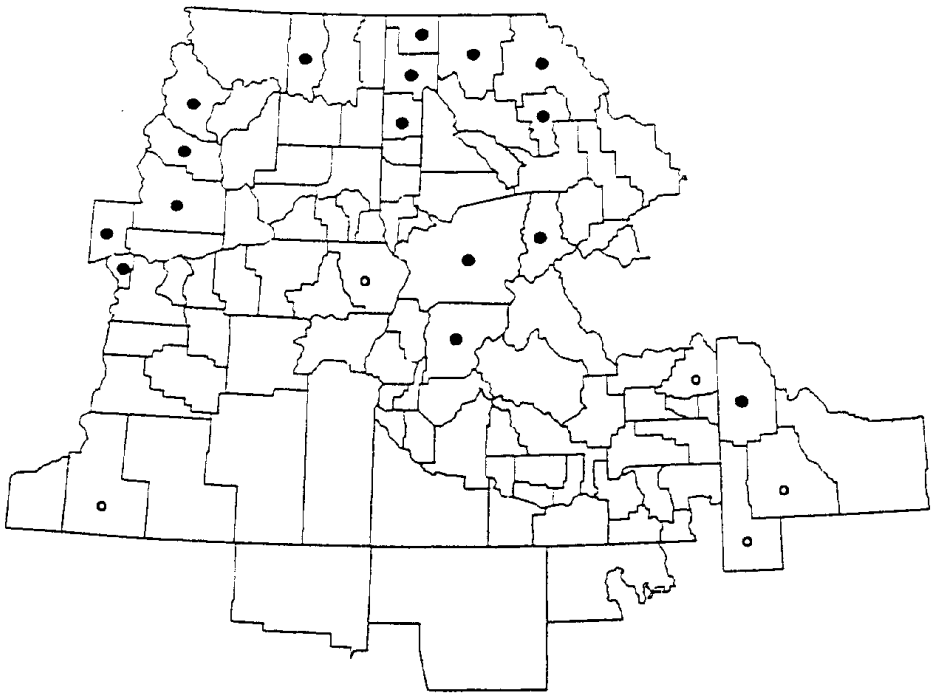


Carex breweri var. breweri



Carex breweri var. paddoensis



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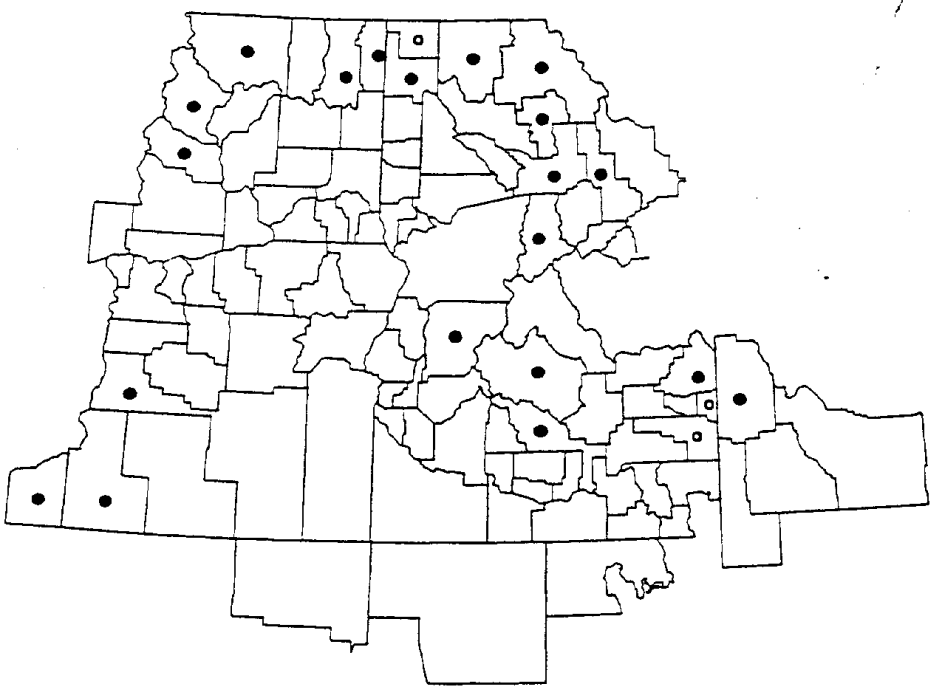
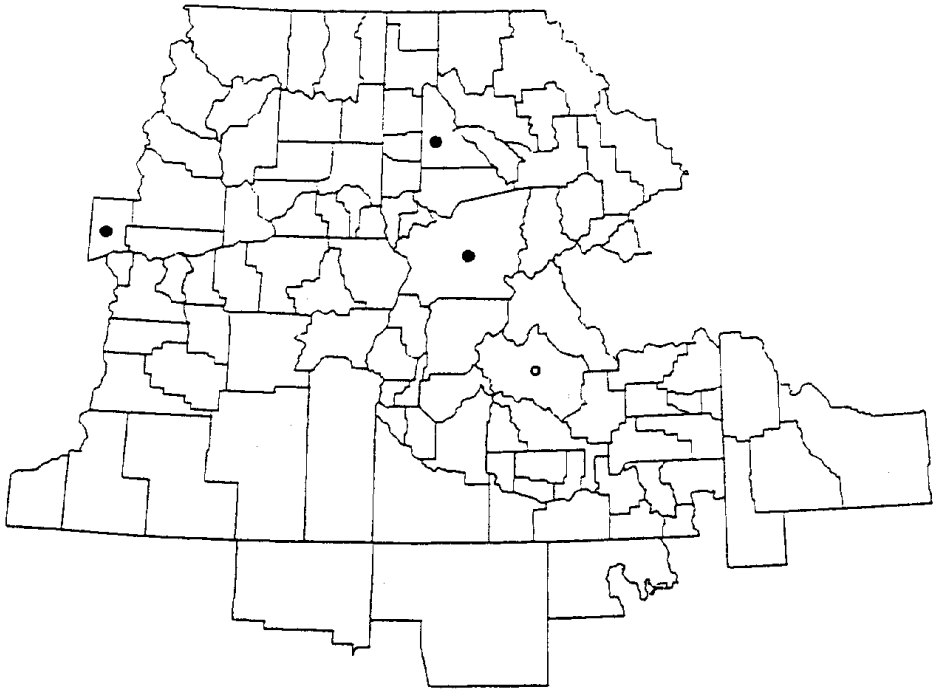


Carex buxbaumii



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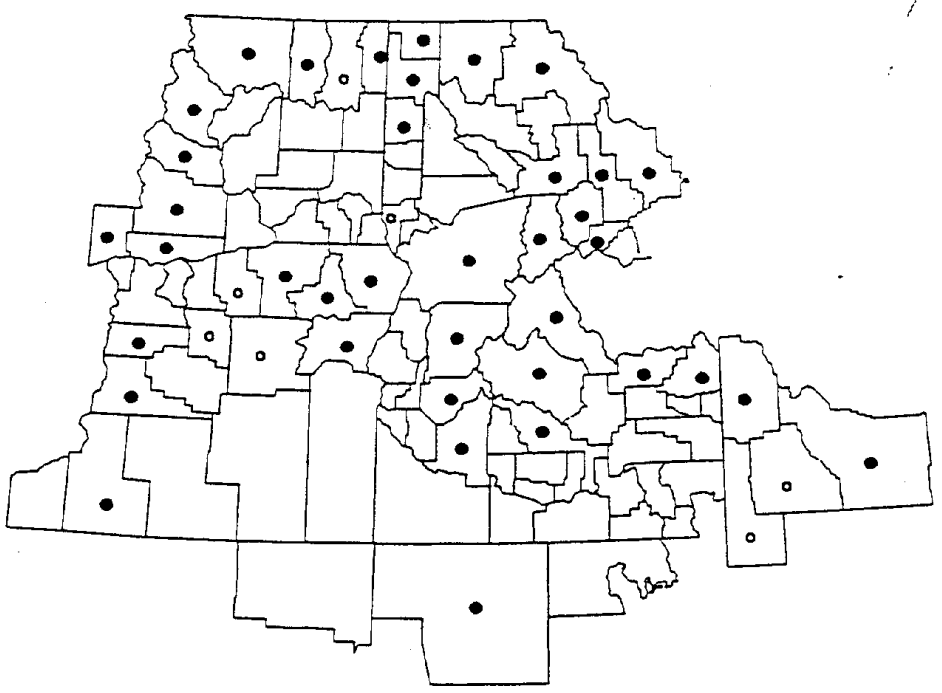

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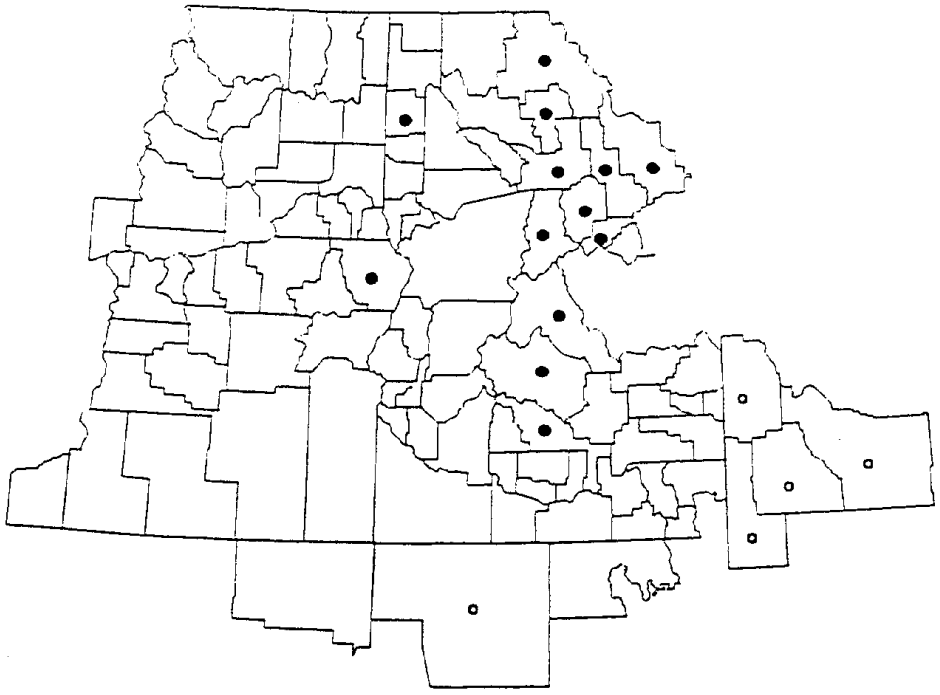
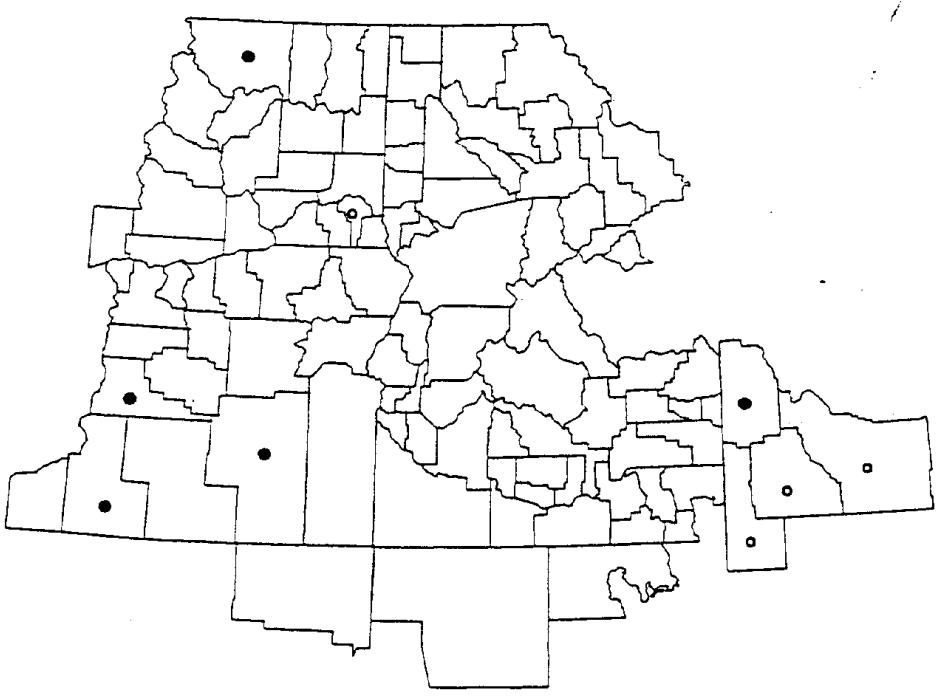
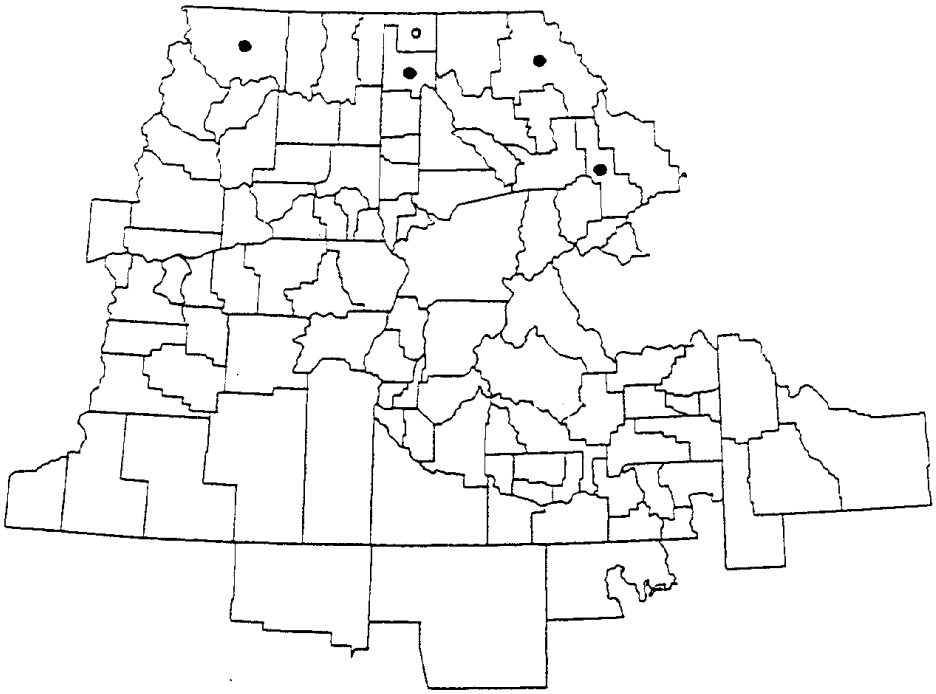


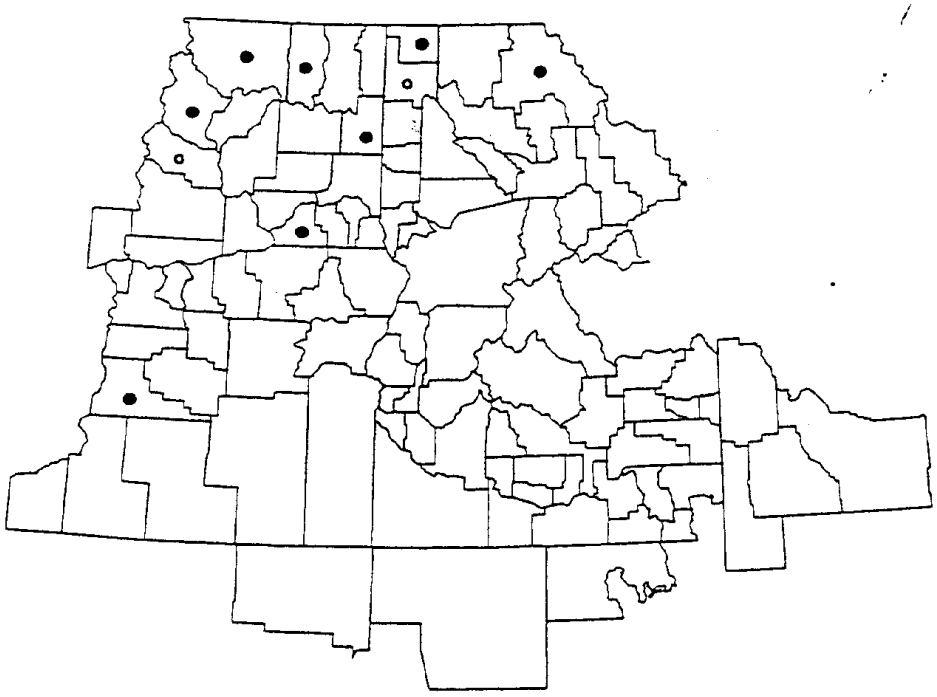
Carex capillaris



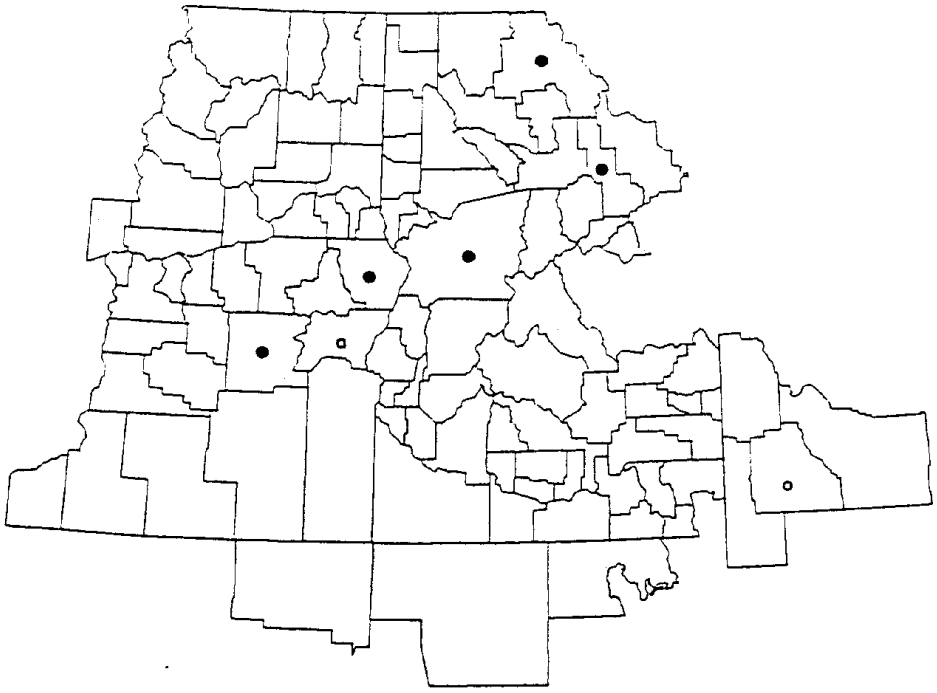
Carex capitata



Carex chordorrhiza



Carex comosa



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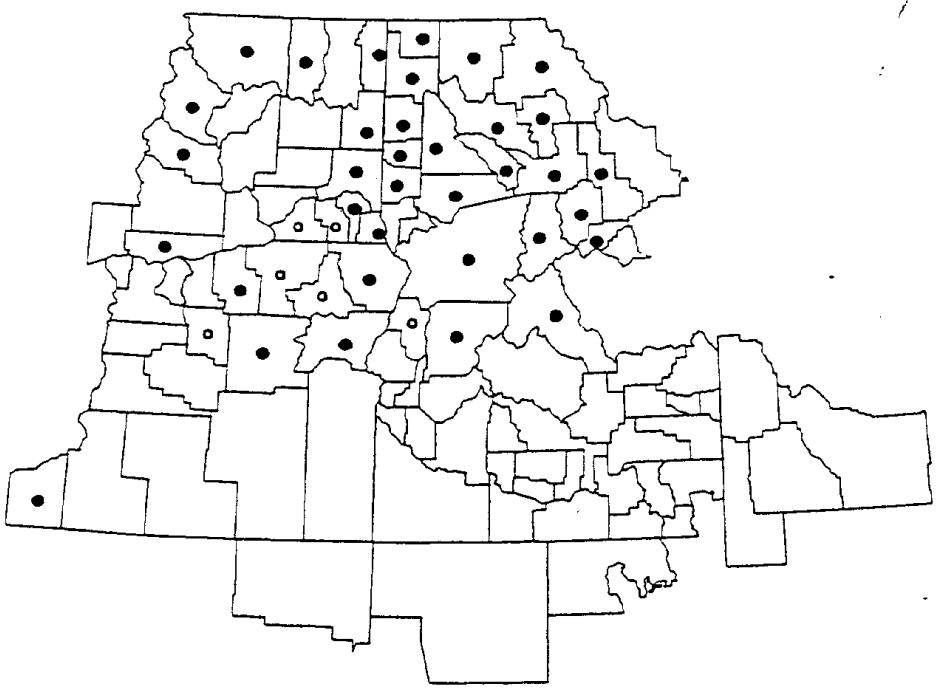

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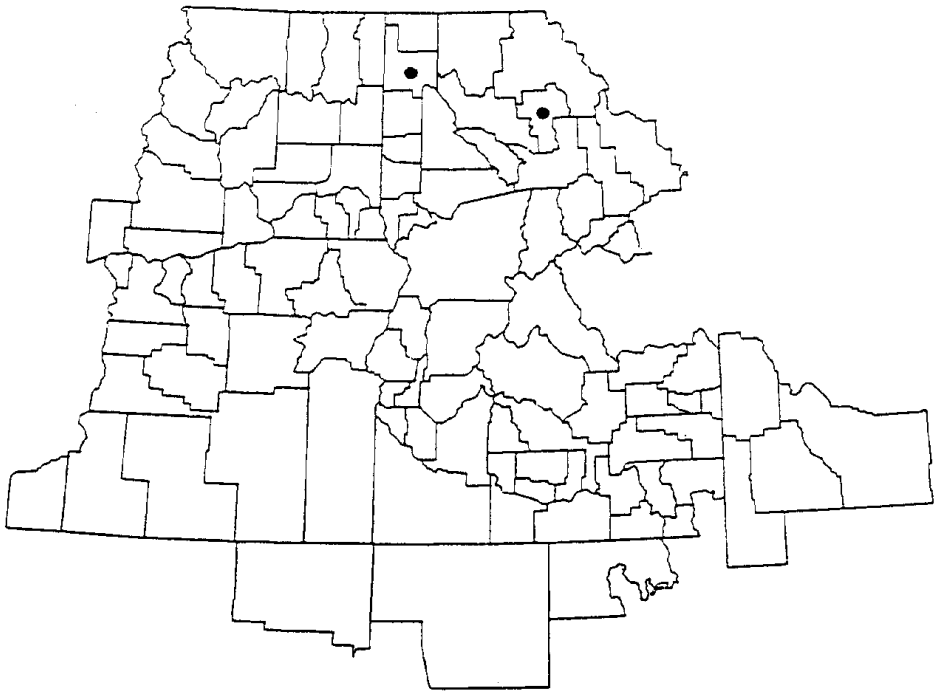

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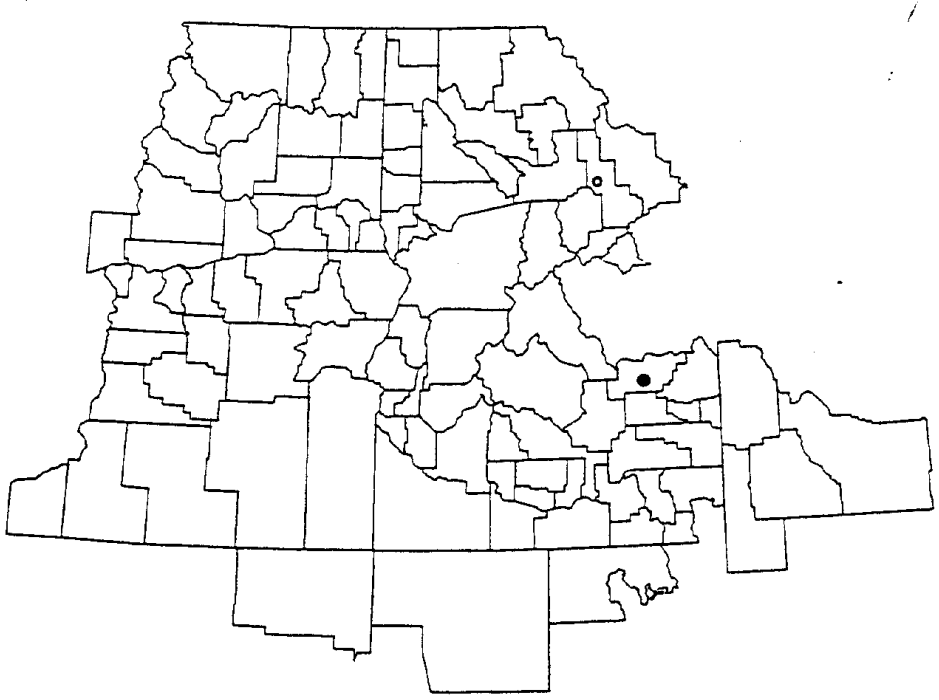

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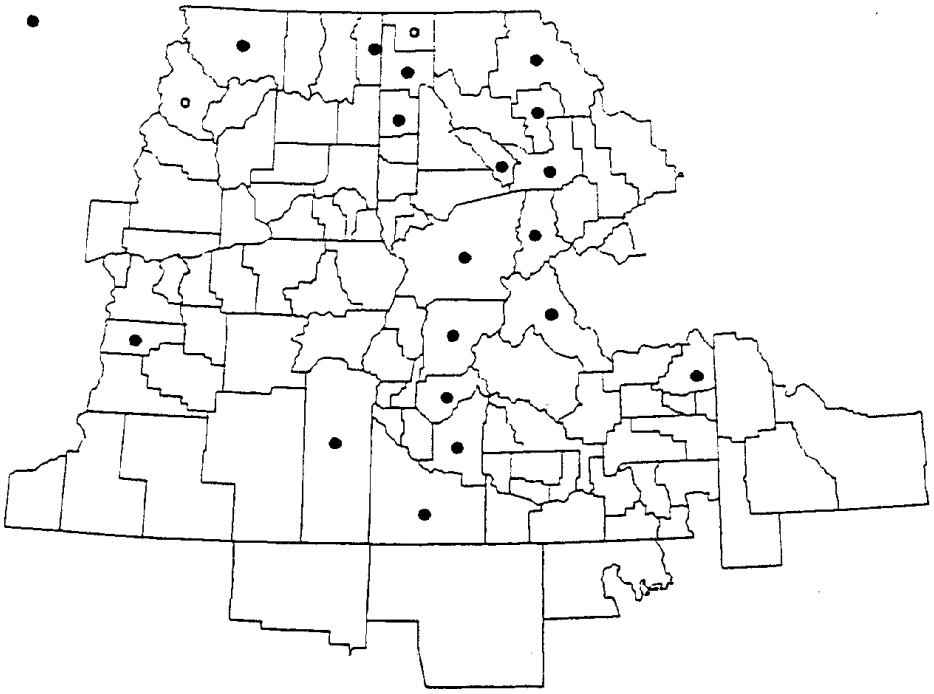
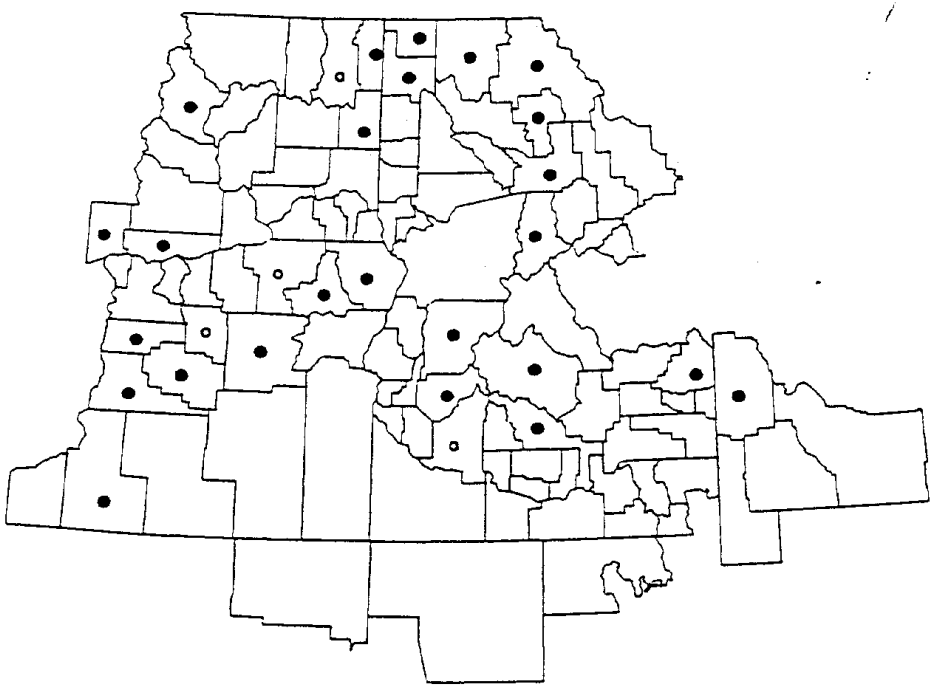


Carex crawfordii



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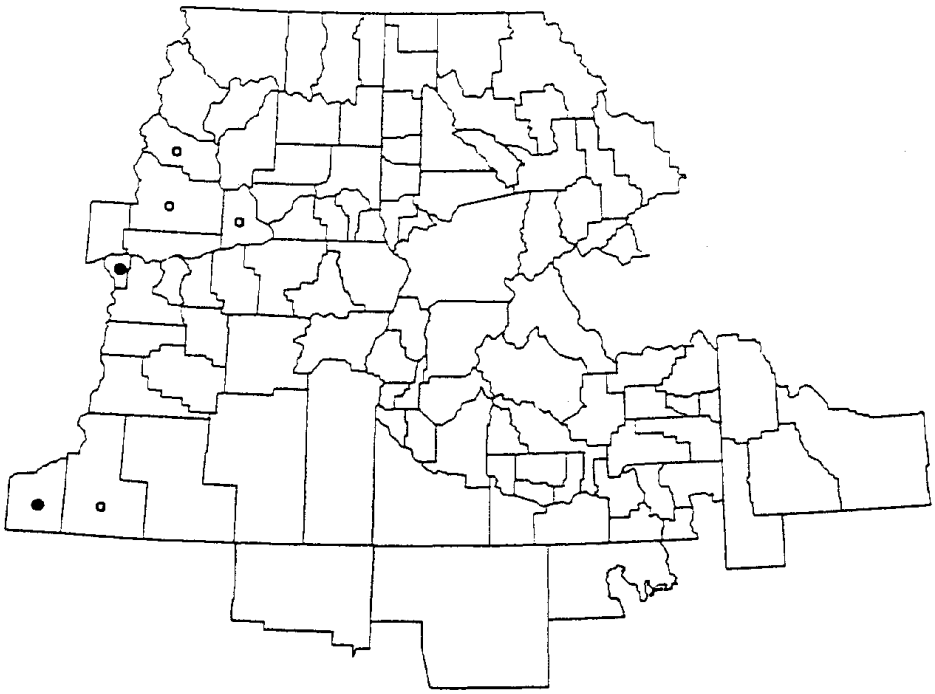

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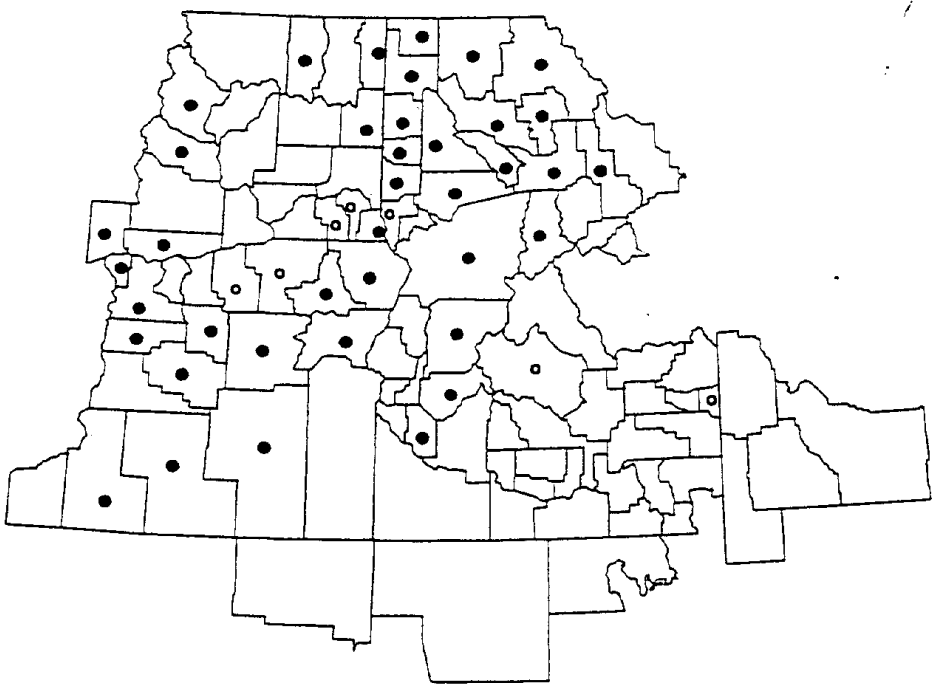
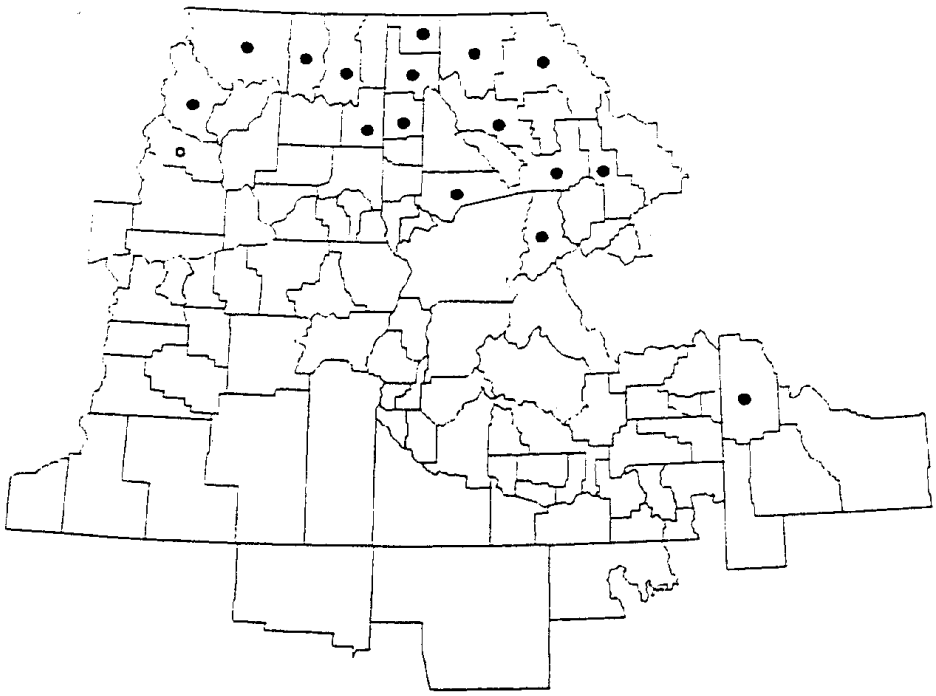


Carex deweyana ssp. leptopoda



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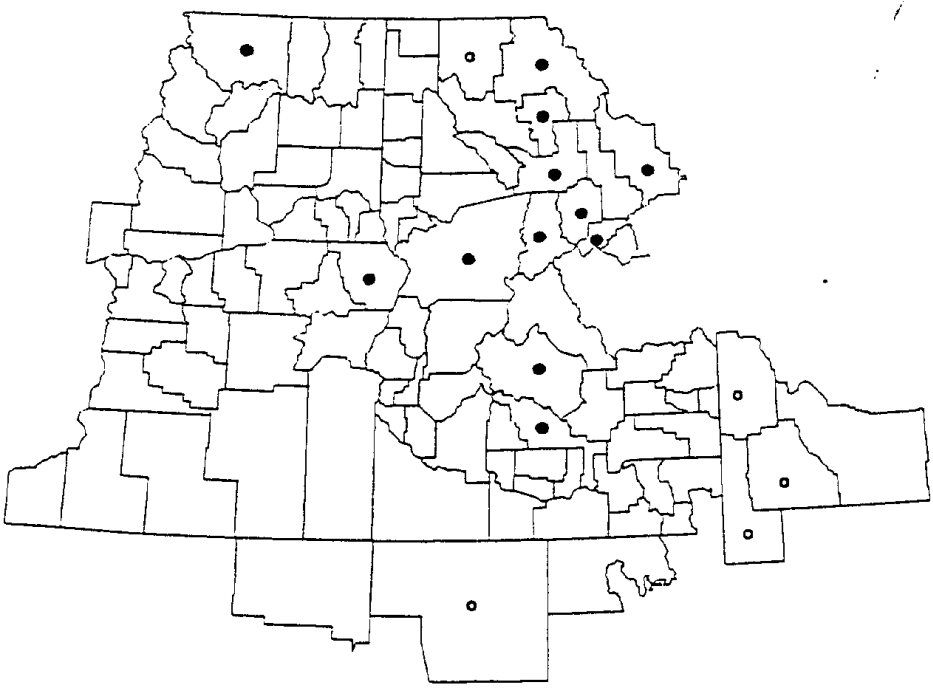
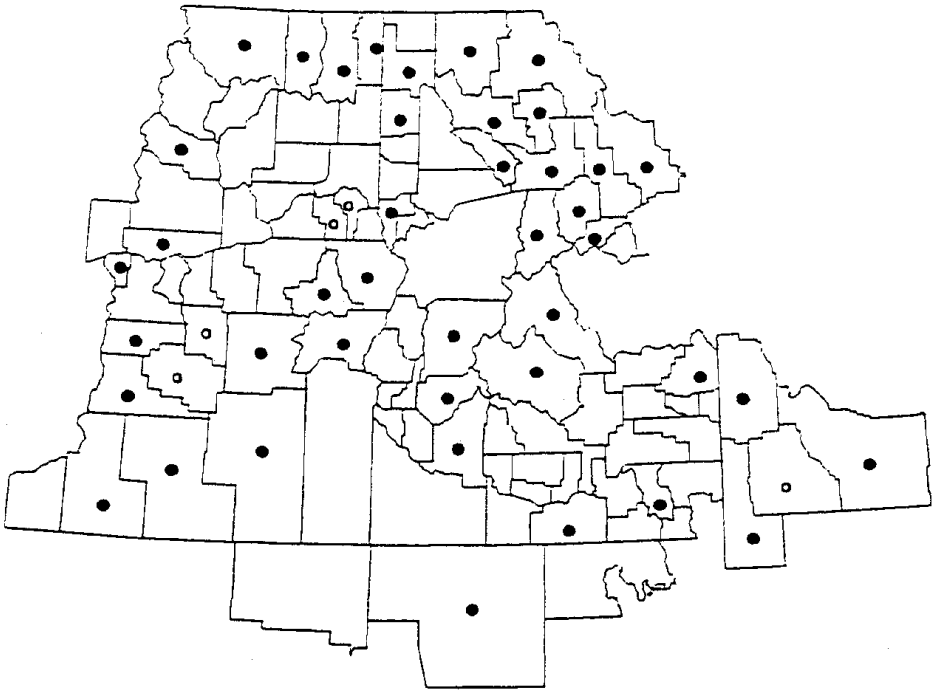


Carex dioica var. gynocrates



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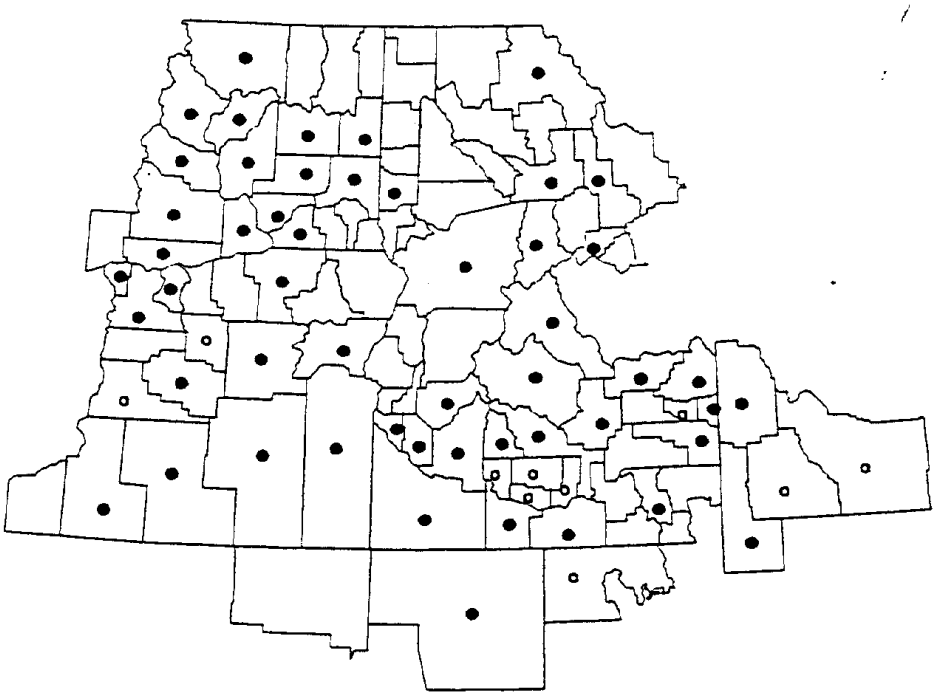

