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RESOURCE DATA AND  
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Status of the  
Tiny Cryptanthe  
(*Cryptantha minima*)  
in Alberta



Alberta Wildlife Status Report No. 54



Alberta Conservation  
Association

Alberta  
SUSTAINABLE RESOURCE  
DEVELOPMENT

# **Status of the Tiny Cryptanthe (*Cryptantha minima*) in Alberta**

Prepared for:  
**Alberta Sustainable Resource Development (SRD)**  
**Alberta Conservation Association (ACA)**

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## PREFACE

Every five years, the Fish and Wildlife Division of Alberta Sustainable Resource Development reviews the general status of wildlife species in Alberta. These overviews, which have been conducted in 1991 (*The Status of Alberta Wildlife*), 1996 (*The Status of Alberta Wildlife*) and 2000 (*The General Status of Alberta Wild Species 2000*), assign individual species “ranks” that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A key objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the general status exercise, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are *At Risk* or *May Be At Risk* in the province, that are of uncertain status (*Undetermined*), or that are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fish and Wildlife Division of Alberta Sustainable Resource Development. They are intended to provide detailed and up-to-date information that will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information that will assist Alberta’s Endangered Species Conservation Committee in identifying species that may be formally designated as *Endangered* or *Threatened* under Alberta’s *Wildlife Act*. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

## EXECUTIVE SUMMARY

This report synthesizes and analyses information currently available on tiny cryptanthe (*Cryptantha minima*)—an annual vascular plant species considered as *May Be At Risk* in Alberta. Tiny cryptanthe, found in Alberta and reported historically in Saskatchewan, was designated as *Endangered* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1997 and 2000. This report, which includes additional, more recent information, including results of field surveys in 2003 and 2004, will be used to more formally evaluate the species' status in Alberta using criteria established by the World Conservation Union (IUCN 2001).

In Alberta, tiny cryptanthe is known only from the vicinity of the lower Bow River and South Saskatchewan River valleys in the Dry Mixedgrass Natural Subregion. The species' habitat is native mixed grasslands in moderately active depositional environments including abandoned sandy terraces on meander lobes in the river valley floodplain, sandy valley slopes, and sand hills near the valley edge. Eighteen subpopulations or occurrences are reported, which make up the known provincial population. Seventeen occurrences are along a 120-km reach of the South Saskatchewan River valley downstream of Medicine Hat and one occurrence is in sand hills near where the Oldman and Bow rivers join to become the South Saskatchewan River, about 105 km upstream of Medicine Hat. Plant numbers appear to fluctuate greatly from year to year within subpopulations. Occurrence reports range from one individual to tens of thousands of individuals. The known area of occupancy of all reported occurrences is less than 1 km<sup>2</sup> and extent of occurrence is less than 2000 km<sup>2</sup>. One extant occurrence is reported in Saskatchewan near the provincial boundary on a tributary valley of the Red Deer River, about 60 km from the nearest occurrence in Alberta. The nearest extant population in northeast Montana is 450 km distant.

A large amount of potential river valley and upland habitat in Alberta has been altered by human activity to the point that it is no longer available for colonization by tiny cryptanthe. Activities include cultivation or seeding to non-native pasture, development of oil and gas well sites, urban and rural residential development, construction of permanent access roads and invasion of native grasslands by non-native plant species. There are specific examples of conversion of native prairie in or near known tiny cryptanthe habitat within the last few years. Further reduction in tiny cryptanthe habitat and area of occupancy is predicted if current trends continue and measures are not taken to identify and protect known subpopulations.

A national recovery strategy for tiny cryptanthe is being developed by a team of federal and provincial representatives. Monitoring and research of tiny cryptanthe in Alberta is recommended, to obtain more complete understanding of the species' habitat requirements and distribution, population size and trends, and the genetic variability and connectivity required to sustain long-term viability of the provincial population.

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## INTRODUCTION

Tiny cryptanthe (*Cryptantha minima* Rydb.), also known as small cryptanthe and little cat's-eye, is an annual vascular plant species found in semi-arid grasslands of the great plains (and intermontane basins) of western North America from Texas to Canada. Its known range in Canada is in the dry mixedgrass prairie of southeastern Alberta and southwestern Saskatchewan.

Tiny cryptanthe is considered as *May Be At Risk*\* according to the preliminary general status review of plant species in Alberta (Alberta Sustainable Resource Development 2000a). The species is ranked as S1 by the Alberta Natural Heritage Information Centre (ANHIC) (Vujnovic and Gould 2002). In Saskatchewan, tiny cryptanthe is also ranked as S1 (Saskatchewan Conservation Data Centre 2003). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the species as *Endangered* in 1997 and re-examined and confirmed the designation in 2000 (COSEWIC 2003a). In the United States, tiny cryptanthe is ranked as S3 in Wyoming, S4 in South Dakota and SNR in the seven other states in which it occurs: Montana, Nebraska, Colorado, Kansas, New Mexico, Oklahoma and Texas (NatureServe 2004).

This report compiles and summarizes historical and recent information on tiny cryptanthe in Alberta to enable more comprehensive assessment of provincial status.

## HABITAT

**1. Habitat Attributes** – In Alberta, tiny cryptanthe is found in the Dry Mixedgrass Natural Subregion of the Grassland Natural Region and is restricted to the vicinity of the South Saskatchewan River valley. The climate is continental, characterized by extremes in

temperatures with warm summers and cold winters. In the South Saskatchewan River valley at Medicine Hat, the mean July temperature is 19.5°C and the mean January temperature is -10.2°C (Environment Canada 2003a). Extremes for the period of record range from a high of 42.2°C to a low of -46.1°C. Dry summers and winters are typical. Average annual precipitation for the South Saskatchewan River valley at Medicine Hat is 334 mm with average annual rainfall of 250 mm and average annual snowfall of 95 cm. Most rainfall occurs in June. Frequently high wind speeds cause high rates of evaporation throughout the summer months.

Site descriptions for occurrences of tiny cryptanthe in Alberta are provided in Appendix 2. Appendix 3 provides descriptions of sites where tiny cryptanthe was sought but not found during a survey in July and August 2003. Characteristically, sites where tiny cryptanthe is found are on poorly developed sandy soils of fluvial or aeolian origin (rego brown chernozems) (Kjearsgaard and Pettapiece 1986). Elevation ranges from 750 m (2460 ft) in the Lower Bow sand hills on the upland north of the confluence of the Bow River and Oldman River (km 0\* of the South Saskatchewan River) to 625 m (2050 ft) in the South Saskatchewan River valley bottom through Canadian Forces Base (CFB) Suffield and the Drowning Ford Grazing Lease. Habitat is generally described as xeric to sub-xeric with substrate of sandy to silty texture on level to gently sloping valley bottom terraces about five to ten metres above mean river level. The origin of these abandoned terraces is attributed to a large, post-glacial river believed to be a precursor to the current South Saskatchewan River (Adams et al. 1997). In addition, tiny cryptanthe has been found on valley slopes with up to 50% slope, and on undulating to rolling sandy upland near the valley breaks.

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\* See Appendix 1 for definitions of selected status designations.

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\* River kilometres are based on maps provided in Dickinson and Baresco (1996).

Vegetation communities in which tiny cryptanthe occurs in Alberta are described generally as grasslands dominated by needle-and-thread (*Stipa comata*) and blue grama (*Bouteloua gracilis*) grass. Commonly associated species include prickly pear (*Opuntia polyacantha*), Indian rice grass (*Oryzopsis hymenoides*), low sedge (*Carex stenophylla*), Pursh's plantain (*Plantago patagonica*), silver sagebrush (*Artemisia cana*) and winter-fat (*Eurotia lanata*). Usually there is 10 to 30 percent bare soil. Some sites are described as disturbed and associated with pipelines and vehicle or livestock trails through native vegetation.

In Saskatchewan, the habitat for tiny cryptanthe, based on one occurrence, is described as a south-facing valley slope with sandy loam substrate. Vegetation is dominated by needle-and-thread grass and Dakota goosefoot (*Chenopodium dacoticum*) with 30% to 40% bare soil (Saskatchewan Environment 2003, C. Elchuk pers. comm.).

In the United States, tiny cryptanthe is found on plains and intermontane basins east of the continental divide of the Rocky Mountains. Habitat is generally characterized as dry grassland on sandy or gravelly (talus) substrate in valley bottoms, at the base of sandstone and limestone outcrops, lower valley slopes, on plains and on stabilized or active sand dunes (Correll and Johnston 1970, McGregor et al. 1986, University of Colorado 2004, D. Dyer pers. comm., B. Heidel pers. comm.). Besides occurring in grasslands, tiny cryptanthe also occurs in shrublands dominated by sand sage (*Artemisia filifolia*) or big sage (*Artemisia tridentata*) and in open ponderosa pine (*Pinus ponderosa*) woodland. Roadsides and reservoir margins also are mentioned as habitats. Botanists studying vegetation in southwest Kansas and southeast Colorado found tiny cryptanthe on prairie dog (*Cynomys ludovicianus*) colonies and not on adjacent non-colonized short-grass prairie (Winter et al. 2002).

A common attribute of habitats for tiny cryptanthe appears to be that the sites have been subjected to moderately active depositional processes through the action of water (sandy river terraces), gravity (lower slopes, midslope benches), wind (sand dunes and plains) or short-term soil-disturbing activities of animals (prairie dogs, large herbivores) or humans. Substrates on which this annual species establishes are generally sorted and coarse in texture, and are composed of silty sands, sands or mixed sands and gravels rather than unsorted tills or deposits rich in clays and organic matter. Tiny cryptanthe does not appear to occupy habitats experiencing active erosion (cutbanks, eroding valley slopes) or intense and repeated disturbance (active point bars, cultivated fields). It also has not been found in vegetation communities with high canopy cover, high litter and little exposed soil. Opening of the vegetation canopy through natural processes (drought, fire, grazing) or human disturbances (establishing trails, mowing) appears to stimulate germination of seeds in the seedbank or provide a seedbed free of competition where plants can establish, but tiny cryptanthe is not associated with sites that have been compacted (well sites, roads) or where there is major alteration of native vegetation (seeded pasture). Livestock grazing may help maintain populations of tiny cryptanthe as has been shown in studies of the effects of grazing on annual plants (Osem et al. 2002, Hayes and Holl 2003). Further study would be required to determine what factors or combination of environmental factors benefit tiny cryptanthe, such as availability of moist bare sites for seed germination, rapid drainage, absence of soil compaction, absence of litter, exposure to sunlight, and lack of competition with other plant species for space and nutrients or minerals.

**2. River Valley Habitat and Loss** – Most known occurrences of tiny cryptanthe in Alberta are in river valley habitat, on second- or third-level terraces 5 m to 10 m above river level (Appendix 2). These terraces were deposited by a larger

post-glacial river (Adams et al. 1997). Over the last 100 years, these habitats have experienced little, if any, flooding. Tiny cryptanthe was also found on valley slopes of south, east and west aspects with up to 50% slope and on adjacent upland within a few hundred metres of the valley edge.