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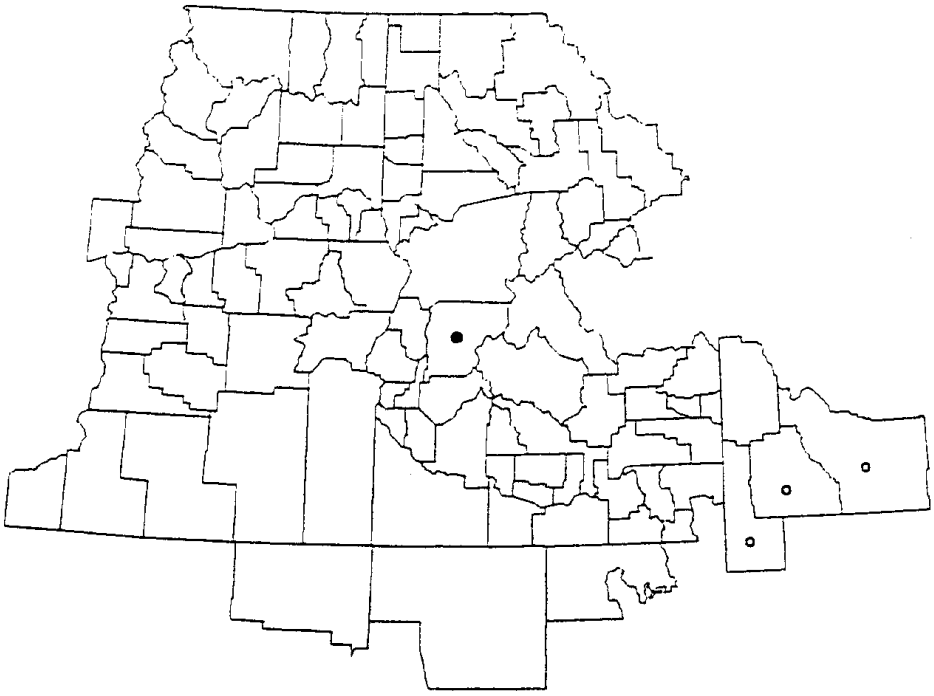

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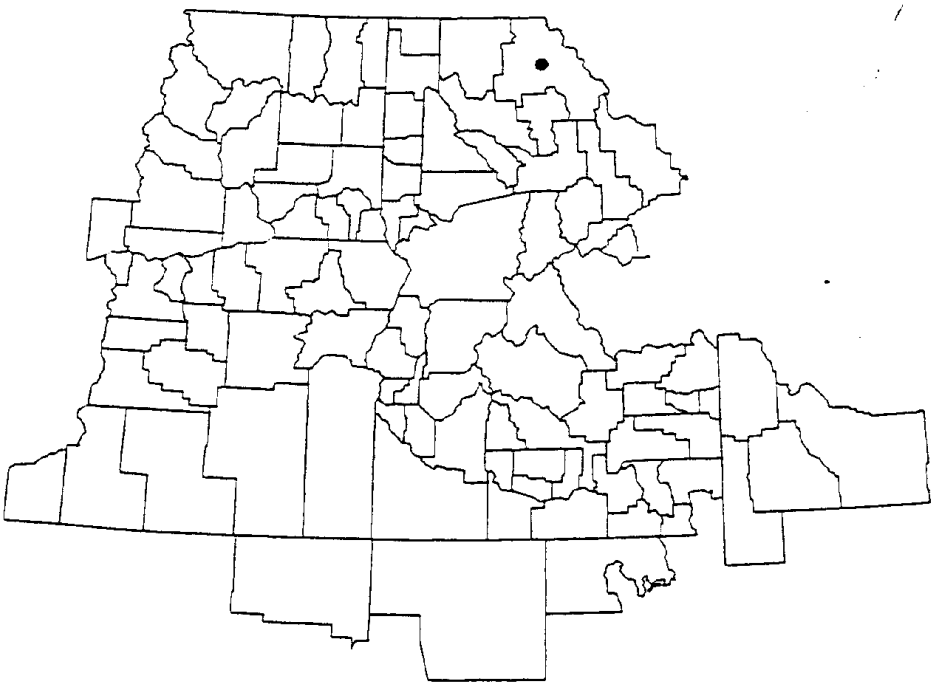

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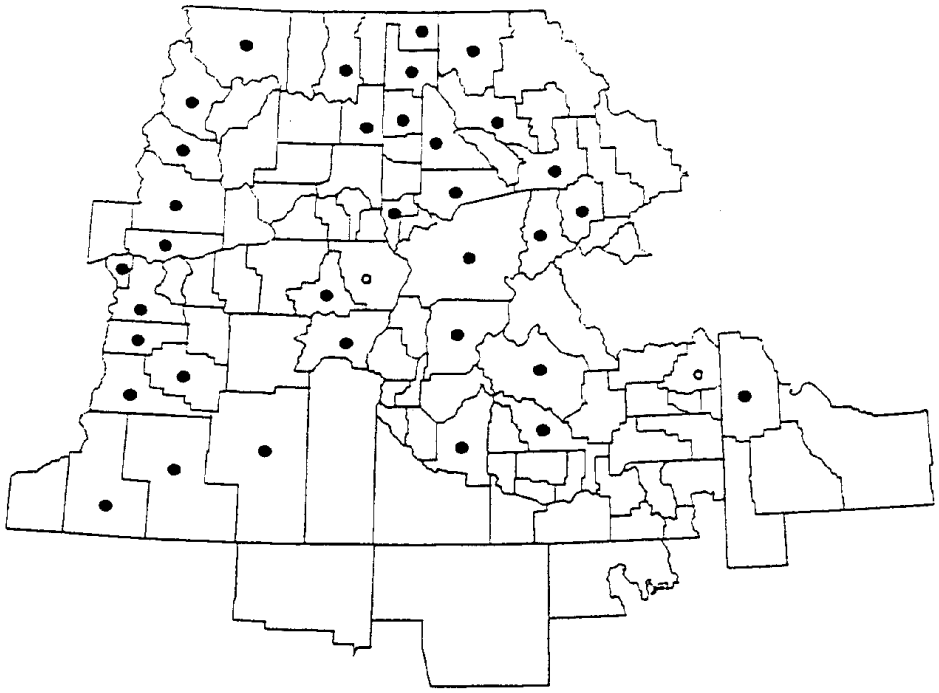
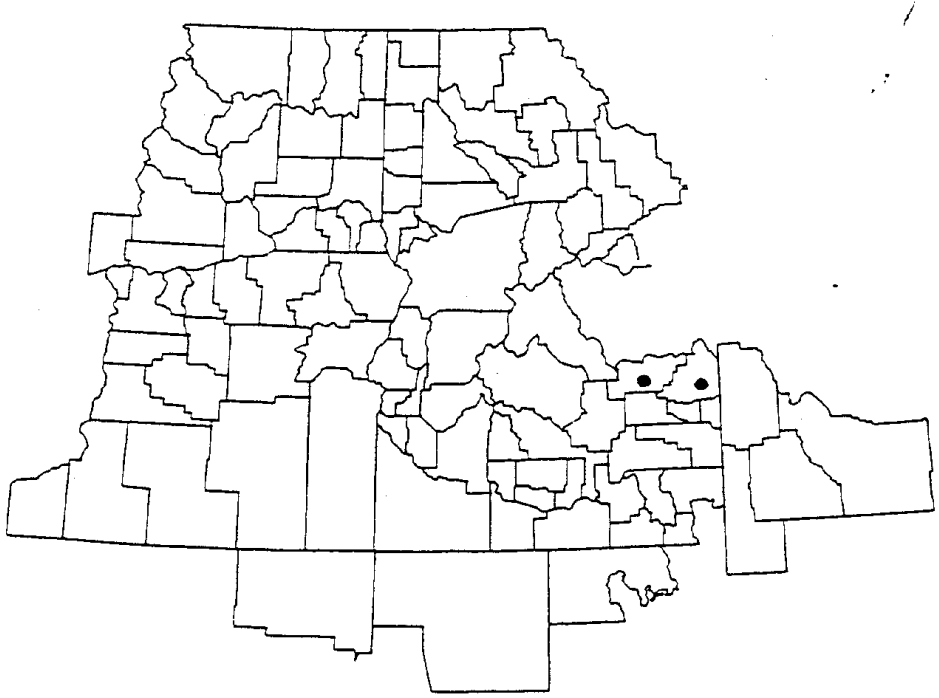


Carex echinata ssp. echinata



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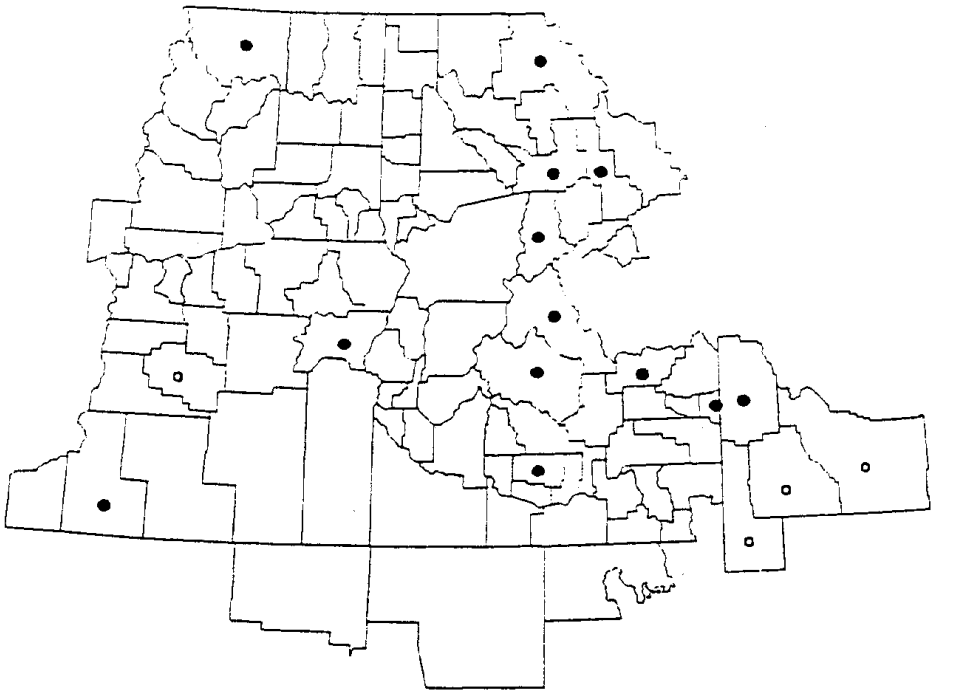

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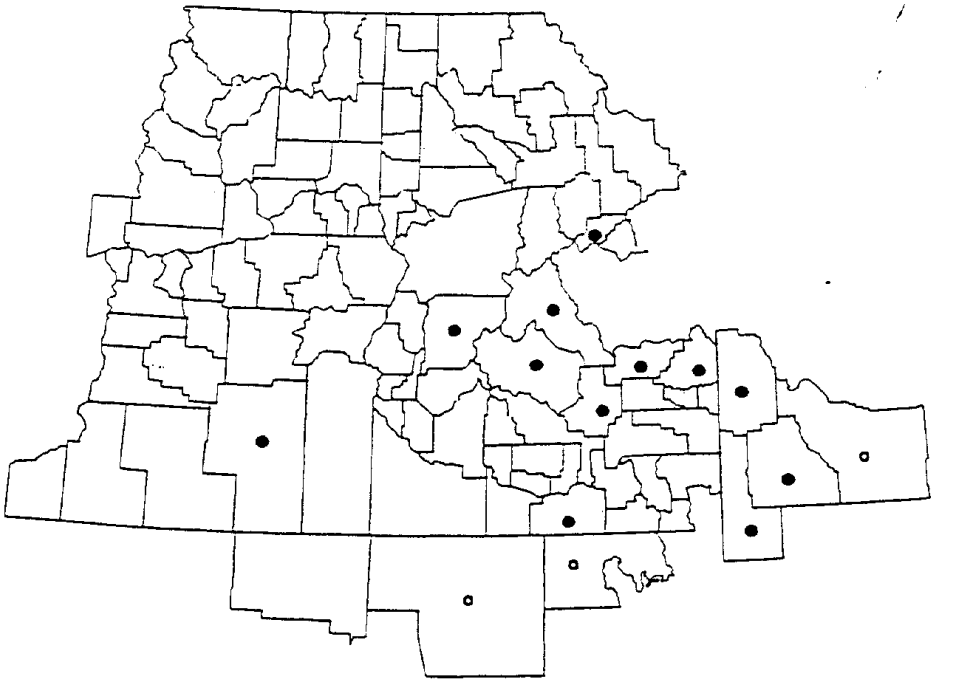

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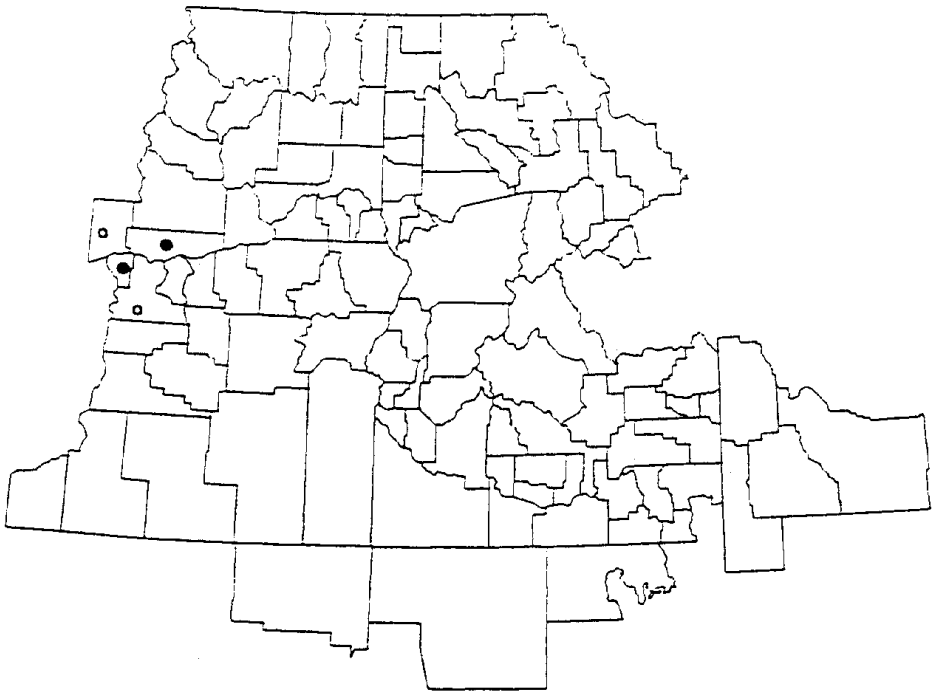

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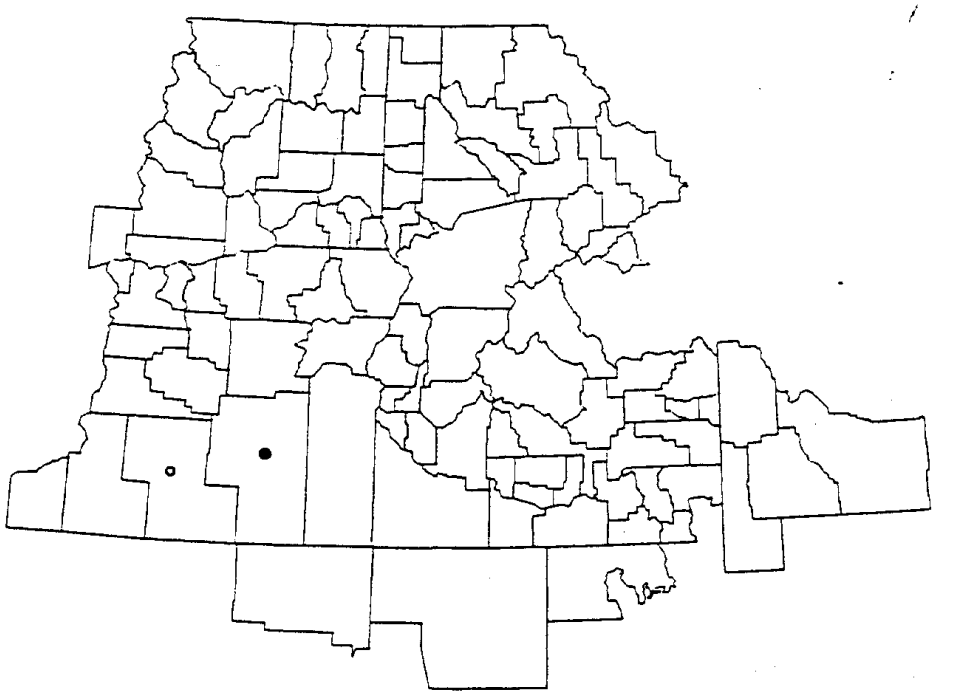
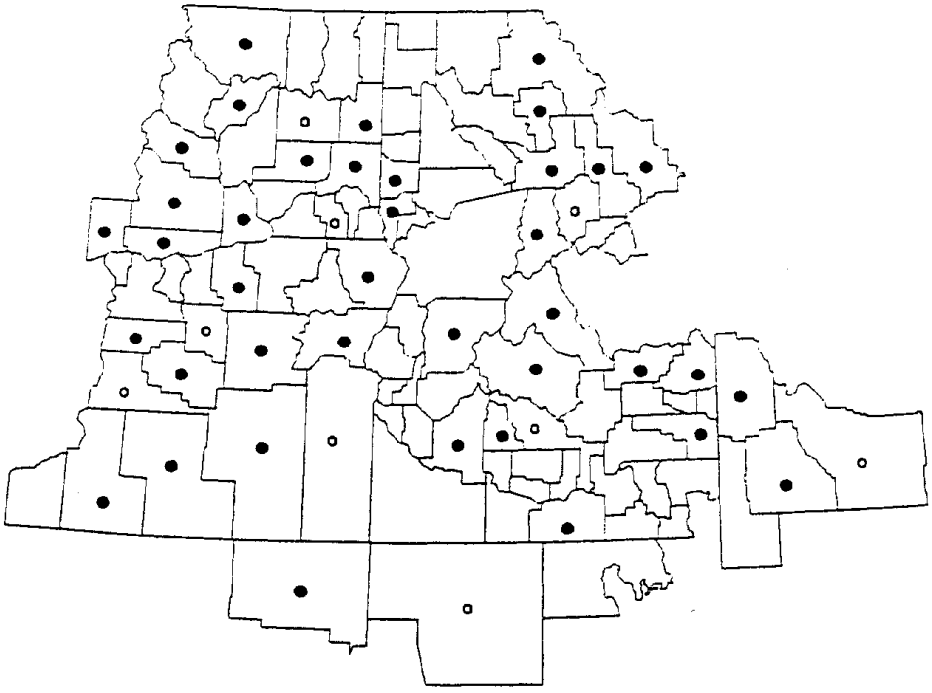


Carex filifolia var. erostrata



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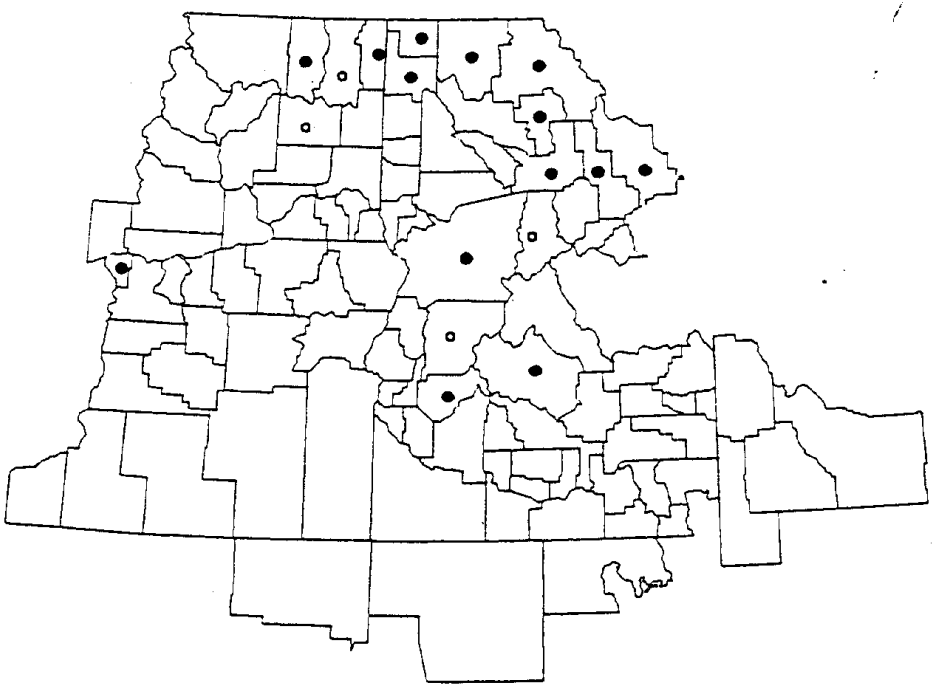
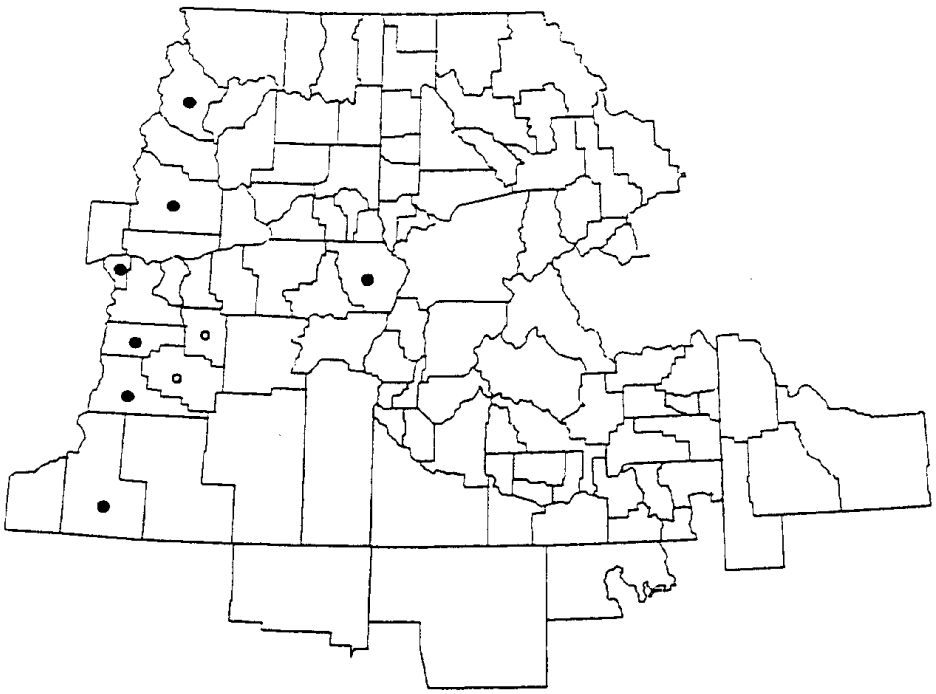
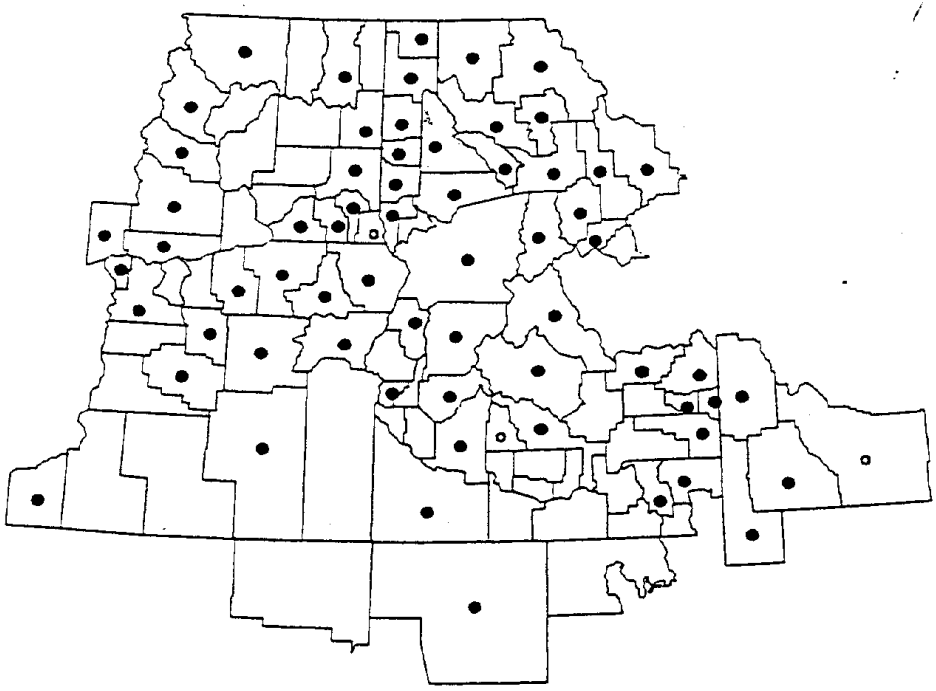


Carex flava



Carex fracta



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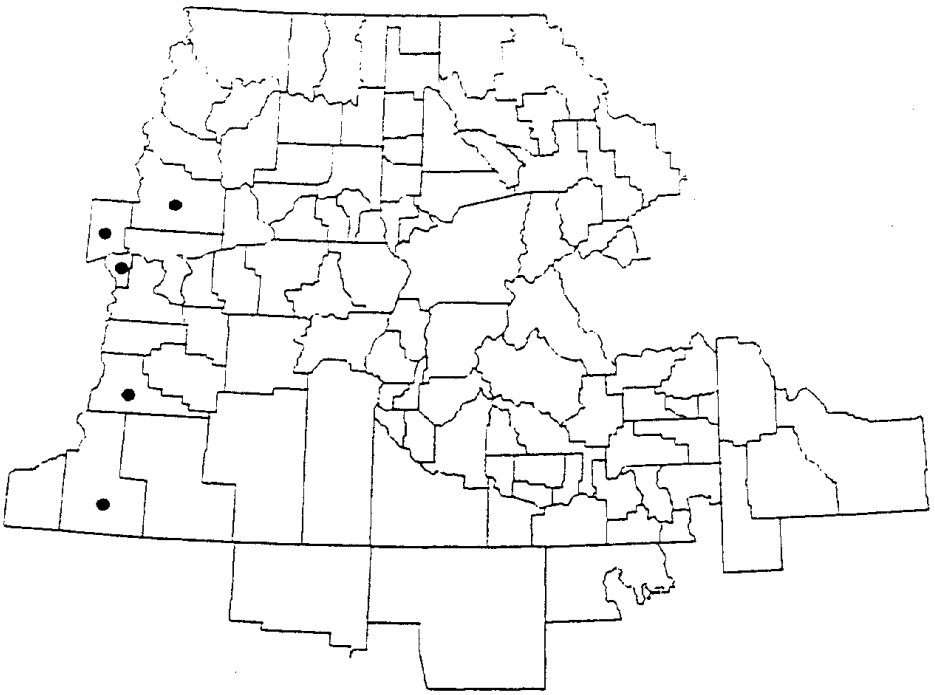
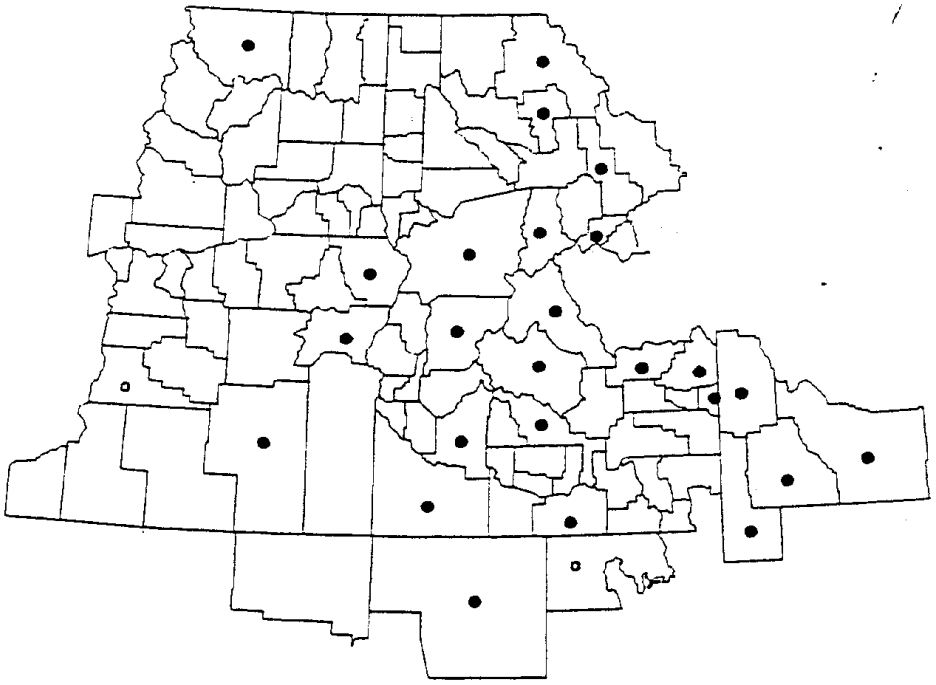


Carex halliana



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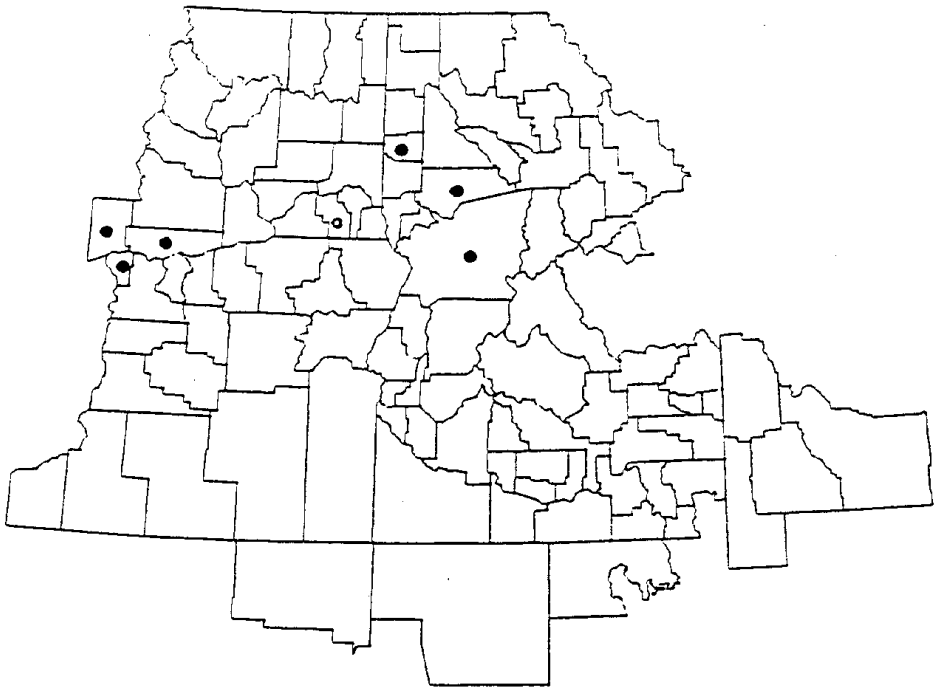

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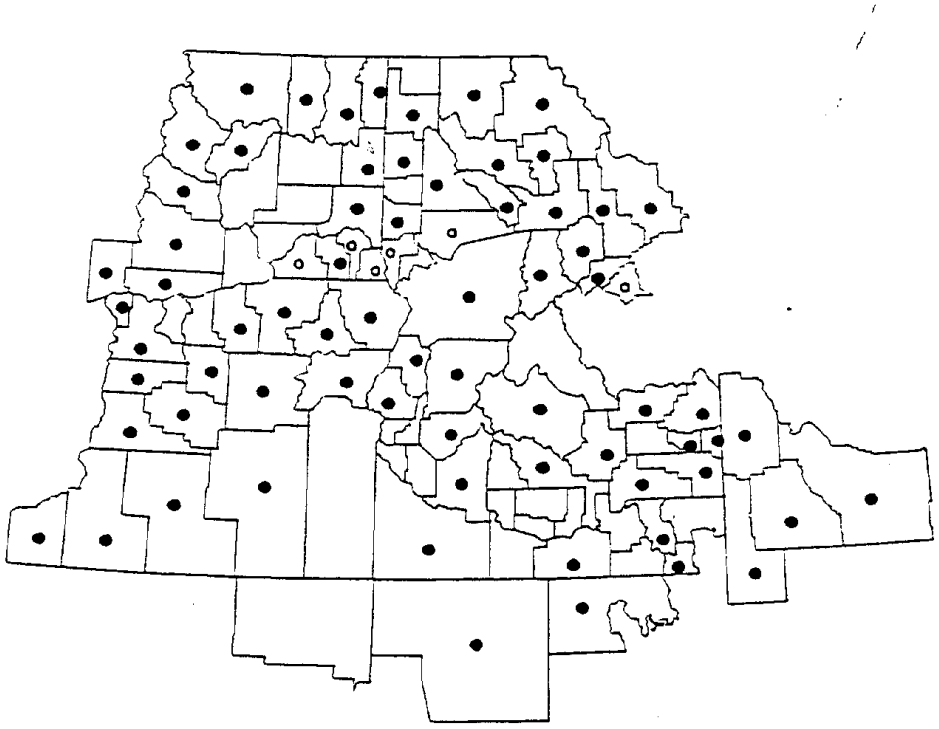
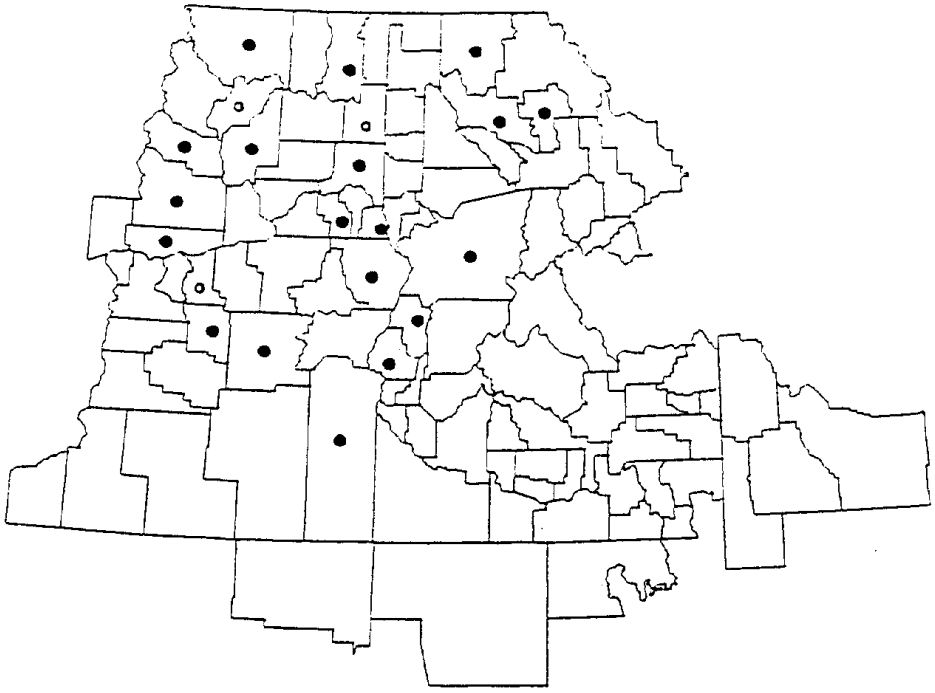
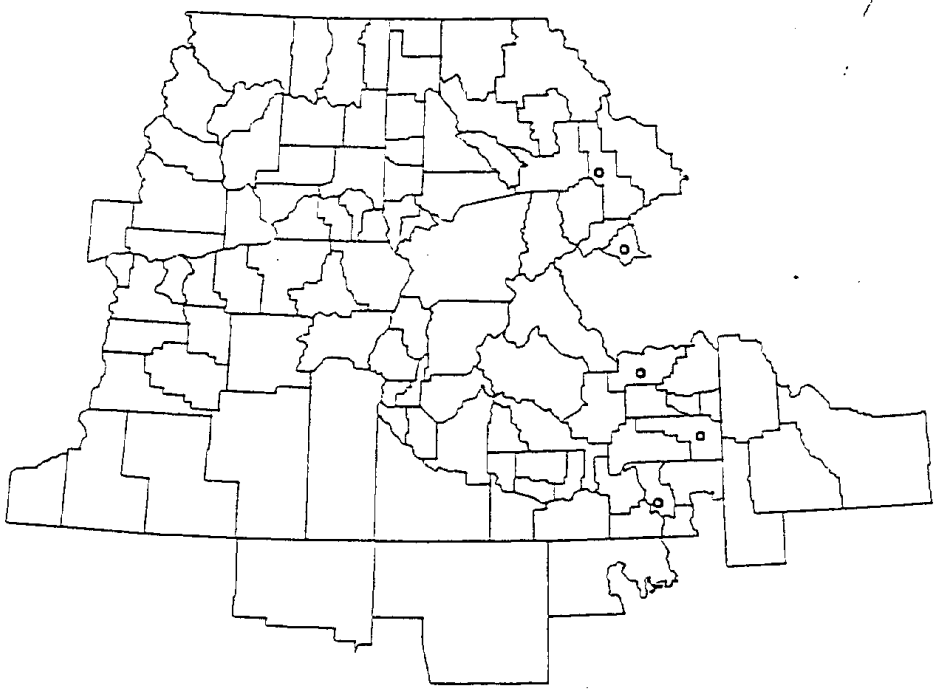


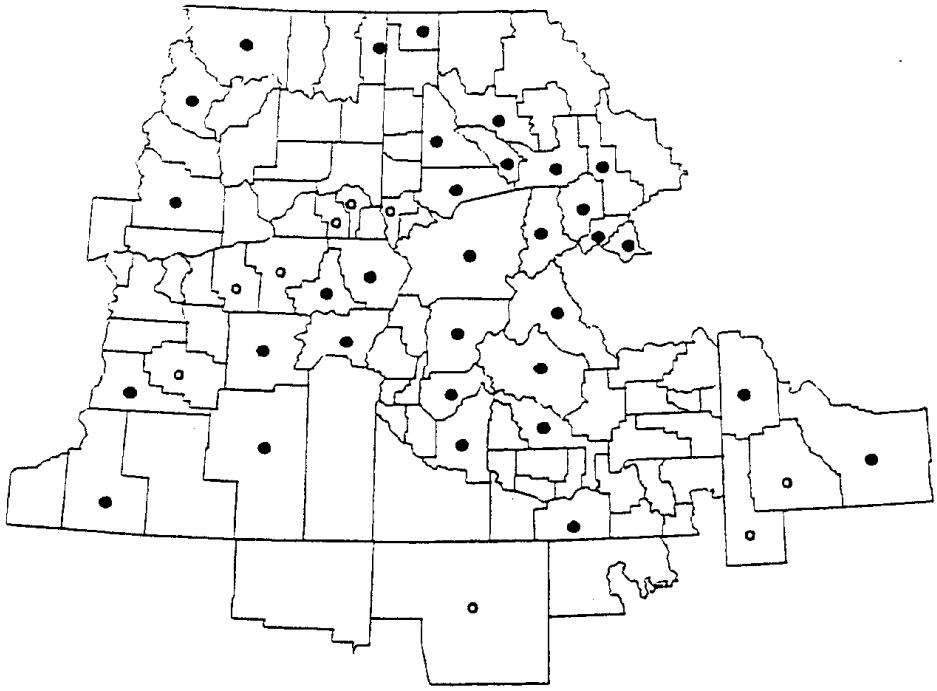
Carex hoodii



Carex hystericina



Carex idahoa



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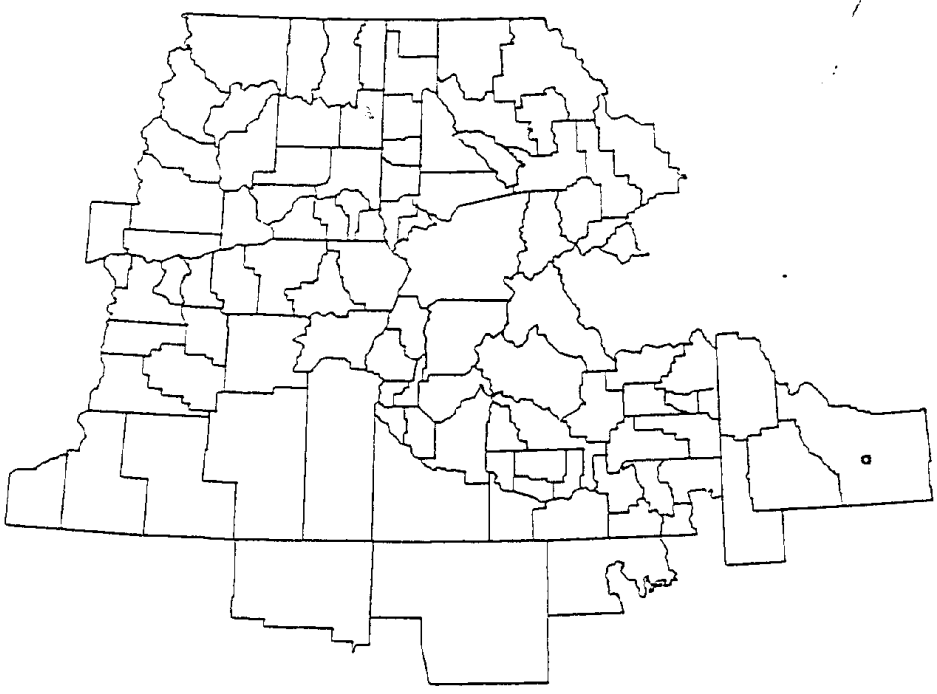
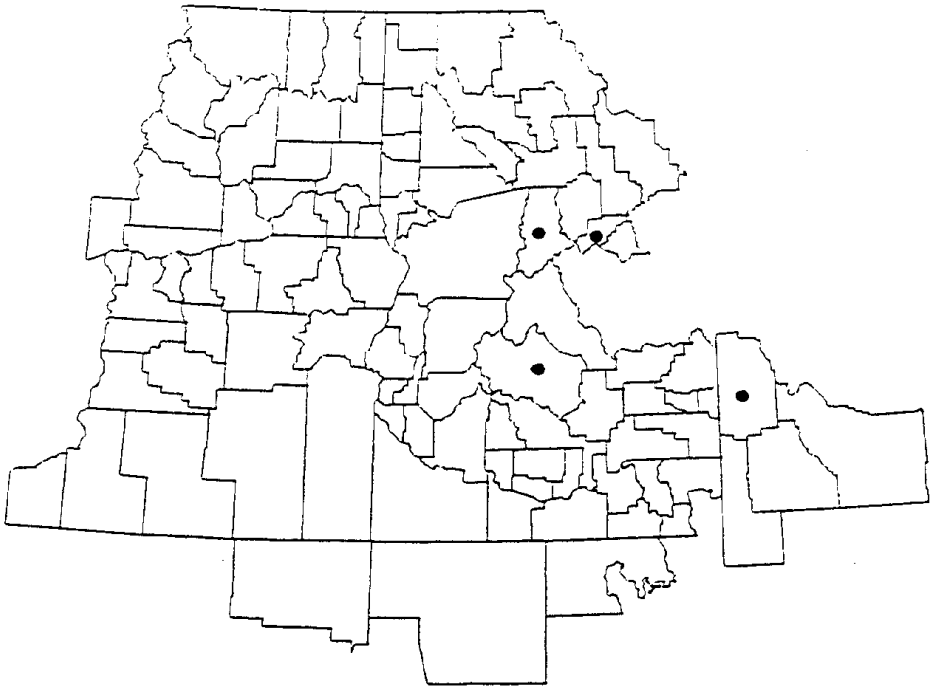


Carex incurviformis var. danaensis



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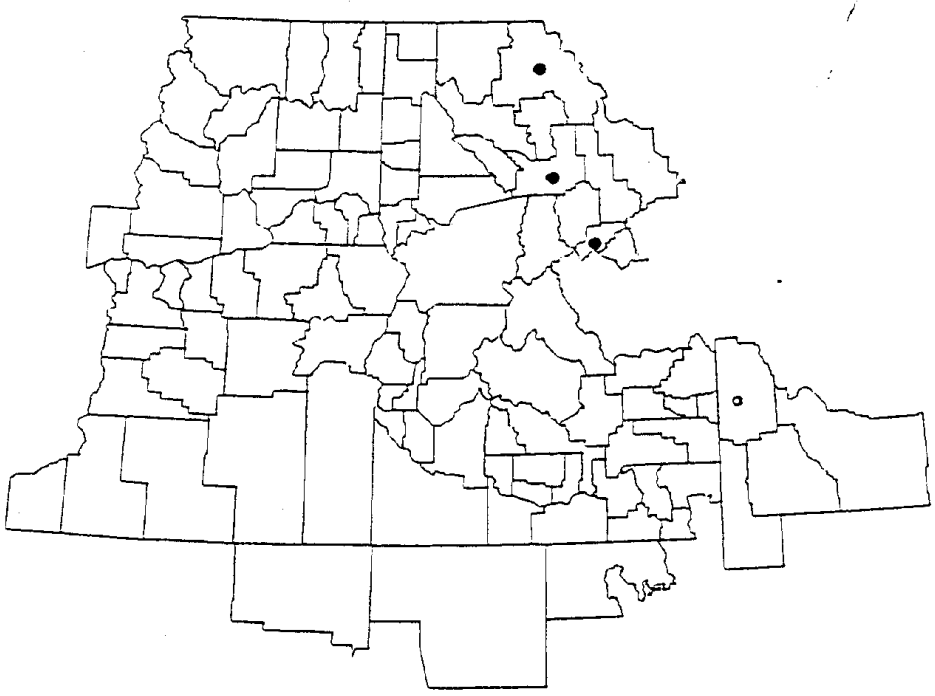
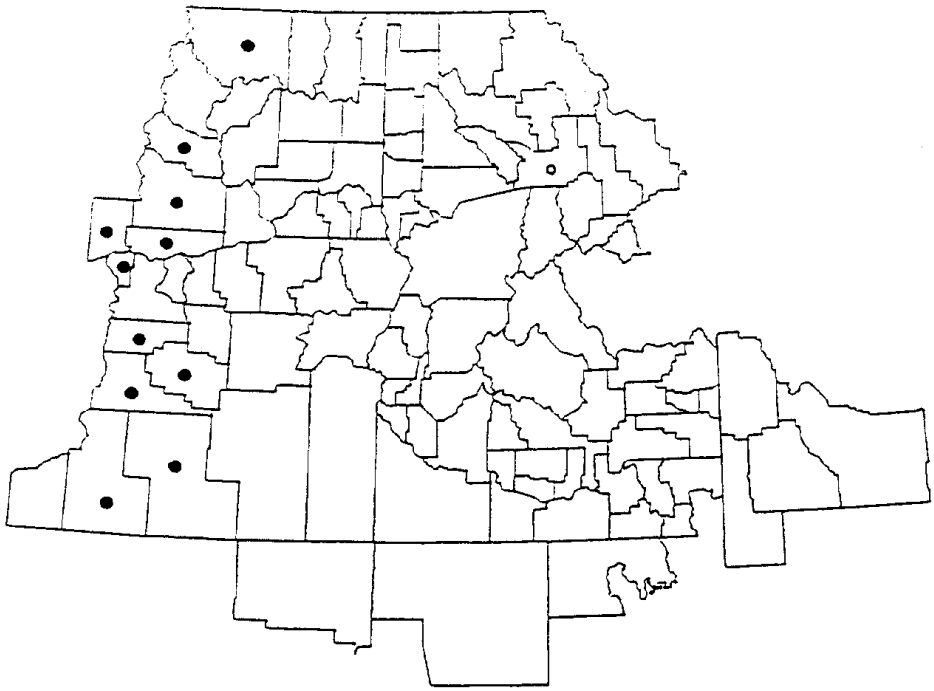


Carex inops ssp. heliophila



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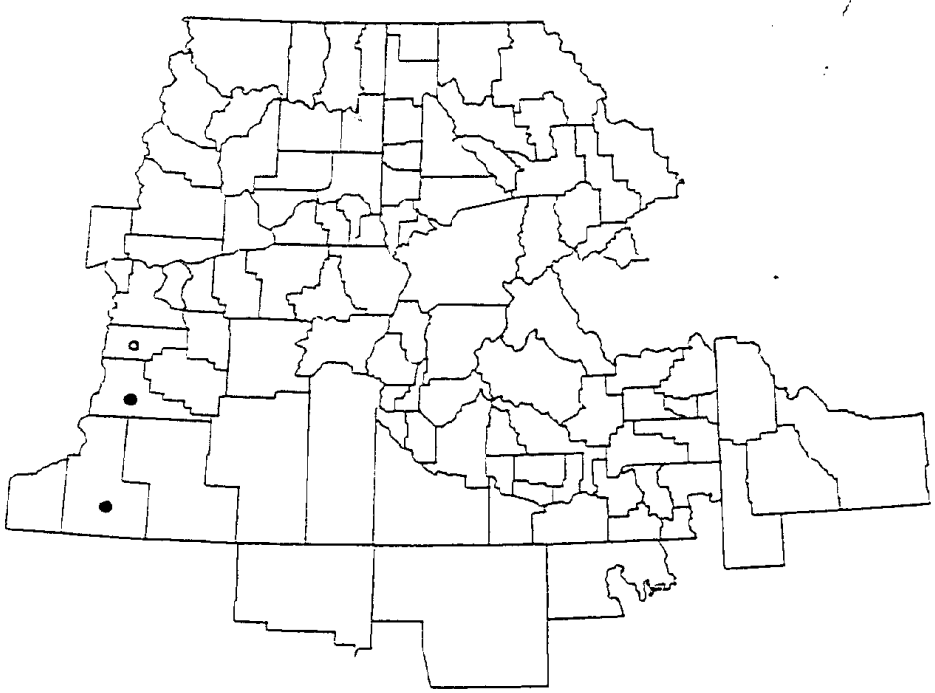
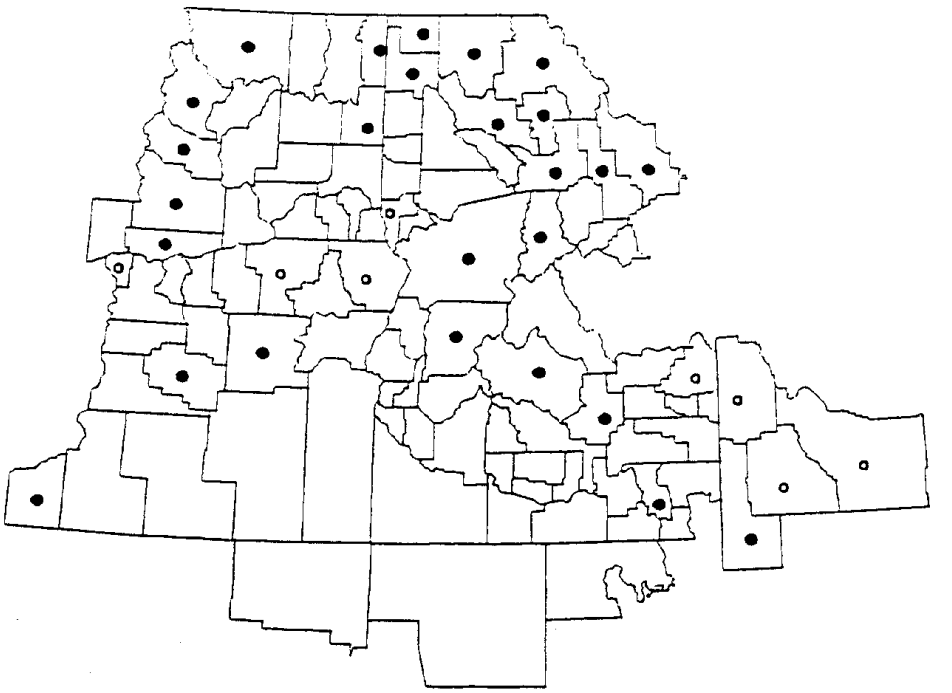
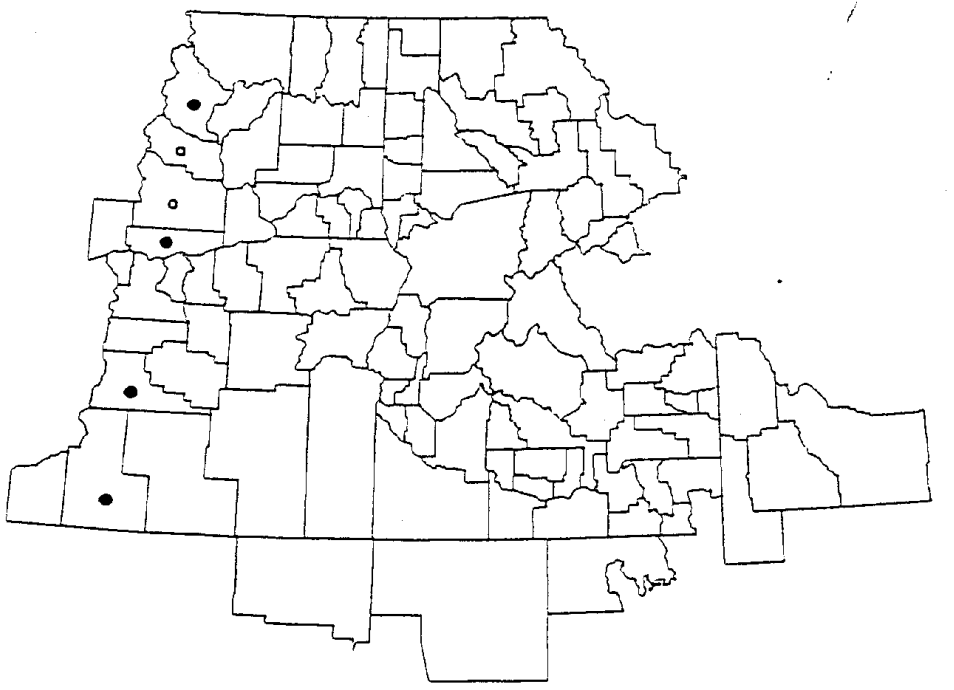


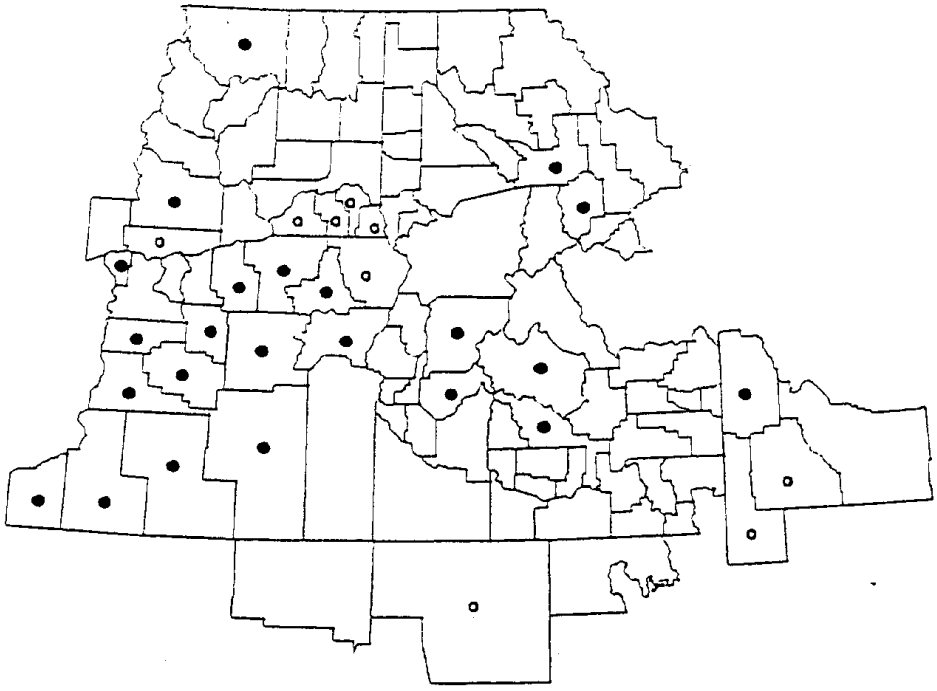
Carex integra



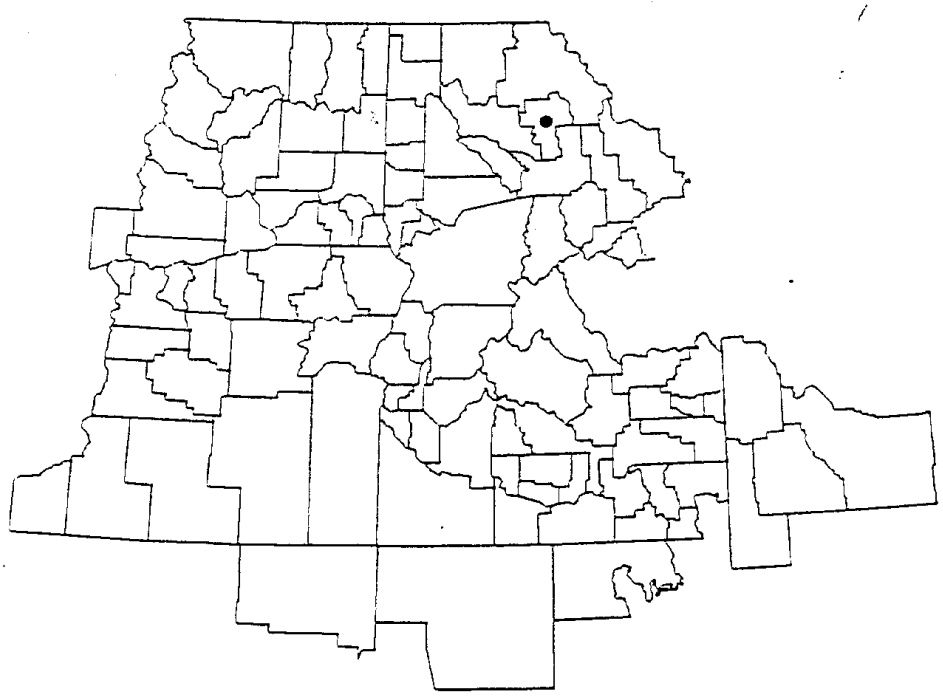
Carex interior



Carex interrupta



Carex jonesii



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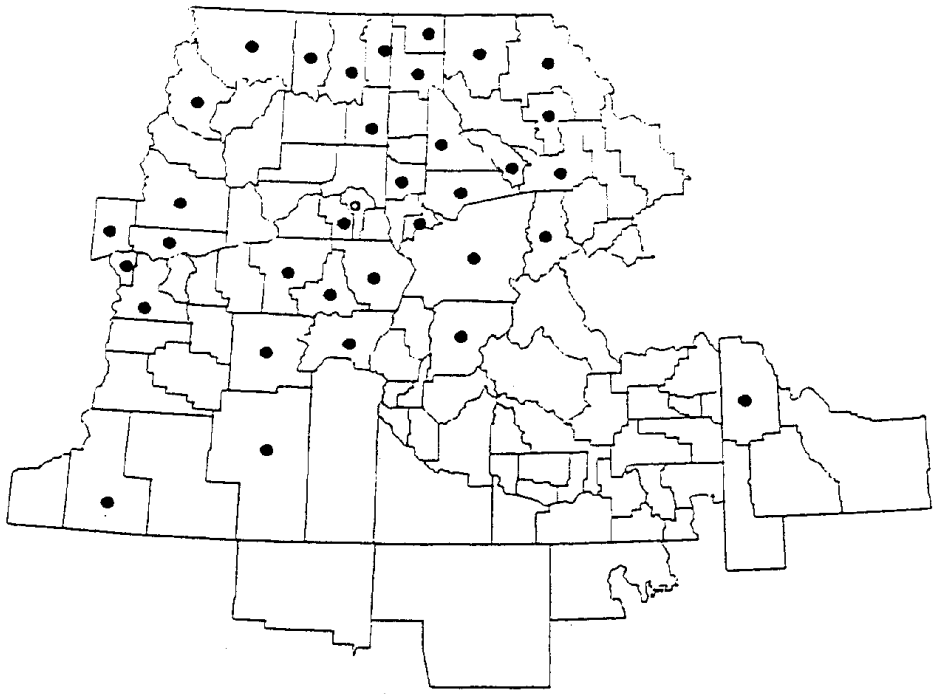

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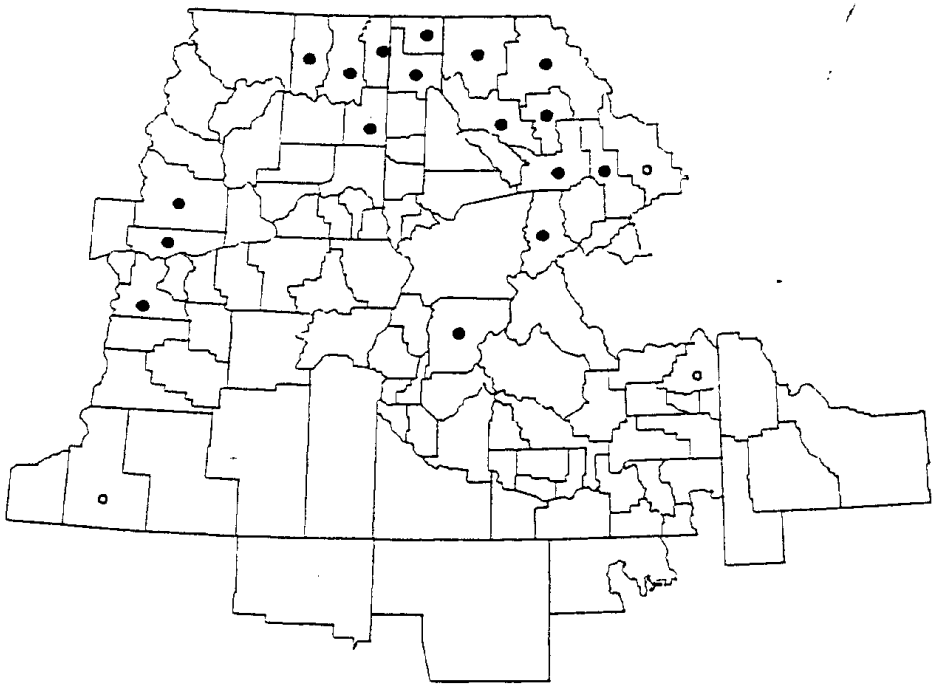
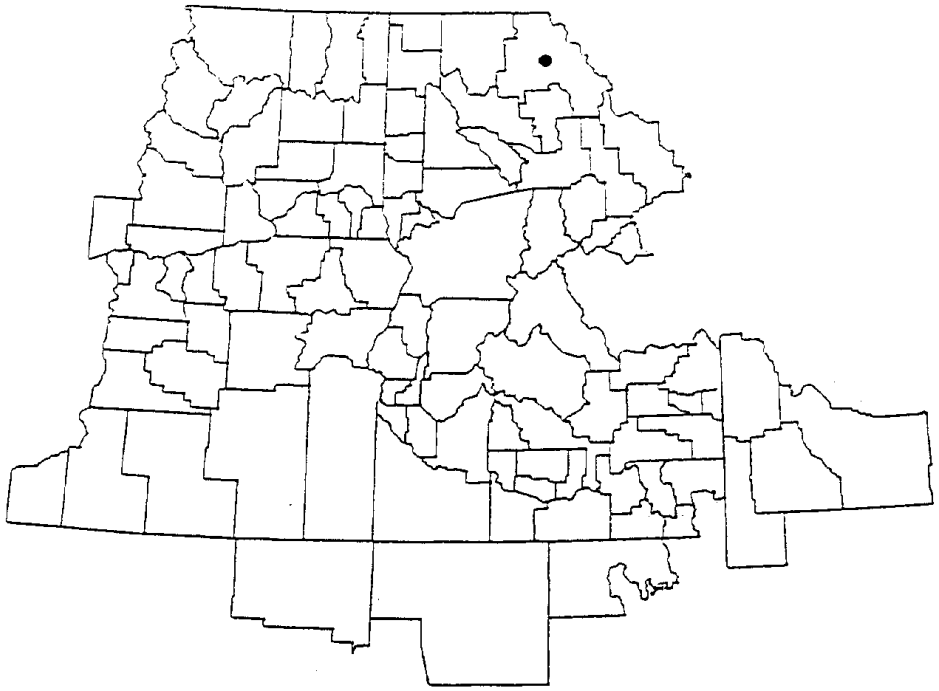
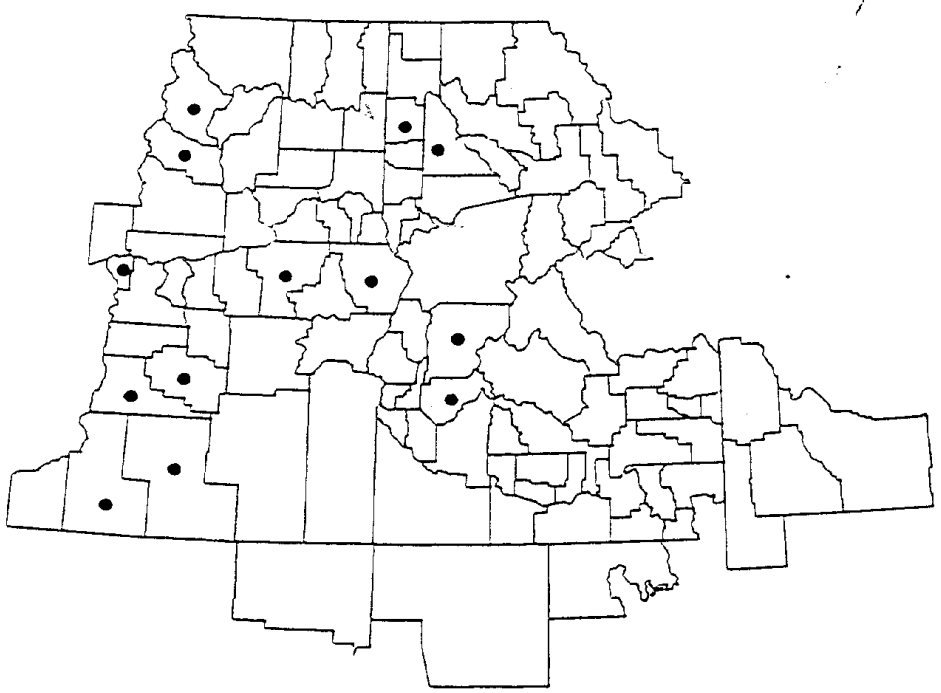


Carex lasiocarpa var. americana



Carex lenticularis var. dolia



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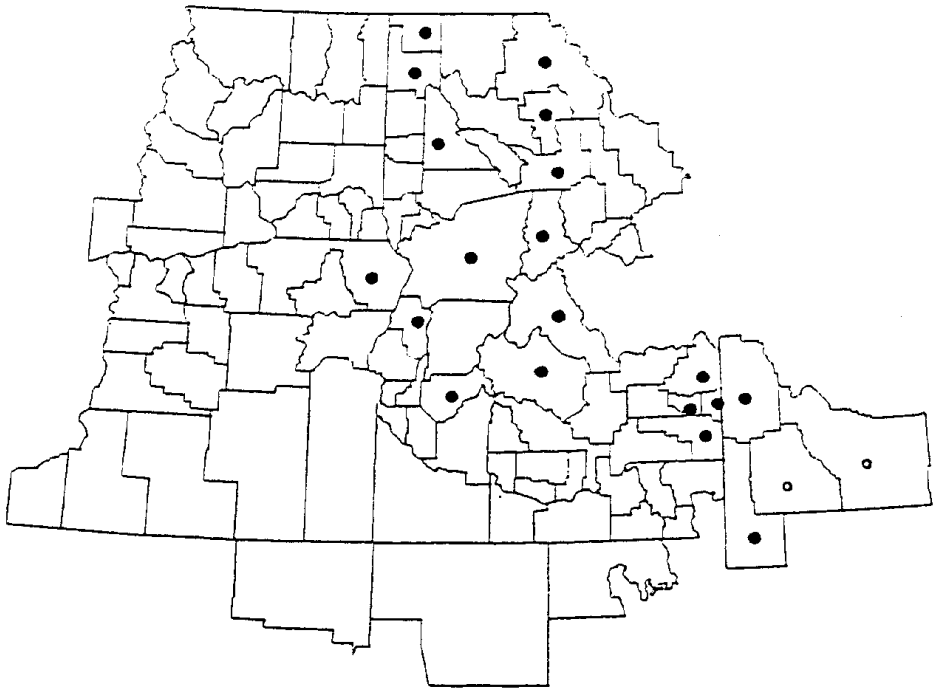

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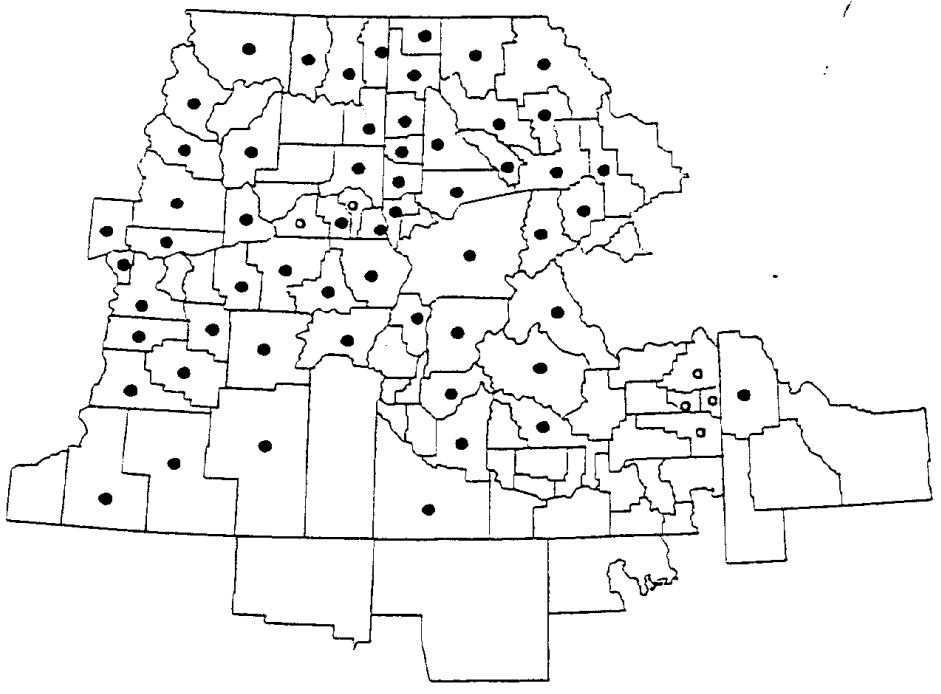
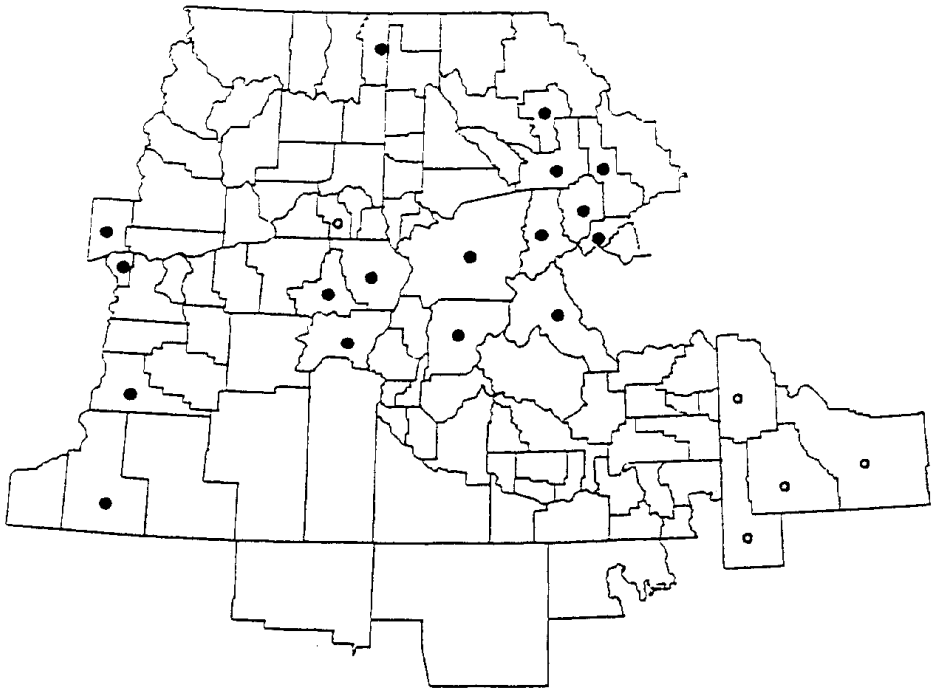


Carex lenticularis var. lipocarpa



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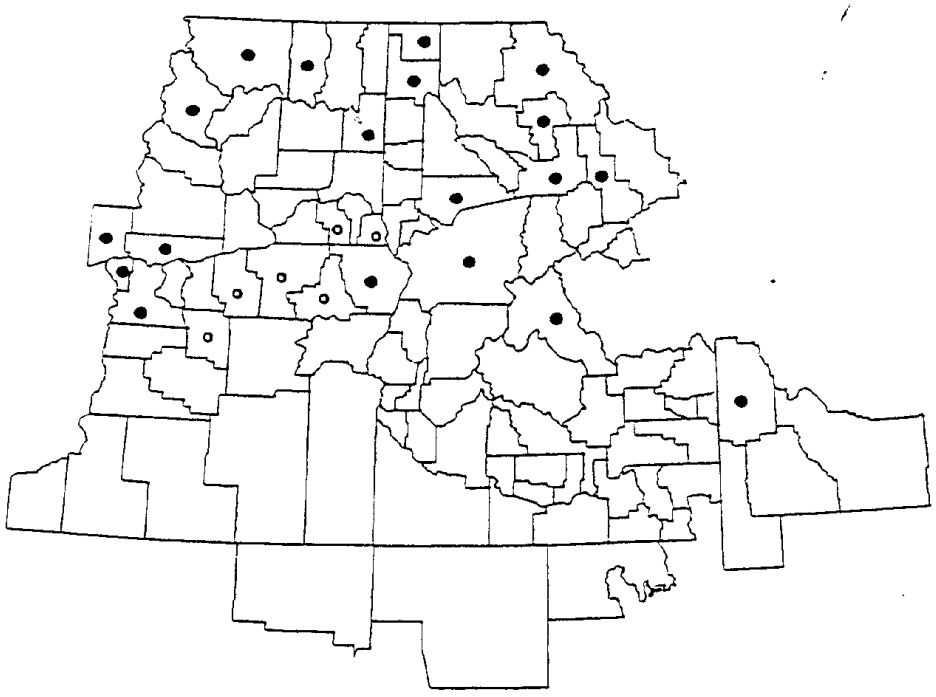

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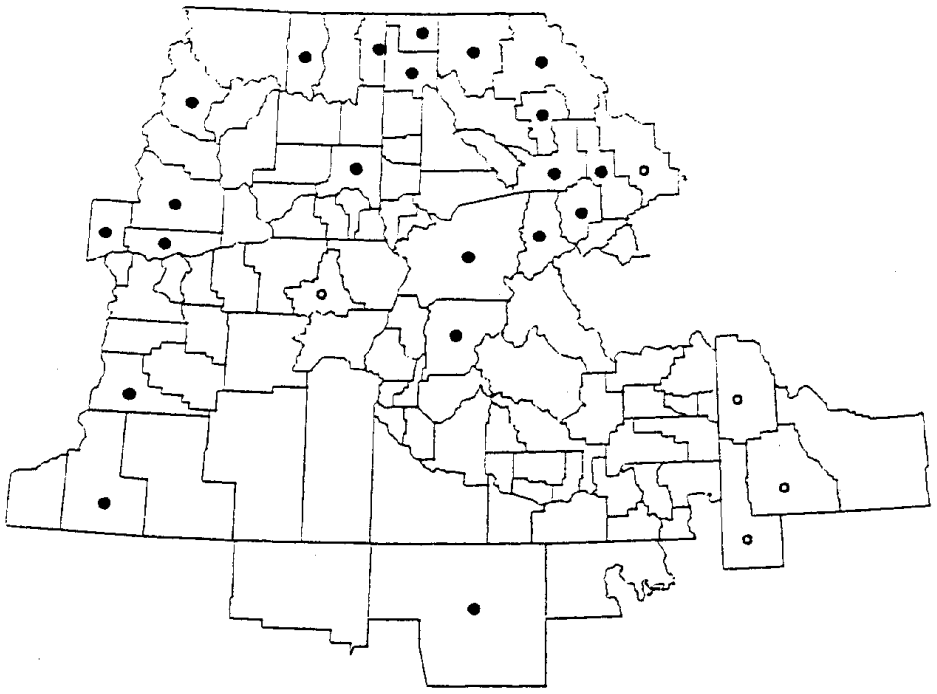

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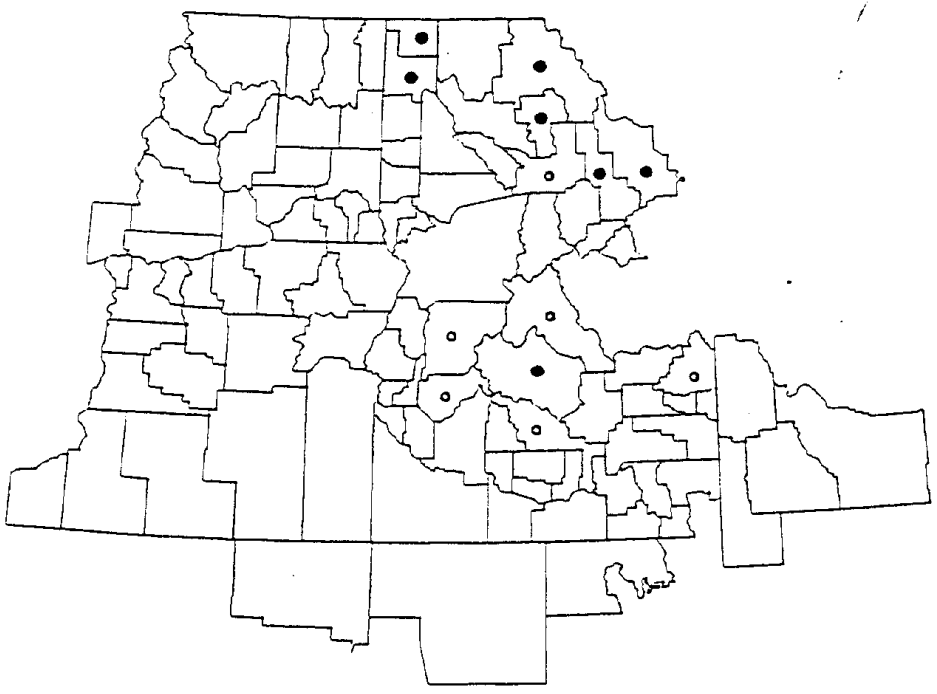