The 51-km reach of the South Saskatchewan River valley in which tiny cryptanthe has been found in the valley bottom (km 157 to km 208) has a broad valley across which the river channel moves, creating large meander lobes. CFB Suffield flanks the valley on the west, and public lands under lease to the Drowning Ford Grazing Association border it on the east. Large portions of terraces on some meander lobes in this reach have been converted to crested wheat grass (*Agropyron pectiniforme*) pasture (Appendix 3). Tiny cryptanthe was found only in native mixed grassland and not in areas converted to non-native pasture. Crested wheat grass appears to be persisting and expanding into native vegetation. It is known to persist for several decades on mixedgrass prairie sites where it has been seeded, particularly on regosol and brown chernozem soils, and has been documented invading native grassland communities (Bush 2001, Bradley 2003, Henderson et al. in press).

All meander lobes on which tiny cryptanthe was found within the Drowning Ford Grazing Lease also have active gas well sites and access roads where vegetation had been removed (Appendix 3). At one site there is a gravel pit. Tiny cryptanthe was absent from the areas that receive repeated disturbance or compaction even when present immediately adjacent to them. Tiny cryptanthe was found in areas of native vegetation on and adjacent to a pipeline right-of-way on the valley slope (Appendix 2).

A 67-km reach of the South Saskatchewan River upstream of CFB Suffield to Redcliff (km 90 to km 157) can also be characterized as a broad valley across which the river channel moves creating large meander lobes. Observations from

accessible viewpoints of the valley top indicated that all meander lobes in this reach have been altered to some extent by cultivation, irrigation and human settlement. Two meander lobes at km 148 and km 156 were searched on foot; tiny cryptanthe was not found (Appendix 3). The meander lobes have been largely converted to irrigated cropland, and remaining fragments of native vegetation are experiencing salinization from increased moisture and conversion to species associated with mesic habitats. Tiny cryptanthe was found on valley slopes and nearby uplands at km 110 and km 112 but not on adjacent river valley terraces, which have been mostly converted to irrigated cropland and urban residential development (Appendix 2). Terraces within Police Point Park in Medicine Hat (km 105 to km 109) still support substantial areas of native grassland vegetation; however, tiny cryptanthe has not been found in vegetation surveys (Appendix 3, D. Baresco pers. comm.). Although river valley habitat in this reach appears to have been suitable for tiny cryptanthe at one time, there is low potential for extant populations because of the high level of conversion of native vegetation to non-native cropland and pasture and human settlement.

The 90-km reach of the South Saskatchewan River upstream of Redcliff (km 0 to km 90) has a narrow valley and the channel is of low sinuosity and often confined by bedrock. There are a few meander lobes with fluvial terraces of low slope. The large majority of quarter sections in this reach are mapped by the native prairie vegetation baseline inventory as having less than 75% native vegetation (Alberta Sustainable Resource Development 2000b). Uplands south of the river valley are largely cultivated and under irrigation. Tiny cryptanthe was not found during a 1996 survey of the Express Pipeline crossing in this reach (AXYS 1996). Investigations of valley bottom terraces on meanders near the Grand Forks found large areas that had annual crops under irrigation or had been converted to non-native pasture (Appendix 3). Invasion of native grassland fragments by

non-native species is occurring. No tiny cryptanthe was found. This reach is considered to have low potential for supporting populations of tiny cryptanthe.

Downstream of CFB Suffield to the provincial boundary, for 89 km (km 212 to km 301), the valley of the South Saskatchewan River is narrow and the channel is confined by bedrock through most of its length. Meander lobe habitat for tiny cryptanthe is scarce. No tiny cryptanthe was found in rare plant surveys annually in 2000 to 2003 along the North Suffield Pipeline routing where it crosses the South Saskatchewan River valley (AXYS 2002). In 2003, areas of potential valley bottom habitat for tiny cryptanthe were searched on foot, including meander lobes near Sandy Point (km 263 and km 270 to km 276) and at the Saskatchewan border (km 291 to km 301). Tiny cryptanthe was not found (Appendix 3). Portions of the meander lobes near Sandy Point have been converted to non-native vegetation through cultivation, recreation site development, water pump installation and roads and facilities associated with major natural gas pipeline construction. A large meander loop straddling the provincial boundary remains largely native vegetation and appears to have suitable habitat; however, searches in 2002 and 2003 failed to find tiny cryptanthe (Appendix 3).

To summarize, about 50% (145 km) of the length of the South Saskatchewan River valley in Alberta historically had suitable meander lobe habitat for tiny cryptanthe. Since the early 1900s, most of the potential meander lobe habitat has been altered to the point that it no longer is suitable for sustaining viable populations of tiny cryptanthe. Most of this habitat loss is on private land; however, river valley habitat under public ownership also has been cultivated or seeded to non-native pasture. Most of the remaining suitable meander lobe habitat lies within a 58-km reach (km 156 to km 214) bounded on the west by CFB Suffield (a portion within the recently designated National Wildlife Area) and

on the east by public lands of the Drowning Ford Grazing Lease. A large meander loop straddling the provincial boundary also appears to remain as potential habitat. Valley slopes with appropriate habitat characteristics, however, still support or have the potential to support tiny cryptanthe.

**3. Upland Habitat and Loss** – Tiny cryptanthe was first found in upland habitat in Alberta in 2002, in an area known as the Lower Bow dunes about 7 km upstream of where the Bow and Oldman rivers join to form the South Saskatchewan River, known as Grand Forks (Appendix 2). The site is 1 km north of a tributary valley to the Bow River and 3 km north of the Bow River valley. In 2003, two occurrences of tiny cryptanthe were reported on sandy upland of the public lands leased to the Drowning Ford Grazing Association in the vicinity of previously documented river valley occurrences. In 2004, tiny cryptanthe was found in stabilized sand dunes of the Middle Sand Hills about 2 km west of the South Saskatchewan River valley breaks (D. Nernberg pers. comm.). Also in 2004, tiny cryptanthe was found in undulating sand hills within 1 km west of the South Saskatchewan River valley breaks in the city of Medicine Hat (D. Nernberg pers. comm.).

Tiny cryptanthe has not been found in several previous surveys of potentially suitable upland habitat in southern Alberta. For example, surveys of sand hill and sand plain habitat in the Mixedgrass Natural Subregion and Dry Mixedgrass Natural Subregion of southern Alberta in 1987 did not find tiny cryptanthe (Wallis and Wershler 1988). Areas surveyed included Remount-Empress, Hilda, Matzhiwin, Suffield, Old Channel Lake, Brooks-Vauxhall, Barnwell, Little Rolling Hills, Lake Newell, Lower Bow, Lost River, Pakowki Lake and Wildhorse-Manyberries (including Lost River). Surveyors reported that Fendler's cryptanthe (*Cryptantha fendleri*) was locally common. Tiny cryptanthe also was not found during several subsequent surveys of sand hill and sand plain

habitat for other plant species at risk, including smooth goosefoot (*Chenopodium subglabrum*) (Smith and Bradley 1992), western spiderwort (*Tradescantia occidentalis*) (Smith 2001) and small-flowered sand-verbena (*Tripterocalyx micranthus*) (Alberta Sustainable Resource Development 2003). In addition, tiny cryptanthe was not found in annual vegetation surveys during 2000 to 2003 of the North Suffield Pipeline Project routing through the Middle Sand Hills (AXYS 2002).

Two intensive vegetation surveys of portions of CFB Suffield by experienced botanists in 1994-1995 and 2003 did not find tiny cryptanthe in upland habitat, although two plants were found about 9 km apart in river valley habitat (Macdonald 1997, Environment Canada 2003b, I. Macdonald pers. comm.) (Appendix 2). A search of sand hills near Purple Springs and Hilda in 2003 failed to find tiny cryptanthe (Appendix 3).

To ascertain whether there is suitable habitat for tiny cryptanthe on the uplands between currently known occurrences, C. Bradley examined soil maps for the presence of sandy soils, acted on by wind or water, which are found on coarse-textured parent material of aeolian or fluvial origin (Kjearsgaard and Pettapiece 1986). Coarse-textured fluvial or aeolian parent materials are common along both sides of the South Saskatchewan River between Medicine Hat and the Saskatchewan border, generally occurring within 5 km of the valley breaks. Included in this band are the Middle Sand Hills, which are largely within the eastern portion of CFB Suffield and are now designated as a national wildlife area. There are a few small scattered patches of sandy soils in the western portion of CFB Suffield and in the area west toward the Lower Bow Dunes; however, the large majority of parent materials are fine- to medium-textured calcareous till (Kjearsgaard and Pettapiece 1986). Most of the area east of the South Saskatchewan River to the provincial boundary also is underlain by fine- to medium-textured calcareous till inconsistent with tiny

cryptanthe habitat. Significant portions of these uplands are under cultivation (Alberta Sustainable Resource Development 2000b).

In Alberta, native prairie is estimated to have declined by 60 to 70 percent since colonization in the late 1890s, as a result of human activities including cultivation, roads and urbanization (Alberta Environmental Protection 1997, Alberta Sustainable Resource Development 2000b). Grasslands in Alberta are in decline with the Dry Mixedgrass Natural Subregion containing most of what is left. However, native prairie in this subregion is also under threat.

The total amount of native prairie remaining in the Dry Mixedgrass Natural Subregion, based on interpretation of 1991-1993 aerial photography, is estimated at 54% (2 576 667 ha) (Alberta Sustainable Resource Development 2000b). This implies a decline of 46% over 100 years. Actual rate of decline of native prairie could be higher, as the interpretation of aerial photography does not allow the interpreter to ascertain which "grasslands" are dominated by non-native species. More detailed inventory and tracking of changes in the amount of native prairie are proposed (Prairie Conservation Forum 2001).

The degree of fragmentation of grasslands in the Dry Mixedgrass Natural Subregion is high. Aerial photo interpretation of the amount of prairie remaining by quarter section found that only 33% of quarter sections have 76-100% native prairie, 14% of quarter sections have 51-75% native prairie and the remainder (55%) have less than 50% native prairie (Alberta Environmental Protection 1997). Relatively large parcels of native grasslands include those portions of the South Saskatchewan River valley and adjacent uplands where tiny cryptanthe has been found in Alberta (Alberta Sustainable Resource Development 2000b).

Specific to the Lower Bow location for tiny cryptanthe, native prairie on sand plain about 10 km east was cultivated for potato production

in 2003 (Bray and Wallis 2003). No survey information for rare plant species is available for this site prior to cultivation.

Native prairie in the Grassland Natural Region is becoming increasingly fragmented not only by cultivation but also by development of oil and gas well sites, country residential subdivision and development and roads. In 1993, there were 51 931 oil and gas well sites in the Dry Mixedgrass Natural Subregion for an average density of 1.11 well sites/km<sup>2</sup> or 103 well sites per township (Alberta Environmental Protection 1997). Major oil and gas fields include Grand Forks and Suffield (including public lands under lease to the Drowning Ford Grazing Association), both areas of known habitat for tiny cryptanthe in Alberta.

The number of well sites within potential habitat for tiny cryptanthe has continued to increase over the last decade. For example, the “Forks” area at the confluence of the Bow and Oldman Rivers, including the Lower Bow Dunes site for tiny cryptanthe, has seen a rapid increase in oil and gas well sites and access roads since the early 1980s. In a 15-km<sup>2</sup> area just north of the confluence, about 50 well sites and 50 km of access roads were constructed between 1977 and 1998 (Prairie Conservation Forum 2003). This rapid rate of fragmentation is also occurring on the public lands under lease to the Drowning Ford Grazing Association (C. Bradley pers. obs., J. Nicholson pers. comm.). Activity proceeds without rare plant inventory. These developments not only remove native vegetation but also provide avenues for invasion of aggressive non-native plant species into native prairie.