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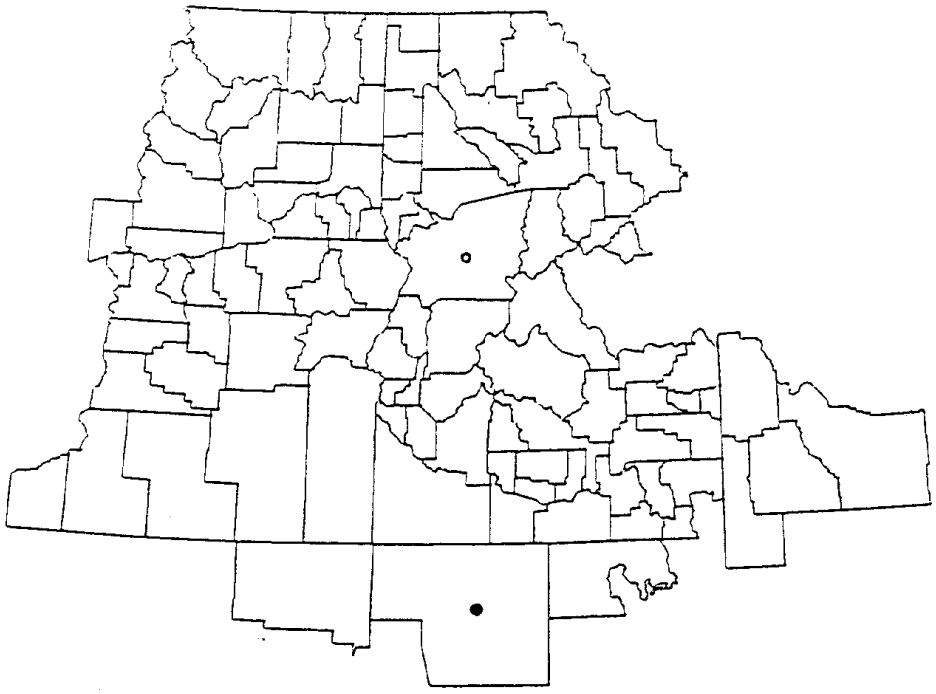
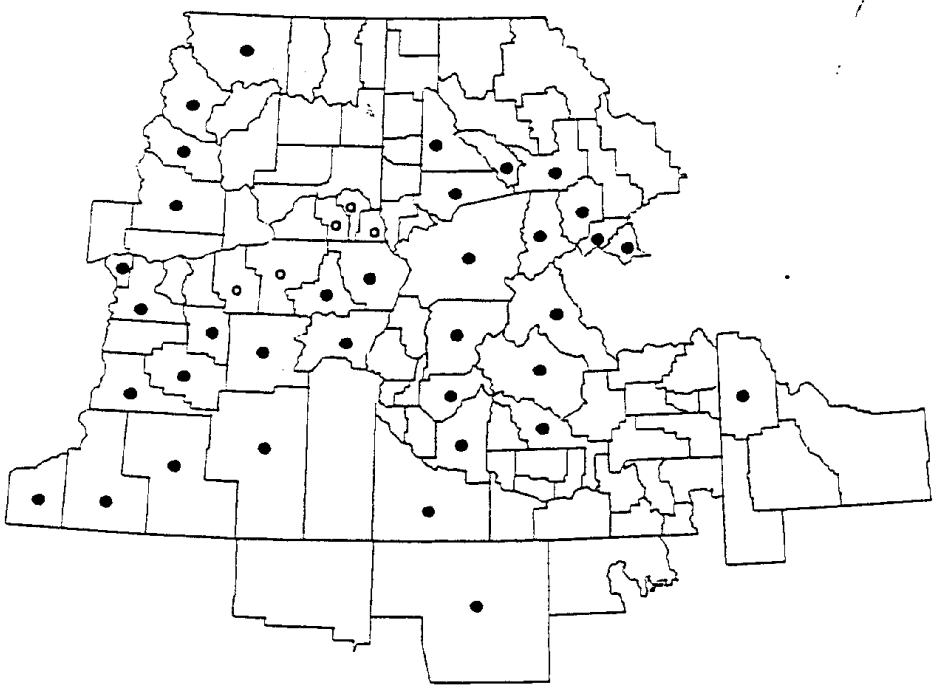
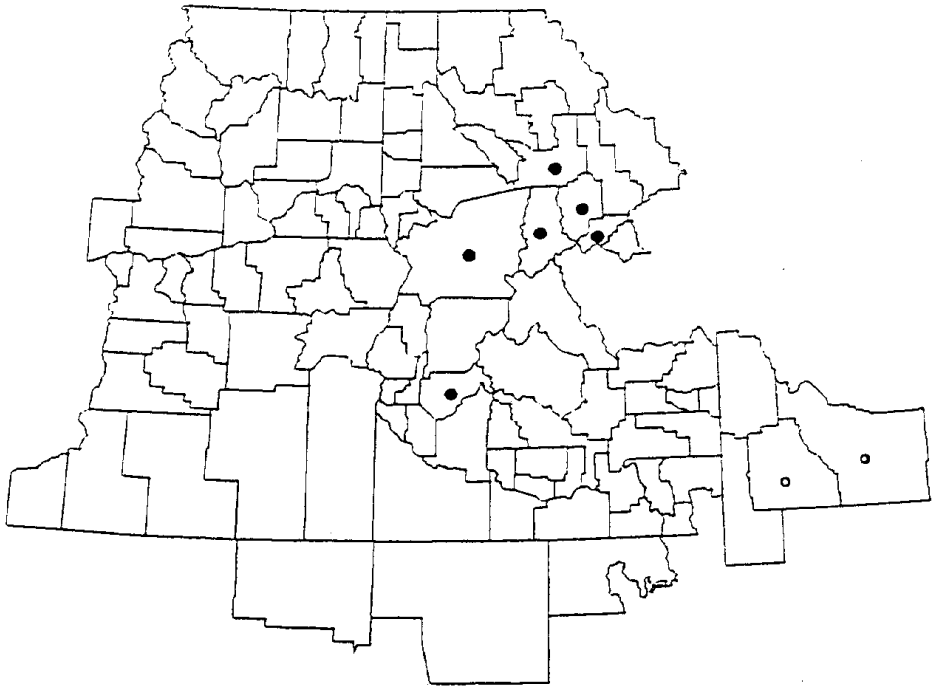


Carex luzulaifolia



Carex luzulina var. ablata



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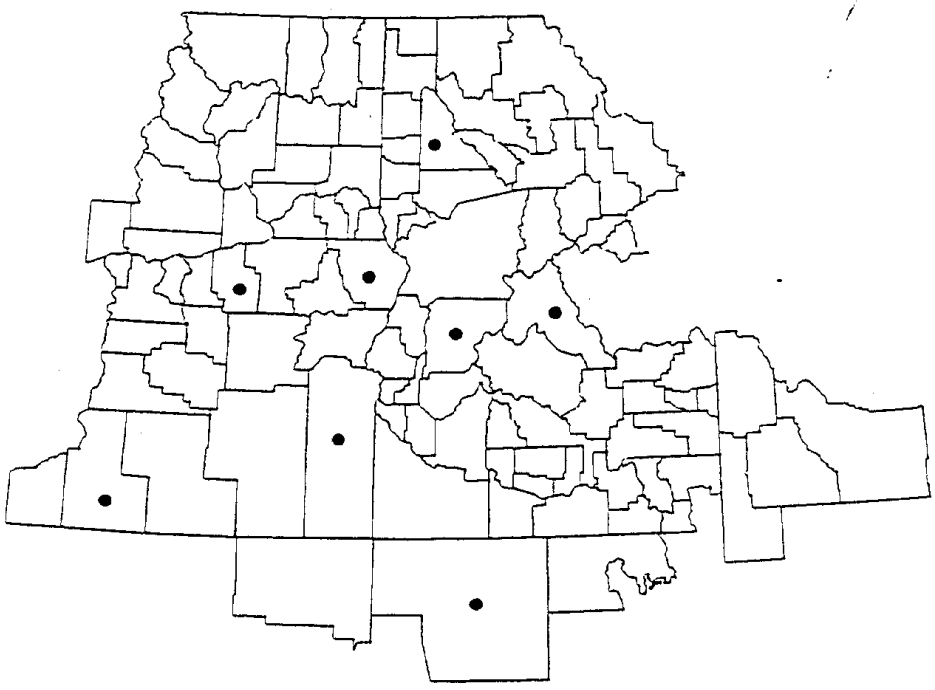
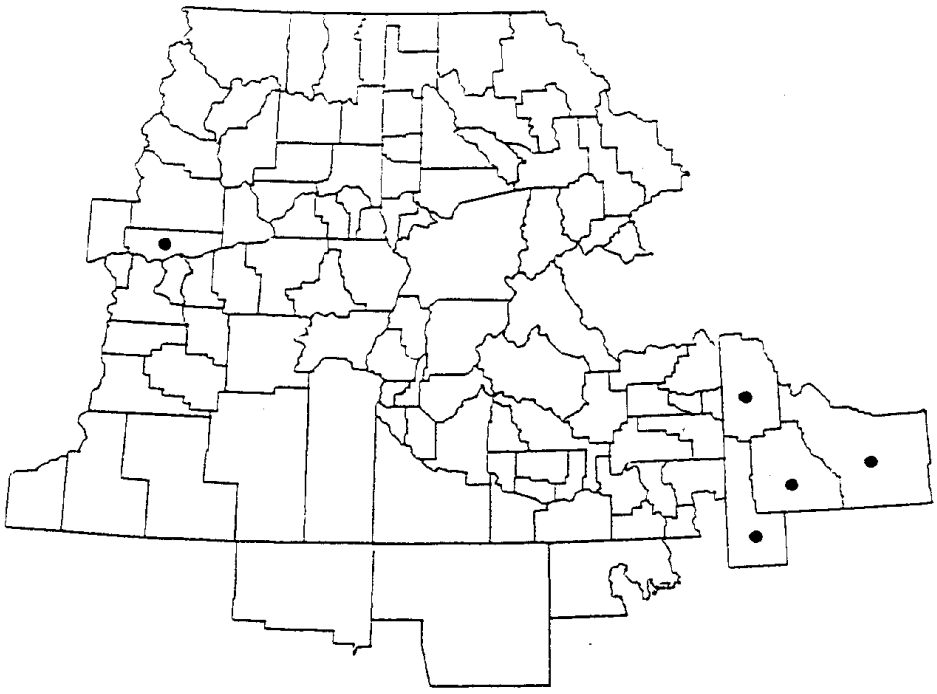
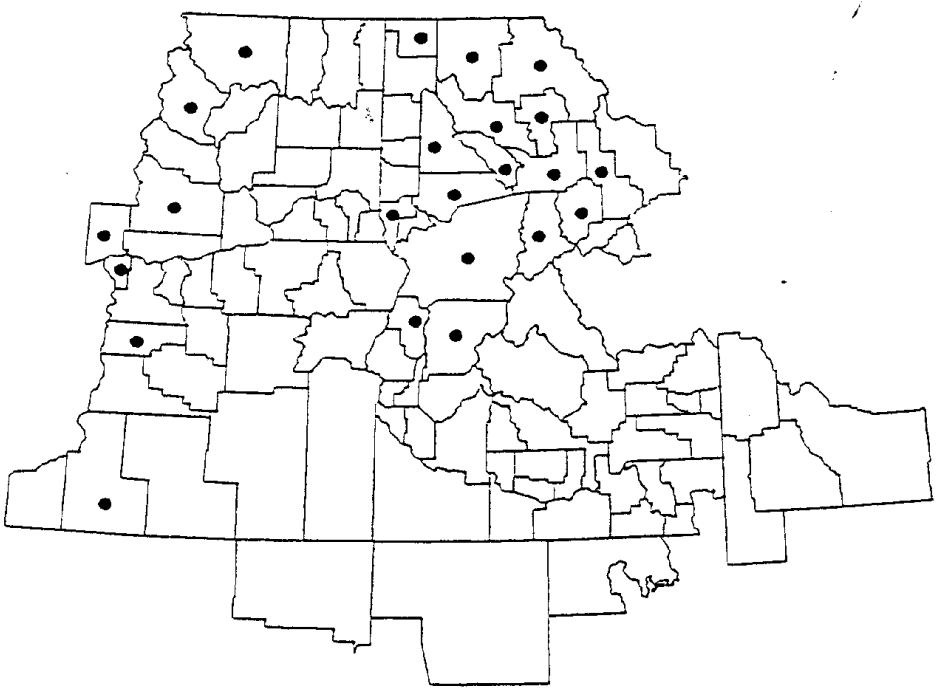