Specific to the Medicine Hat location for tiny cryptanthe, recent urban residential development has eliminated a portion of the subpopulation, thereby fragmenting it into two subpopulations. The development occurred prior to documentation of the tiny cryptanthe subpopulation within the city. The remainder of

the subpopulation on the upland in Medicine Hat is threatened by planned urban residential expansion (D. Nernberg pers. comm.).

A project to model the cumulative environmental effects of human activities in the Grassland Natural Region using the landscape simulator ALCES has led participants to the following conclusion: “If we factor in future land deletions caused by the expansion of settlements, energy development, agricultural production and transportation networks, we will see a gradual reduction in native prairie through time” (Prairie Conservation Forum 2003). Conservative projections are that 1000 ha of native prairie will be lost each year, resulting in a 25 percent reduction in native prairie over the next 100 years (Prairie Conservation Forum 2003). More than double that amount of loss is predicted if current rates of expansion of the human footprint continue.

A conclusion from the information provided in this section is that a large portion of potential native upland and river valley habitat for tiny cryptanthe has been lost owing to human activity over the last century, and substantial further loss is predicted if current trends in land use continue without measures being taken to identify and protect sites where tiny cryptanthe occurs.

## CONSERVATION BIOLOGY

Tiny cryptanthe, also known as small cryptanthe, little cryptanthe or little cat’s-eye, is an annual vascular plant species in the borage family (Boraginaceae). Annual plants only grow for one year and a large portion of their life cycle is as seed.

The type specimen of tiny cryptanthe was collected in Colorado in 1900 and described by the American botanist Rydberg in 1901 (New York Botanic Garden 1901). The stem of the plant is branched from near the base. The bristly-hairy branches can reach 20 cm in height and often are prostrate. The leaves are bristly-hairy, alternate, with blunt tips and tapered bases, and

linear, up to 3 cm long and 0.5 cm wide. The small white flowers are tube-like with lobes at right angles at the top and a yellow “eye” in the centre. They measure up to 3 mm long and 2 mm across. The flowers can be present in up to two-thirds of the plant’s height, on one side of the uncoiling branches. The sepals enlarge to about 5 mm long when the plant is in fruit and have veins that are whitish, thick and hard. Each flower (or fruit) has a leaf-like bract below it on the stem. The fruits are four whitish nutlets. They are of two sizes, with one nutlet being smooth and larger (2 mm x 1.2 mm) and the other three being rough (with bumps) and smaller (1.5 mm x 0.9 mm). The odd nutlet is more firmly attached to the base (receptacle) than the other three.

Tiny cryptanthe superficially resembles two other species, Fendler’s cryptanthe and Kelsey’s cat’s-eye (*Cryptantha kelseyana*). Fendler’s cryptanthe has branches arising closer to the top of the stem, bracts only under the lowest flowers and smooth-sided nutlets. Kelsey’s cat’s-eye also has bracts only under the lowest flowers but its nutlets are similar to those of tiny cryptanthe, with one larger and smooth and three smaller and rough; however, the midrib of the calyx is not as thick as in tiny cryptanthe. Fendler’s cryptanthe is a common species in sand dune areas in southern Alberta whereas Kelsey’s cat’s-eye has only recently been documented as occurring in the province. Tiny cryptanthe occurs in habitats that also may support Fendler’s cryptanthe and Kelsey’s cat’s-eye. Close examination is required to differentiate the species.

In Alberta, tiny cryptanthe has been found flowering in late June and early July. Reproduction is sexual. Agents for pollination are unknown; hence, the minimum distance that one tiny cryptanthe plant must be to another for cross-pollination to occur is also unknown. As well, it is not known what factors affect seed production in tiny cryptanthe.

Fruits of tiny cryptanthe mature in late July and August in Alberta. It is likely that most of the small seeds of tiny cryptanthe are dispersed close to the parent plant; however, a small proportion may be dispersed further by the action of wind, water or animals (birds, mammals, insects) digging or walking (Primack and Miao 1992, Murphy and Lovett-Doust 2004). Annual and short-lived plant species generally are adapted to germinate on bare soil. Persistence of an occurrence of tiny cryptanthe or establishment of a new occurrence therefore partly depends on having suitable bare soil habitat accessible to dispersing seeds (Harrison et al. 2000, Freckleton and Watkinson 2002).

Of the seeds produced each year by annual plants such as tiny cryptanthe, some are non-viable, some are lost to seed predators, some form seedlings and some are stored in the seed bank for germination in a future year. Seed bank and germination ecology are especially important to annual plants, but information on these topics is extremely difficult and time-consuming to gather; therefore, little is known (Elzinga et al. 1998). For example, it is not known what proportion of tiny cryptanthe seeds is stored in the seed bank or for how long seeds remain viable. As a general rule, annual plants depend on seed longevity to buffer their populations against environmental unpredictabilities (Harper 1977). It is not known what conditions stimulate germination of tiny cryptanthe seeds.

Many species of annual plants experience large flushes of germination when conditions are right, which may occur as infrequently as once in a decade or more (Elzinga et al. 1998). Plant numbers may fluctuate wildly from year to year depending on the seed production in previous years, germination of seedlings, and environmental conditions, such as the timing and amount of rainfall (Bush and Lancaster in press). As well, there may be random environmental influences, such as weather, habitat changes, herbivores and fire or flood that affect growth



and survival of plants once germination occurs. Subpopulations may disappear and others appear (Harrison et al. 2000). There is some evidence that such large fluctuations are characteristic of tiny cryptanthe (see *Population Size and Trends* section).

In summary, very little is known about the life cycle and ecology of tiny cryptanthe. Challenges to monitoring populations and evaluating their potential viability are greater for annual plants, such as tiny cryptanthe, than for perennial species because traditional demographic approaches, which consider age or stage class and rates of mortality, recruitment, or growth, are not appropriate (Elzinga et al. 1998).

## DISTRIBUTION

**1. Alberta** – All reports of tiny cryptanthe in Alberta are along the South Saskatchewan River valley (except for one report along the Bow River valley) within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region. Eighteen occurrences are identified in Appendix 2 and mapped in Figure 1. These occurrences have been documented by several botanists and are contained in the records of the Alberta Natural Heritage Information Centre (ANHIC). For the purposes of this document an occurrence is defined as the location of a subpopulation, which is consistent with the definition used by ANHIC (J. Gould pers. comm.). Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little known exchange, of either pollen or seed (IUCN 2001). For annual plants, subpopulations are separated by distances of a few hundred metres and more because long-distance dispersal of plant seed beyond a few hundred metres is rare (Cain et al. 2000). A population is the total number of individuals in the province.

The first Alberta report of tiny cryptanthe is based on a collection by John Macoun made on 2 June 1894 near the “police barracks, Medicine Hat.” The collection is filed with the Canadian

Museum of Nature National Herbarium (1894; Macoun #5803, CAN 93956). The collection was made before formal description of the species in 1901. The three specimens on the herbarium sheet were identified by Macoun as *Krynitzia crassisepala*, which today is known as thick sepal cryptanthe (*Cryptantha crassisepala*), a species of the southern U.S. Great Plains. The specimens later were revised by F. Johnston to be in part tiny cryptanthe (*C. minima*) and in part Kelsey’s cat’s-eye (*C. kelseyana*). In 1964, the identification of specimens was revised to Fendler’s cryptanthe (*C. fendleri*) by H.G. Scoggan who notes in *The Flora of Canada* that the identification requires clarification (Scoggan 1979). C. Bradley examined the specimens in May 2004 and determined that the one specimen with nutlets is *C. kelseyana* but the other two specimens are too immature for positive identification. Later botanical surveys of Police Point Park in Medicine Hat—the site of the old North West Mounted Police barracks—including the 2003 survey by C. Bradley, failed to find tiny cryptanthe (D. Baresco pers. comm.). In 2004, however, large numbers of *C. minima* and *C. kelseyana* were reported on valley slopes and sandy uplands 1 km northwest of Police Point Park (D. Nernberg pers. comm., Appendix 2). This likely is the subpopulation sampled by the 1894 collections.

The second Alberta report of tiny cryptanthe was in 1973, at km 164 (SS6) on the west side of the South Saskatchewan River near the southern boundary of Suffield Military Reserve, about 55 km downstream of Medicine Hat. There is some uncertainty about the precise location. A specimen was collected by Hope Johnson in late July and had mature fruits, allowing positive identification.

Following this discovery, the species appeared in a supplement to the *Flora of Alberta* (Packer 1974) and a decade later was listed in *A Checklist of the Rare Vascular Plants in Alberta* (Packer and Bradley 1984) and in the revised *Flora of*

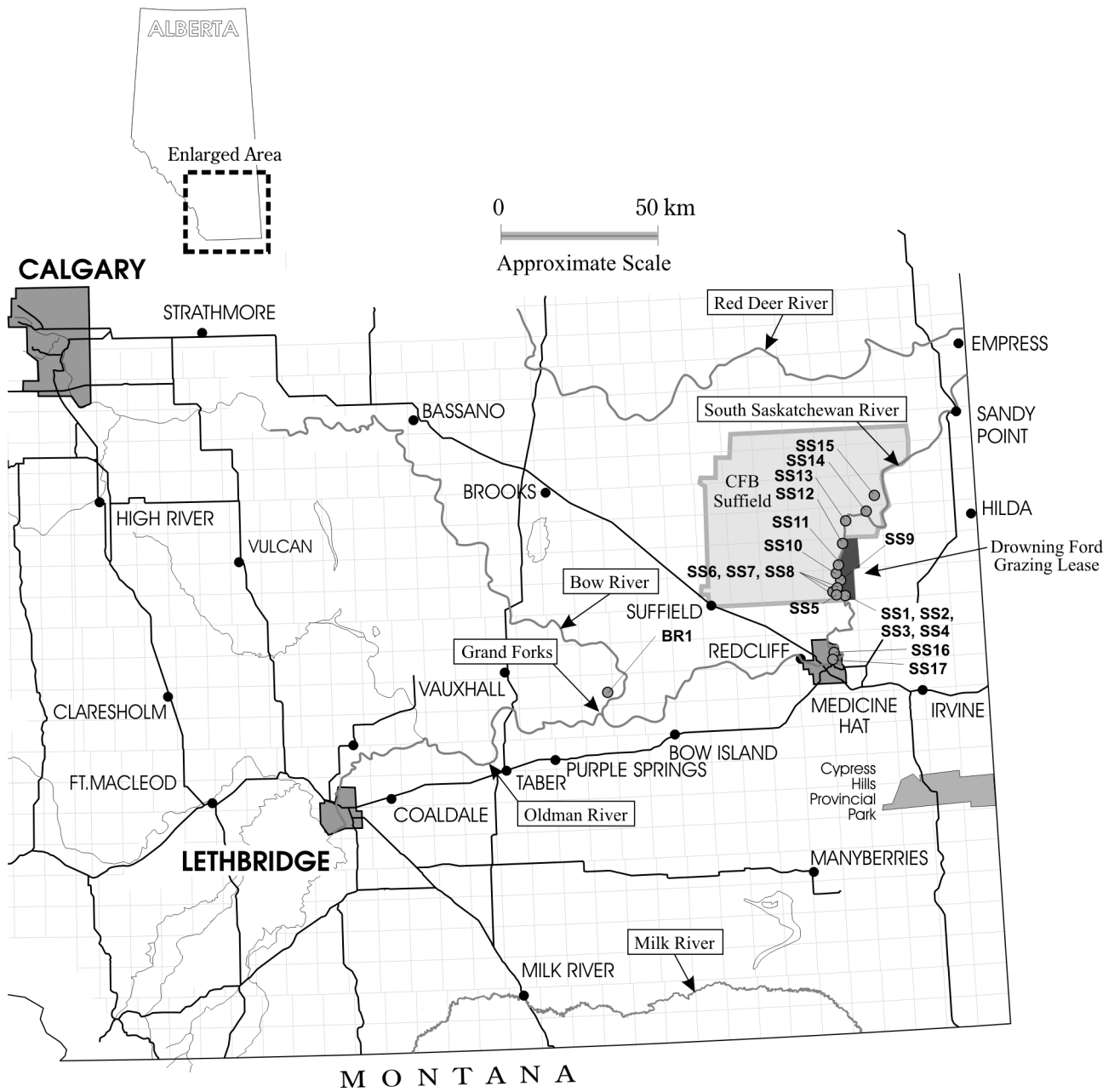


Figure 1. Distribution of tiny cryptanthe in Alberta. Numbers correspond to site numbers in Appendix 2.

*Alberta* (Moss 1984), prompting botanists to search for additional occurrences during vegetation surveys. In 1994, an individual tiny cryptanthe plant was found at km 208 (SS14) during a rare plants survey within the proposed National Wildlife Area on CFB Suffield (Macdonald 1997). In 1998, another individual was found during a rare plant survey of a proposed pipeline route crossing at km 158 (SS2a), on public land leased to the Drowning Ford Grazing Association (D. Bush pers. comm.).

In 2002, tiny cryptanthe was reported in the Lower Bow dunes (BR1), near where the Bow and Oldman rivers merge to form the South Saskatchewan River, over 155 km upstream of the nearest previously reported occurrence (B. Smith pers. comm.). Two occurrences also were reported within 1 km of each other, near km 157 (SS1a) and km 158 (SS2b), where a proposed pipeline right-of-way crossed the South Saskatchewan River valley. One of these, SS2b, coincides with the 1998 occurrence (D. Bush pers. comm.).

In 2003, eleven occurrences of tiny cryptanthe were reported during two surveys. One rare plant survey focused search effort in the National Wildlife Area of CFB Suffield on the west side of the South Saskatchewan River and reported one individual tiny cryptanthe plant at km 208 (SS14) (I. Macdonald pers. comm.). The other survey was conducted by C. Bradley along the South Saskatchewan River outside of CFB Suffield, from the river's origin at the Forks near Bow Island to the Saskatchewan border. The survey specifically focused on tiny cryptanthe. Eleven occurrences of tiny cryptanthe were reported between km 157 and km 190. Two of these occurrences were in locations where subpopulations had been previously reported (SS1b and SS2c) and nine were in locations where subpopulations had not been previously reported (SS3, SS4, SS5, SS7, SS8, SS9, SS10, SS11, SS12) (Appendix 2).

A 1996 collection of a cryptanthe near Empress on the Red Deer River was initially reported as tiny cryptanthe but in 2003 it was re-identified as Kelsey's cat's-eye (B. Smith pers. comm.), the first confirmed record of that species in Alberta. In 2002, a cryptanthe species, initially identified as tiny cryptanthe, was found along a pipeline right-of-way at km 263, on the upland and at the base of the valley slope (N. DeCarlo pers. comm.). It has tentatively been re-identified as Kelsey's cat's-eye by C. Bradley. In 2003, river valley terraces in the Red Deer River valley near Empress and 3 km upstream were surveyed by C. Bradley (Appendix 3). Tiny cryptanthe was not found; however, Kelsey's cat's-eye was found on a disturbed site corresponding to the 1996 occurrence. In 2004, three additional occurrences of tiny cryptanthe were reported, one in the Middle Sandhills of CFB Suffield and the other two within 1 km of each other on sandy uplands and valley slopes in Medicine Hat.

In summary, 18 occurrences make up the known population of tiny cryptanthe in Alberta. Seventeen occurrences are within a 120-km reach of the South Saskatchewan River downstream of Medicine Hat between km 110 and km 230 (Figure 1, SS1-17). Distances between known occurrences in this reach vary from a few hundred metres to about 20 km. One occurrence is highly disjunct from the others, located 75 km directly southwest in dunes along the lower Bow River valley just upstream of its confluence with the Oldman River (Figure 1, BR1). Given that there is no information on genetic exchange among known occurrences and that long-distance dispersal of plant seed beyond a few hundred metres is rare (Cain et al. 2000), it is recommended for the purposes of status assessment that these occurrences be considered subpopulations. Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little exchange (typically one successful migrant individual or gamete per year or less) (IUCN 2001). Further study would be required to confirm this conclusion.

There has been substantial search effort for rare vascular plant species in sand dune and sand hill habitat in southeastern Alberta as described in Wallis and Wershler (1988), Smith and Bradley (1992), Macdonald (1997), Smith (1997), Smith (2001), Alberta Sustainable Resource Development (2003) and in Appendix 2 and Appendix 3. These sources also contain documentation of some search effort in the South Saskatchewan and Red Deer river valleys. In addition there have been several rare plant surveys along proposed pipeline routings through sand dune and sand hill habitat and crossing river valleys. Therefore, there is some degree of confidence that the provincial distribution mapped in Figure 1 is truly representative of the actual distribution. A caution that must be placed on this conclusion, however, is that tiny cryptanthe is an annual plant which may or may not be found during surveys even though it may be present in the seed bank. More systematic monitoring of known locations and searching of suitable habitat over several years are required to verify the provincial distribution.

The extent of occurrence of the tiny cryptanthe in Alberta can be calculated in two ways. One is to make a polygon by drawing straight lines between the most northerly, westerly, southerly and easterly occurrences. The area circumscribed by this polygon is about 1600 km<sup>2</sup>. Alternatively, it could be assumed that the polygon representing extent of occurrence can be defined as the Bow and South Saskatchewan river valleys and adjacent uplands from Lower Bow Dunes to km 230, a total distance of about 235 km. Valley length is about 190 km, less than channel length because of channel sinuosity. Assuming an average valley width of about 3 km to include valley bottom, slopes and adjacent uplands, extent of occurrence is about 570 km<sup>2</sup>.

Area of occupancy, defined as the area within the extent of occurrence that is occupied by tiny cryptanthe excluding unsuitable or unoccupied habitats (IUCN 2001), is about 820 000 m<sup>2</sup>,

slightly less than 1 km<sup>2</sup>, based on information provided in Appendix 2 and Table 1. The loss of the Medicine Hat population to urban residential development would result in a 30% decline in known area of occupancy of the Alberta population.

**2. Other Areas** – In Saskatchewan, there is one known extant occurrence of tiny cryptanthe on the slopes of a tributary valley of the Red Deer River 2 km east of the border with Alberta (C. Elchuk pers. comm.). Its area of occupancy is reported as about 2800 m<sup>2</sup>. There is also a 1981 collection from this location (Smith 1997). A collection in 1977 near the town of Westerham (25 km east of the provincial border and 5 km south of the South Saskatchewan River) was identified as tiny cryptanthe (Smith 1997). Subsequent surveys of this location, however, have not found tiny cryptanthe but report an abundance of Fendler's cryptanthe and some Kelsey's cat's-eye, which are similar in appearance to tiny cryptanthe (S. Lamont pers. comm., C. Elchuk pers. comm.).

The closest known extant occurrence of tiny cryptanthe in the United States is Sheridan County in northeast Montana, about 450 km southeast of the Alberta range (B. Heidel pers. comm.) (Figure 2). The range of the species extends south through the plains of eastern Montana and Wyoming, the southwest corner of South Dakota, western Nebraska and Kansas, the eastern plains of Colorado and some western intermontane basins, eastern New Mexico, the panhandles of Oklahoma and Texas and south in western Texas to Mexico. The species' range in Canada is less than one percent of its continental range.

## POPULATION SIZE AND TRENDS

**1. Alberta** – The population of annual plants, such as tiny cryptanthe, consists not only of the plants that are rooted and growing but also of the buried viable seed (Harper 1977). Determining population size, therefore, requires not only counting the number of plants on the

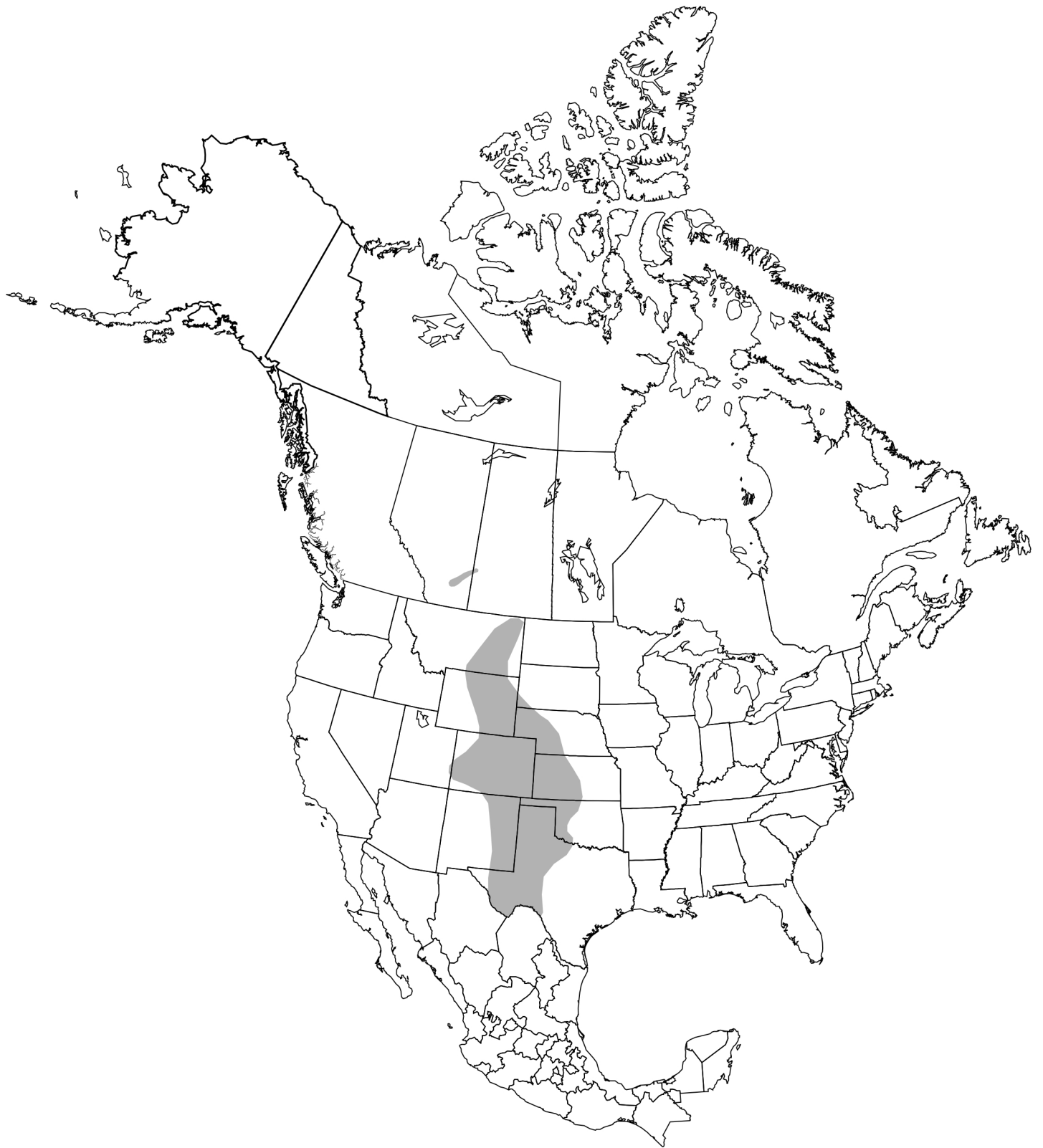


Figure 2. Distribution of tiny cryptanthae in North America.