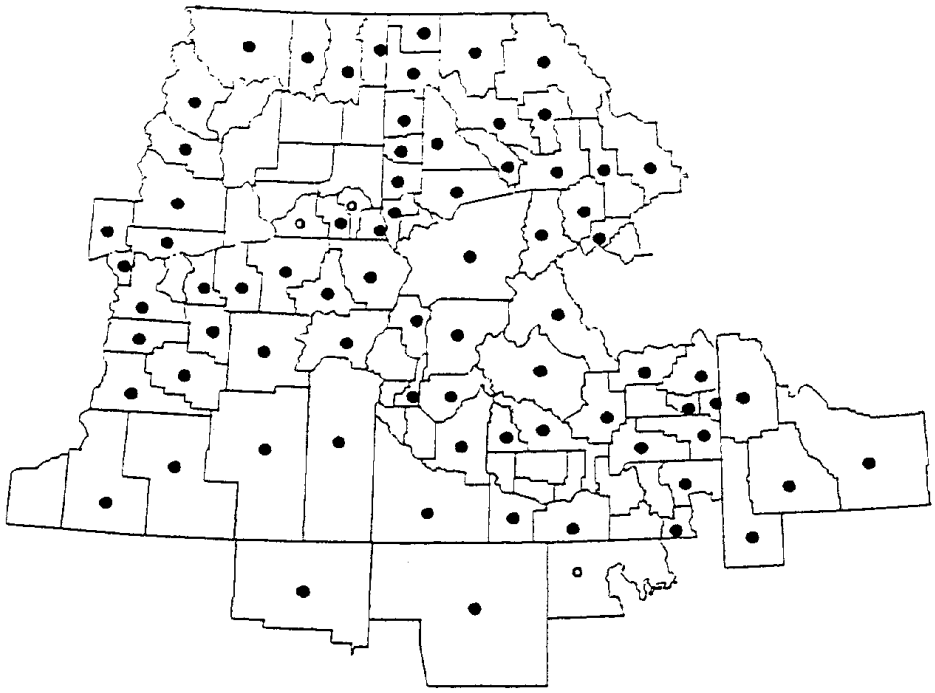
Carex luzulina var. luzulina



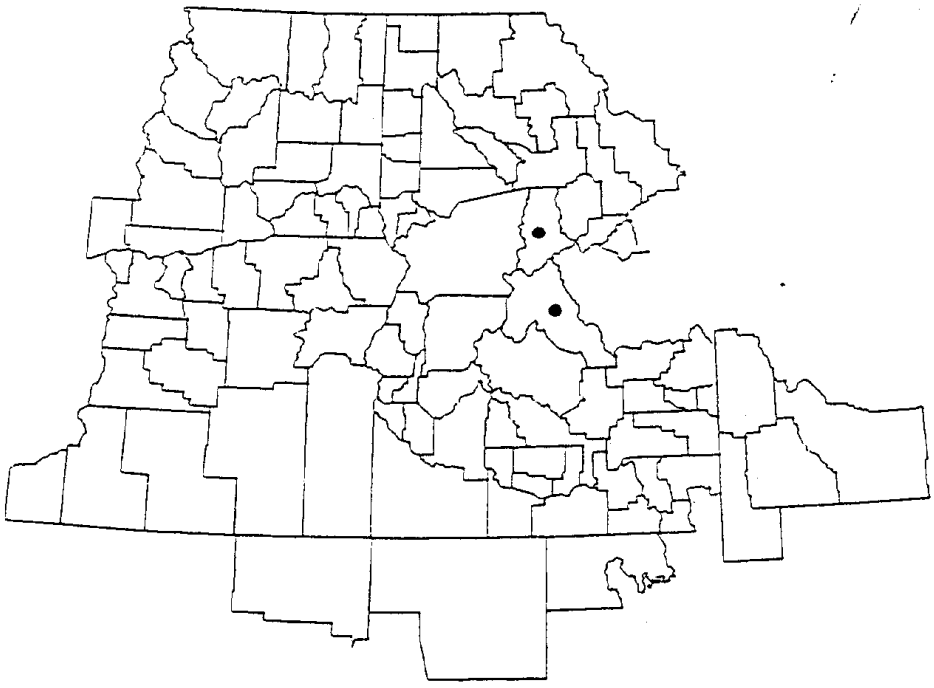
Carex macloviana



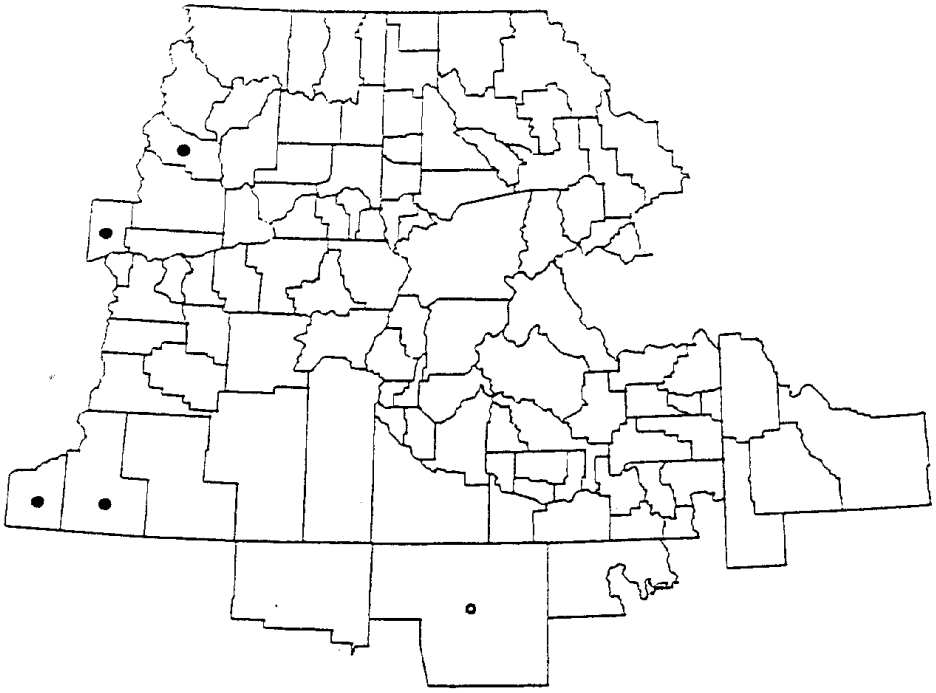
Carex mertensii



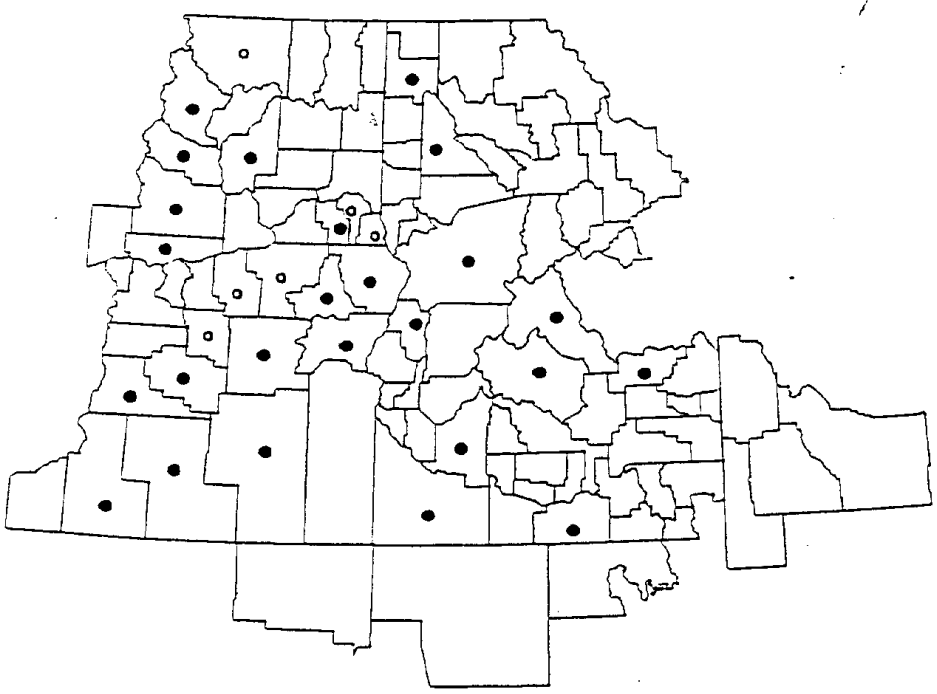
Carex microptera



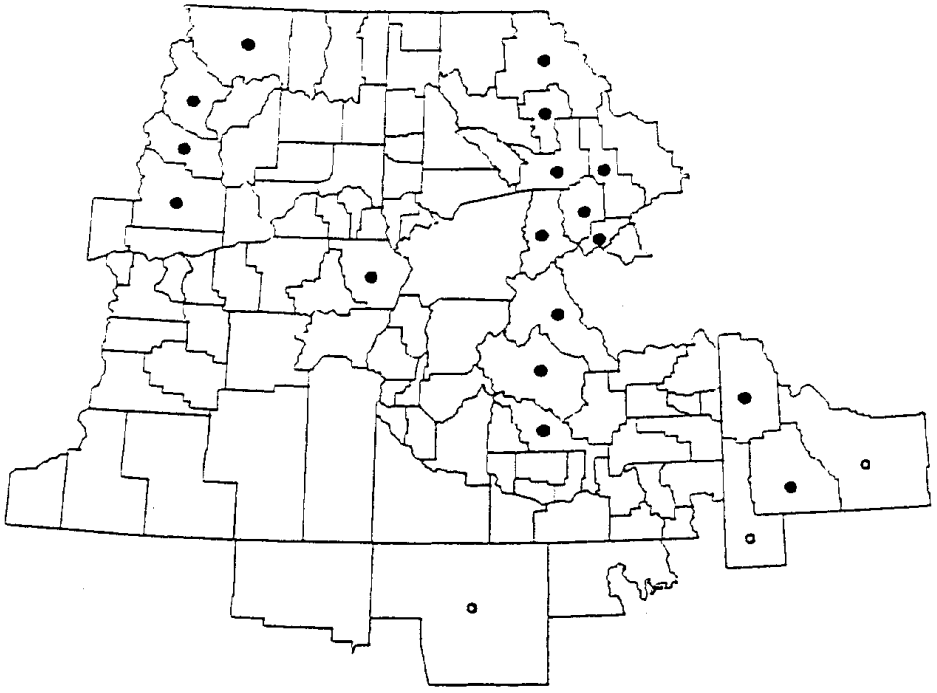
Carex misandra



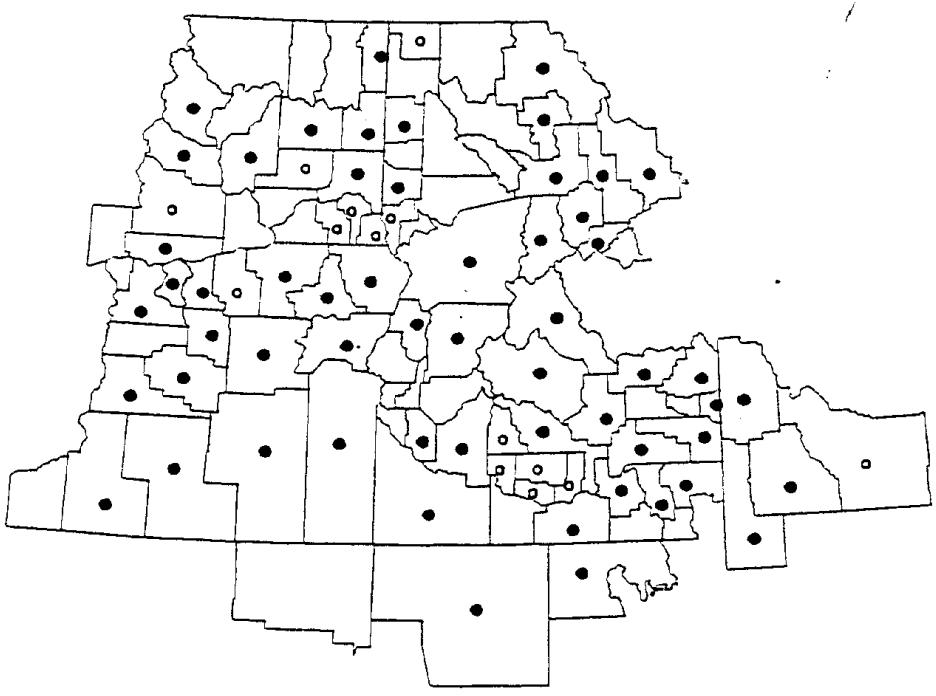
Carex multicaulis



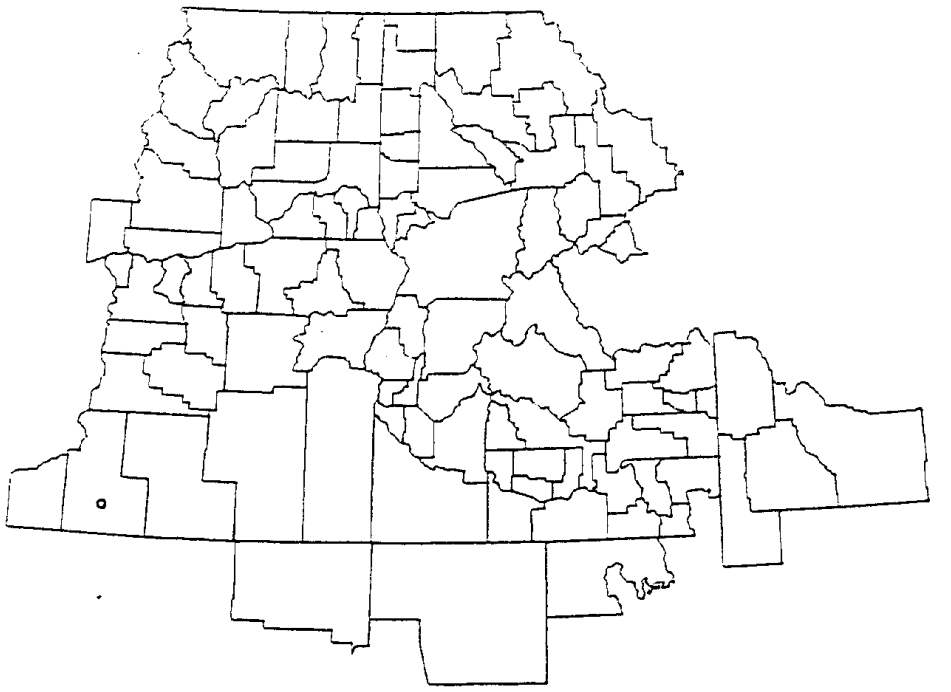
Carex multicostata



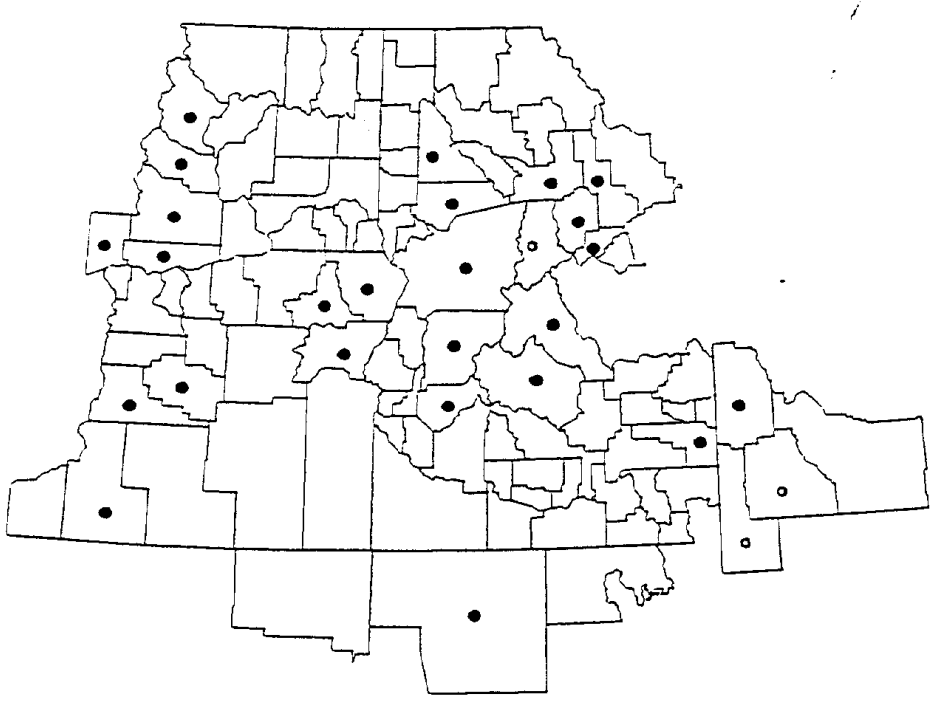
Carex nardina



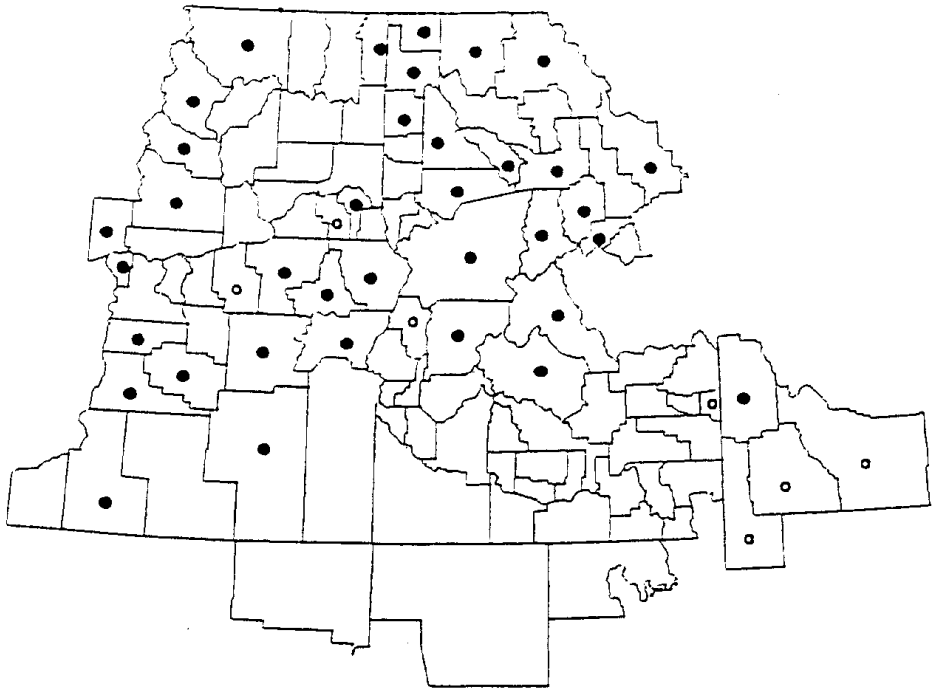
Carex nebrascensis



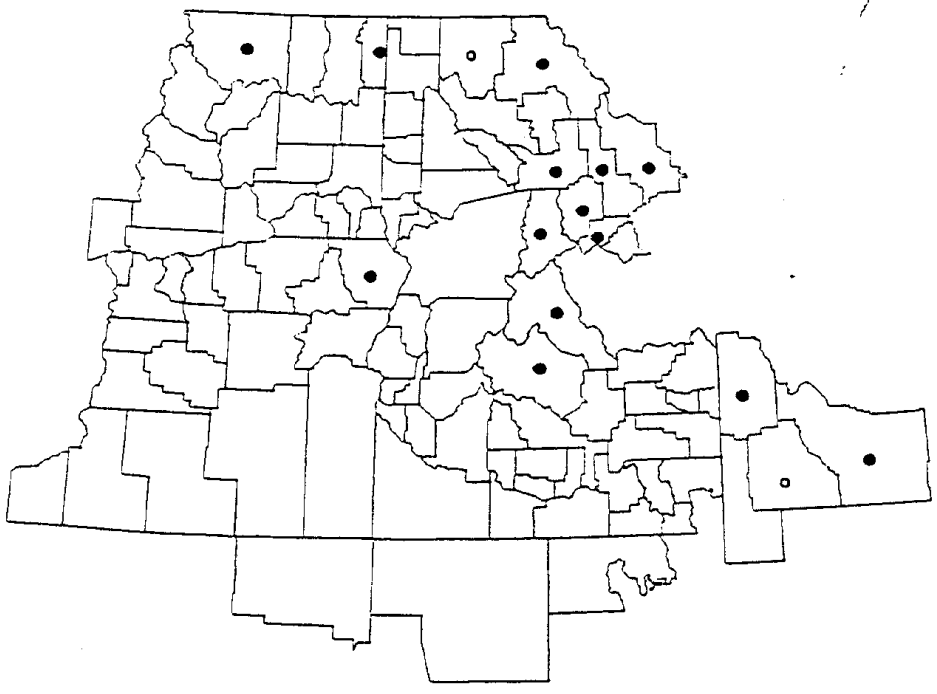
Carex nervina



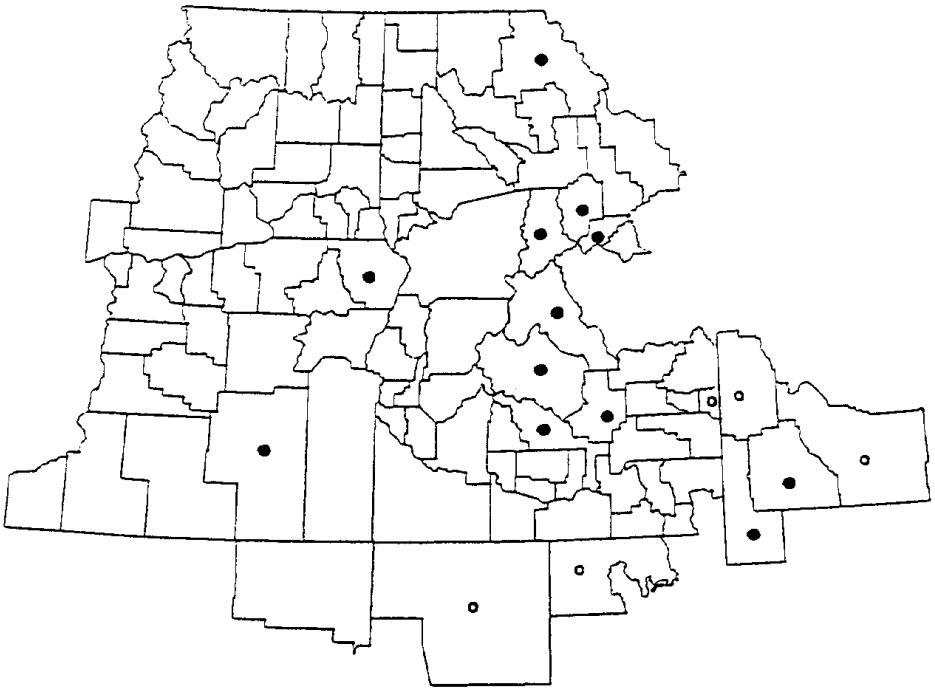
Carex neurophora



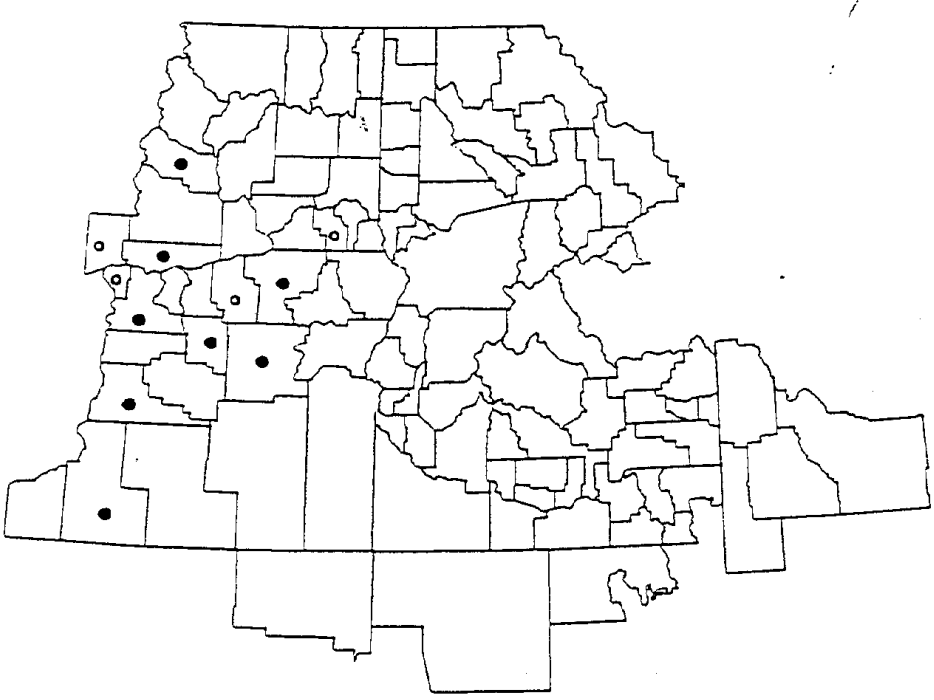
Carex nigricans



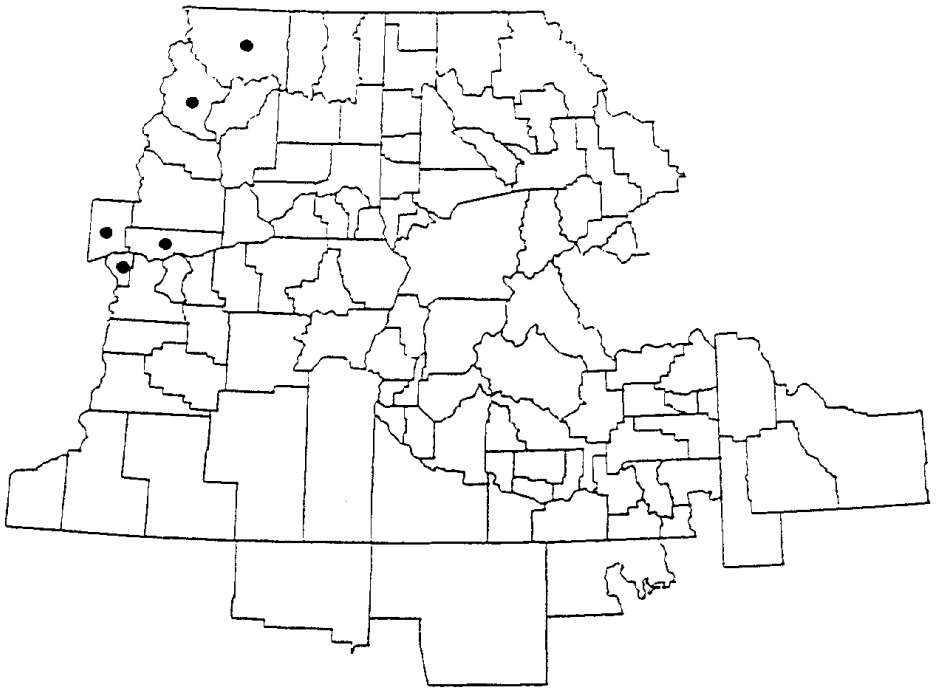
Carex norvegica ssp. norvegica



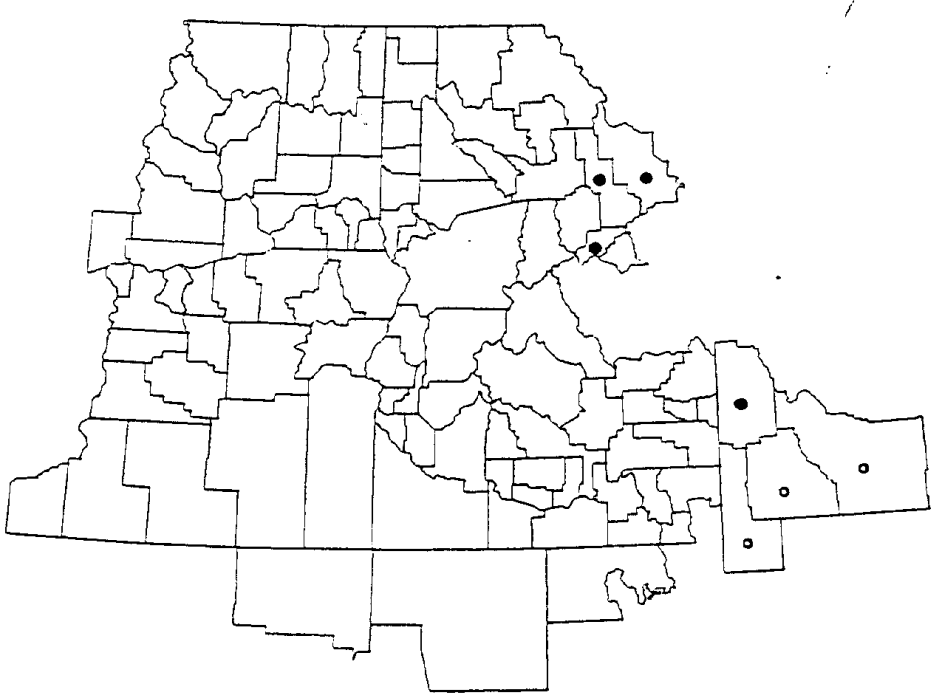
Carex nova



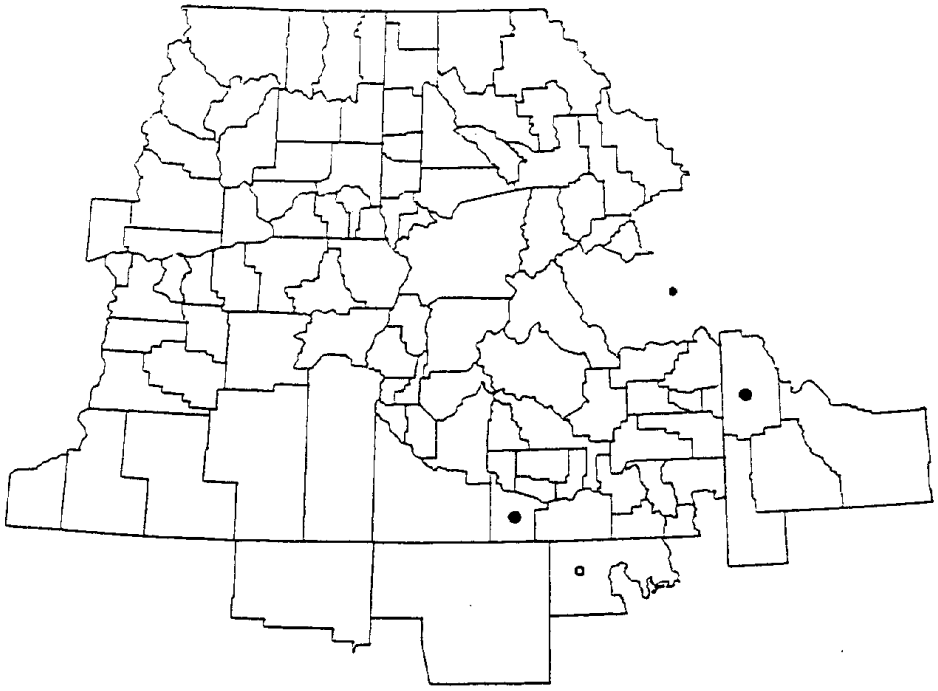
Carex nudata



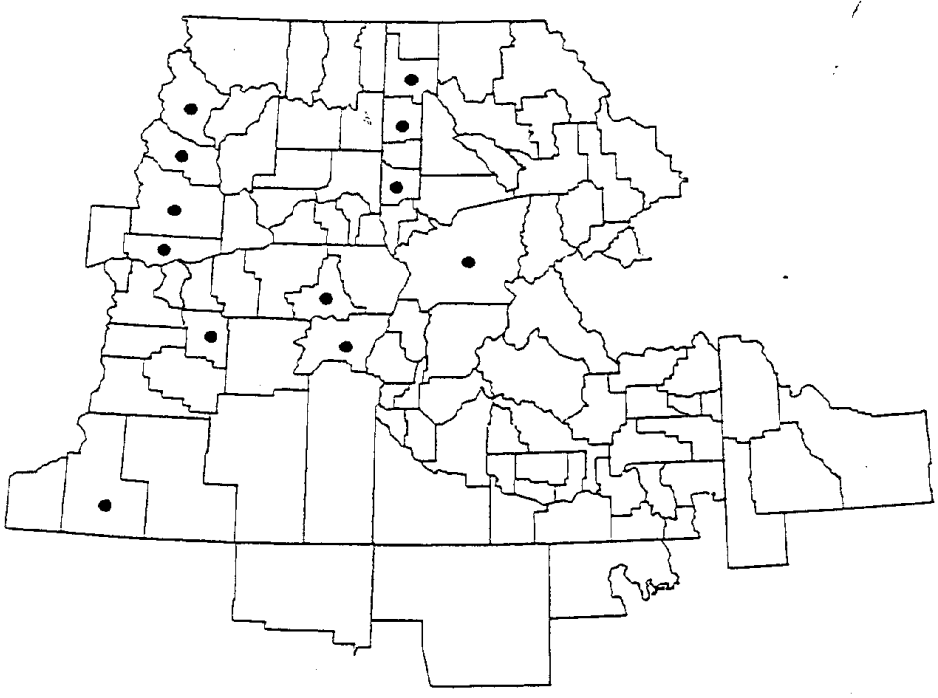
Carex obnupta



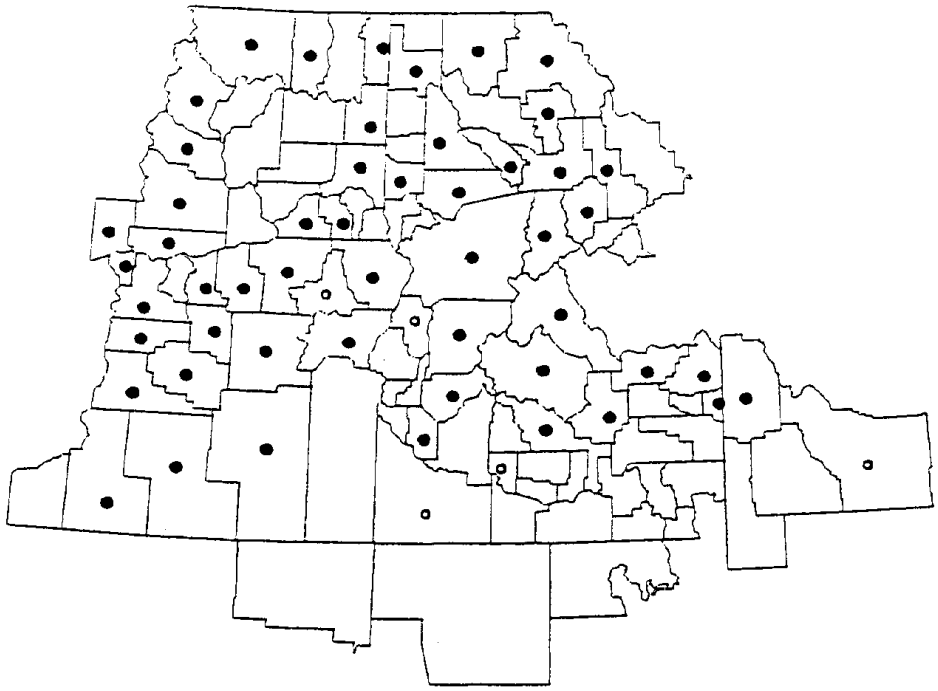
Carex obtusata



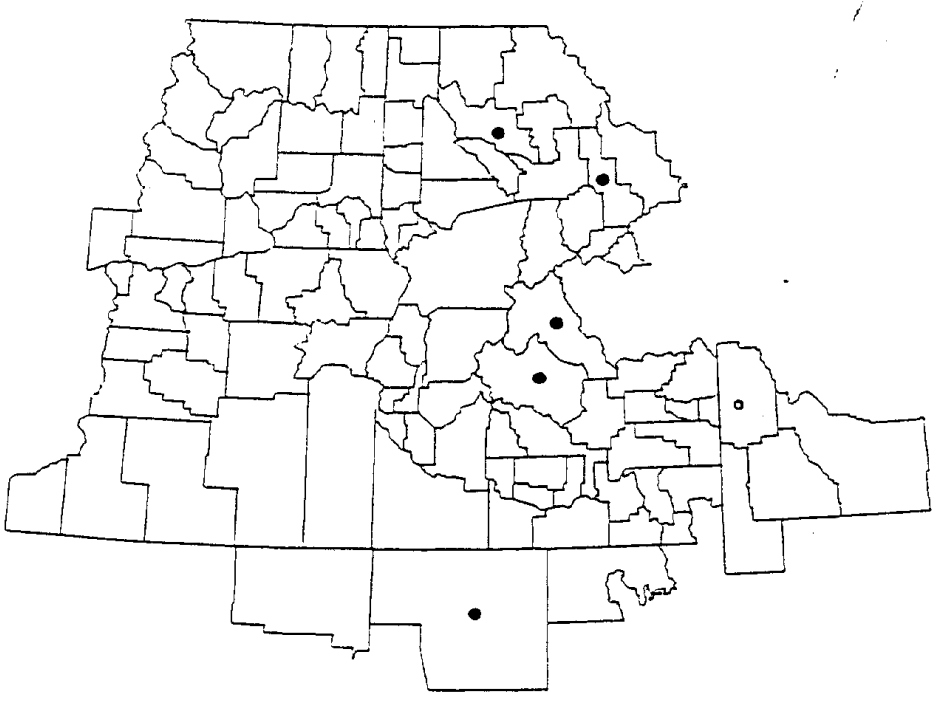
Carex occidentalis



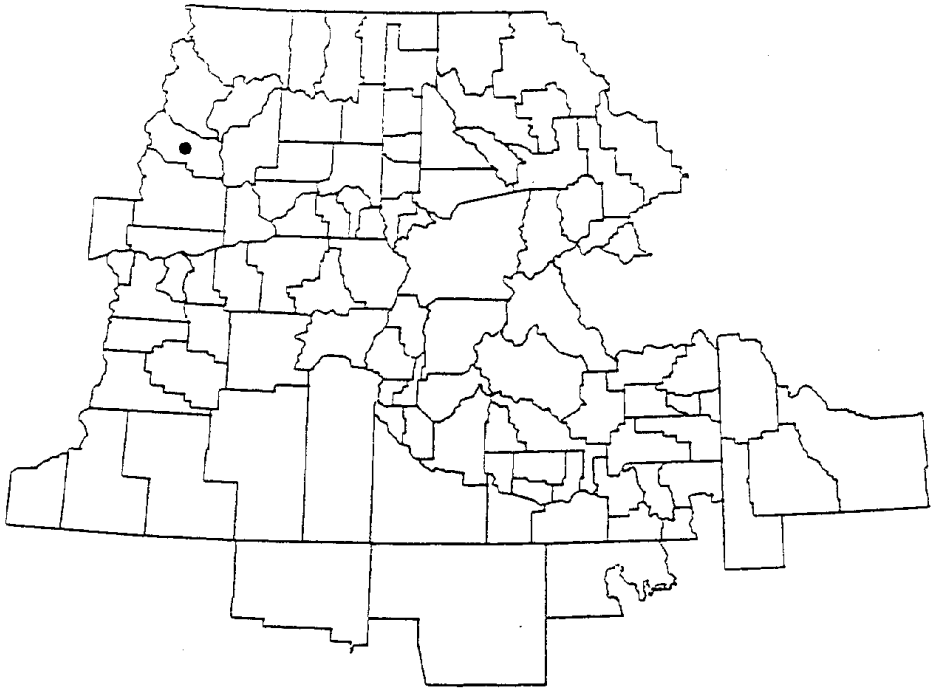
Carex ovalis



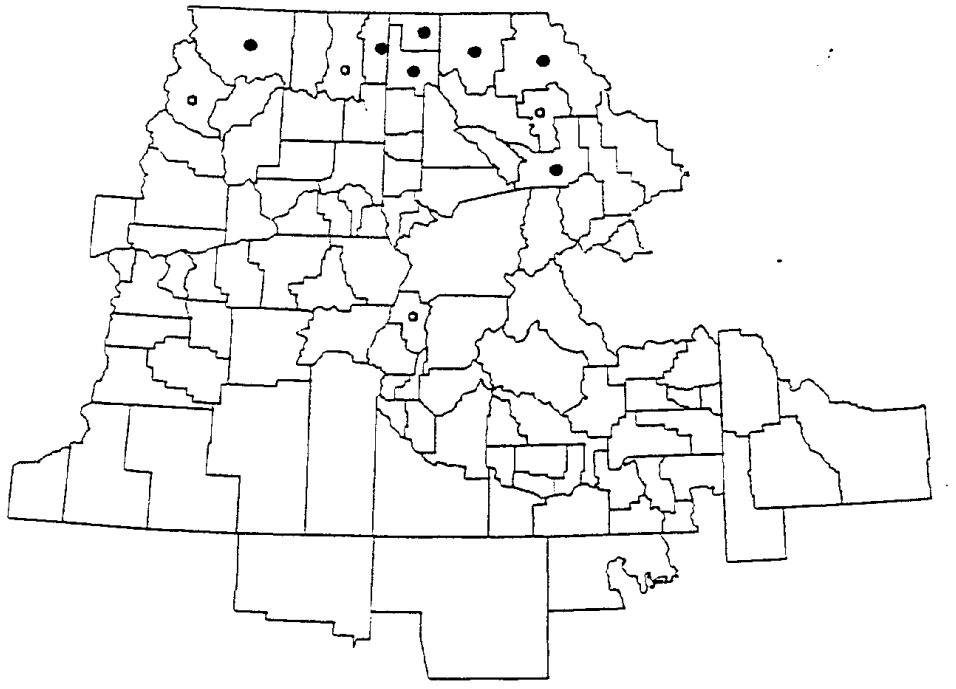
Carex pachystachya



Carex parryana var. parryana



Carex pauciflora



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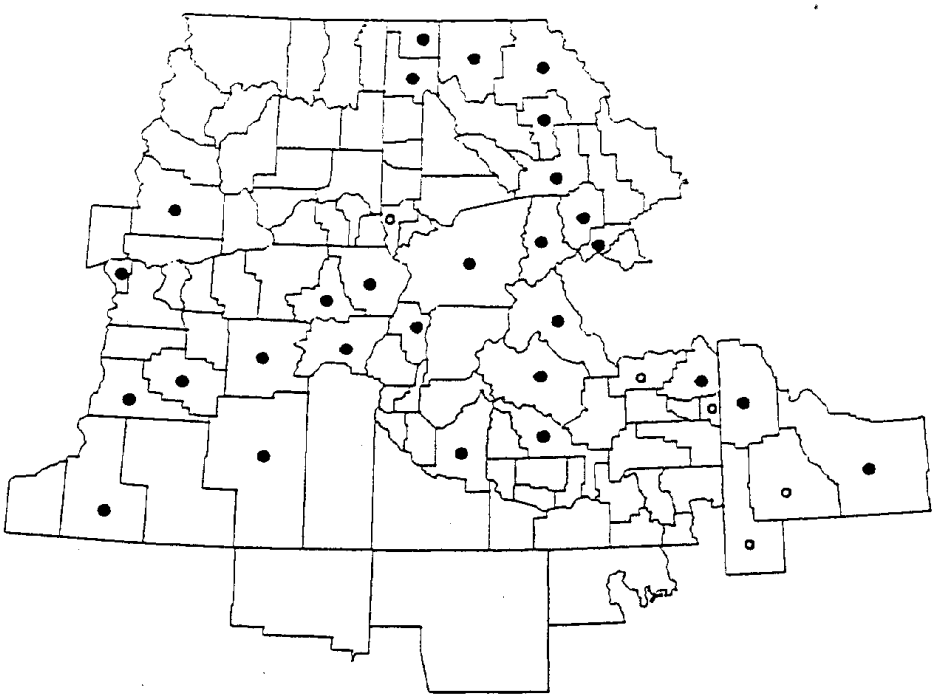
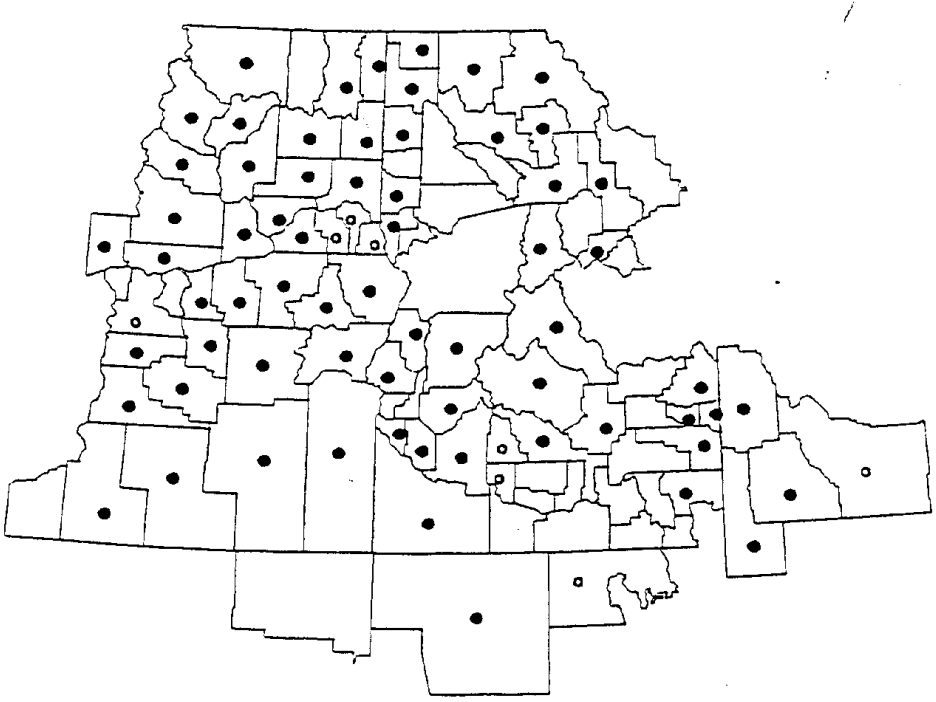
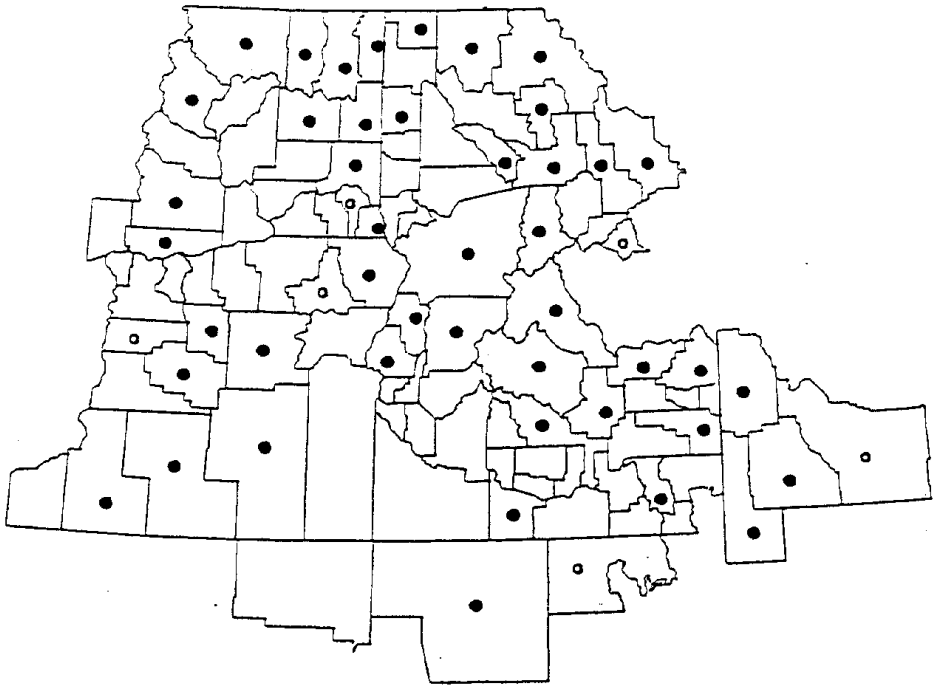


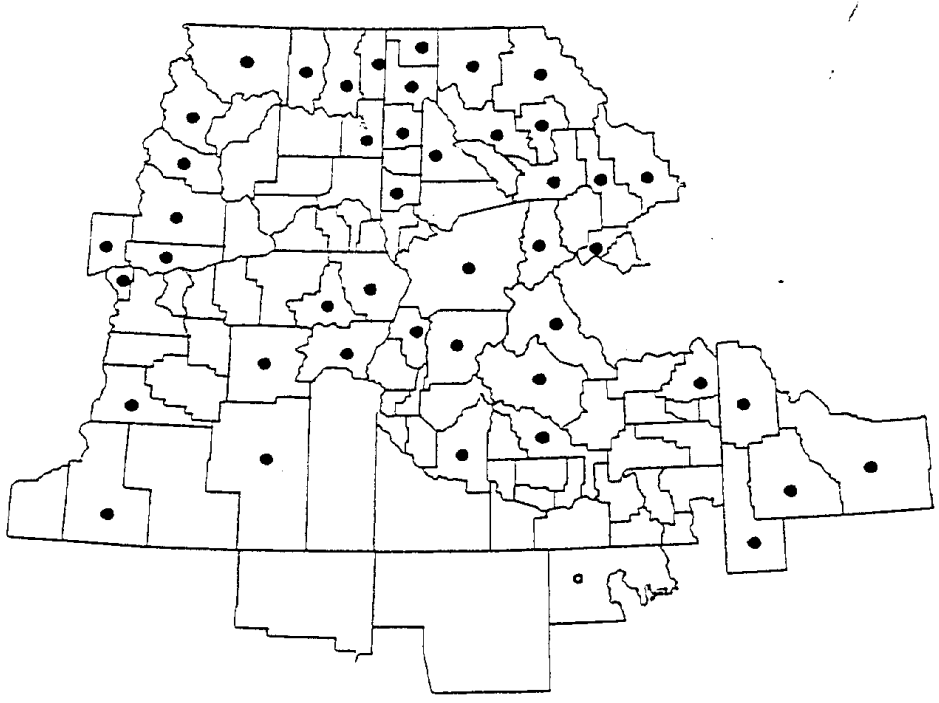
Carex paysonis



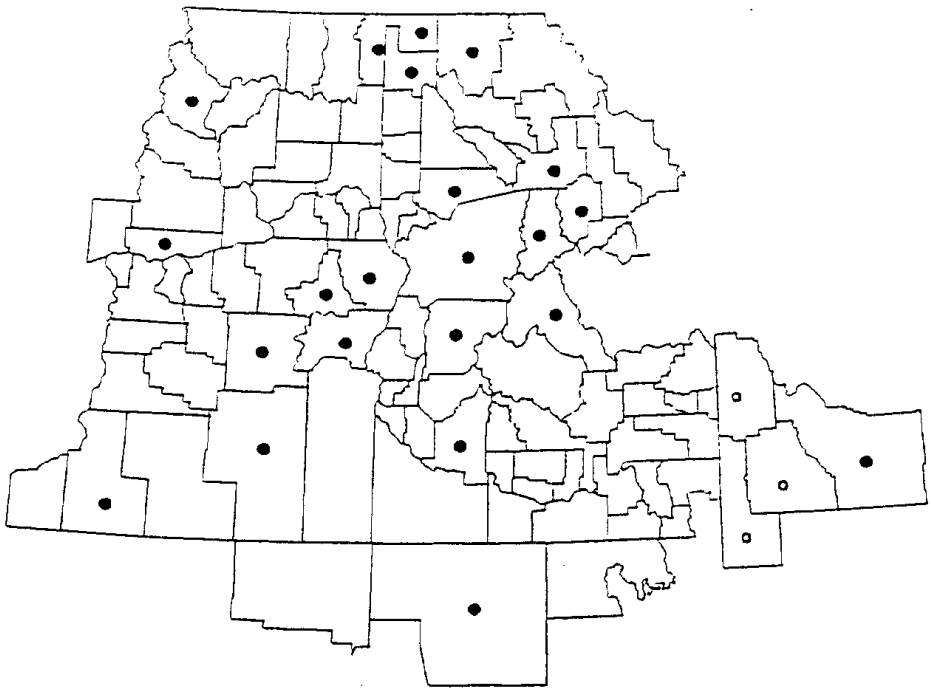
Carex pellita



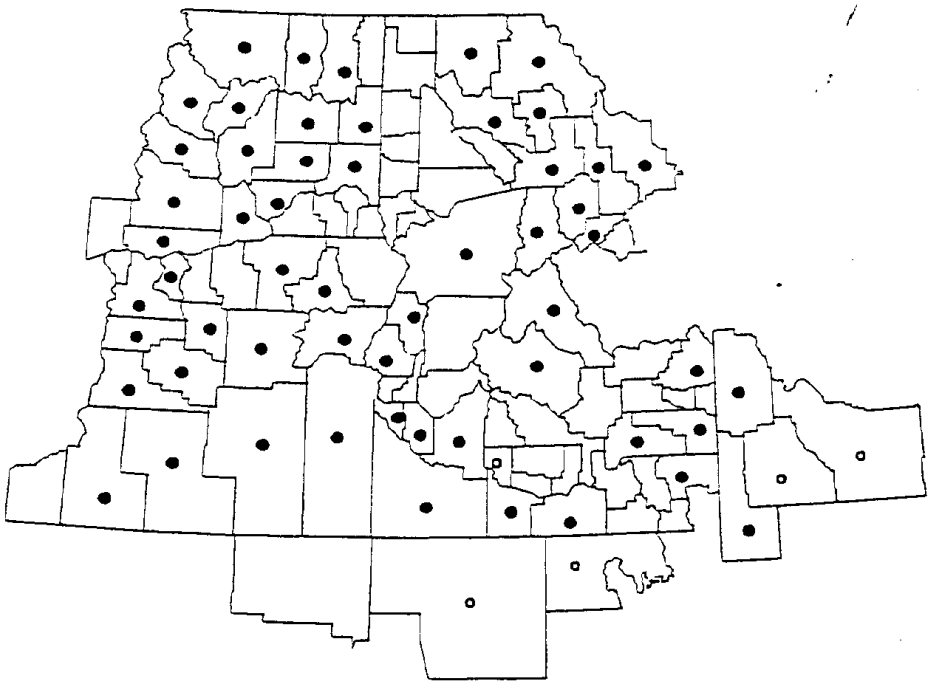
Carex petasata



Carex phaeocephala



Carex praeceptorum



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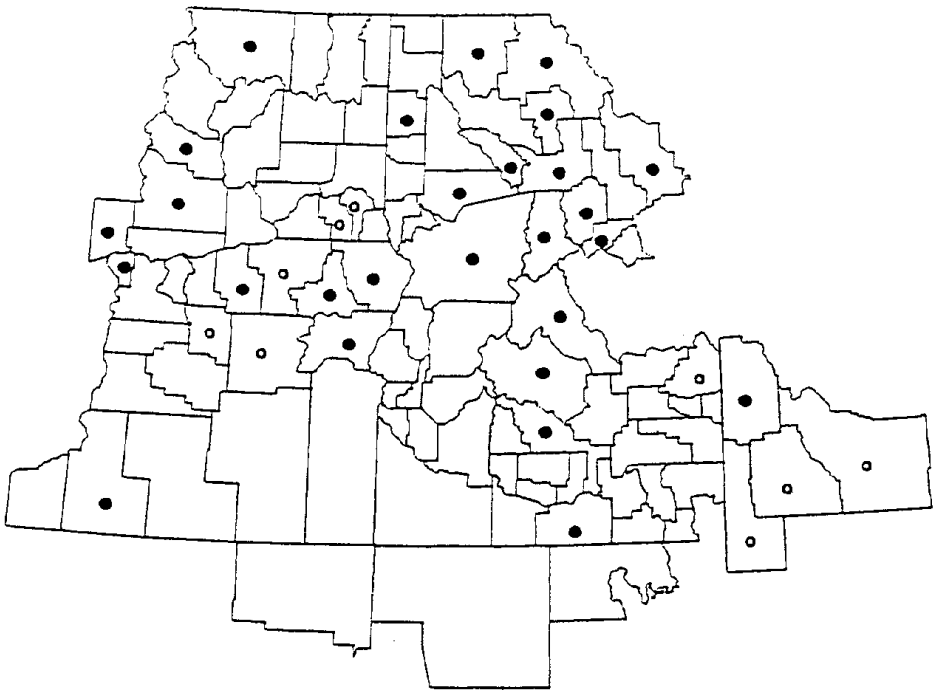
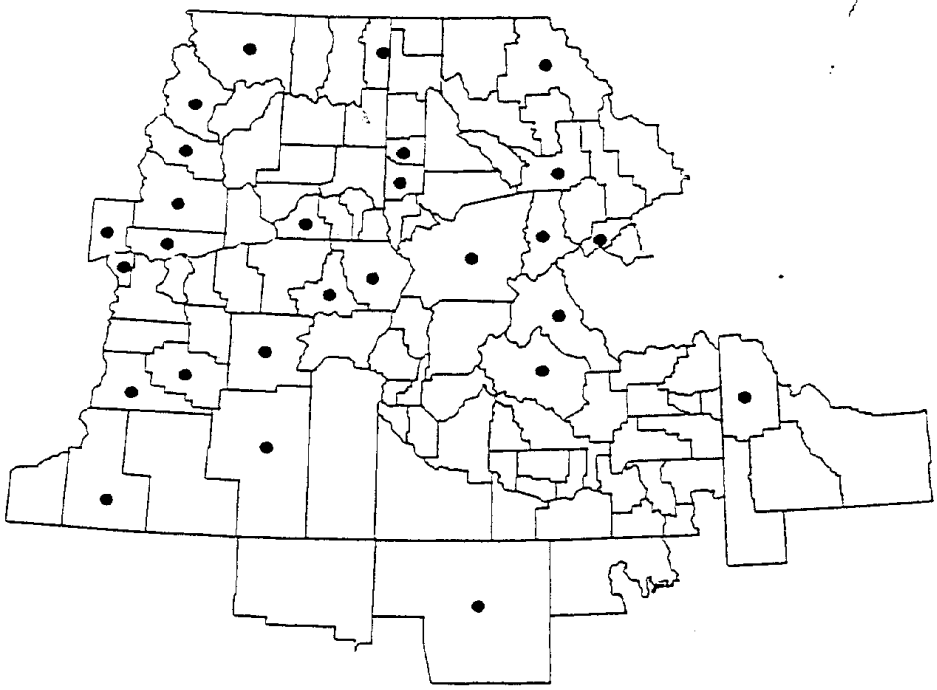
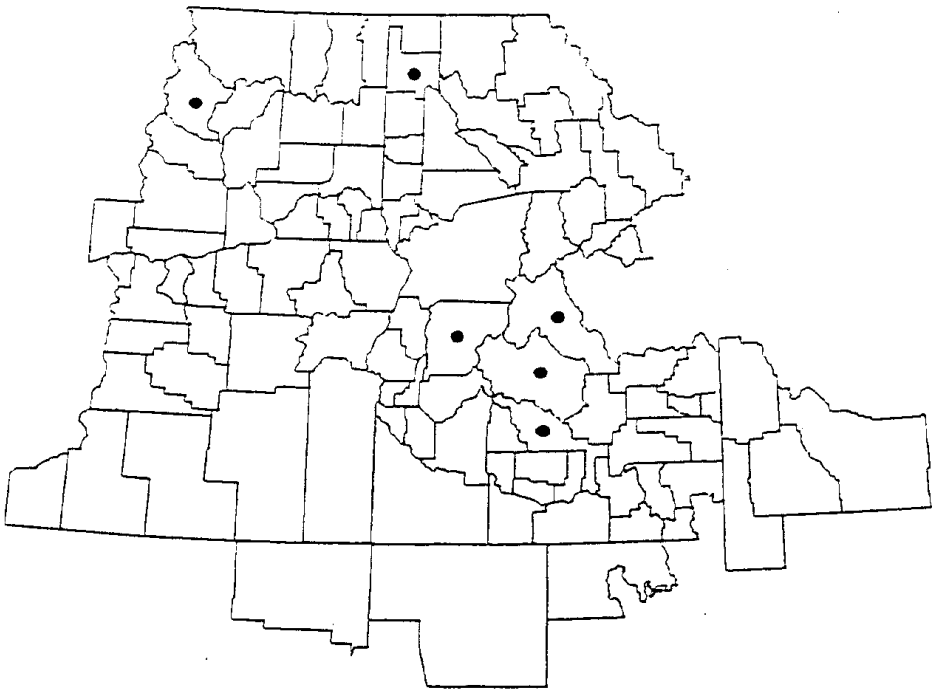