surface but also analyzing the size and viability of the seed bank using techniques that extract soil cores and use flotation to separate the seeds for counting or grow out the cores in a greenhouse (Elzinga et al. 1998). As well, given that the seed bank may represent an accumulation of seeds from many previous generations, determining fluctuations or trends in population size requires that cohorts of new additions be distinguished from the bulk accumulated from the past. Harper (1977) refers to this as a “hidden overlap of generations.” Furthermore, germination can be spatially variable from year to year; hence, permanent plots may be of little value unless they are designed to capture changes in location of disturbance patches. Nonetheless, counts of mature plants in a location where they have been previously reported can be undertaken to determine germination and establishment in a given year, to assess factors which promote germination and establishment, and to assist in evaluating the status of subpopulations over time and their significance for the larger population (Elzinga et al. 1998, Morris et al. 1999).

Data available for number of tiny cryptanthe plants associated with reported occurrences in Alberta are presented in Table 1. For some subpopulations, plant numbers are provided for more than one year. These data were collected by a variety of botanists for various purposes using different techniques and in different years. Number of mature individuals reported for any one occurrence varies from 1 to estimates of 50 000. These data are provided as preliminary information but are insufficient for assessing the size of the provincial population because they have been obtained without systematic survey methodology and without standardized sampling techniques, represent only a small number of years and do not consider seed bank.

The data suggest that plant numbers of tiny cryptanthe fluctuate greatly from year to year. For example, at the Lower Bow Dunes site (BR1) no plants were found in surveys in 1987,

2001, 2003 or 2004; however, in 2002, 62 plants were counted in a 5 m x 8 m area (Wallis and Wershler 1988, Alberta Sustainable Resource Development 2003, Appendix 2). Similarly, at km 157 on the South Saskatchewan River (SS1), tiny cryptanthe was found at a density of 0.06 plants/m<sup>2</sup> in 2002 and at an average density of 0.23 plants/m<sup>2</sup> in 2003 (Appendix 2). At km 198 on the South Saskatchewan River (SS2), 1 plant was found in 1998, no plants were found in 1999 or 2000, 74 plants were found in 2002 and 170 plants were found in 2003 (Appendix 2).

Although different survey techniques by different botanists may account for some of the fluctuation in plant numbers from year to year, this fluctuation is also indicative of the biological characteristics of annual species. Many species of annual plants experience large flushes of germination when conditions are right, which may occur with a frequency of every few years or perhaps once in a decade or more (Elzinga et al. 1998, Bush and Lancaster in press). Hence, plant numbers may fluctuate wildly from year to year depending on the seed production in previous years, germination of seedlings, and environmental conditions, such as the timing and amount of rainfall.

Since challenges of monitoring annual plant populations are so great, management objectives may be better focused on habitat features such as level of human activity, invasion of exotics and other changes in plant community composition caused by succession or alteration in natural disturbance regime (Elzinga et al. 1998).

Noteworthy is that the predicted loss of the large Medicine Hat subpopulation of tiny cryptanthe (SS16) to planned urban residential development would result in immediate loss of a seed bank capable of producing 50 000 mature individuals in one year—a subpopulation three times the size of the next largest annual subpopulation of mature individuals previously reported in Alberta (SS7).

Table 1. Summary of data on number of plants for occurrences/subpopulations of tiny cryptanthus in Alberta. (see Figure 1 for occurrence locations; see Appendices 2 and 3 for site descriptions and more details)

| Occurrence/<br>Subpopulation | Date        | # Plants  | Area (m <sup>2</sup> ) | Density<br>(plants/m <sup>2</sup> ) |
|------------------------------|-------------|-----------|------------------------|-------------------------------------|
| BR1                          | 1987        | Not found | n/a                    | -                                   |
|                              | 2001        | Not found | n/a                    | -                                   |
|                              | 12 Jul 2002 | 62        | 40                     | 1.55                                |
|                              | 30 Jul 2003 | Not found | n/a                    | -                                   |
|                              | 9 Jul 2004  | Not found | n/a                    | -                                   |
| SS1                          | 1998        | Not found | n/a                    | -                                   |
|                              | 16 Jul 2002 | 160       | 2 500                  | 0.06                                |
|                              | 1 Aug 2003  | 11 500*   | 50 000                 | 0.23                                |
| SS2                          | 3 Jul 1998  | 1         | n/a                    | -                                   |
|                              | 1999        | Not found | n/a                    | -                                   |
|                              | 2000        | Not found | n/a                    | -                                   |
|                              | 15 Jul 2002 | 74        | n/a                    | -                                   |
|                              | 4 Aug 2003  | 170       | 5 000                  | 0.03                                |
| SS3                          | 4 Aug 2003  | 555       | 5 000                  | 0.11                                |
| SS4                          | 4 Aug 2003  | Numerous  | n/a                    | -                                   |
| SS5                          | 5 Aug 2003  | 110       | 4 000                  | 0.03                                |
| SS6                          | 22 Jul 1973 | 2         | n/a                    | -                                   |
|                              | Aug 2003    | Not found | n/a                    | -                                   |
| SS7                          | 5 Aug 2003  | 17 500*   | 250 000                | 0.07                                |
| SS8                          | 5 Aug 2003  | several   | n/a                    | -                                   |
|                              | 10 Jul 2004 | 80        | 80                     | 1.00                                |
| SS9                          | 5 Aug 2003  | 12        | 120                    | 0.10                                |
| SS10                         | 10 Aug 2003 | 7 500*    | 250 000                | 0.03                                |
| SS11                         | 11 Aug 2003 | 37        | 25                     | 1.40                                |
| SS12                         | 11 Aug 2002 | 2         | 3                      | 0.67                                |
| SS13                         | 22 Jul 2003 | 1         | n/a                    | -                                   |
| SS14                         | 7 Jul 1994  | 1         | n/a                    | -                                   |
| SS15                         | 14 Jul 2004 | 399       | 300                    | 1.33                                |
| SS16                         | 10 Aug 2004 | 50 000*   | 250 000                | 0.20                                |
| SS17                         | 15 Aug 2004 | 500*      | 5 000                  | 0.10                                |

\* indicates that values are estimates based on subplot counts and estimated extent.

**2. Other Areas** – In Saskatchewan, the one known extant population of tiny cryptanthe was estimated to be 12 000 plants in 2004 (C. Elchuk pers. comm.). An expanded search of the area would likely have resulted in more mature plants being reported (C. Elchuk pers. comm.). No other data are available on population size or trends in that province.

There is no known effort throughout the species' range in the United States to document population size or trends in population of tiny cryptanthe (C. Emerson pers. comm., B. Heidel pers. comm.).

## LIMITING FACTORS

Limiting factors discussed in this report are major factors that affect habitat quality and availability, reproductive output, or survival of individuals. The focus is on factors that have an anthropogenic origin. Three major limiting factors have been identified by C. Bradley: modification of climate, modification of natural disturbance regime and changes in land use.

**1. Modification of Climate** – The reason(s) why tiny cryptanthe occurs in Alberta but is confined to the vicinity of the South Saskatchewan River valley (and Bow River valley) probably relates to climate. The core of the species' range comprises hotter and drier environments in the central Great Plains of the western United States (Figure 2). Perhaps tiny cryptanthe colonized southern Alberta during a period of warmer and drier climate and, as climate cooled, persisted in that portion of Alberta where climate is most similar to that in the core range. The international scientific community has concluded that there is compelling evidence that human activity, particularly activities associated with energy use and deforestation, is accelerating the concentration of greenhouse gases in our atmosphere and that climate change is a likely consequence accompanied by largely unpredictable impacts on the earth's ecosystems (Government of Canada 2002). A shift to a warmer climate may result in expansion of the

species' range provincially, provided that there is not significant disruption of the native habitats in which it occurs and that the frequency of successful seed production and germination events is adequate. A rapid shift to a cooler climate could lead to extirpation of tiny cryptanthe from Alberta. Either way, climate change introduces considerable uncertainty regarding the species' survival.

## **2. Modification of Natural Disturbance Regime**

– Tiny cryptanthe appears to be adapted to habitats of sandy substrate, with varying amounts of silt, that experience disturbance. Its affinity to sandy river terraces and undulating or rolling sand dunes, stabilized or not, suggests a reliance on wind shifting sand to create and maintain suitable habitat. Its affinity to habitats in dips and benches on valley slopes may indicate a reliance on slope wash to create openings for establishment and persistence. Drought and fire may play important roles in removing canopy vegetation to promote germination or in destabilizing sandy substrates to create new sites for establishment. Finally, tiny cryptanthe's association with trails and mounds of burrowing mammals suggests an adaptation to the disturbance processes associated with the activities of native animals, such as ground squirrels and bison. Today, domestic livestock mimic to some extent the historic role of bison in the prairie ecosystem.

If a disturbance regime is modified beyond the range of natural variability, consequences for native species can be expected (Bradley and Wallis 1996). For example, climate change or water management that reduces periodic large floods and inhibits channel migration could have negative implications for the creation and maintenance of tiny cryptanthe habitat. Stabilization of sand dunes through fire suppression could also have negative effects. Elimination of burrowing mammals as a result of pest control programs or complete removal of large grazing animals from the grassland ecosystem also have the potential for negative effects on habitat for tiny cryptanthe.