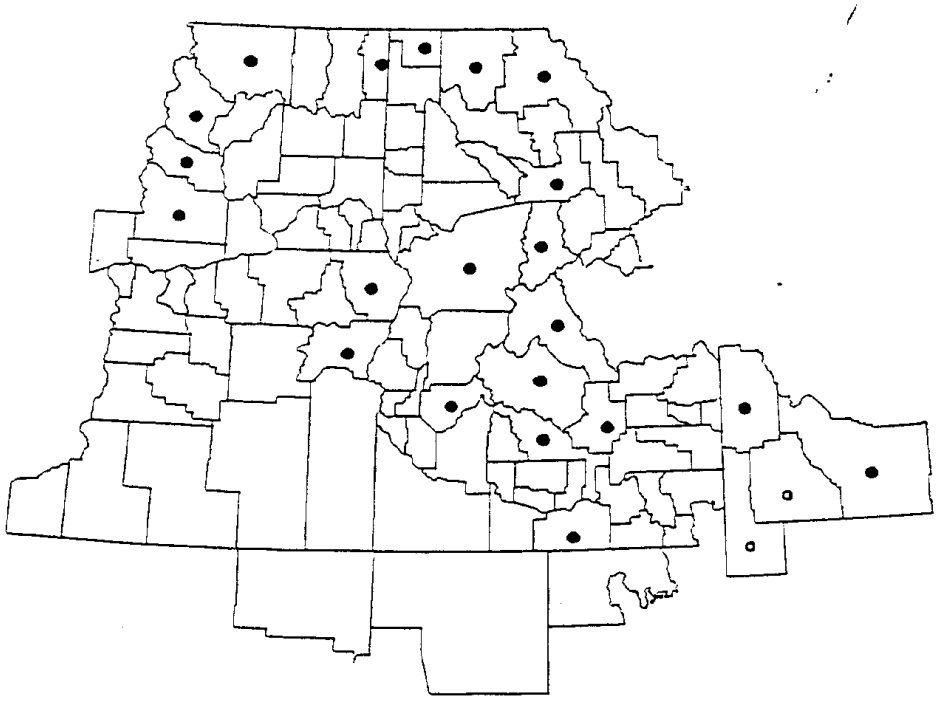
Carex praticola



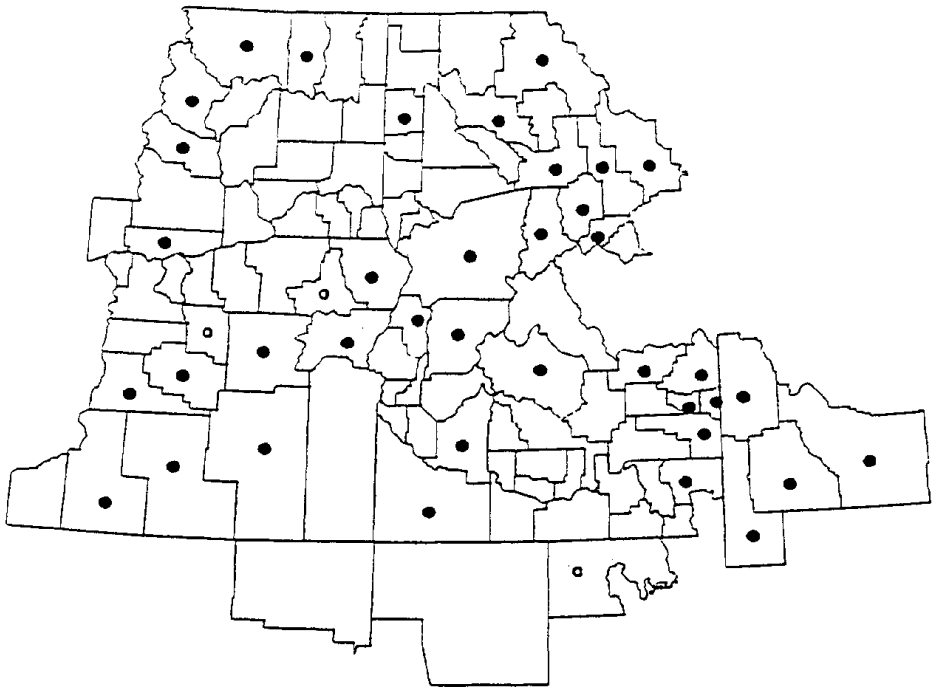
Carex preslii



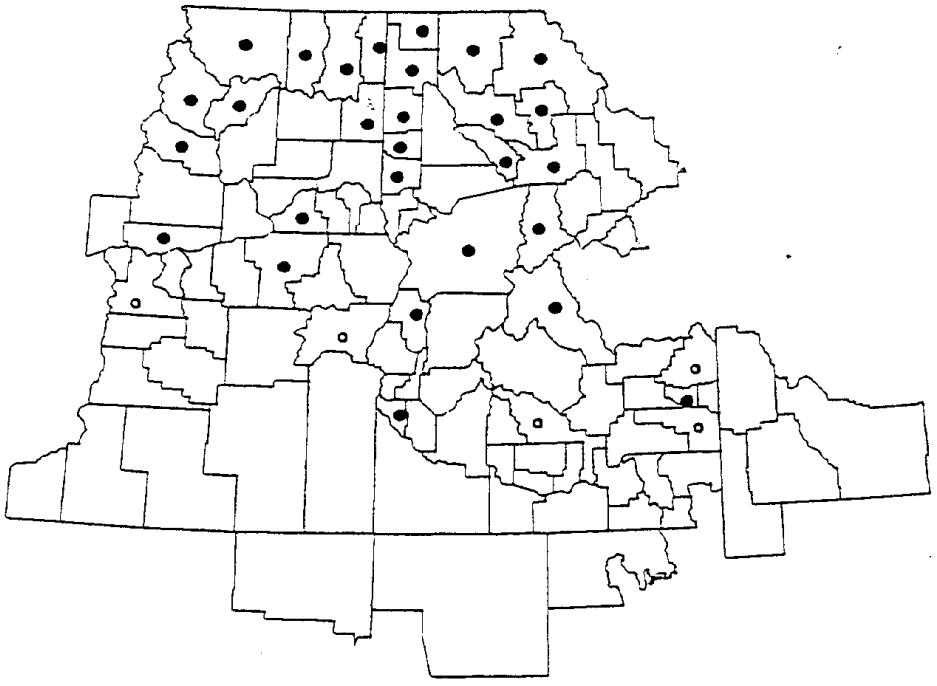
Carex proposita



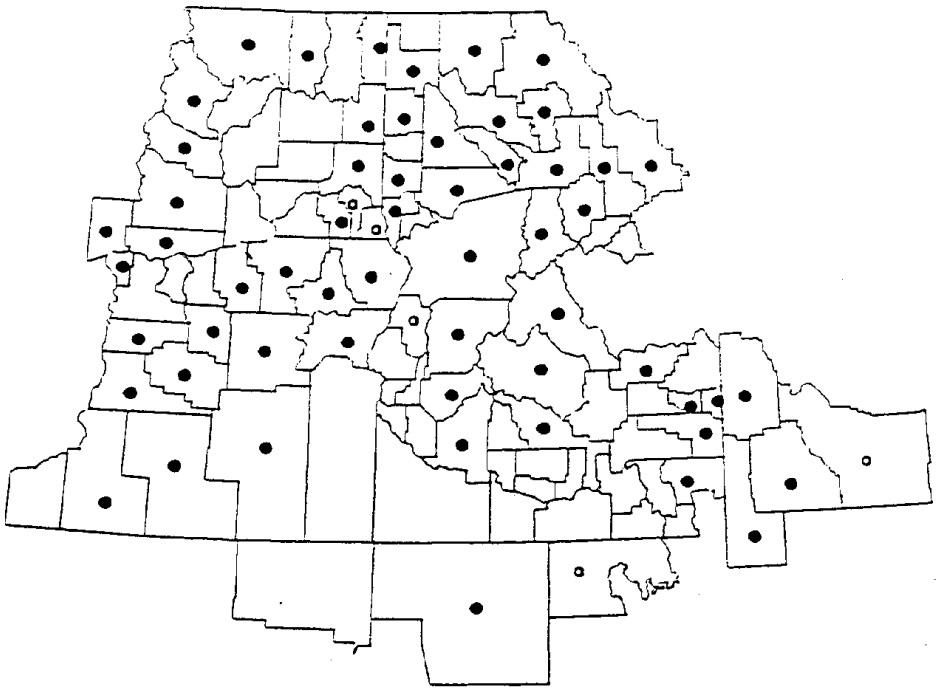
Carex pyrenaica



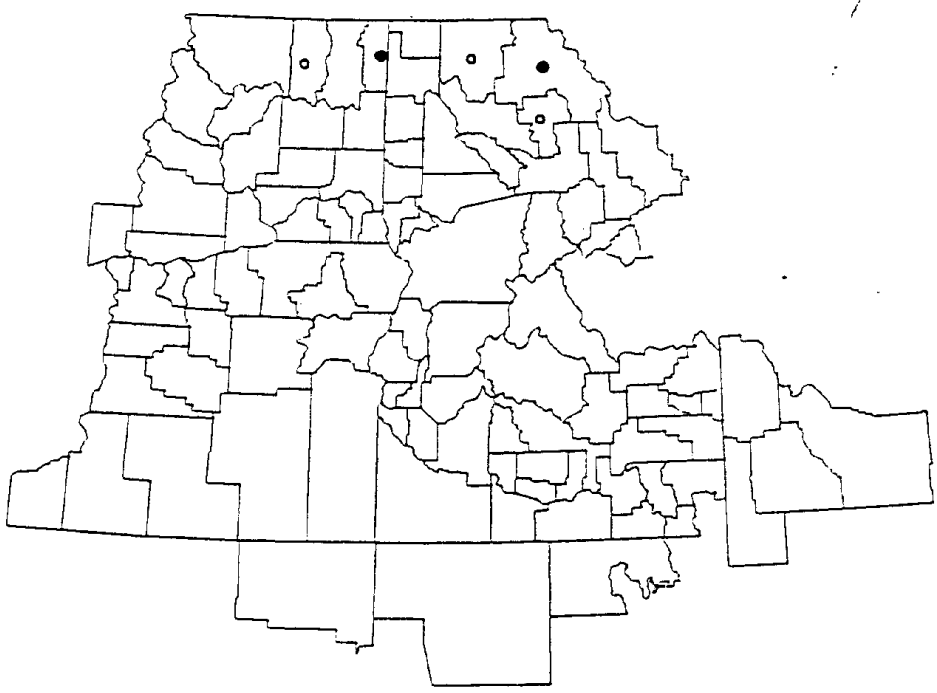
Carex raynoldsii



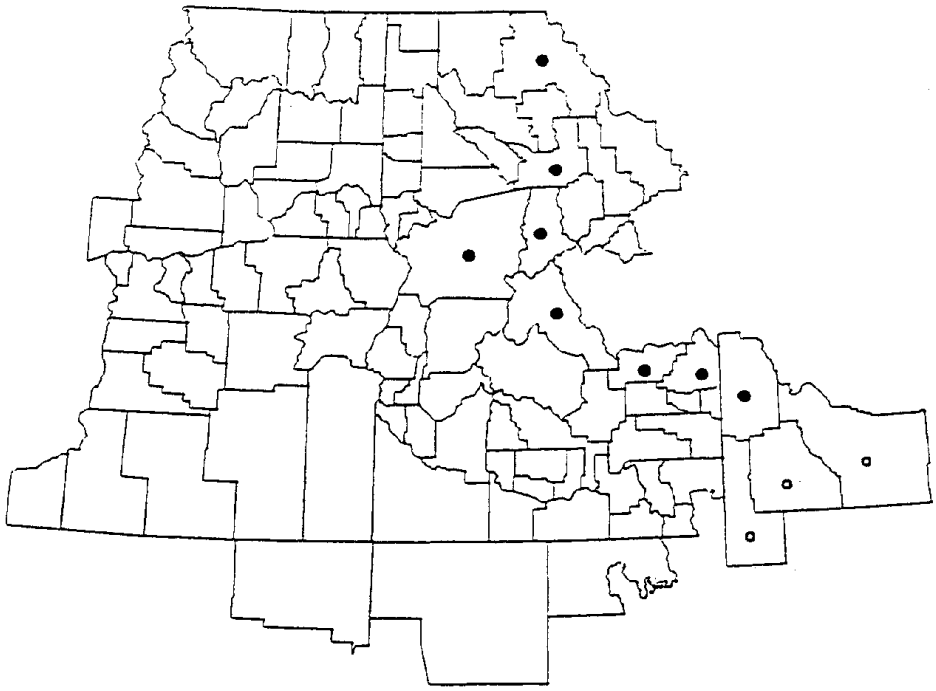
Carex retrorsa



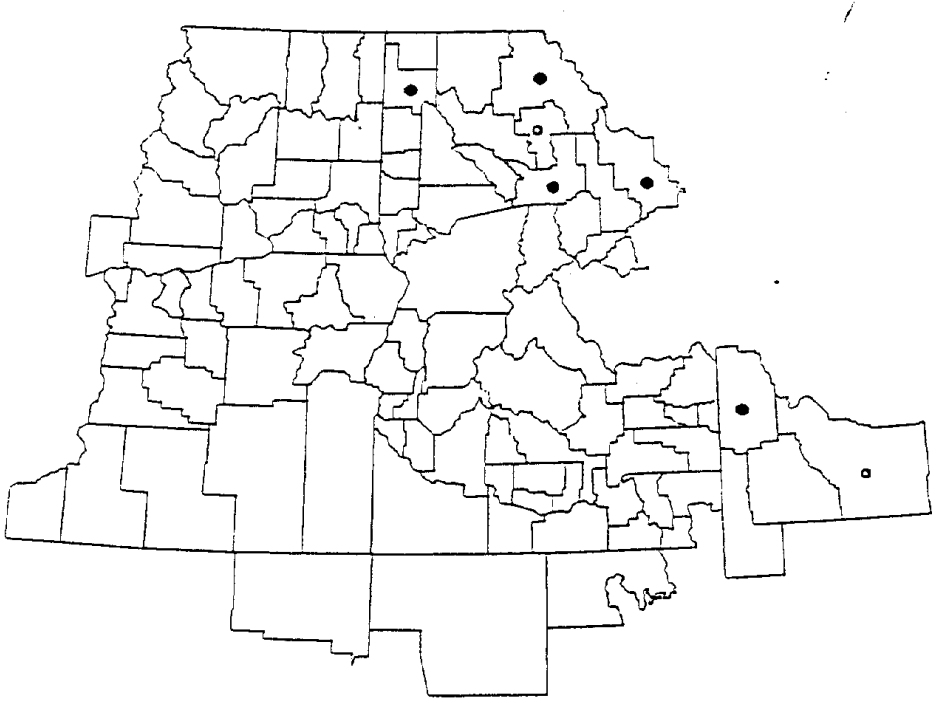
Carex rossii



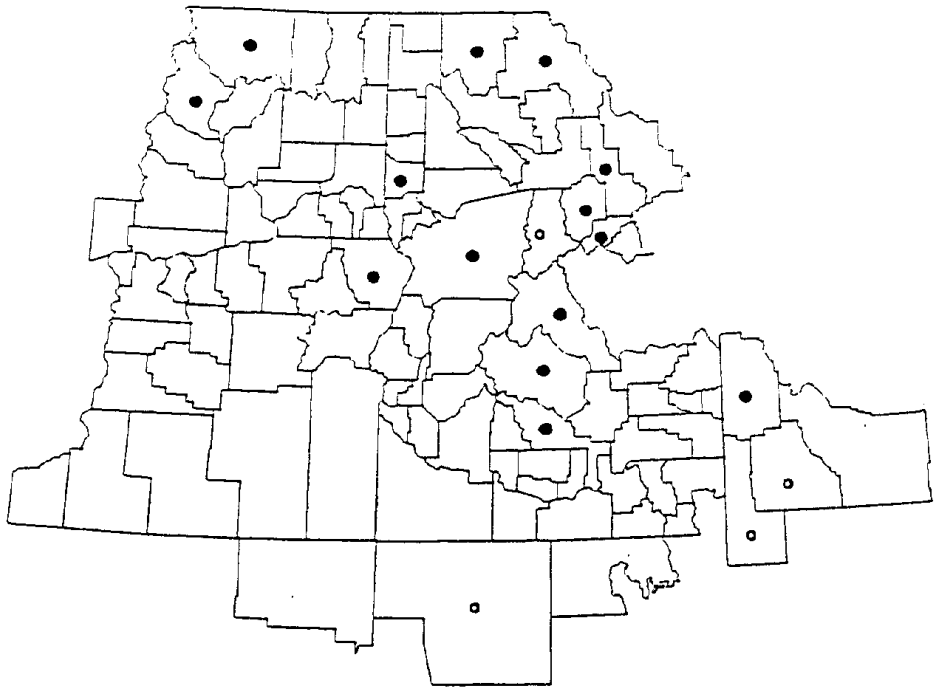
Carex rostrata



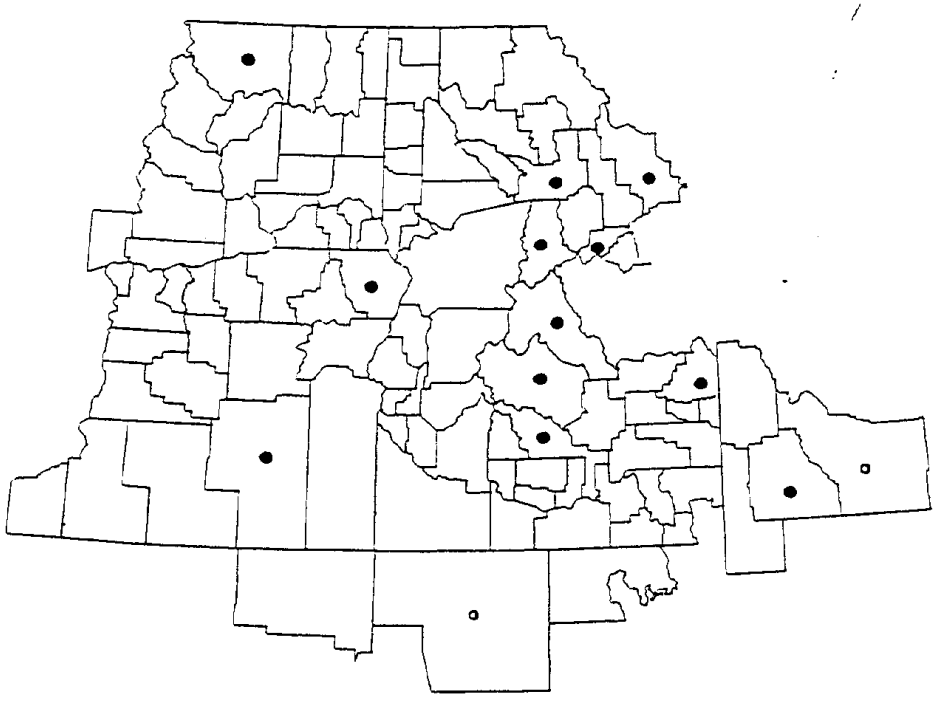
Carex rupestris



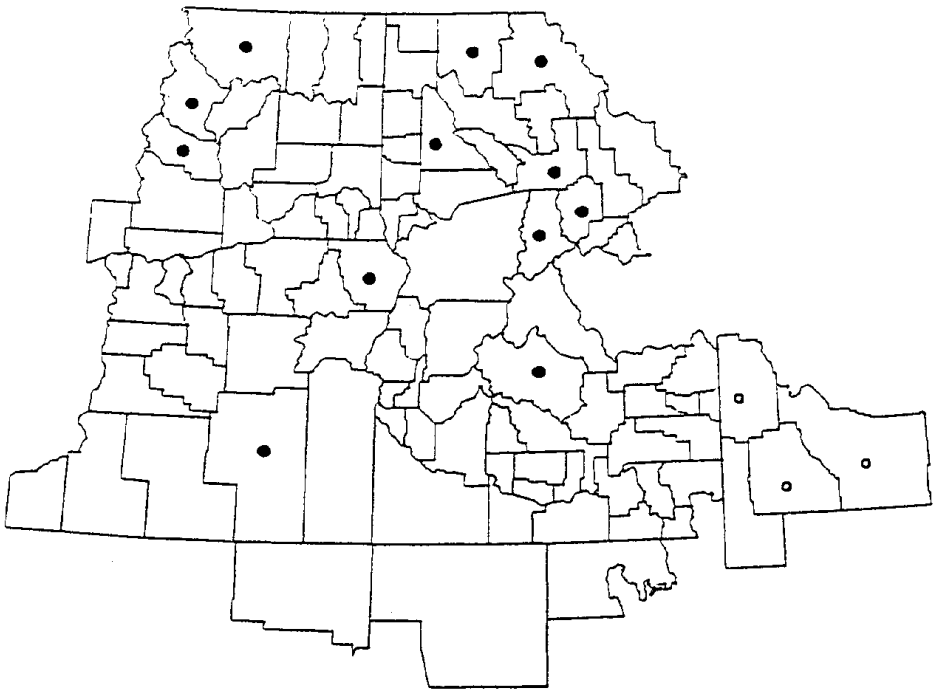
Carex sartwellii



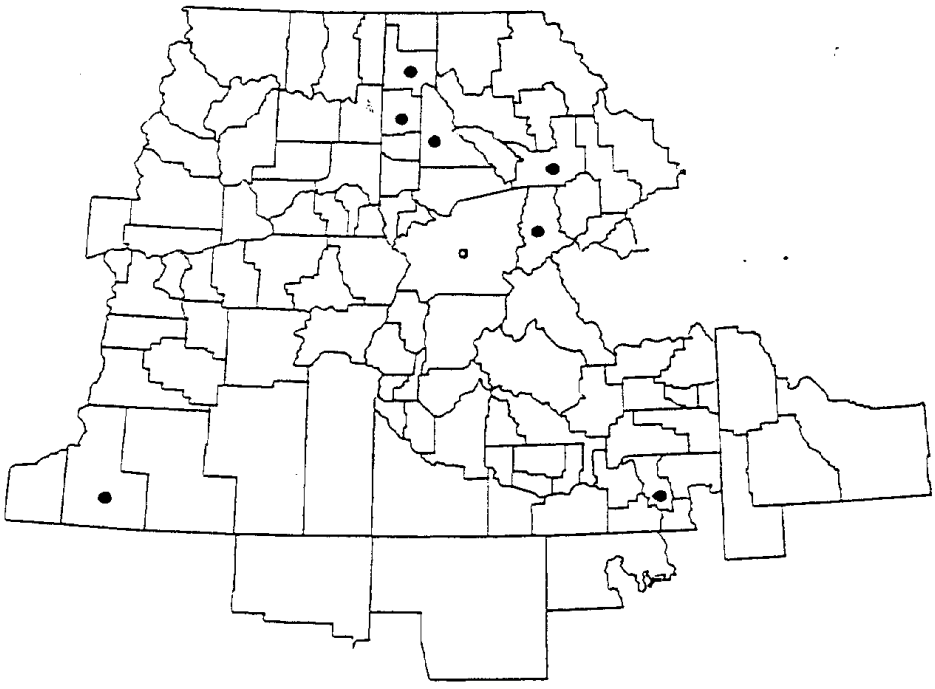
Carex saxatilis var. major



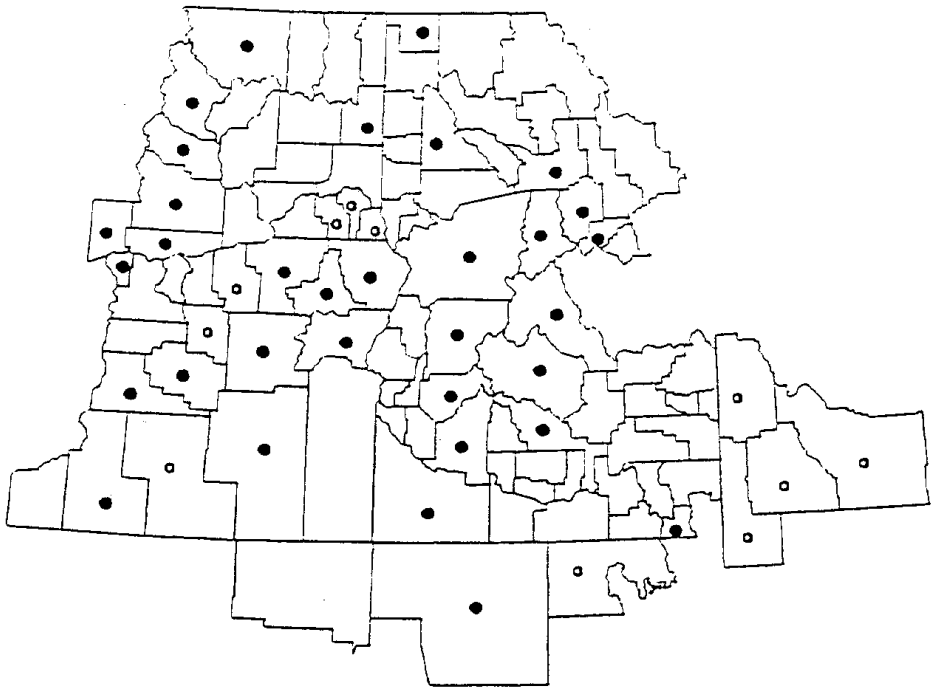
Carex scirpoidea var. pseudoscirpoidea



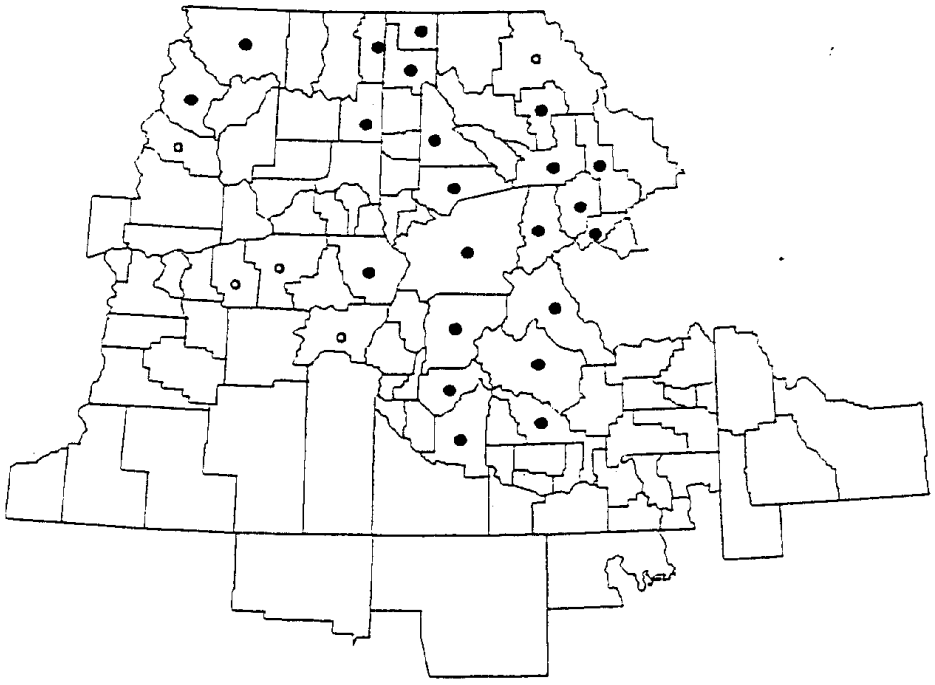
Carex scirpoidea var. scirpoidea



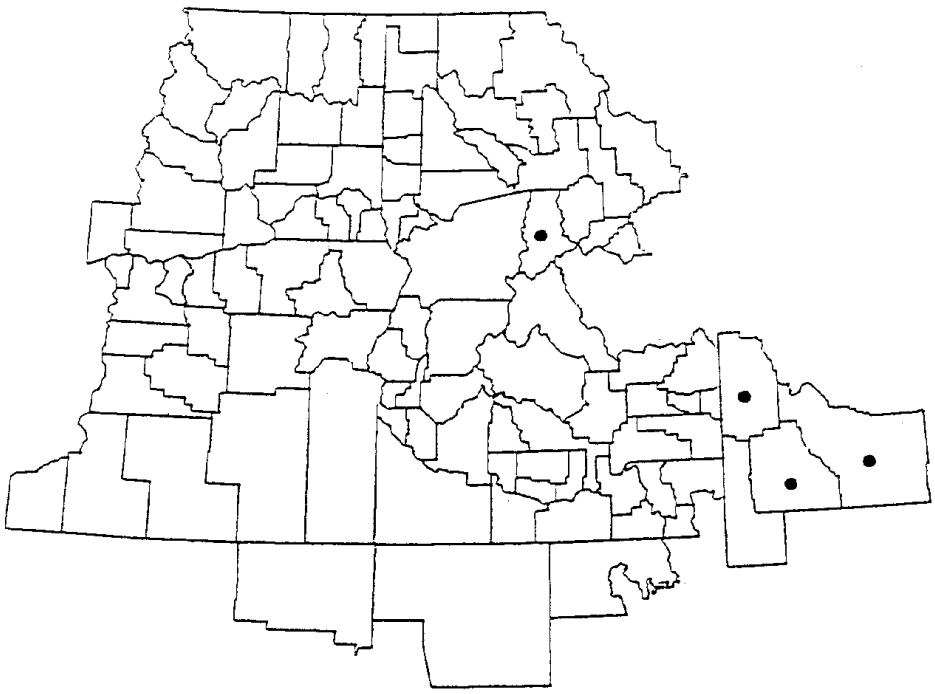
Carex scoparia



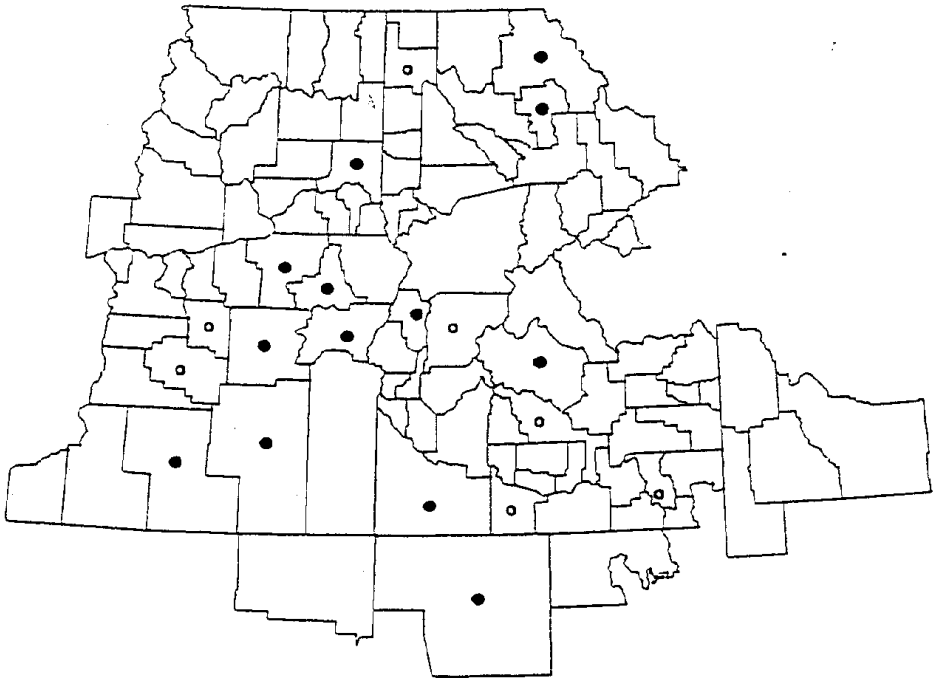
Carex scopulorum var. bracteosa



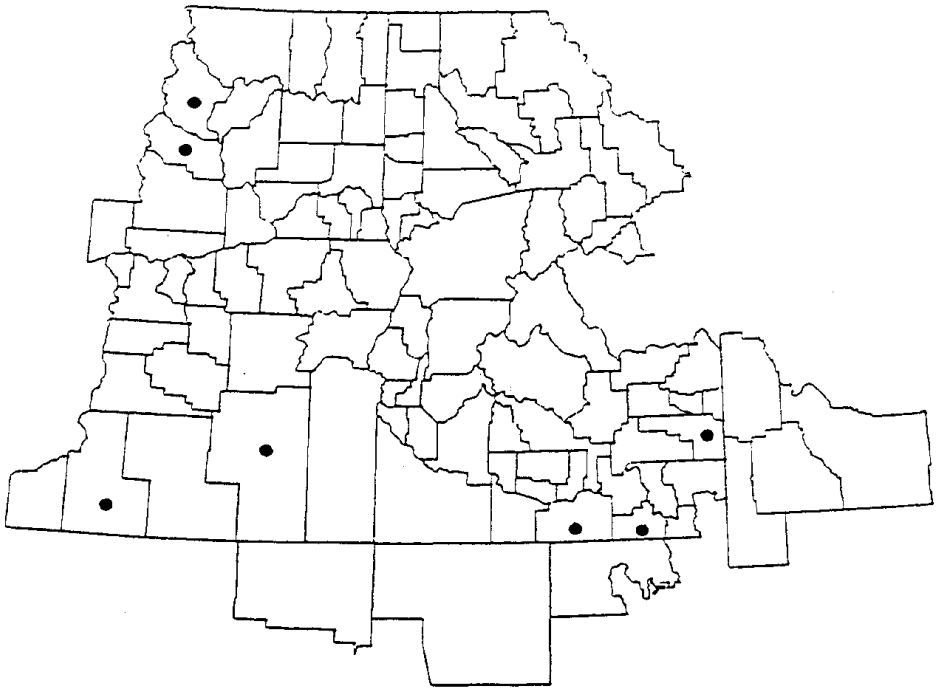
Carex scopulorum var. prionophylla



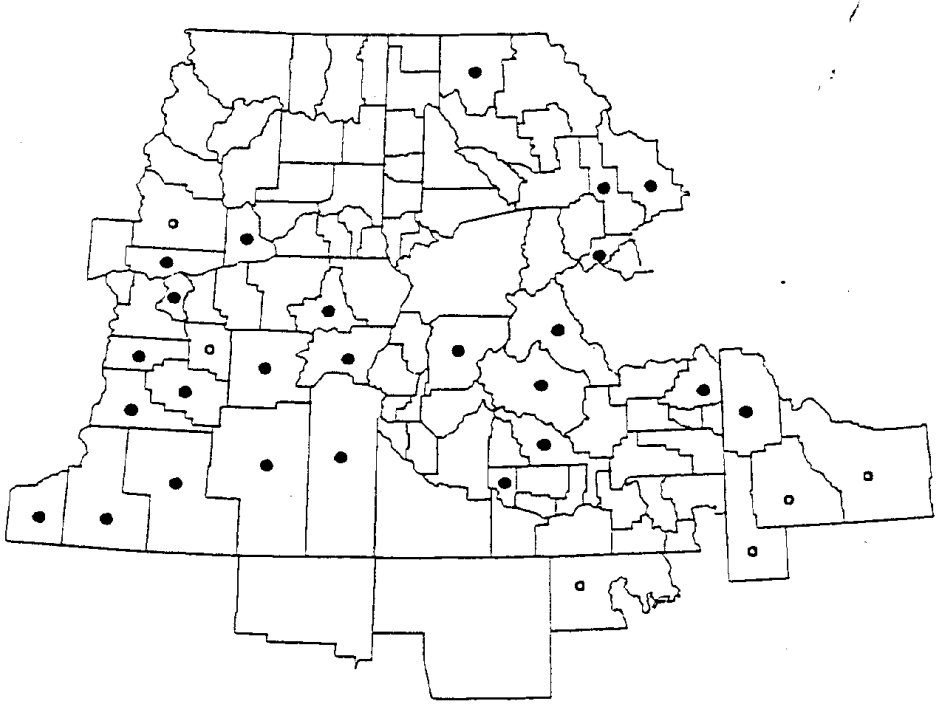
Carex scopulorum var. scopulorum



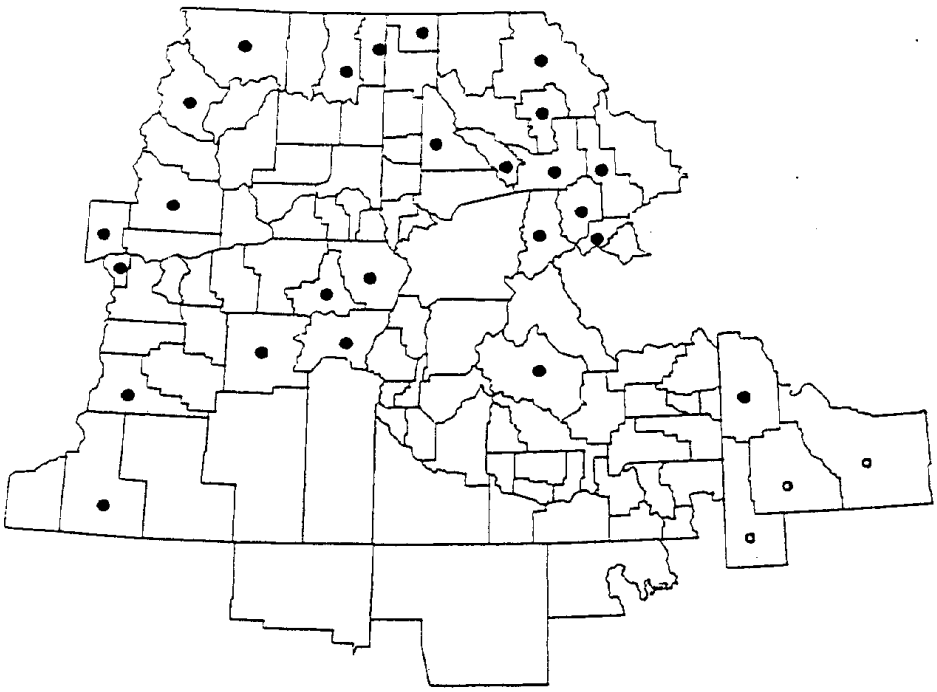
Carex sheldonii



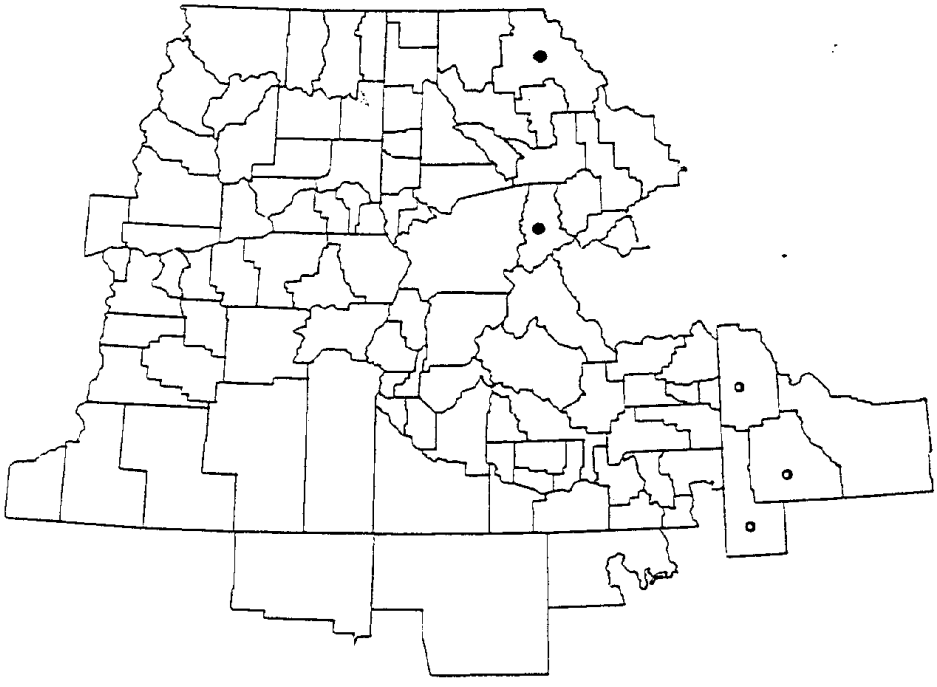
Carex siccata



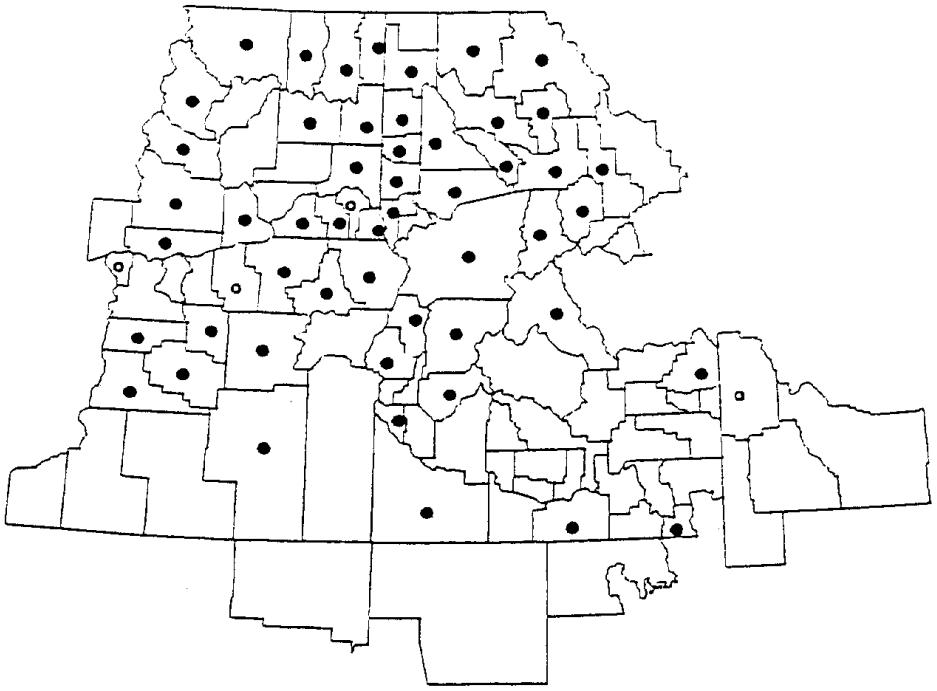
Carex simulata



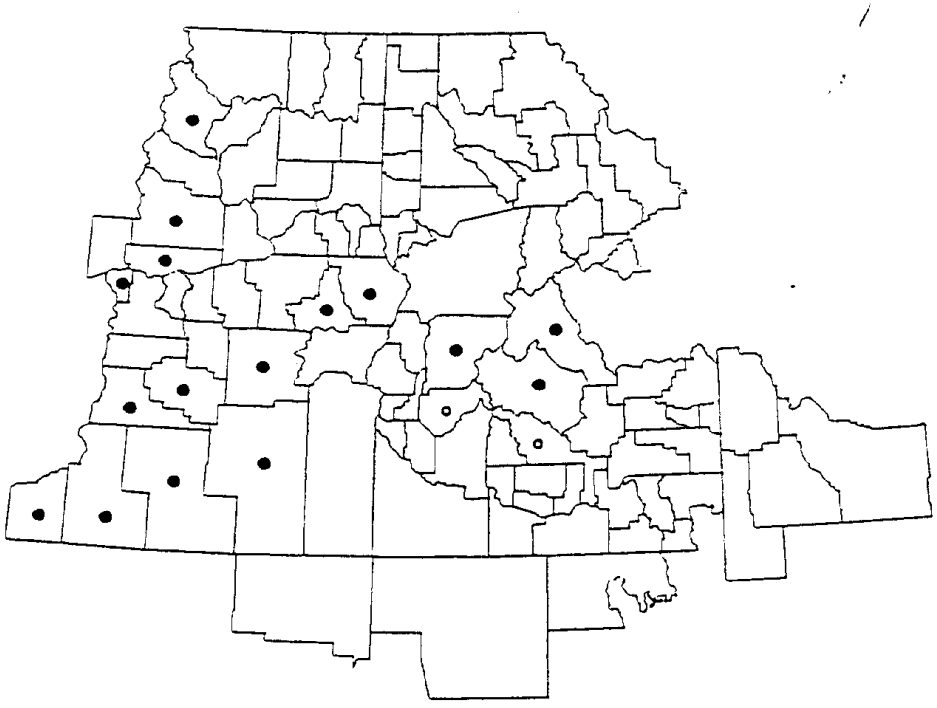
Carex spectabilis



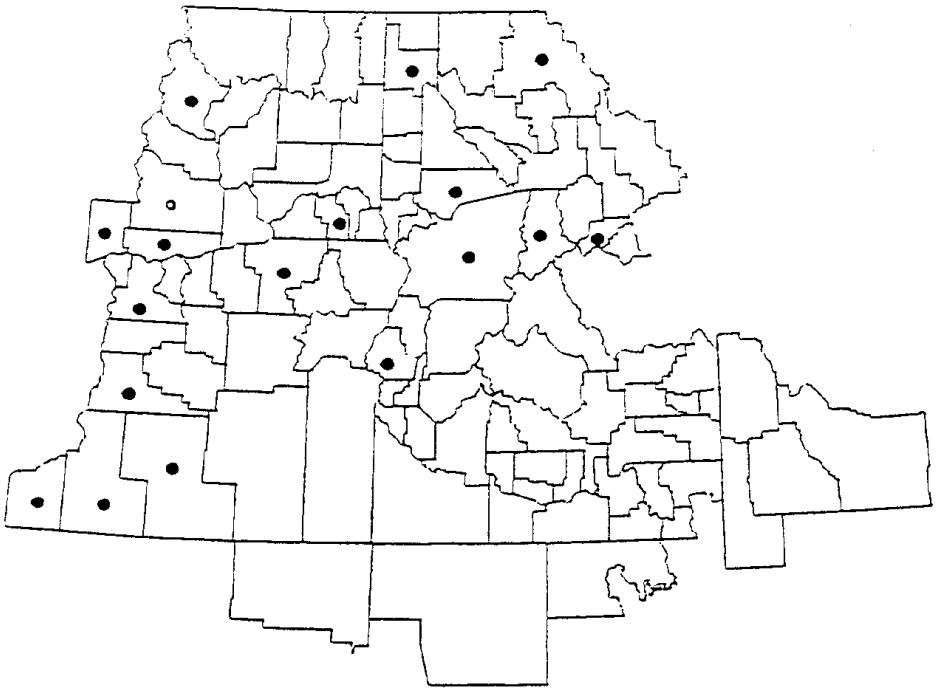
Carex stenoptila



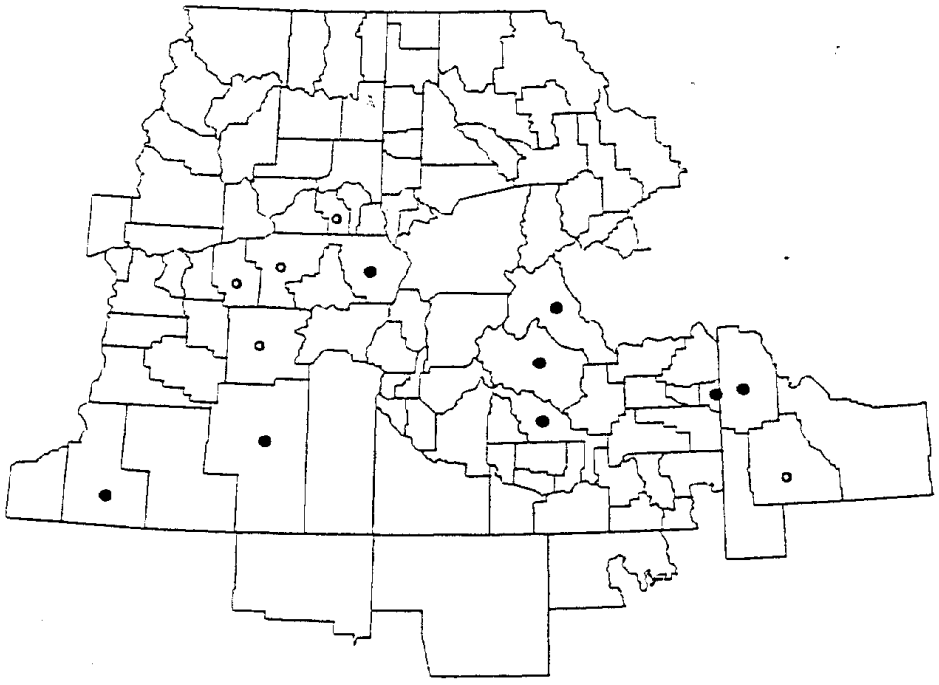
Carex stipata var. stipata



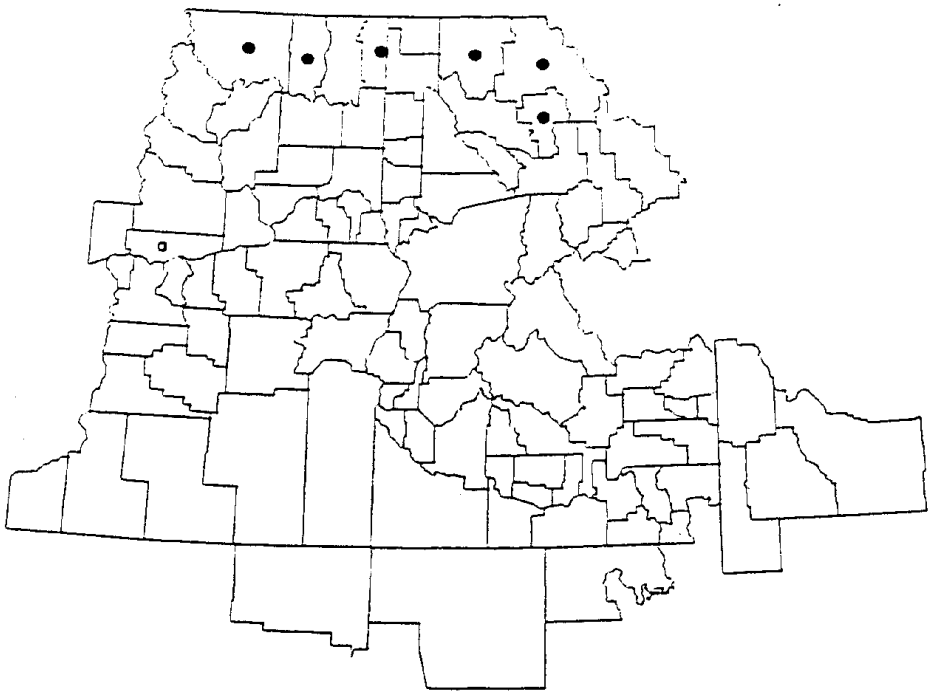
Carex straminiformis



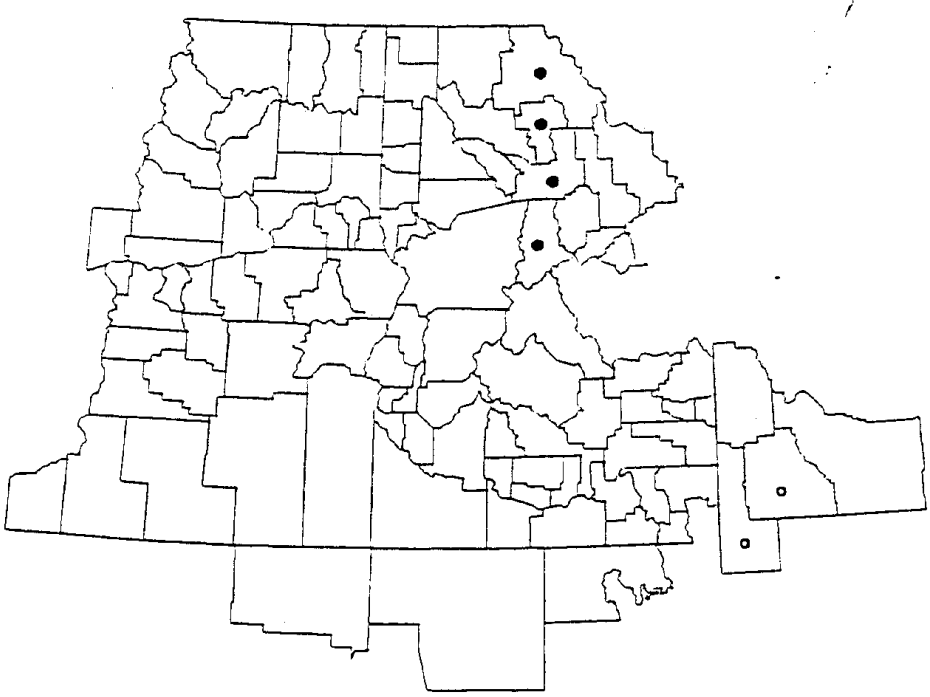
Carex subfusca



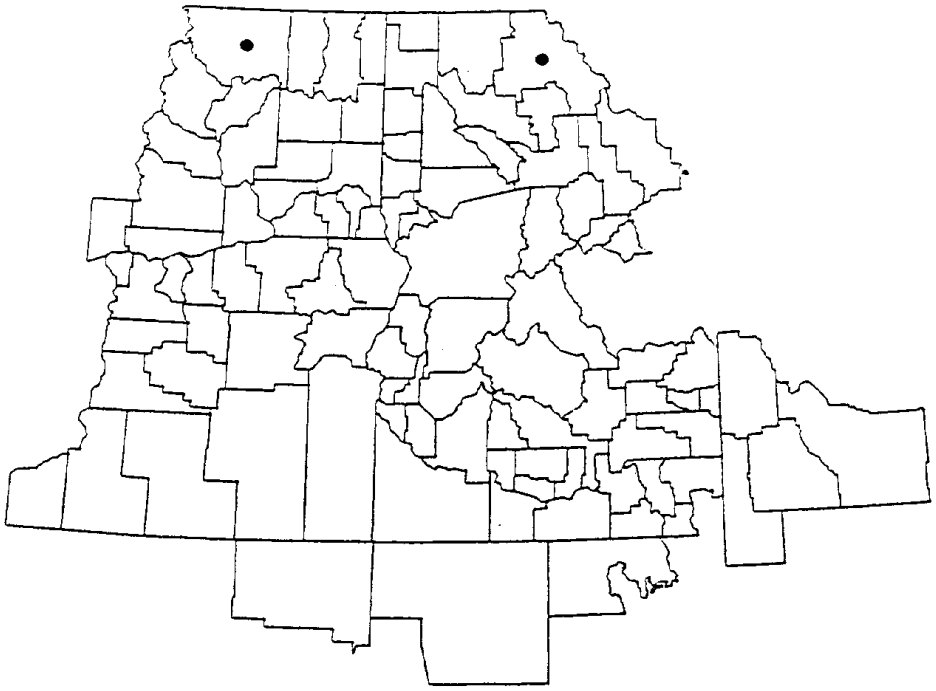
Carex subnigricans



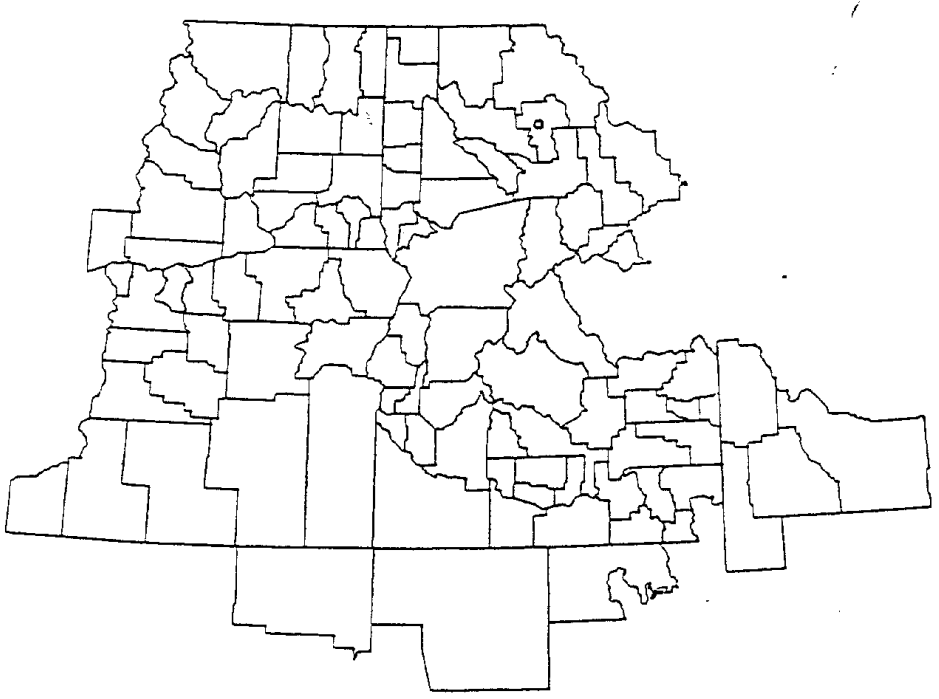
Carex sychnocephala



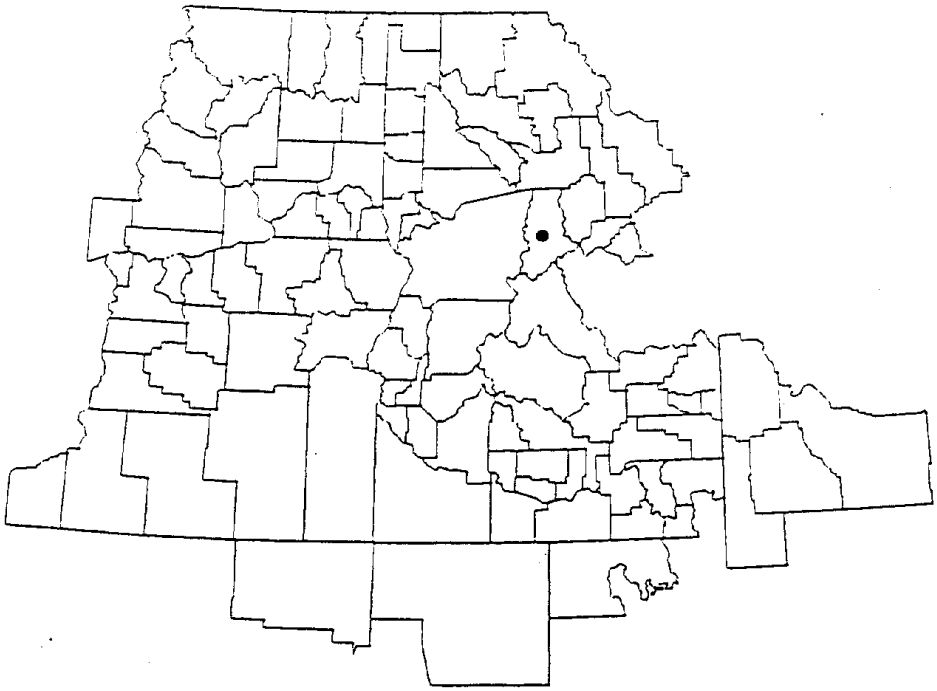
Carex tenera



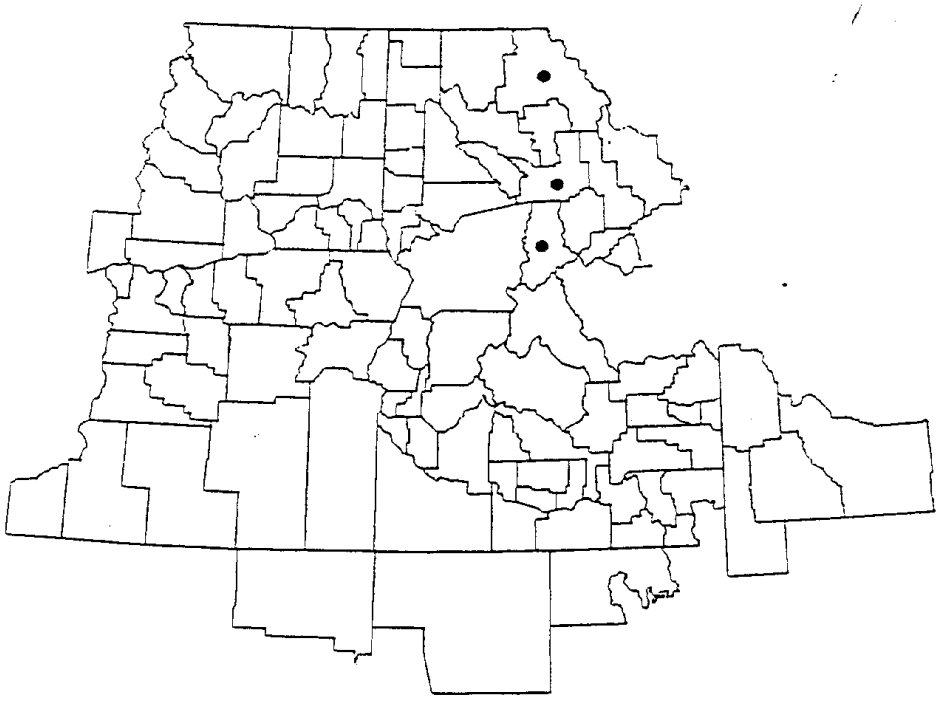
Carex tenuiflora



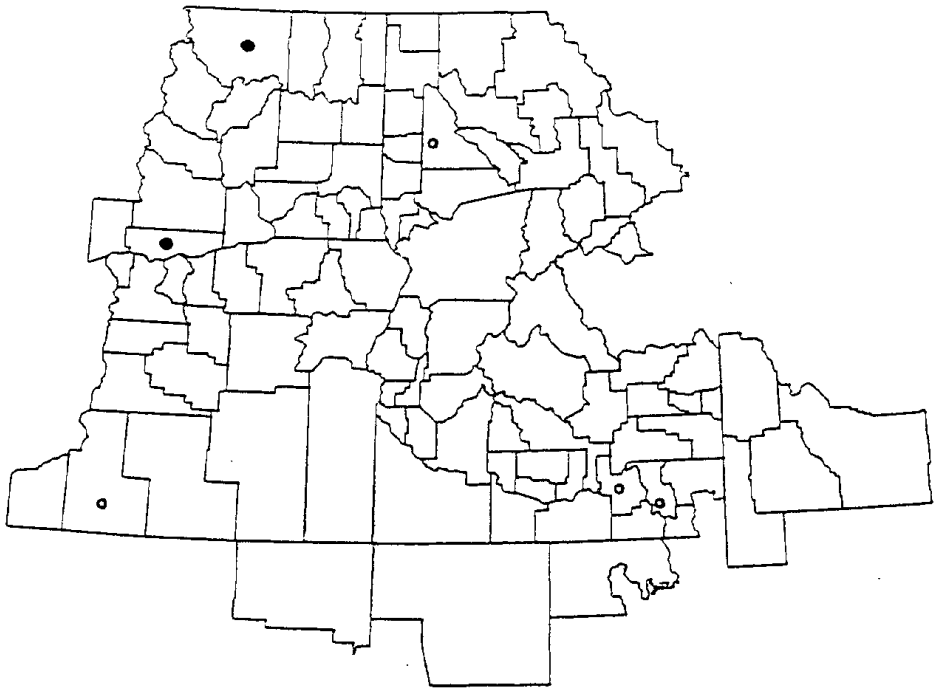
Carex tincta



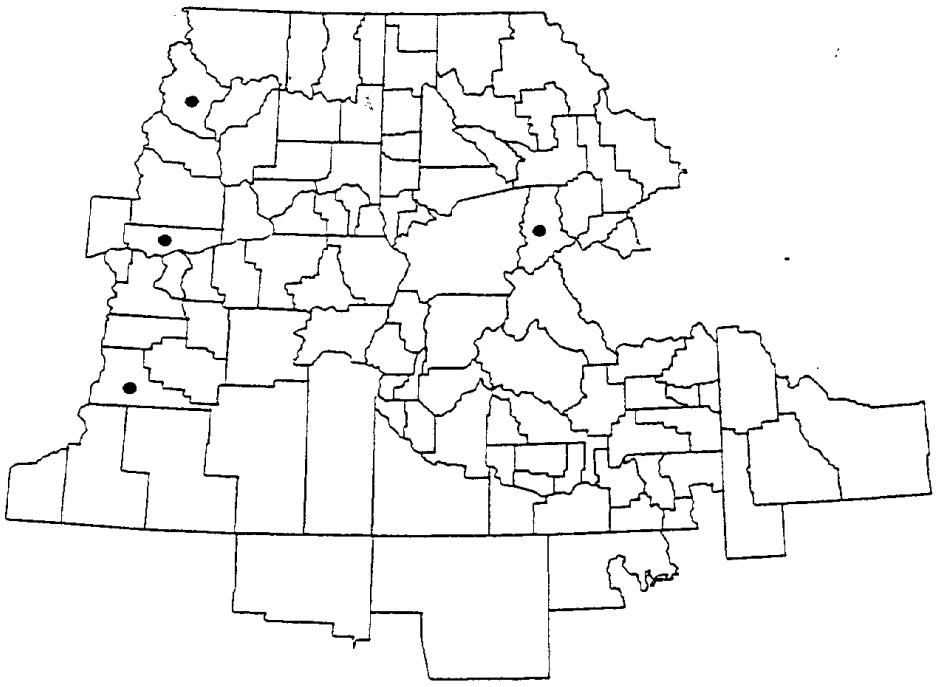
Carex torreyi



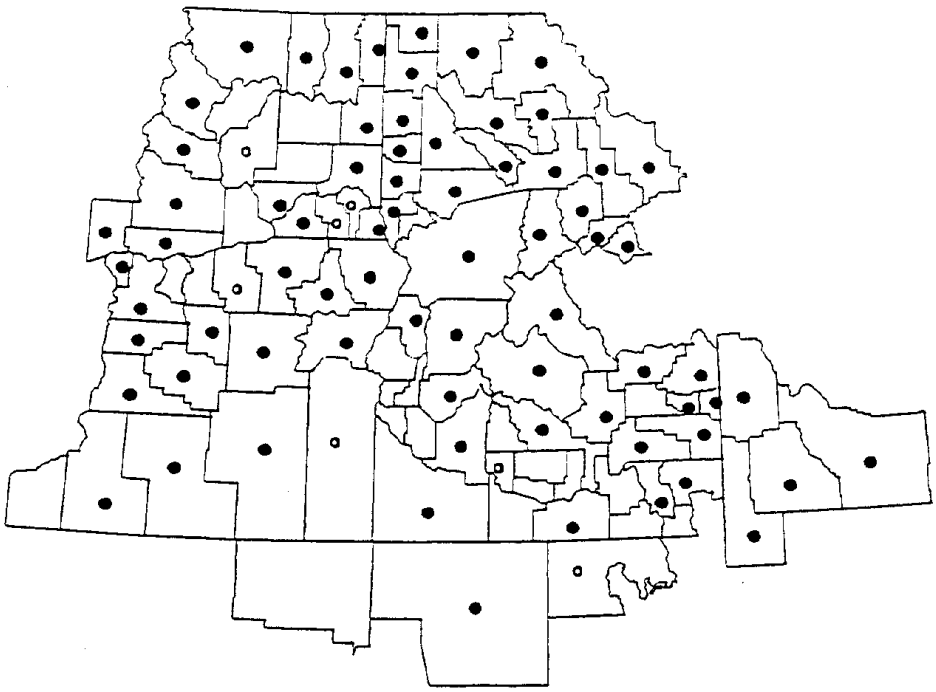
Carex tribuloides



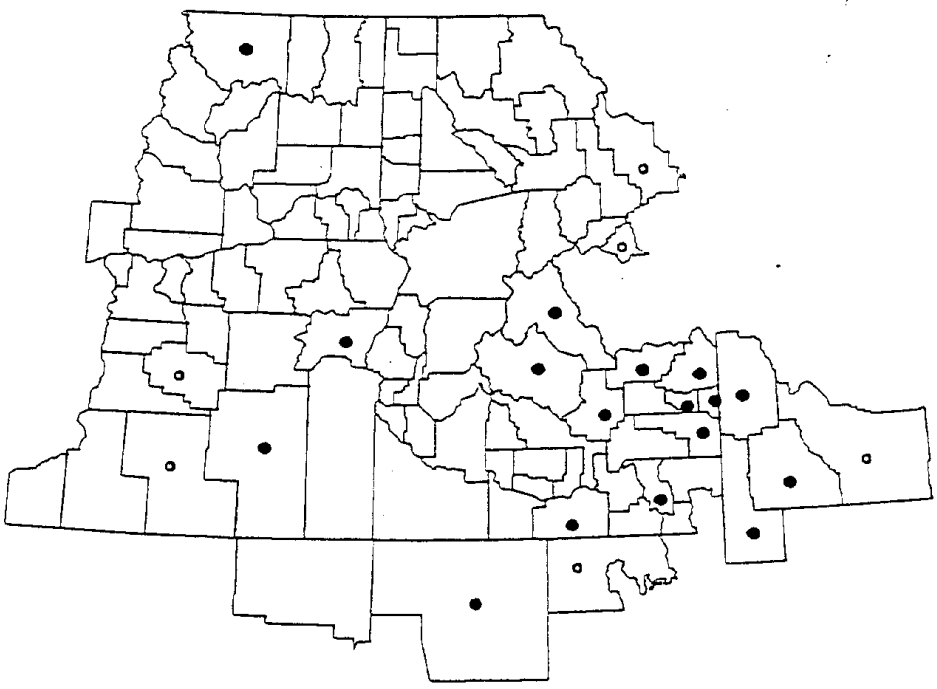
Carex tumulicola



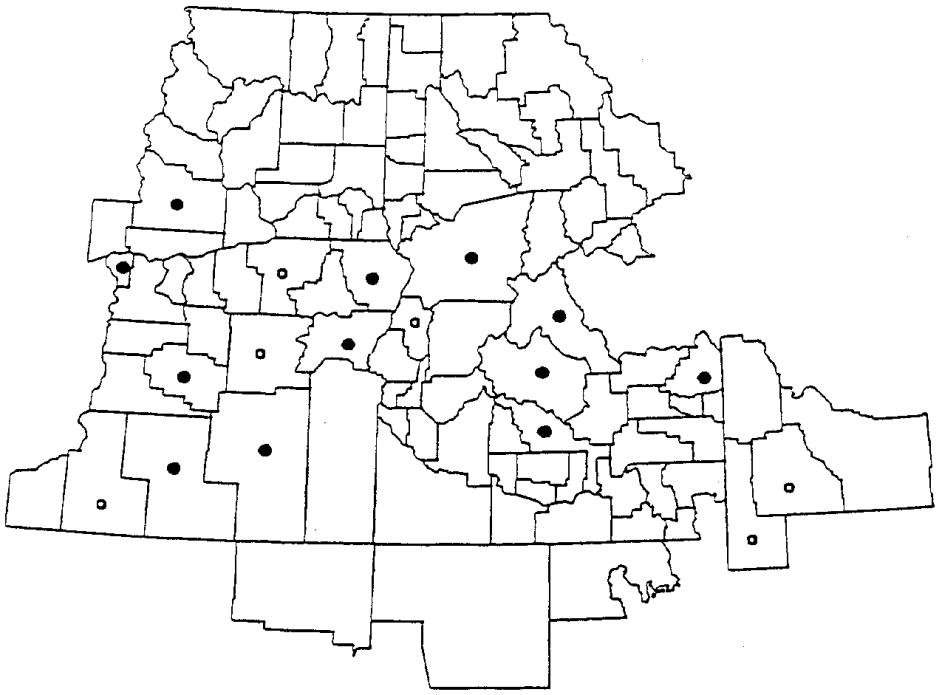
Carex unilateralis



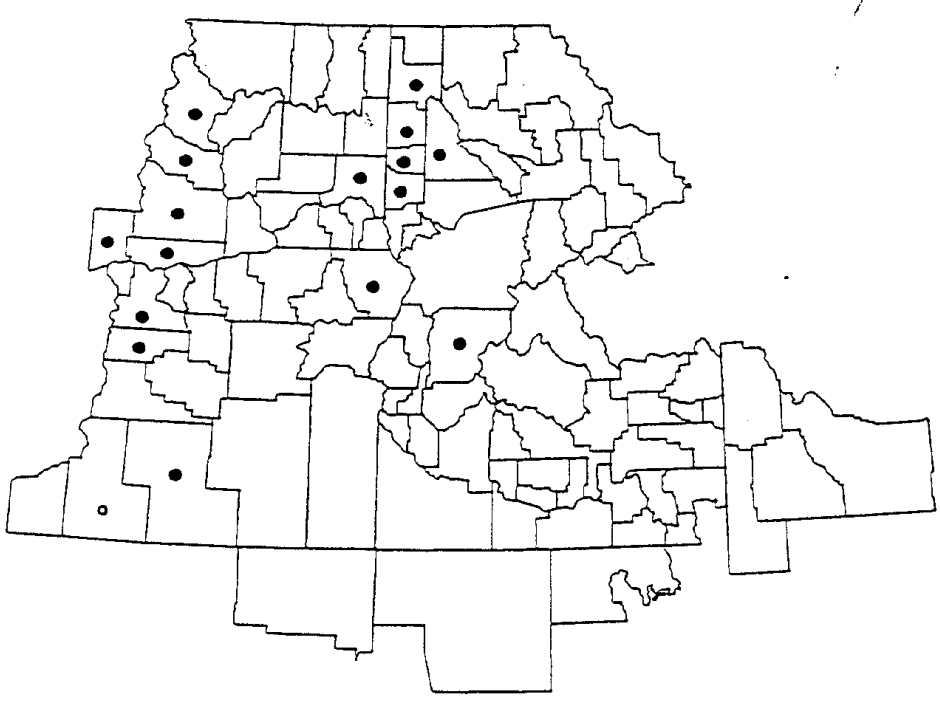
Carex utriculata



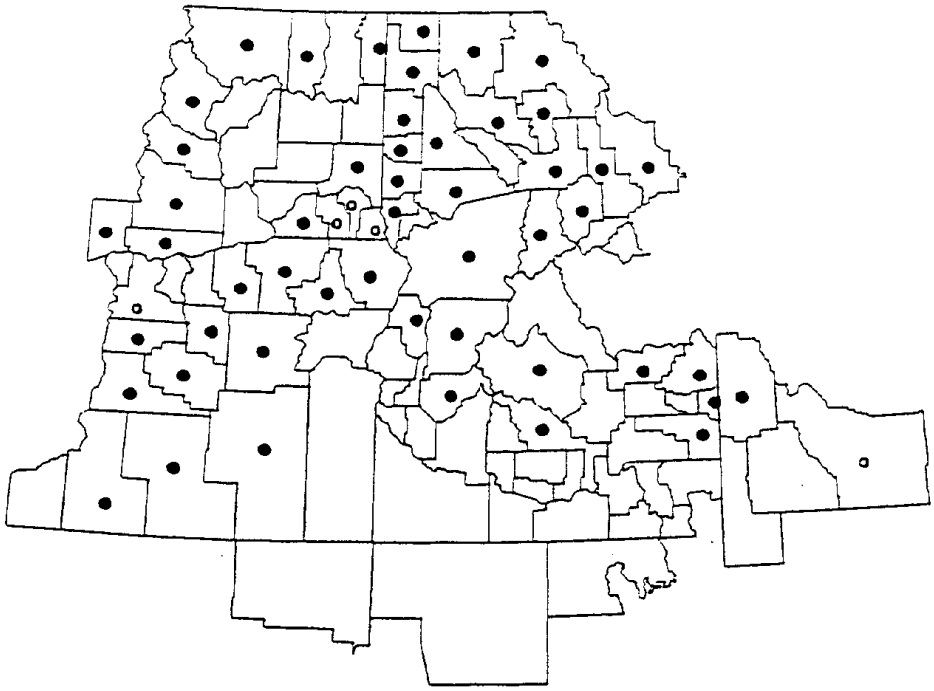
Carex vallicola



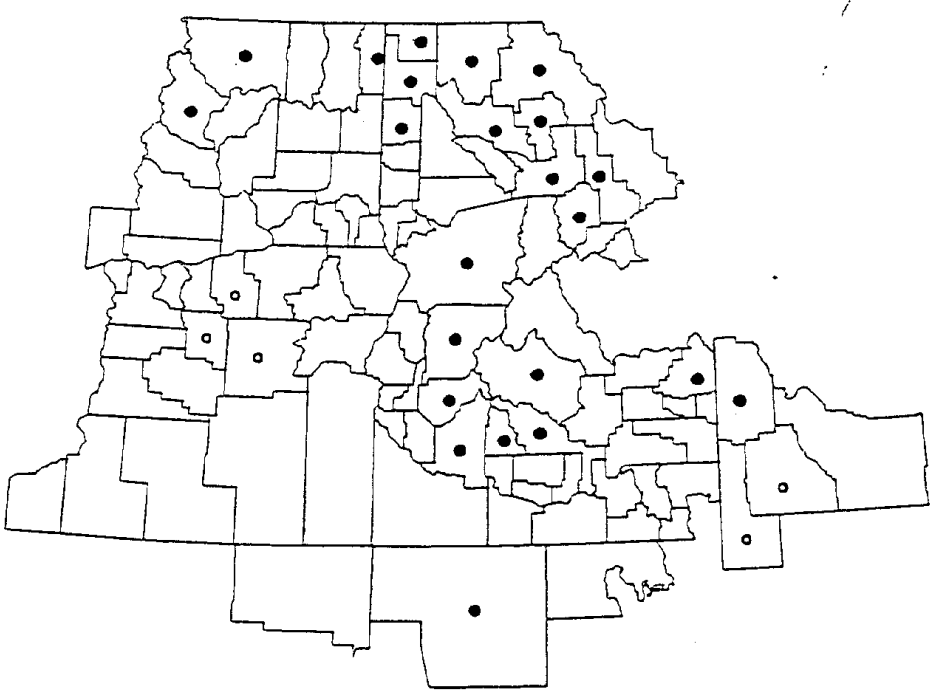
Carex vernacula



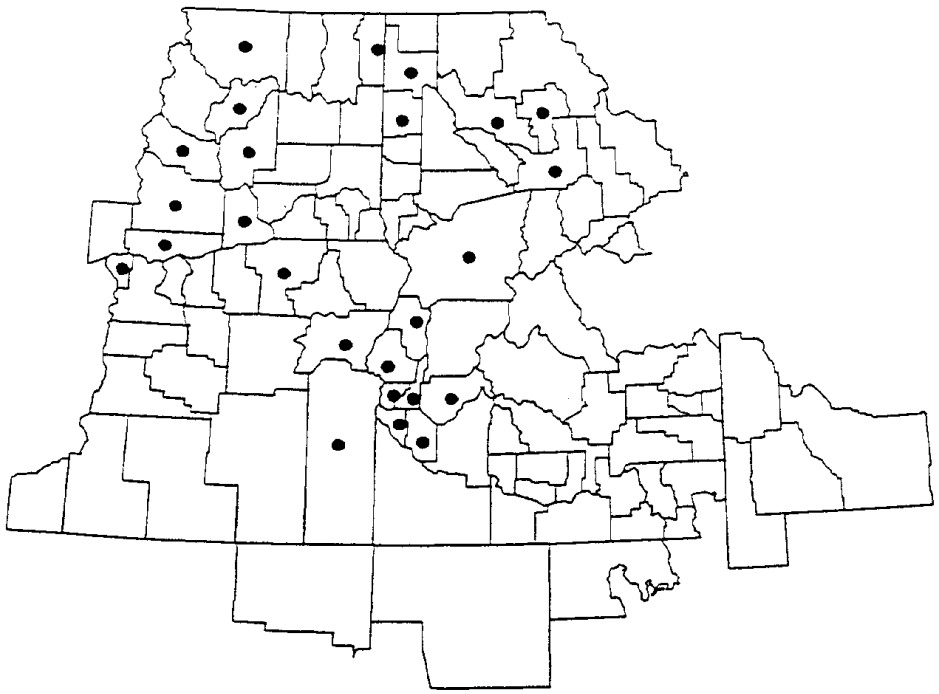
Carex vesicaria var. major



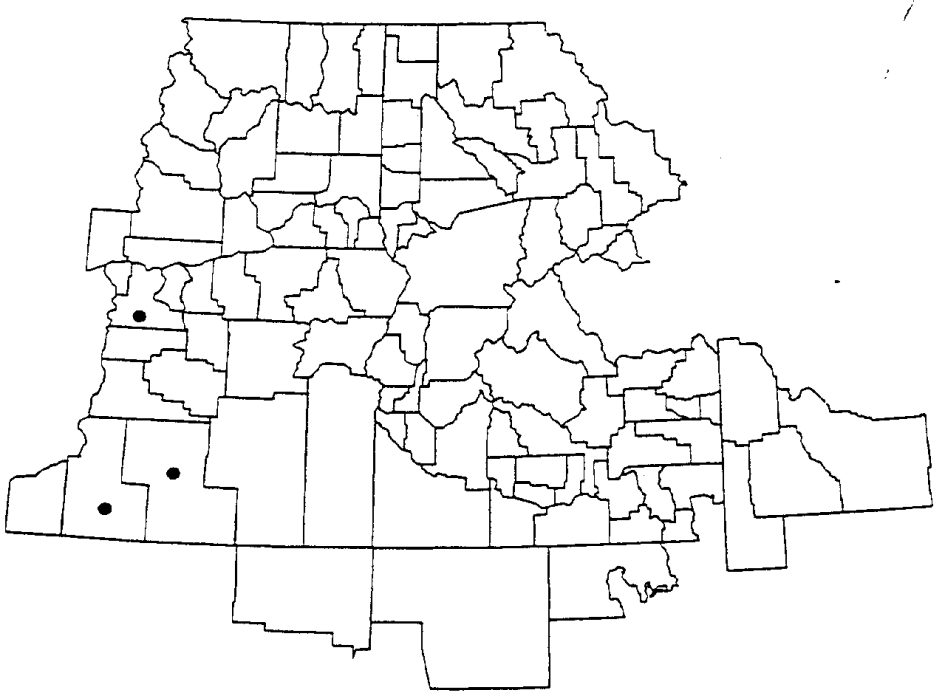
Carex vesicaria var. vesicaria



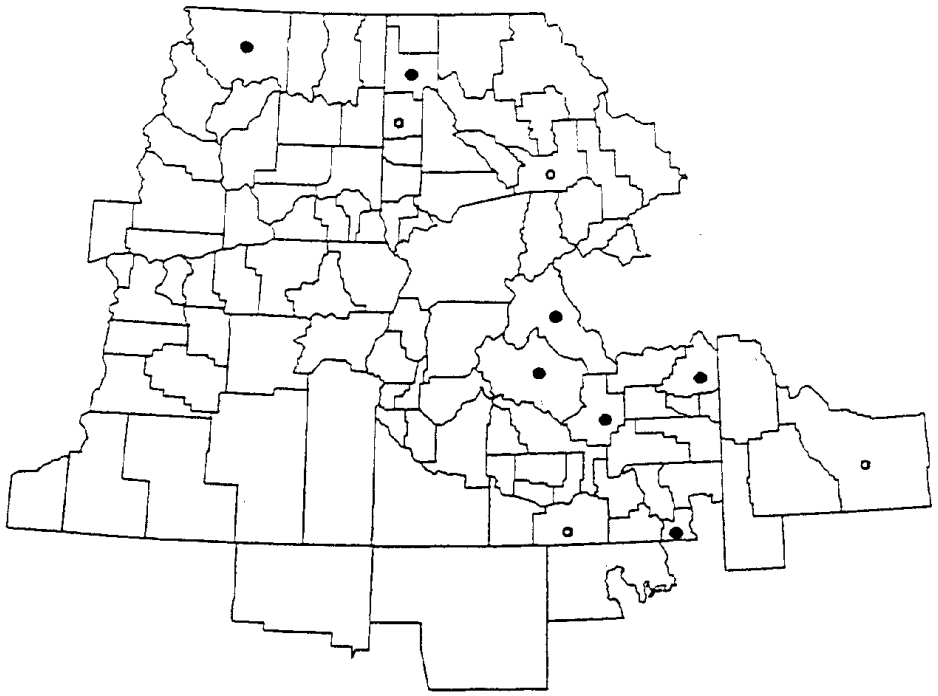
Carex viridula



Carex vulpinoidea



Carex whitneyi



Carex xerantica

Appendix 3a. Recognized *Carex* taxa in the EEMP area.

Taxa with an asterisk are listed as rare, threatened or endangered by at least one state natural heritage program.

aboriginum *
abrupta *
aenea *
albonigra
amplifolia *
angustata *
aperta
aquatilis var. aquatilis
aquatilis var. dives
arapahoensis *
arcta
atherodes
athrostachya
atrata var. atrosquama *
atrata var. chalciolepis
atrata var. erecta *
aurea
backii *
bebbii
bigelowii
bipartita
brainerdii
brevicaulis
brevior
breweri var. breweri
breweri var. paddoensis *
brunnescens
buxbaumii *
californica *
canescens
capillaris
capitata
chordorrhiza *
comosa *
concinna *
concinnoides
conjuncta *
crawei *
crawfordii
cusickii
densa *
deweyana ssp. leptopoda *
diandra
dioica var. gynocrates *
disperma
douglasii
ebenea
eburnea *
echinata ssp. echinata
egglestonii
eleocharis *
elynoides
feta
filifolia var. erostrata
filifolia var. filifolia
flava *
fracta
geyeri
halliana
haydeniana *
hendersonii *
hoodii
hystericina *
idahoa *
illota
incurviformis var. danaensis *
incurviformis var. incurviformis *
inops ssp. heliophila
inops ssp. inops
integra
interior *
interrupta
jonesii
lacustris
laeviculmis
lasiocarpa var. americana
lenticularis var. dolia *
lenticularis var. impressa
lenticularis var. lenticularis
lenticularis var. lipocarpa
leporinella
leptalea *
limosa
livida *
luzulaifolia
luzulina var. ablata
luzulina var. atropurpurea *
luzulina var. luzulina
macloviana
mertensii
microptera
misandra
multicaulis
multicostata *
nardina *
nebrascensis
nervina
neurophora *

nigricans
norvegica ssp. norvegica *
nova *
nudata
obnupta
obtusata
occidentalis
ovalis
pachystachya
parryana var. parryana
pauciflora
paupercula *
paysonis
pellita
petasata
phaeocephala
praeceptorum *
praegracilis
praticola
preslii
proposita *
pyrenaica
raynoldsii
retrorsa *
rossii
rostrata *
rupestris
sartwellii var. sartwellii
saxatilis var. major *
scirpoidea var. pseudoscirpoidea
scirpoidea var. scirpoidea *
scoparia *
scopulorum var. bracteosa
scopulorum var. prionophylla
scopulorum var. scopulorum
sheldonii *
siccata
simulata
spectabilis
stenoptila *
stipata var. stipata
straminiformis *
subfusca
subnigricans
sychnocephala *
tenera
tenuiflora *
tincta *
torreyi *
tribuloides
tumulicola *
unilateralis
utriculata
vallicola *
vernacula
vesicaria var. major
vesicaria var. vesicaria
viridula
vulpinoidea
whitneyi *
xerantica

Appendix 3b. Synonymy of *Carex* taxa in the EEMP area.

Format: synonym = accepted name for this report.

ablata = luzulina var. ablata
aboriginum
abrupta
aenea
albo-nigra = albonigra
albonigra
amplifolia
angustata
angustior = echinata ssp. echinata
aperta
apoda = atrata var. atrosquama
aquatilis var. aquatilis
aquatilis var. dives
arapahoensis
arcta
atherodes
athrostachya
atrata var. atrosquama
atrata var. chalciolepis
atrata var. erecta
atratiformis (sensu Davis) = ? atrata
atrosquama = atrata var. atrosquama
aurea
backii *
backii var. subrostrata = backii
bebbii
bigelowii
bipartita
bolanderi = deweyana ssp. leptopoda
bonanzensis = praeceptorum
brainerdii
brevicaulis
breviligulata = densa
brevior
brevipes = rossii
breweri var. breweri
breweri var. paddoensis
brunnescens
buxbaumii
californica
campylocarpa = scopulorum var. bracteosa
canescens
canescens var. disjuncta = canescens
capillaris
capitata
cephalantha = echinata ssp. echinata
chimaphila = scopulorum var. scopulorum
chordorrhiza
comosa
concinna
concinnoides
conjuncta
constanceana = petasata
crawei
crawfordii
cusickii
deflexa (sensu Davis) = rossii
densa
deweyana ssp. leptopoda (all deweyana vars.)
diandra
dioica var. gynocrates (all dioica)
disperma
douglasii
drummondiana = rupestris
durifolia = backii
duriuscula = eleocharis
eastwoodiana = phaeocephala
ebenea
eburnea
echinata ssp. echinata
egglestonii
eleocharis
eleusinoides (of Hitchcock & Cronquist) = lenticularis var. dolia
elynoides
emoryi (sensu Davis) = ? section acutae
engelmannii = breweri var. paddoensis
epapillosa = atrata var. erecta
eurycarpa = angustata
exserta = filifolia var. erostrata
exsiccata = vesicaria var. major
festivella = microptera

feta
filifolia var. erostrata
filifolia var. filifolia
fissuricola = luzulina var. luzulina
flava
foenea = siccata
foetida var. vernacula = vernacula
fracta
garberi = aurea
geyeri
gymnoclada = scopulorum var. bracteosa
gynocrates = dioica var. gynocrates
halliana
hallii = parryana
hassei = aurea
haydeniana *
haydenii (reports in OR by Peck) = haydeniana
heliophila = inops ssp. heliophila
hendersonii
hepburnii = nardina
heteroneura = atrata var. erecta
hindsii = lenticularis var. limnophila
hoodii
hystericina
hystricina = hystericina
idahoa
illota
incurviformis var. danaensis
incurviformis var. incurviformis
inflata = utriculata
inops ssp. heliophila
inops ssp. inops
integra
interior
interrupta
jepsonii = whitneyi
jonesii
kelloggii = lenticularis var. lipocarpa
lachenalii = bipartita
lacustris
laeviconica (sensu Davis) = vesicaria
laeviculmis
lanuginosa = pellita
lasiocarpa var. americana
lenticularis var. dolia
lenticularis var. impressa
lenticularis var. lenticularis
lenticularis var. lipocarpa
lenticularis var. pallida = var. lenticularis
leporina = ovalis
leporinella
leptalea
leptopoda = deweyana ssp. leptopoda
limnophila = microptera
limosa
livida
luzulaifolia
luzulina var. ablata
luzulina var. atropurpurea
luzulina var. luzulina
luzulaefolia = luzulaifolia
macloviana
macloviana ssp. subfusca = subfusca
magellanica ssp. irrigua = paupercula
maritima var. incurviformis = incurviformis var. incurviformis
media = norvegica
mertensii
microptera
microptera var. crassinerva = microptera
microptera var. limnophila = microptera
misandra
miserabilis = scopulorum var. prionophyllum
montanensis = spectabilis
multicaulis
multicostata
muricata (of authors) = echinata ssp. echinata
nardina
nebrascensis
nebraskensis = nebrascensis
nelsonii = nova
nervina
neurophora
nigricans
norvegica ssp. norvegica
norvegica var. stevenii = ssp. norvegica
nova

nova var. pelocarpa = nova
nubicola = haydeniana
nudata
obovoidea = cusickii
obnupta
obtusata
occidentalis
oederi = viridula
oederi var. recterostrata = viridula
oregonensis = halliana
ormantha = echinata ssp. echinata
ovalis
oxycarpa = angustata
pachycarpa = multicostata
pachystachya
pachystachya ssp. compacta = pachystachya
parryana ssp. hallii = parryana var. parryana
parryana var. hallii = parryana var. parryana
parryana ssp. idahoa = idahoa
parryana var. parryana
parryana var. unica = parryana var. parryana
paucicostata = lenticularis var. impressa
pauciflora
paupercula
paysonis
pellita
pelocarpa = nova
pensylvanica var. digyna = inops ssp. heliophila
pensylvanica var. vespertina = inops ssp. inops
petasata
phaeocephala
phyllomanica = echinata ssp. phyllomanica
physocarpa = saxatilis var. major
piperi = praticola
platylepis = pachystachya
plectocarpa = lenticularis var. dolia
podocarpa = paysonis in OR; type may = spectabilis
polytrichoides = leptalea
praeceptorium = praeceptorum
praeceptorum
praegracilis
prairea (sensu Davis) = ?cusickii or diandra
pratensis = praticola
praticola
preslii
prionophylla = scopulorum var. prionophylla
proposita
pseudoscirpoidea = scirpoidea var. pseudoscirpoidea
pyrenaica
raynoldsii
retrorsa
rossii
rostrata
rupestris
sartwellii var. sartwellii
saxatilis var. major
saximontana = backii
scirpiformis = scirpoidea var. scirpoidea
scirpoidea var. pseudoscirpoidea
scirpoidea var. scirpoidea
scirpoidea var. stenochlaena = scirpoidea var. scirpoidea
scoparia
scopulorum var. bracteosa
scopulorum var. prionophylla
scopulorum var. scopulorum
sheldonii
siccata
simulata
sitchensis = aquatilis var. dives
specifica (of OR reports) = fracta
spectabilis
stellulata (of OR reports) = echinata ssp. echinata
stenophylla = eleocharis
stenoptila
sterilis (of OR reports) = echinata ssp. echinata
stipata var. stipata

straminea = brevior, or feta, or
straminiformis, or tenera
straminiformis
subfusca
subnigricans
suborbiculata = nudata
suksdorfii = aquatilis var. aquatilis
sychnocephala
tenella = disperma
tenera
teneraeformis = subfusca
tenuiflora
teretiuscula = diandra
tincta
tolmiei = spectabilis
torreyi
tracyi = ovalis
tribuloides
trichocarpa var. aristata = atherodes
tumulicola
unilateralis
utriculata
vahlii = norvegica
vallicola
vernacula
vesicaria var. major
vesicaria var. vesicaria
vespertina = inops ssp. inops
vicaria = densa
viridior = ?atrata vars.
viridula
vulpinoidea
whitneyi
xerantica

Appendix 4. Common misidentifications of *Carex* taxa encountered in the EEMP area.