**3. Changes in Land Use** – Information on past and predicted changes in land use since the early 1900s within the range of tiny cryptanthe in Alberta is provided in the *Habitat* section of this report. Key conclusions include the following:

- Most of the potential meander lobe habitat in the South Saskatchewan River valley has been altered by cultivation or seeding to non-native pasture and by invasion of non-native plant species to the point that it is no longer considered suitable habitat for tiny cryptanthe.
- Native prairie on uplands in the Dry Mixedgrass Natural Subregion, including sand plain and sand hill habitats suitable for tiny cryptanthe, has declined by at least 46% over the last century due to cultivation. Considerably more suitable habitat has been fragmented by roads, residential development and oil and gas well sites, which not only remove native vegetation but also provide avenues for invasion by aggressive non-native plant species.
- Modelling of the cumulative environmental effects of human activities predicted in the Grassland Natural Region over the next 100 years suggests further reduction in native prairie by between 25 and 50 percent.
- There are specific examples of conversion of native prairie in or near known tiny cryptanthe habitat within the past 10 years including cultivation of sandy plain for potato production in the Lower Bow area, urban residential expansion in Medicine Hat, and rapid development of oil and gas wells and access roads in the Lower Bow, Suffield and Drowning Ford Grazing Lease areas.

Alberta's tiny cryptanthe population is small in extent of occurrence and area of occupancy. It is disjunct by 60 km from the only population known in Saskatchewan and by 450 km from the nearest known extant population in Montana. Little genetic exchange between subpopulations separated even by a few hundred metres is expected. Direct loss of even one subpopulation

of tiny cryptanthe in Alberta and isolation of subpopulations through further fragmentation of suitable habitat can result in a provincial population so reduced in genetic resources and connectivity that the long-term viability of the provincial population is threatened.

#### STATUS DESIGNATIONS\*

**1. Alberta** – Tiny cryptanthe is considered as *May Be At Risk* according to the preliminary general status review of plant species in Alberta (Alberta Sustainable Resource Development 2000a). Considerations that went into the assessment in the late 1990s were that the species had been assessed as endangered nationally, there were few reported occurrences in Alberta hence very little was known about population size and distribution, and petroleum and natural gas activities were a threat to its known habitat.

The Alberta Natural Heritage Information Centre (ANHIC) database has ranked tiny cryptanthe as S1 since the provincial vascular plant tracking list was first compiled in 1996. ANHIC botanists and an advisory group of professional botanists review rankings periodically and until the present have chosen to maintain the S1 rank given that five or fewer occurrences are reported and only a few individuals were associated with each occurrence (Vujnovic and Gould 2002). Threat to the species' habitat from oil and gas development activity also was a consideration.

Information from a variety of rare plant surveys since 2002 has greatly increased our knowledge about tiny cryptanthe in Alberta. The information is summarized in this report, which will be used to evaluate the provincial status of the species.

**2. Other Areas** – The Committee on the Status of Endangered Wildlife in Canada designated tiny cryptanthe as *Endangered* in 1998 based on a status report submitted in January 1997 (Smith 1997). COSEWIC re-examined the report and

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\* See Appendix 1 for definitions of selected status designations.

confirmed the designation in May 2000 using revised IUCN criteria (COSEWIC 2003a). The species qualified for *Endangered* status because the known population at that time in Canada was fewer than 250 individuals (IUCN criterion D1). Low relative mobility and distance from nearby populations were considered to likely limit the rate of exchange with populations in the United States hence ranking was not downgraded. This report provides substantially more information on occurrences of tiny cryptanthe in Canada than was contained in the 1997 report.

Globally, tiny cryptanthe (also known as little cat's-eye) is ranked as G5, meaning that there are more than 100 occurrences and/or it is demonstrably secure (NatureServe 2004). Its national heritage status rank in the United States is NNR, meaning that tiny cryptanthe has not yet been ranked nationally (NatureServe 2004). In Canada, the national heritage status rank is N1 (22 March 1989) (NatureServe 2004). In Saskatchewan, tiny cryptanthe is ranked as S1 (Saskatchewan Conservation Data Centre 2003). Tiny cryptanthe is ranked as S3 in Wyoming, S4 in South Dakota and SNR in the seven other states in which it occurs: Montana, Nebraska, Colorado, Kansas, New Mexico, Oklahoma and Texas (NatureServe 2004). The species is widely distributed in most of these states; hence the SNR ranking may indicate that the species is not considered at risk and has not been a priority for ranking (McGregor et al. 1986, University of Wyoming 1998, New Mexico Natural Heritage Program 2004, Texas A&M University Bioinformatics Working Group 2004, United States Department of Agriculture 2004, University of Colorado 2004, C. Emerson pers. comm., B. Heidel pers. comm.). In the Great Plains of the United States, state-wide estimates of mixedgrass prairie habitat loss since pre-settlement times range from a low of 30 percent in Texas to as high as 75 percent in Nebraska, suggesting threats to tiny cryptanthe habitat similar to those in Canada (Bachand 2001).

## RECENT MANAGEMENT IN ALBERTA

Tiny cryptanthe is listed as *Endangered* in Schedule 1 of the federal *Species at Risk Act* (Government of Canada 2004). Three Alberta occurrences are within the Suffield National Wildlife Area, which is managed as a protected wildlife area under federal jurisdiction. A national recovery strategy is in development by a recovery team that includes representatives from Environment Canada, Agriculture and Agri-Food Canada, Department of National Defence (CFB Suffield), Alberta Sustainable Resource Development, Saskatchewan Environment, Manitoba Conservation and the Canadian Cattlemen's Association (R. Gutsell pers. comm.).

## SYNTHESIS

Tiny cryptanthe (*Cryptantha minima*) is an annual species found in the vicinity of the lower Bow River and South Saskatchewan River valleys in the Dry Mixedgrass Natural Subregion of southeastern Alberta. Its habitat is moderately active depositional environments on sandy meander lobe terraces in the river valley floodplain, sandy valley slopes, and sand hills near the valley edge. Eighteen subpopulations are recognized: 17 are found along a 120-km reach of the South Saskatchewan River extending downstream from Medicine Hat through CFB Suffield (west side) and public rangelands leased by the Drowning Ford Grazing Association (east side), and one subpopulation is widely disjunct, occurring on public land in the Lower Bow sand hills. The extent of occurrence of the species in Alberta is estimated at 570 km<sup>2</sup> or 1600 km<sup>2</sup> using two different methodologies, and the known area of occupancy is less than 1 km<sup>2</sup>.

The results of substantial search efforts to date, and analysis of maps of soils and land use, indicate that the species is unlikely to occur in the river valley and uplands between the Lower

Bow sand hills and Medicine Hat. A few additional subpopulations may be found in and along the South Saskatchewan River valley downstream of Medicine Hat; however, their discovery would be unlikely to increase either the known area of occupancy or population size significantly. More structured and systematic surveys would be needed to confirm this conclusion. Most potential meander lobe habitat in the South Saskatchewan River valley has been altered by cultivation or seeding to non-native pasture and by invasion of non-native plant species to the point that it is no longer available for colonization by tiny cryptanthe. Upland habitat has experienced similar pressures. There are specific examples of conversion of native prairie in or near known tiny cryptanthe habitat within the last few years. Modelling of the cumulative environmental effects of human activities predicted in the Grassland Natural Region over the next 100 years suggests further reduction in native prairie between 25 and 50 percent should current trends continue. Other potential limiting factors are modification of the natural disturbance regime and modification of climate.

Estimates of plant numbers of tiny cryptanthe at the 18 known occurrences range from 1 to 50 000 plants and suggest large fluctuations depending on the seed production in previous years, germination of seedlings, and

environmental conditions, such as the timing and amount of rainfall. This fluctuation is characteristic of annual plant species, which spend a large part of their life cycle as seeds. To get a better understanding of the number of subpopulations, their distribution, annual fluctuations, trends and factors that affect survival, it is necessary to implement a standardized monitoring methodology of known occurrences and suitable habitat over several years.

Alberta's tiny cryptanthe population is small in extent of occurrence and area of occupancy. It is disjunct by 60 km from the only population known in Saskatchewan and by 450 km from the nearest population in Montana. Little genetic exchange between subpopulations separated even by a few hundred metres is expected. Tiny cryptanthe is designated as *Endangered* by COSEWIC, first in 1998 and reassessed in 2000 (COSEWIC 2003a), and is listed in Schedule 1 of the federal *Species at Risk Act* (Government of Canada 2004). A national recovery strategy is being developed. Direct loss of even one subpopulation of the current population of tiny cryptanthe in Alberta and further isolation of subpopulations through fragmentation of suitable habitat could result in reductions in genetic resources and connectivity to the point that the long-term viability of the provincial population is threatened.

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## Appendix 1. Definitions of selected legal and protective designations.

### A. The General Status of Alberta Wild Species 2000 (after Alberta Sustainable Resource Development 2001)

| 2000 Rank          | 1996 Rank           | Definitions  |
|--------------------|---------------------|--|
| At Risk            | Red                 | Any species known to be <i>At Risk</i> after formal detailed status assessment and designation as <i>Endangered</i> or <i>Threatened</i> in Alberta.       |
| May Be At Risk     | Blue                | Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.                                   |
| Sensitive          | Yellow              | Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.          |
| Secure             | Green               | Any species that is not <i>At Risk</i> , <i>May Be At Risk</i> or <i>Sensitive</i> .   |
| Undetermined       | Status Undetermined | Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.                                    |
| Not Assessed       | n/a                 | Any species known or believed to be present but which has not yet been evaluated.  |
| Exotic/Alien       | n/a                 | Any species that has been introduced as a result of human activities.  |
| Extirpated/Extinct | n/a                 | Any species no longer thought to be present in Alberta ( <i>Extirpated</i> ) or no longer believed to be present anywhere in the world ( <i>Extinct</i> ). |
| Accidental/Vagrant | n/a                 | Any species occurring infrequently and unpredictably in Alberta, i.e., outside its usual range.  |

### B. Alberta Wildlife Act/Regulation

Species designated as *Endangered* under Alberta's *Wildlife Act* include those listed as *Endangered* or *Threatened* in the *Wildlife Regulation*.

|            |   |
|------------|---|
| Endangered | A species facing imminent extirpation or extinction.                                |
| Threatened | A species that is likely to become endangered if limiting factors are not reversed. |

### C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2003b)

|                 |  |
|-----------------|--|
| Extinct         | A species that no longer exists.   |
| Extirpated      | A species that no longer exists in the wild in Canada, but occurs elsewhere.   |
| Endangered      | A species facing imminent extirpation or extinction.   |
| Threatened      | A species that is likely to become endangered if limiting factors are not reversed.  |
| Special Concern | A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. |
| Not at Risk     | A species that has been evaluated and found to be not at risk.   |
| Data Deficient  | A species for which there is insufficient scientific information to support status designation.                                    |

**Appendix 1** continued.

**D. Heritage Status Ranks: Global (G), National (N), Sub-National (S)** (after Alberta Natural Heritage Information Centre 2002, NatureServe 2004)

|             |   |
|-------------|---|
| G1/N1/S1    | 5 or fewer occurrences or only a few remaining individuals. May be especially vulnerable to extirpation because of some factor of its biology.  |
| G2/N2/S2    | 6 to 20 or fewer occurrences or with many individuals in fewer locations. May be especially vulnerable to extirpation because of some factor of its biology.  |
| G3/N3/S3    | 21 to 100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations). May be susceptible to extirpation because of large-scale disturbances. |
| G4/N4/S4    | Typically > 100 occurrences. Apparently secure.   |
| G5/N5/S5    | Typically > 100 occurrences. Demonstrably secure.   |
| GX/NX/SX    | Believed to be extinct or extirpated, historical records only.  |
| GH/NH/SH    | Historically known, may be relocated in the future.   |
| GNR/NNR/SNR | Unranked—conservation status not yet assessed.  |

**E. United States Endangered Species Act** (after National Research Council 1995)

|            |   |
|------------|---|
| Endangered | Any species which is in danger of extinction throughout all or a significant portion of its range.  |
| Threatened | Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. |

**Appendix 2.** Confirmed occurrences of tiny cryptanthae (*Cryptantha minima*) in Alberta (August 2004)

| Site#/EO# <sup>1</sup> | Location  | Date(s) Observed          | Observer (Collection #)  | Site Description   | Population/Search Information   |
|------------------------|---|---------------------------|--|--|---|
| BR1/<br>EO 08          | Lower Bow River near confluence with Oldman River (km 0 <sup>2</sup> of the South Saskatchewan River) | 12 Jul 2002<br>2 Sep 2002 | Bonnie Smith<br>Ian Macdonald (UAC <sup>4</sup> , three specimens) | - elevation 750 m (2450 ft)<br>- upland; partly stabilized dune crest and upper slope<br>- sandy substrate<br>- with <i>Stip com</i> , <i>Chen pra</i> , <i>Cryp fen</i> , <i>Opun pol</i> , <i>Plan pat</i> , <i>Psor lan</i> , <i>Lapp red</i> , <i>Lupi pus</i> , <i>Lepi der</i> ; bare soil 10%-15%                             | - 62 plants counted in a 5 m x 8 m (40 m <sup>2</sup> ) area<br>- plants fully developed; flower and fruit on 12 Jul; fruit only on 2 Sep<br>- no plants found by Bonnie Smith in 2001 or in search of area by Cheryl Bradley in Aug 2003 and July 2004   |
| SS1a/<br>EO 05         | South Saskatchewan River (km 157, east side)<br>Drowning Ford Grazing Lease                           | 16 Jul 2002               | Dana Bush (AXYS, #363)   | - flood plain with 0% slope<br>- subhygric<br>- clay (?) substrate<br>- weedy  | - 160 plants counted in 50 m x 50 m (2500 m <sup>2</sup> ) plot (subsample); population extends several hundred metres<br>- plants fully developed and bearing green fruit<br>- no plants found in 1998 survey  |
| SS1b/<br>EO 05         | South Saskatchewan River (km 157, east side)<br>Drowning Ford Grazing Lease                           | 1 Aug 2003                | Cheryl Bradley (CB03-005)  | - elevation 630 m (2075 ft)<br>- valley bottom; broad terrace, 6-8 m above river level; 0%-5% slope, various aspects<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland with <i>Arte can</i> , <i>Opun pol</i> , <i>Euro lan</i> , <i>Sals kal</i> , <i>Plan pat</i> , <i>Hede his</i> ; bare soil 20% | - 11 500 plants estimated in a polygon 185 m x 265 m (49 025 m <sup>2</sup> ) using ave. density 0.24 plants/m <sup>2</sup> ; plant density estimated using four 10 m x 10 m plots and four 200 m x 5 m transects to north, south, east and west from central point; 6-hour search<br>- plants dead (brittle) and nutlets being dispersed |
| SS2a/<br>EO 05         | South Saskatchewan River (km 158, east side)<br>Drowning Ford Grazing Lease                           | 3 Jul 1998                | Dana Bush  | - elevation 665 m<br>- steep eroding slope<br>- active sand<br>- xeric   | - 1 plant counted<br>- no plants found in survey of proposed pipeline right of way by Dana Bush during 1999 or 2000   |
| SS2b/<br>EO 05         | South Saskatchewan River (km 158, east side)<br>Drowning Ford Grazing Lease                           | 15 Jul 2002               | Dana Bush (AXYS, #361)   | west-facing slope (16%-30%) and midslope bench<br>- xeric<br>- with <i>Arte can</i> , <i>Oryz hym</i> , <i>Stip com</i> , <i>Bout gra</i> , <i>Opun pol</i> , <i>Heli sub</i> , <i>Sals kal</i> , <i>Chen alb</i> , <i>Cusc gro</i>  | - 74 plants counted, 50 on disturbed pipeline ROW, 23 to south and 1 to north<br>- 15% in flower, 85% in fruit  |

| Site#/EO# <sup>1</sup> | Location   | Date(s) Observed | Observer (Collection #)  | Site Description  | Population/Search Information  |
|------------------------|--|------------------|--|---|--|
| SS2c/<br>EO 05         | South Saskatchewan River<br>(km 158, east side)<br>Drowning Ford Grazing Lease | 4 Aug 2003       | Cheryl Bradley<br>Glennis Lewis<br>(photo)                     | - elevation 670 m (2200 ft)<br>- west-facing valley slope; mid-slope bench and dip; 0%-10% slope, west aspect<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland with <i>Arte can</i> , <i>Opun pol</i> , <i>Oryz hym</i> ; patches of bare soil                      | - 170 plants counted in 16 clumps in a polygon 140 m x 35 m (4900 m <sup>2</sup> ) with long axis parallel to slope; south of pipeline disturbance; 4-hour search<br>- may be considered the same subpopulation as SS3<br>- plants dead (brittle) and nutlets being dispersed  |
| SS3/<br>EO 05          | South Saskatchewan River<br>(km 158, east side)<br>Drowning Ford Grazing Lease | 4 Aug 2003       | Cheryl Bradley<br>Glennis Lewis<br>(CB03-006, CB03-007, photo) | - elevation 685 m (2250 ft)<br>- gently undulating upland on edge of river valley; 0%-10% slope, various aspects<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland with <i>Arte can</i> , <i>Oryz hym</i> , <i>Cala lon</i> , <i>Opun pol</i> ; patches of bare soil | - 555 plants counted; 400 plants in a corridor 100 m x 10 m (1000 m <sup>2</sup> ) including a vehicle trail and extending 3 m each side, 30 plants in a polygon 50 m x 20 m (1000 m <sup>2</sup> ) extending into a dip west of the trail, and 125 plants in a polygon 100 m x 30 m (3000 m <sup>2</sup> ) east of the trail; 4-hour search<br>- may be considered the same subpopulation as SS2<br>- plants dead (brittle) and nutlets being dispersed |
| SS4/<br>EO 05          | South Saskatchewan River<br>(km 158, east side)<br>Drowning Ford Grazing Lease | 4 Aug 2003       | Cheryl Bradley<br>Glennis Lewis                                | - elevation 685 m (2250 ft)<br>- gently undulating upland on edge of river valley; 0%-10% slope, various aspects<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland; patches of bare soil   | - numerous plants observed along both sides of a vehicle trail; no search to define area of occupancy or to count number of plants<br>- plants dead (brittle) and nutlets being dispersed  |

| Site#/EO# <sup>1</sup> | Location  | Date(s) Observed | Observer (Collection #)                        | Site Description  | Population/Search Information   |
|------------------------|---|------------------|--|---|---|
| SS5/<br>EO 11          | South Saskatchewan River<br>(km 160, east side)<br>Drowning Ford Grazing Lease                | 5 Aug 2003       | Cheryl Bradley<br>Glennis Lewis<br>(photos)    | - elevation 630 m (2075 ft)<br>- valley bottom meander lobe; broad terrace, 6-8 m above river level; 0%-5% slope, south aspect<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra-Opun pol</i> grassland with <i>Mama viv</i> , <i>Plan pat</i> , <i>Euro lan</i> , <i>Sals kal</i> ; 10% bare soil | - 110 plants counted in a polygon 200 m x 20 m (4000 m <sup>2</sup> ) with long axis parallel to the river; 3-hour search<br>- no plants found to east or south; to north meander lobe has been converted to crested wheat grass; may be additional plants to the west<br>- plants dead (brittle) and nutlets being dispersed   |
| SS6/<br>EO 01          | South Saskatchewan River<br>(km 164, west side)<br>C.F.B. Suffield, Bull Pen area             | 22 Jul 1973      | Hope Johnson<br>PMAE <sup>5</sup><br>B73.69.68 |   | - 2 plants counted in 1973; in fruit<br>- no plants found during 5-hour search by Ian Macdonald in Aug 2003<br>- accuracy of the site description is low and the sighting may actually be east of the river on Brush Flats  |
| SS7/<br>EO 12          | South Saskatchewan River<br>(km 167, east side)<br>Drowning Ford Grazing Lease<br>Brush Flats | 5 Aug 2003       | Cheryl Bradley<br>Glennis Lewis<br>(photos)    | - elevation 630 m (2075 ft)<br>- valley bottom meander lobe; broad terrace, 8-10 m above river level; 0% slope<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Opun pol</i> grassland with <i>Bout gra</i> , <i>Euro lan</i> , <i>Cryp cele</i> ; 15% bare soil   | - population estimated at < 17 500 plants if assume about 25 ha of meander lobe is suitable habitat and maximum density of 0.07 plants/m <sup>2</sup> ; 700 plants estimated in a plot 100 m x 100 m (10 000 m <sup>2</sup> ) (subsample) using four 50 m x 5 m transects to north, south, east and west from UTM point; 3-hour search<br>- may be the same subpopulation as SS8<br>- plants dead (brittle) and nutlets being dispersed |
| SS8a/<br>EO 12         | South Saskatchewan River<br>(km 169, east side)<br>Drowning Ford Grazing Lease<br>Brush Flats | 5 Aug 2003       | Cheryl Bradley<br>Glennis Lewis                | - elevation 630 m (2075 ft)<br>- valley bottom meander lobe; broad terrace, 8-10 m above river level; 0% slope<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland; patches of bare soil   | - several plants observed along vehicle trail; no search to define area of occupancy or to count number of plants; may be the same subpopulation as SS7<br>- plants dead (brittle) and nutlets being dispersed  |