If the label says	The specimen may well be . . . .
C. abrupta	*C. mariposana, C. microptera*
C. aenea	*C. siccata*; or in the *Ovales*, *C. praticola, C. petasata, C. xerantica*
C. albonigra	One of the other components of *C. atrata* s. l.
C. angustata	Any of the section *Acutae*, especially *C. aquatilis* or *C. nebrascensis*
C. aperta	Any of the section *Acutae*
C. aquatilis	Almost any of the section *Acutae*, especially *C. angustata*
C. arapahoensis	Any of the *Ovales* with a single dense head such as *C. microptera*
C. athrostachya	*C. unilateralis*, or late flowering culms of section *Ovales* such as *C. microptera, C. abrupta*; these culms often have expanded inflorescence bracts suggesting *C. athrostachya.* Stems of *C. athrostachya* lacking an expanded inflorescence bract are confused with many section *Ovales* sedges or even *C. hoodii, C. jonesii, C. nervina, C. neurophora, C. tumulicola* or *C. vernacula.*
C. atrata	One of the segregates of *C. atrata*
C. bebbii	*C. brevior* or *C. tenera*
C. bigelowii	*C. scopulorum*
C. bipartita	*C. brunnescens, C. canescens, C. praeceptorum*
C. brainerdii	*C. rossii*
C. brevicaulis	*C. rossii*
C. brevior	Any of the *Ovales* but most likely *C. straminiformis* or *C. bebbii*
C. brunnescens	*C. laeviculmis*, less often *C. bipartita, C. canescens, C. praeceptorum*
C. canescens	*C. bipartita, C. brunnescens, C. praeceptorum*
C. concinna	*C. concinnoides*

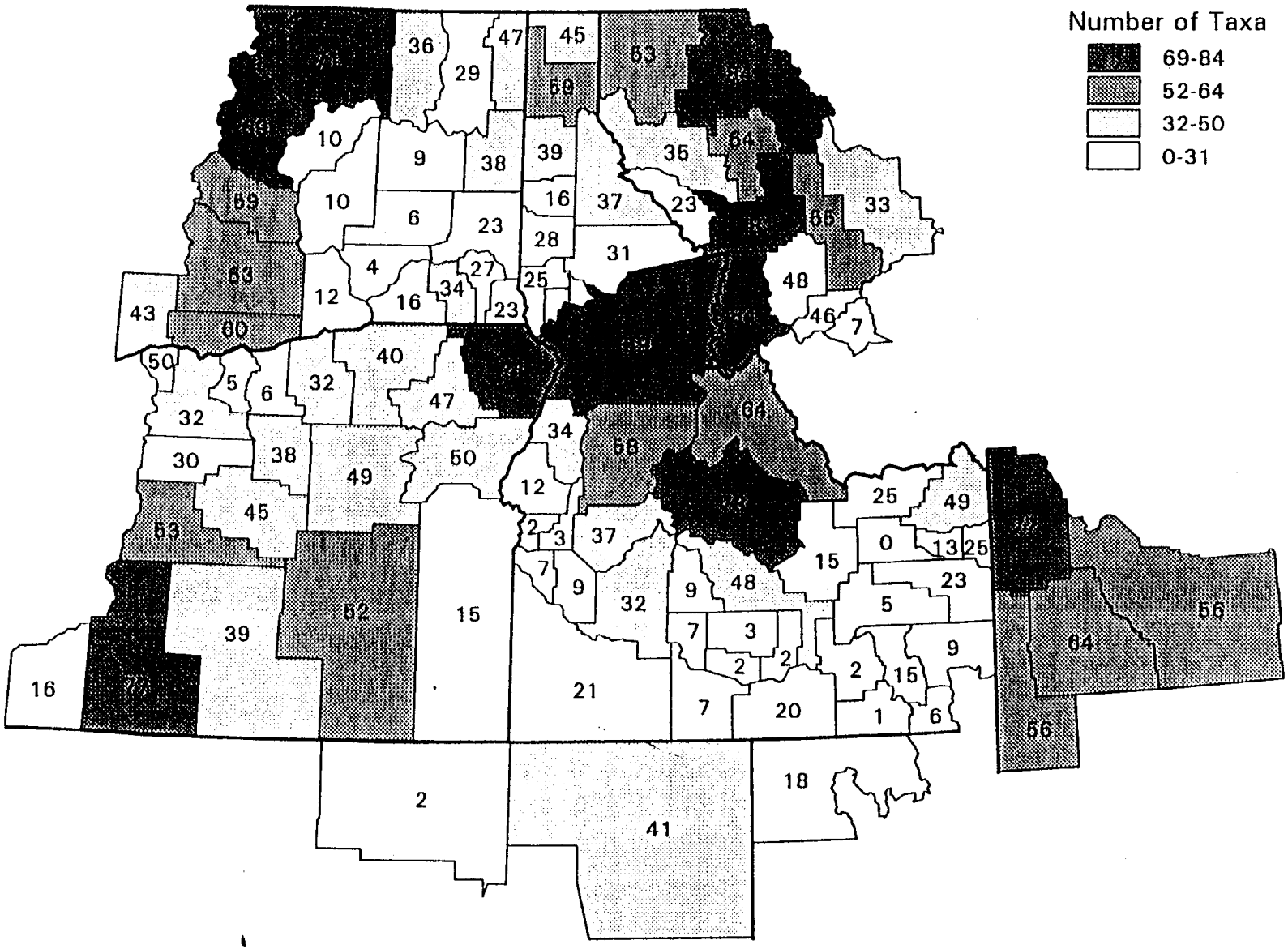
If the label says	The specimen may well be . . . .
C. concinnoides	*C. concinna, C. globosa*
C. conjuncta	*C. stipata*
C. crawfordii	Almost any immature *Ovales*, or mature *C. scoparia*
C. densa	*C. vulpinoidea*
C. ebenea	Any of the *Ovales* with a single dense head, particularly *C. microptera* or *C. haydeniana*
C. elynoides	*C. filifolia* or *C. nardina*
C. feta	Any of the *Ovales* which do not have a dense head, usually *C. scoparia* or *C. fracta*
C. fracta	Any of the *Ovales* which do not have a dense head such as *C. feta*
C. haydeniana	Any of the *Ovales* with a single dense head, particularly *C. microptera* or *C. ebenea*; or *C. hoodii, C. nervina, C. neurophora*
C. hoodii	Any of the *Ovales* with a single dense head, particularly *C. microptera*; *C. jonesii, C. nervina, C. neurophora, C. vernacula*
C. integra	*C. illota* or *C. subfusca*
C. interior	*C. laeviculmis*; immature (less often, mature) *C. echinata; C. interior* does not live in acidic habitats
C. interrupta	Any of the section *Acutae*, especially *C. lenticularis* or *C. aquatilis*
C. jonesii	*C. nervina, C. illota, C. neurophora*
C. lacustris	*C. vesicaria*
C. lasiocarpa	*C. pellita*
C. lenticularis	Any of the *Acutae*
C. leporinella	Any of the *Ovales*, especially *C. abrupta* or *C. subfusca*
C. macloviana	Any of the *Ovales* with a single dense head, especially *C. pachystachya* or *C. microptera*

If the label says	The specimen may well be . . . .
C. microptera	Any of the *Ovales* with a single dense head, particularly *C. pachystachya*, *C. macloviana* or *C. abrupta*
C. nebrascensis	Any sedges in section *Acutae*, especially *C. angustata* or glaucous individuals of *C. aquatilis*
C. nervina	*C. jonesii*, or perhaps *C. neurophora*, *C. vernacula*, or many of the *Ovales* with a single dense head
C. neurophora	*C. jonesii*, or perhaps *C. neurophora*, *C. vernacula*, or many of the *Ovales* with a single dense head
C. nudata	Any of the *Acutae;* if collected without bases or habitat information, then often *C. interrupta* or *C. angustata*
C. occidentalis	Immature *C. vallicola*; *C. hoodii*
C. pachystachya	Many of the *Ovales* with a single dense head, especially *C. microptera*, *C. macloviana* and *C. abrupta*
C. paysonis	*C. spectabilis*
C. pellita	*C. lasiocarpa*
C. phaeocephala	Many of the *Ovales*, particularly *C. praticola*
C. praeceptorum	*C. bipartita*, *C. brunnescens*, *C. canescens*
C. praticola	Many of the *Ovales*, especially *C. aenea*, *C. leporinella*, *C. ovalis*, *C. phaeocephala*, or *C. petasata*
C. preslii	Any of the *Ovales* with a single, dense head, especially *C. pachystachya*
C. proposita	Many of the *Ovales* with a single, dense head, especially *C. straminiformis* and *C. microptera*
C. retrorsa	*C. vesicaria* var. *major*
C. richardsonii	*C. concinna*
C. rostrata	*C. utriculata*
C. scoparia	Any of the *Ovales*, particularly *C. feta* or *C. ovalis*
C. scopulorum	*C. spectabilis*, less likely *C. paysonis* or members of the *Acutae*
C. siccata	*C. praegracilis*

If the label says	The specimen may well be . . . .
C. spectabilis	*C. paysonis*
C. straminiformis	Many of the *Ovales* with a single, dense head, especially *C. proposita*, *C. phaeocephala*, *C. microptera* or *C. subfusca*
C. subfusca	Many of the *Ovales* with a single, dense head, especially *C. integra* and *C. pachystachya*
C. sychnocephala	Immature *C. athrostachya*; or *C. unilateralis*
C. tenera	*C. bebbii, C. brevior*
C. tribuloides	*C. bebbii, C. brevior, C. tenera*
C. tumulicola	*C. vallicola, C. hoodii*
C. trichocarpa	*C. atherodes* with sparsely hairy to pubescent perigynia
C. unilateralis	*C. athrostachya*
C. utriculata (immature)	Immature *C. vesicaria*; hybrids of *C. utriculata* and *C. vesicaria*
C. vernacula	*C. jonesii, C. hoodii, C. neurophora*
C. vesicaria (immature)	*C. utriculata* (immature) or hybrids
C. xerantica	*C. petasata, C. aenea*

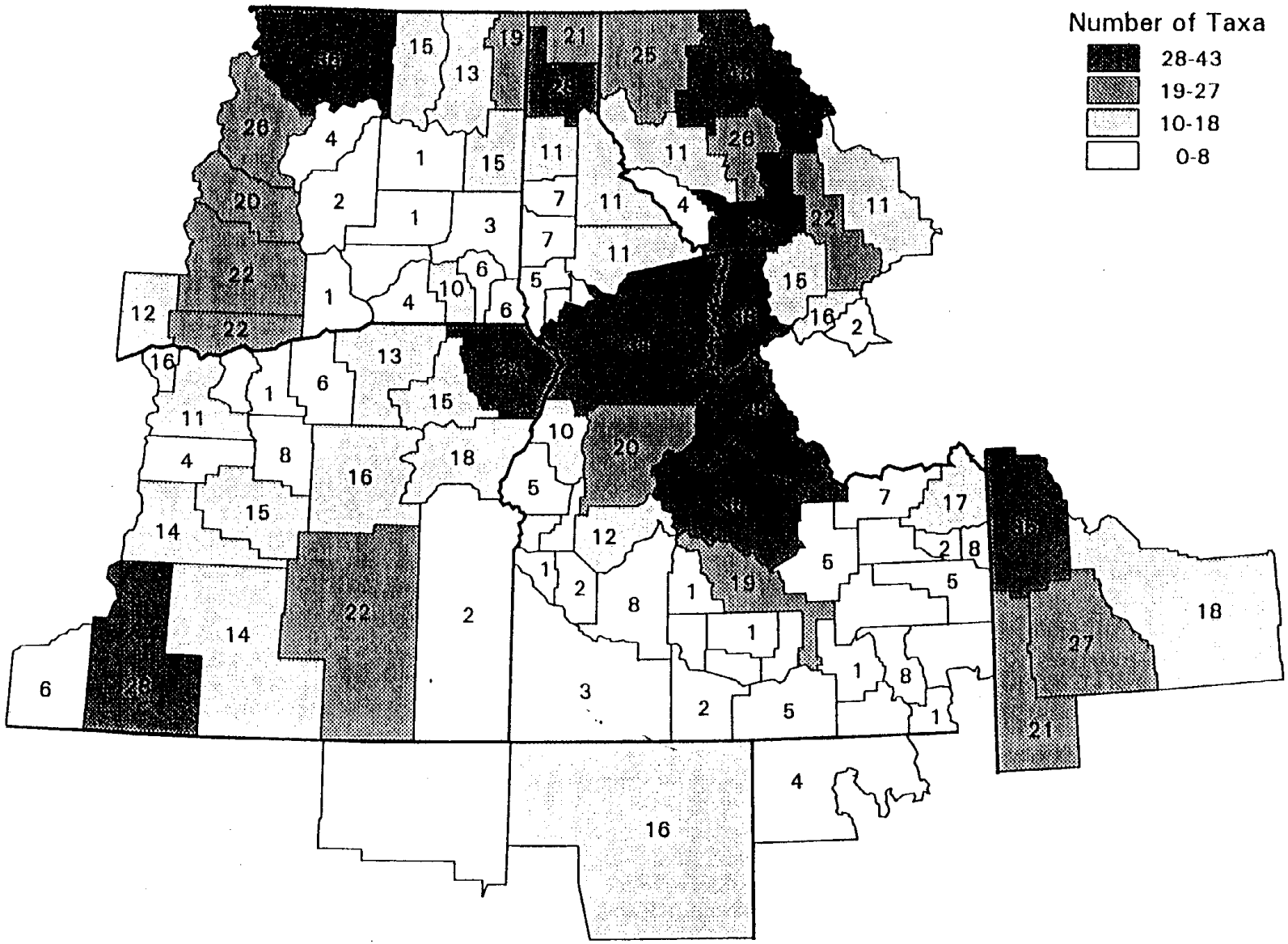
Appendix 5. County summary maps.

Total Carex Taxa by County

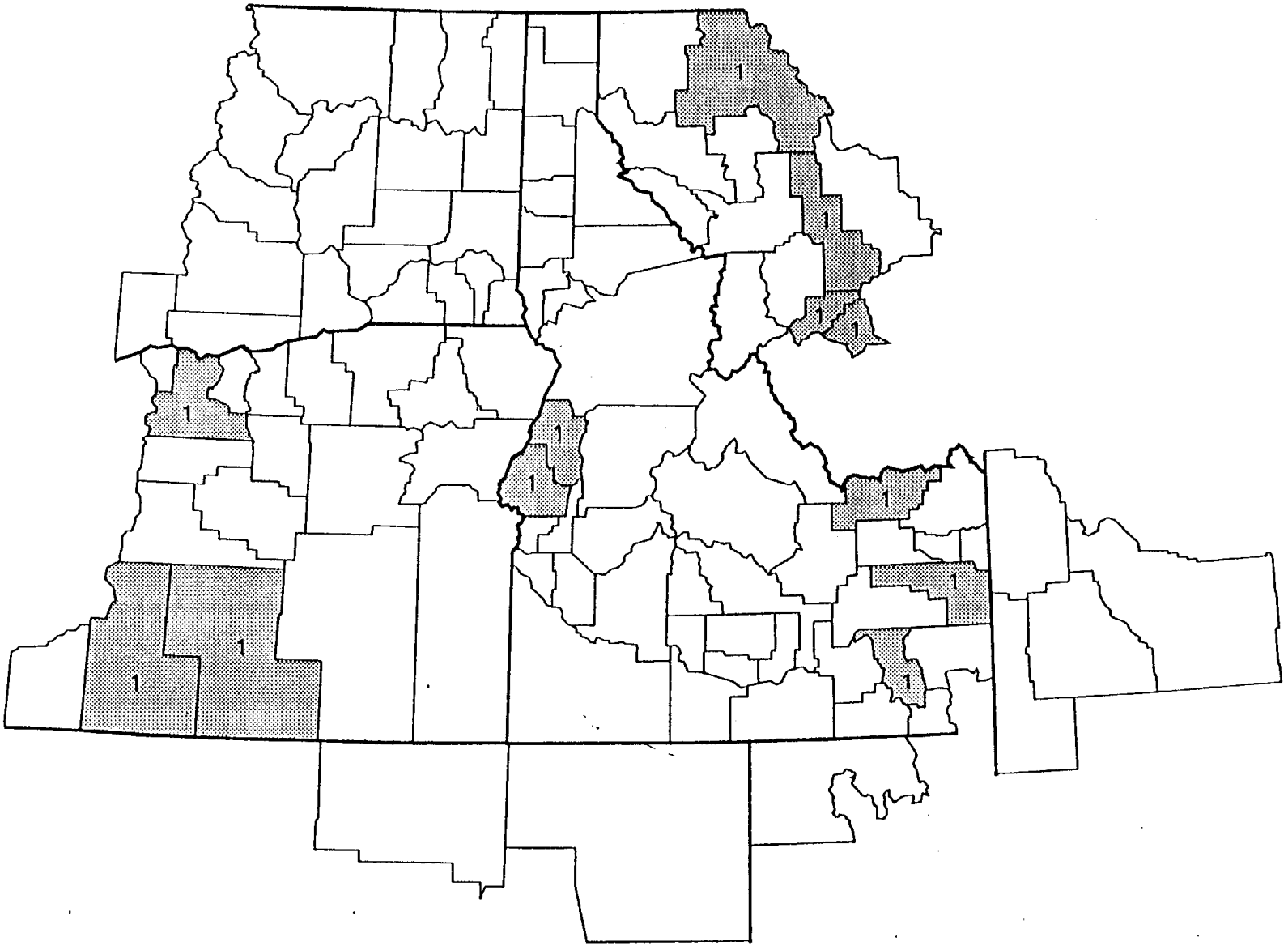


1.0.5

Rare Carex Taxa by County



Federal Candidate Carex Taxa by County



5, p.3

Appendix 6. Status of rare *Carex* taxa in the EEMP area.

Taxa listed as rare, threatened or endangered by one or more natural heritage programs in the states within the study area. An explanation of the codes follows table.

Carex Species	U.S. ESA	Global TNC	USFS	BLM	State TNC	Other	Comments
aboriginum	3A	GX			ID:SX	INPS:X	Regional endemic, presumed extinct
abrupta		G5			ID:S1	INPS:R	
aenea		G5	R4:S R6:S	WA:BA	ID:S2 WA:S1	INPS:R	
amplifolia		G3G4			MT:S1		
angustata		G5			ID:S1?	INPS:R	
arapahoensis	3B	G2G4			UT:S1		
atherodes		G5			OR:S1 UT:S1		
atrata var. atrosquama		G5 T4?	R6:S	OR:BT WA:BA	OR:S1 UT:S2 WA:S1	ONHP:3	
atrata var. erecta			R6:S	WA:BA	OR:S3 WA:S2		
backii		G4			ID:S? OR:S1	INPS:R ONHP:3	
bebbii		G5			OR:S1 UT:S1		
bipartita		G5			UT:S1	WYNDD:W	
breweri var. paddoensis		G5 T4	R4:E		ID:S1 UT:S1	INPS:S ONHP:N	
brunnescens		G5			UT:S1	ONHP:N	
buxbaumii		G5	R1:S FS:TNF R4:E R6:S	ID:BS OR:BT WA:BA	ID:S3 OR:S2 WA:S2S3 WY:S2	INPS:S ONHP:3 WYNDD:P	
californica		G5	R1:S		ID:S1 OR:S2S3	INPS:S ONHP:C	See Standley & Dudley 1991
capitata		G5			OR:S1 UT:S1		
chordorrhiza		G5	R1:S	WA:BA	ID:S1 MT:S1 WA:S1	INPS:1 MT:S	

Carex Species	U.S. ESA	Global TNC	USFS	BLM	State TNC	Other	Comments
comosa		G5	R1:S R6:S	OR:BT WA:BA	ID:S1 MT:S1 OR:SH WA:S2	INPS:1 ONHP:3	
concinna		G4G5	R6:S	OR:BA	OR:S1 WY:S1	ONHP:2 WYNDD:P	
crawei		G4G5			MT:S1 UT:S1 WY:SH	MT:S WYNDD:P	
cusickii		G5			OR:S4 WY:S1	WYNDD:P	
densa		G5	R6:S	WA:BA	OR:S5 WA:S1		
deweyana var. bolanderi		G5 T5			OR:S5 WY:S1	WYNDD:P	Synonym included in C. deweyana
diandra		G5			UT:S1 WY:S1	ONHP:N WYNDD:P	
dioica var. gynocrates				OR:BA	OR:S1	ONHP:2	
eburnea		G5			MT:SU WY:S1	WYNDD:P	
echinata ssp. echinata		G5 T5			OR:S5 WY:S1	WYNDD:P	
egglestonii		G4			WY:S1	WYNDD:R	
eleocharis		G5		OR:BT	OR:SH WA:S1	ID:C ONHP:3	
flava		G5	R6:S	ID:BS WA:BA	ID:S3 WA:S1S2	INPS:S	
haydeniana				OR:BT	OR:S1	ONHP:4	
helleri				OR:BT		ONHP:N	
hendersonii		G5	R1:S	ID:BS	ID:S3 OR:S5	INPS:S	
hystericina		G5	R6:S	OR:BA WA:BA	OR:S2 WA:S2	ONHP:2	
idahoa	3C	G2Q	R1:S		ID:SH MT:S2	INPS:R MT:S	Regional endemic
incurviformis var. danaensis		G3T3	R4:S		WY:S2	WYNDD:R	
incurviformis var. incurviformis		G2G3	R4:S		ID:S1 MT:S1	INPS:2 MT:S	
interior				OR:BT	OR:S1	ONHP:3	

Carex Species	U.S. ESA	Global TNC	USFS	BLM	State TNC	Other	Comments
jonesii		G5			OR:S5 UT:S2		
laeviculmis		G5			OR:S5 WY:S1	WYNDD:P	
lasiocarpa		G5			UT:S1		
lenticularis var. dolia	C2	G5T2			MT:S1	MT:S	
leptalea		G5	R1:S		ID:S1 OR:S2 UT:S1 WY:S1	INPS:S WYNDD:P	
limosa		G5			OR:S2 WY:S1	WYNDD:P	
livida		G5	R1:S R2:S R4:E R6:S	OR:BA	ID:S2 MT:S2 OR:S2 WY:S1	INPS:S MT:S ONHP:2 WYNDD:D	
luzulina var. atropurpurea		G5 T2T3	R4:S		MT:S2 WY:S2	WYNDD:R	Regional endemic
mariposana						ID:N ONHP:N	
microptera var. crassinerva	3B	G5 T3T4?			NV:SU	NV:D	Synonym included in C. microptera (CO,MT,NV,WY)
misandra		G5			UT:S1 WY:S1	WYNDD:P	
multicostata		G5	R1:W		MT:S1 OR:S3S4	MT:S	
nardina				OR:BT	OR:S1	ONHP:3	
neurophora		G4			MT:S1 OR:S3		
norvegica var. norvegica		G5	R6:S	OR:BA WA:BA	OR:S1 WA:S2	ONHP:2	
nova		G3	R6:S	OR:BA	OR:S1 WY:S2	ONHP:2 WYNDD:R	
obtusata		G5	R6:S	WA:BA	WA:S2		
occidentalis		G4			MT:SH WY:S1	MT:S WYNDD:P	
parryana var. parryana		G3G5			WY:S1	WYNDD:P	Including var. unica
pauciflora		G5	R6:S	WA:BA	WA:S2		

Carex Species	U.S. ESA	Global TNC	USFS	BLM	State TNC	Other	Comments
paupercula		G5	R1:S R6:S	WA:BS	ID:S2 MT:S2 WA:S2 WY:S1	INPS:2 MT:S WYNDD:D	
praeceptorum				OR:BT	OR:S2	ONHP:3	
preslii		G4Q			OR:? WY:S1	WYNDD:P	
proposita		G3G4	R6:S	WA:BA	WA:S1		
pyrenaica		G4G5			OR:S1 UT:S1		
retrorsa		G5		OR:BT	OR:S1	ONHP:3	
rostrata s. str.		G5		WA:BA	MT:S1 WA:S1		
sartwellii var. sartwellii		G4 T?			WY:S1	WYNDD:P	
saxatilis var. major		G5 TQ	R6:S	OR:BA WA:BT	OR:S1 WA:S2	ONHP:3	
scirpoidea var. pseudoscirpoidea		G5			OR:S2S3 UT:S4		
scirpoidea var. scirpoidea		G5 T4	R6:S	WA:BA	OR:S2 WA:S2 WY:S1	WYNDD:P	(including C. scirpiformis)
scoparia		G5			MT:S1 OR:S3	MT:S ONHP:C	
sheldonii		G4?		OR:BT	ID:S1 OR:S3S4 WA:	INPS:R ONHP:4	
stenoptila		G3?			MT:S1 WA:	MT:S	
straminiformis		G4			ID:S2 OR:S4	INPS:S	
subfusca		G5			OR:S3? UT:S1		
subnigricans		G5			OR:S2 UT:S1		
sychnocephala		G4	R6:S	WA:BA	MT:S1 WA:S1S2		
tenuiflora		G5		WA:BA	MT:S1 WA:S1	MT:S	
tincta		G4G5			MT:SU		
torreyi		G4			MT:S1	MT:S	

Carex Species	U.S. ESA	Global TNC	USFS	BLM	State TNC	Other	Comments
tumulicola		G4			ID:SH OR:S5	INPS:S	
vallicola var. vallicola		G5		WA:BA	MT:S2S3 OR:S4 WA:S1	MT:S	
vernacula		G?			OR:S2 UT:S1		
whitneyi	3C	GU		OR:BT	OR:S4	NV:A ONHP:3	
xerantica		G5			ID:S1	INPS:R	

Explanation of Codes Used in Table

U.S. ESA: Candidate status for listing as threatened or endangered under the U.S. Endangered Species Act

C1	Category 1, sufficient data indicate taxon is appropriate for federal listing as threatened or endangered.
C2	Category 2, possibly appropriate for federal listing as threatened or endangered. Further research needed to assess status.
3A	Category 3A, no longer receiving federal consideration for listing as threatened or endangered because of persuasive evidence of extinction.
3B	Category 3B, no longer receiving federal consideration for listing as threatened or endangered due to indistinct taxon; considered a synonym of a common taxon.
3C	Category 3C, no longer receiving federal consideration for listing as threatened or endangered because more widespread or abundant than once believed, or not subject to identifiable threats.

Global TNC ratings.

Global and state TNC (The Nature Conservancy) status is based on the most recently published state natural heritage program publications. See Master (1991) for detailed explanation of TNC ranking system.

G	rangewide, or global ranking
S	statewide ranking
T	rangewide (global) trinomial ranking of an infraspecific taxon, (e.g., a var. or a ssp.)
U	unknown
Q	indicates some question about the taxonomic status
?	ranking is not completed

SH	formerly part of the state's native flora, implying that it may be rediscovered
GX, SX	presumed extinct or extirpated, Globally, or Statewide
G1, S1	critically imperiled (usually 5 or fewer populations)
G2, S2	imperiled (usually 6-20 populations)
G3, S3	uncommon or rare but not imperiled (usually 21-100 populations)
G4, S4	not rare, apparently secure, some cause for long-term concern (usually more than 100 populations)
G5, S5	globally secure, or statewide secure

Note: State natural heritage programs provided the TNC ratings (CDC 1994; MNHP 1994; ONHP 1993; UNHP, unpublished file; WNHP 1994; Fertig 1994).

USFS: U.S. Forest Service status.

R1	Region 1, Northern Region (1994)
R2	Region 2, Rocky Mountain Region
R4	Region 4, Intermountain Region (1994)
R6	Region 6, Pacific Northwest Region (Updated March 1993)

S	sensitive, taxa for which viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
PS	proposed for sensitive status

W watch list. limited distribution but no current threats. or only suspected to be on USFS land
E edge of range, important in biodiversity analysis, generally quite rare in Region (4)
FS-TNF forest sensitive in Teton National Forest, Region 4 (Fertig 1994)

BLM: U.S. Bureau of Land Management status

The BLM has designated a sensitive species list in three of the EEMP states.

ID Idaho
OR Oregon
WA Washington

BS Bureau Sensitive
BA Bureau Assessment
BT Bureau Tracking

Other: Rankings by state natural heritage programs, native plant societies

Idaho Native Plant Society ratings.
INPS:1 Priority 1. In danger of becoming extinct or extirpated in Idaho in the foreseeable future
INPS:2 Priority 2. Likely to become Priority 1 in Idaho in the foreseeable future, if population declines or habitat loss continues
INPS:M Monitor. Common within a limited range, or no identifiable threats in Idaho
INPS:R Review. May be of conservation concern in Idaho; more research is needed to evaluate status
INPS:S Sensitive. Populations and habitats may be jeopardized without active management or removal of threats in Idaho
INPS:X Historical/extirpated. Taxa which are known in Idaho only from historical (pre-1920) records or are considered extirpated from the state by the INPS
ID:N No evidence of ID occurrence, misidentification (Whitkus thesis)
ID:C Common to abundant, dropped from consideration in ID (CDC 1994, p.22)

Montana Natural Heritage Program ratings (Lesica and Shelly 1991).
MT:S Sensitive. May become threatened or endangered within Montana, has limited populations or restricted habitats

Northern Nevada Native Plant Society (NNNPS) status (Morefield and Knight 1992, Morefield 1994)
NV:A Absent from Nevada currently and historically (but previously reported)
NV:D Deleted, presently secure or indistinct taxon in Nevada

Oregon Dept. of Agriculture status (ONHP 1993) under the state endangered species act.
ODA:C Candidate for state listing as threatened or endangered

Oregon Natural Heritage Program (ONHP 1993) rankings
ONHP:1 Endangered or threatened throughout range
ONHP:2 Endangered or threatened in Oregon but more common elsewhere
ONHP:3 Review of status needed to determine if qualified for categories 1 or 2
ONHP:4 Rare but secure, or declining but too common for listing as threatened or endangered in Oregon; watch list
ONHP:C Common and/or secure, so dropped from consideration as a state rare, threatened or endangered species

ONHP:N Never documented in Oregon, although reported in literature

Wyoming Natural Diversity Database rankings (Fertig 1994)

WYNDD:D Disjunct in WY
WYNDD:P Populations in WY peripheral to contiguous range
WYNDD:R Regional endemic, taxon range is smaller than WY
WYNDD:U Uncertain status, reported from WY
WYNDD:W Watch list, dropped from higher WY status between 1993 and 1994

Species	Published range comments	State where disjunct	Herbarium or other Documentation
C. vesicaria v. *major*	West of the Cascade Mts., also E in N Washington, N Idaho, NW Montana (Hitchcock et al. 1969)	ID OR: Wallowa Co: WA: Whitman Co.	ID, RM, WS, WTU

Species	Published range comments	State where disjunct	Herbarium or other Documentation
*C. tenuiflora**	Circumboreal at high latitudes (Hulten 1968); tracked as rare in Washington (Washington Natural Heritage Program 1994)	WA, MT	WS, MONTU
*C. tincta**	A rare midwestern and eastern species (Gleason and Cronquist 1991); tracked as rare in Montana (Lesica and Shelly 1991). Reznicek (pers. comm.) suggests the Montana record of this species could be a could be a congested inflorescence form of *C. tenera*. Our attempts to locate and check the citation were unsuccessful.	MT	literature record Heidel (1994)
*C. tumulicola**	W of the Cascade Mts. and in the Columbia Gorge to Bingen, Washington (Hitchcock et al. 1969). Confirmed specimens but no recent records from Idaho (Conservation Data Center 1994)	ID	
C. unilateralis	West of the Cascade Mts., with specimens from B.C. and Saskatchewan (Hitchcock et al. 1969). Of east-side specimens, identification of only the Deschutes County, Oregon, record has been verified (B. Wilson, pers. obs.)	ID, MT	MONTU
*C. vallicola**	Eastern Oregon and central Idaho, to Wyoming and W South Dakota, S to California, S Nevada, and S Utah (Hitchcock et al. 1969); tracked as rare in Washington (Washington Natural Heritage 1994)	WA	WTU

Species	Published range comments	State where disjunct	Herbarium or other Documentation
C. multicaulis	California (Mastrogiuseppe 1993), reaching SW OR, often on serpentine *(Carex* Working Group 1993). Resembles *C. geyeri*	WA	WS
C. nudata	CA, WA and western OR (Standley 1985). Some EEMP reports outside of the John Day River valley may be erroneous.	WA, OR	RM,WS
*C. occidentalis**	S. Wyoming to New Mexico, W to Utah, Nevada, Arizona, and California (Cronquist et al. 1977). Teton Co., Wyoming, specimen should be checked (P. Zika, pers. obs.); tracked as rare in Montana and Wyoming (Lesica and Shelly 1991, Fertig 1994)	ID, WY	RM, WTU
*C. pauciflora**	Circumboreal, S near coast to Olympic Peninsula (Hitchcock et al. 1969), where rare.	WA: Kittitas Co.	WTU !Zika
C. proposita	Sierran CA, and type from Blaine Co., ID, Hermann (1970)	WA: Chelan Co.	NY, RM, WTU
C. siccata	Maine to New Jersey, W to Mack. Alberta, Washington (Wenatchee Mts.), Wyoming, Utah, and Arizona (Hitchcock et al. 1969)	OR	CIC, OSC
C. sychnocephala	Ontario and New York to Alberta, Montana, S. Dakota, W to Okanogan Co., Washington (Hitchcock et al. 1969); Tracked as rare in WA, but not cited in Klickitat Co. (Washington Natural Heritage Program 1994)	WA: Klickitat Co.	literature record

Species	Published range comments	State where disjunct	Herbarium or other Documentation
C. hendersonii	In and west of the Cascade Range, disjunct in Idaho (Hitchcock et al. 1969); known and tracked as rare by Idaho Dept. Fish and Game (Conservation Data Center 1994)	ID	ID, MRC, RM, WS, WTU
C. incurviformis v. *danaensis*	Isolated populations in Park and Clear Creek Cos., Colorado, and in California (Hermann 1970)	WY	
C. interrupta	Mainly in and west of the Cascade Mountains (Hitchcock et al. 1969; Standley 1985)	ID, MT	ID
*C. lacustris***	Quebec and Virginia to Saskatchewan and Nebraska (Gleason and Cronquist 1991), disjunct in Idaho (Steyermark 1963). (Specimen ! A. A. Reznicek)	MT	MONTU
C. lasiocarpa	Circumboreal, S in Cascades to N Idaho and S Washington (Hitchcock et al. 1969). Wasco Co., OR sheet !Carex Working Group, resembles *C. pellita*	OR: Klamath Co.	literature record
C. macloviana	Broadly defined, this species would be common in our area, but strictly defined, it is a circumboreal taxon not reaching as far south as the EEMP area. See Dorn 1992. Reznicek (pers. comm.) considers the Klickitat Co. collection to be suspicious, although that specimen was annotated recently by a worker in the section.	WA, WY	

Species	Published range comments	State where disjunct	Herbarium or other Documentation
*C. californica**	W of Cascade summits, Idaho (Hitchcock et al. 1969); disjunct in Idaho (Hermann 1970), where tracked as rare (Conservation Data Center 1994)	ID	MRC, WS, WTU, MONTU
*C. conjuncta***	NE North America, west to S Dakota and Kansas (Steyermark 1963); winged stem is character shared with *C. stipata*. Identification is suspicious and should be checked (Reznicek, pers. comm.)	ID, MT	MONTU
C. diandra	Circumboreal, S to central WA, NW Wyoming (Hitchcock et al. 1969)	WA: Skamania Co.	ID
*C. eburnea**	Nova Scotia to Alaska, and south east of the Rockies (Gleason and Cronquist 1991, Hulten 1968); many of the populations disjunct (Hulten 1968, Zika pers. obs.); tracked as rare in Montana (Lesica and Shelly 1991)	MT	MONTU
C. egglestonii	S Wyoming & Colorado W to Utah, reported S to Mexico (Cronquist et al. 1977); Reznicek (pers. comm.) states that records from Mexico are erroneous; tracked as rare in Wyoming (Fertig 1994)	ID	WTU
C. flava	Circumboreal, to Montana & central Idaho (Hitchcock et al. 1969); a calciphile, and Hood River Co., Oregon	OR	RM
C. fracta	Cascade-Sierra and Coast Range Mountains (Hitchcock et al. 1969)	OR: Wallowa Co.	WS

Appendix 7. Disjunct *Carex* taxa within the EEMP area.

* Taxa tracked as rare by the relevant state natural heritage program or equivalent
** Taxa widely disjunct from the main range
! Confirmed by ...

Species	Published range comments	State where disjunct	Herbarium or other Documentation
C. aquatilis v. *dives*	In and west of the Cascade Range (Standley 1985); some individuals of *C. a.* v. *aquatilis* approach this taxon	east WA, ID, MT	WS, ID, RM, OSC
C. arapahoensis	Colorado, Utah, S Wyoming (Cronquist, 1977); tracked as rare in Utah (Utah Natural Heritage Program, 1994), not tracked in Montana (Lesica and Shelly 1991, Heidel 1994)	MT	WTU, MONTU
C. atrata v. *chalciolepis*	Colorado, SE Wyoming, SE Utah, N Arizona (Cronquist 1977), a specimen in EEMP area in NE Nevada, but otherwise south of it (Murray 1969)	MT, ID, WY	RM
*C. bigelowii***	Arctic tundra and disjunct in Appalachian alpine areas (Hulten 1968; Zika pers. obs.)	ID, MT	ID, RM, WTU
C. brevicaulis	Near the coast, British Columbia to Calif. (Hitchcock et al. 1969).	WA: Chelan Co.	WTU !Zika
C. brevior	NE N America, west to NW Washington (Hitchcock et al. 1969)	OR: Klamath Co.	WTU
C. brunnescens	Circumboreal, S perhaps to Oregon (Hitchcock et al. 1969) but all Oregon specimens checked by the *Carex* Working Group were *C. laeviculmis*	OR	RM and Applegate (1939)