| Site#/<br>EO# <sup>1</sup> | Location   | Date(s)<br>Observed | Observer<br>(Collection #)                   | Site Description  | Population/Search Information   |
|----------------------------|--|---------------------|--|---|---|
| SS8b/<br>EO 12             | South Saskatchewan River<br>(km 169, east side)<br>Drowning Ford Grazing Lease<br>Brush Flats                | 10 Jul 2004         | Cheryl Bradley<br>Linda Duncan<br>(CB04-001) | - elevation 630 m (2075 ft)<br>- valley bottom meander lobe; broad<br>terrace, 8-10 m above river level; 0% slope<br>- silty-sandy substrate<br>- subxeric<br>- along margin of vehicle trail in <i>Stip com-</i><br><i>Bout gra</i> grassland with <i>Opun pol</i> , <i>Heli</i><br><i>ann</i> , <i>Euro lan</i> . <i>Spha coc</i> ; 30% bare soil | - 80 plants counted in a 40 m x 2 m strip on<br>the east side of the vehicle trail where the<br>grassland had been mowed in 2003; not<br>found in adjacent grasslands and not found<br>on nearby well site clearing; there may be<br>more plants further along the trail<br>- plants fully developed and leaves fading;<br>in bloom and bearing nutlets   |
| SS9/<br>EO 14              | South Saskatchewan River<br>(km 174, east side)<br>Drowning Ford Grazing Lease<br>Minor Flats                | 5 Aug 2003          | Cheryl Bradley<br>Glennis Lewis<br>(photo)   | - elevation 630 m (2075 ft)<br>- valley bottom, abandoned meander lobe;<br>on small knoll; 0%-2% slope, S aspect<br>- silty-sandy substrate<br>- subxeric<br>- in <i>Stip com-Bout gra-Opun pol</i> grassland<br>with <i>Cala lon</i> , <i>Care fil</i> , <i>Arte fri</i> , <i>Plan pat</i> ,<br><i>Liat lig</i> , <i>Cryp cel</i> ; 10% bare soil  | - 12 plants counted in a polygon 10 m x<br>12 m (120 m <sup>2</sup> ); 1-hour search<br>- possibly there are additional plants south<br>and west however none found in extensive<br>search to the east which appeared to be<br>most suitable habitat<br>- plants dead (brittle) and nutlets being<br>dispersed  |
| SS10/<br>EO 15             | South Saskatchewan River<br>(km 178, east side)<br>Drowning Ford Grazing Lease<br>and other nearby locations | 10 Aug 2003         | Cheryl Bradley                               | - elevation 625 m (2050 ft)<br>- valley bottom meander lobe; two terrace<br>levels, 5 m and 8 m above river level; 0%-<br>10% slope, south aspect<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra-Opun pol</i> grassland<br>with <i>Arte can</i> , <i>Plan pat</i> , <i>Arte fri</i> ; 25% bare<br>soil                          | - population estimated at < 7500 plants if<br>assume 25 ha of meander lobe is suitable<br>habitat and maximum plant density of<br>0.03 plants/m <sup>2</sup> ; 96 plants counted in a<br>polygon 125 m x 25 m (3125 m <sup>2</sup> ) with long<br>axis parallel to river; 4-hour search<br>- plants observed at three other locations<br>along a 500-m transect northwest from the<br>polygon<br>- plants dead (brittle) and nutlets being<br>dispersed |

| Site#/<br>EO# <sup>1</sup> | Location  | Date(s)<br>Observed | Observer<br>(Collection #)                             | Site Description  | Population/Search Information   |
|----------------------------|---|---------------------|--|---|---|
| SS11/<br>EO 16             | South Saskatchewan River<br>(km 181, east side)<br>Drowning Ford Grazing Lease                              | 11 Aug 2003         | Cheryl Bradley<br>(CB03-010<br>photo)                  | - elevation 625 m (2050 ft)<br>- valley bottom meander lobe; near base of<br>valley slope on broad terrace, 10 m above<br>river level; 0%-2% slope, west aspect<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra</i> grassland with <i>Poa<br/>jun</i> , <i>Opun pol</i> , <i>Plan pat</i> , <i>Lapp occ</i> , <i>Arte fri</i> ;<br>10%-25% bare soil                               | - 1 plant counted at site #1 and 36 plants<br>counted in polygon 5 m x 5 m (25 m <sup>2</sup> ) at<br>site #2; 3 hour search<br>- no additional plants found in intensive<br>search of polygon 20 m x 20 m at site #1 or<br>in extensive search of meander lobe<br>- plants dead (brittle) and nutlets being<br>dispersed |
| SS12/<br>EO 17             | South Saskatchewan River<br>(km 190, east side)<br>Drowning Ford Grazing Lease                              | 11 Aug 2003         | Cheryl Bradley   | - elevation 625 m (2050 ft)<br>- valley bottom meander lobe; terrace, 8-<br>10 m above river level; 2% slope, north<br>aspect<br>- silty-sandy substrate<br>- xeric<br>- in <i>Stip com-Bout gra-Poa jun</i> grassland<br>with <i>Arte can</i> , <i>Euro lan</i> , <i>Opun pol</i> , <i>Plan<br/>pat</i> , <i>Hede his</i> , <i>Arte fri</i> ; 10% bare soil  | - 2 plants counted 3 m apart; 3-hour search<br>- no additional plants found in intensive<br>search of polygon 100 m x 100 m or in<br>extensive search of remainder of meander<br>lobe<br>- plants dead (brittle) and nutlets being<br>dispersed   |
| SS13/<br>EO 18             | South Saskatchewan River<br>(km 199, east side)<br>C.F.B. Suffield, Koomati area                            | 22 Jul 2003         | Ian Macdonald<br>Garry Trottier<br>(#030722a2,<br>UAC) | - elevation 625 m (2050 ft)<br>- valley bottom meander lobe; terrace at<br>base of valley slope; along cattle trail<br>paralleling vehicle track<br>- medium to fine sand substrate<br>- subxeric<br>- in <i>Oryz hym-Stip com</i> grassland with <i>Arte<br/>can</i> , <i>Bout gra</i> , <i>Agro pec</i> , <i>Cala lon</i> , <i>Lith inc</i> ,<br><i>Gau coc</i> , <i>Opun fra</i> , <i>Spha coc</i> | - 1 plant counted; searched area within<br>50-m radius of the plant and along 200-m<br>stretch of the nearby road as well as cattle<br>trails and open sand sites in the vicinity<br>- plant dead (brittle) and nutlets being<br>dispersed  |
| SS14/<br>EO 02             | South Saskatchewan River<br>(km 208, north side)<br>C.F.B. Suffield, Ypres area<br>Mule Deer Springs valley | 7 Jul 1994          | Ian Macdonald<br>(#U12 &<br>PMAE<br>B94.4.527)         | - elevation 610-625 m<br>- disturbed sandy ground near pond<br>- with Chen pra, Axyr ama, Poly are  | - 1 plant;<br>- immature fruit<br>- not found by Ian Macdonald in Aug 2003  |

| Site#/EO# <sup>1</sup> | Location  | Date(s) Observed | Observer (Collection #)  | Site Description   | Population/Search Information   |
|------------------------|---|------------------|--|--|---|
| SS15/<br>EO na         | South Saskatchewan River<br>(km 230, west side)<br>CFB Suffield National<br>Wildlife Area, Ypres) | 15 Jul 2004      | Brent Smith<br>Dean Nernberg<br>(photo)  | - elevation 725 m<br>- aeolian sand dune field; moderate relief;<br>5%-15% slopes; along a pipeline right-of-<br>way and access trail disturbed in 2002<br>- very coarse loamy sand to sand substrate<br>- xeric<br>- in <i>Stip com</i> – <i>Bout grac</i> grassland with<br><i>Cala lon</i> , <i>Agro pec</i> , <i>Psor lan</i> , <i>Lepi den</i> ,<br><i>Plan pat</i> , <i>Hete vil</i> , <i>Cryp fen</i> , <i>Heli cou</i> , <i>Lith</i><br><i>inc</i> , <i>Arte fri</i> | - 399 plants counted along about 150 m of<br>trail; 354 were along the trail and 45 were<br>off the trail; plants occurred along the edge<br>of the trail and between tire tracks   |
| SS16a/<br>EO 03        | South Saskatchewan River<br>(~km 108-112, west side)<br>Medicine Hat                              | 2 Jun 1894       | John Macoun<br>(Macoun #5803,<br>CAN 93956);<br>identification is<br>in question | - Police Barracks, Medicine Hat  | - the collection is of three plants; original<br>identification by Macoun as <i>Krynitzia</i><br><i>crassisepele</i> Gr.; revised by E.B. Payson<br>(n.d.) to “probably <i>Cryptantha kelseyana</i> ”;<br>revised by F. Johnston (n.d.) to <i>C.</i><br><i>kelseyana</i> in part and <i>C. minima</i> in part;<br>noted “ <i>Vidit</i> ” by Boivin (in 1963); revised<br>by H.G. Scoggan (in 1964) to <i>C. fendleri</i> ;<br>(“nutlet solitary, smooth”); C. Bradley (in<br>2004) noted heteromorphic nutlets and<br>absence of bracts on one plant, hence<br>determined it is <i>C. kelseyana</i> ; the other two<br>specimens were too immature for visual<br>identification |



| Site#/<br>EO# <sup>1</sup> | Location  | Date(s)<br>Observed | Observer<br>(Collection #)                     | Site Description  | Population/Search Information   |
|----------------------------|---|---------------------|--|---|---|
| SS16b/<br>EO 03            | South Saskatchewan River<br>(km 112, west side)<br>Medicine Hat | 10 -15 Aug<br>2004  | Dean Nernberg<br>(several plants<br>collected) | - elevation 685-700 m<br>- undulating upland and valley slope with<br>stabilized aeolian features; 0%-50% slope;<br>mostly south and east aspects; adjacent to<br>area cleared for urban residential<br>development; vehicle trails traverse the area<br>- loamy sand substrate<br>- subxeric<br>- in mixed grassland communities<br>dominated by <i>Stip com</i> and <i>Bout gra</i> and<br>with co-dominants <i>Care ste</i> , <i>Oryz hym</i> ,<br><i>Opun pol</i> , <i>Plan pat</i> and/ or <i>Sela den</i> .<br>Associated species include <i>Poa san</i> , <i>Lepi<br/>den</i> , <i>Lapp occ</i> , <i>Desc pin</i> ; 5%-30% bare soil | - total population estimate is in the order of<br>50 000 plants in an area 500 m x 500 m;<br>about 39 375 plants were counted including<br>23 860 plants in clumps throughout the<br>upland grasslands, about 15 170 plants<br>concentrated along vehicle trails on the<br>upland and valley slope and 345 plants in<br>clumps on the valley slope<br>- plants dead (brittle) and nutlets being<br>dispersed<br>- immediately south of this location, plants<br>of unknown numbers, which were formerly<br>part of the subpopulation, have recently<br>been destroyed by urban residential<br>development |
| SS17/<br>EO 03             | South Saskatchewan River<br>(km 110, west side)<br>Medicine Hat | 15 Aug 2004         | Dean Nernberg                                  | - elevation 685-700 m<br>- mid- to upper valley slope; 0%-45%<br>slope, southeast aspect; remnant area of<br>native grassland bounded by roads; portion<br>of area disturbed by removal of native<br>vegetation;<br>- sandy loam to loamy sand substrate<br>- subxeric<br>- in <i>Stip com-Bout gra-Sela den</i> grassland<br>with <i>Opun pol</i> , <i>Care ste</i> , <i>Lepi den</i> , <i>Arte fri<br/>Arte cam</i> , <i>Liat pun</i> and in sparsely<br>vegetated disturbance with <i>Cheno alb</i> , <i>Sals<br/>kal</i> , <i>Heli am</i> ; >50% bare soil  | - population estimated at > 500 plants in an<br>area about 100 m by 50 m (5000 m <sup>2</sup> );<br>detailed survey of population size and<br>extent not conducted<br>- plants dead (brittle) and nutlets being<br>dispersed<br>- recently separated from SS16 by urban<br>residential development, hence considered a<br>separate subpopulation  |

<sup>1</sup> Site # is the reference number for mapping purposes given to the occurrence of a subpopulation as defined by C. Bradley; "a", "b", "c" indicates additional occurrence reports from the same site. EO# is the Element Occurrence reference number assigned by the Alberta Natural Heritage Information Centre. EO numbers are used by ANHIC to track the provincial population of species which may be at risk and to assess their rank. EO numbers are provided here to assist in cross-referencing information provided in this report with information in ANHIC's database. See Note below.

<sup>2</sup> River kilometres are based on maps provided in Dickinson and Baresco (1996)

<sup>3</sup> UAC – University of Calgary herbarium

<sup>4</sup> PMAE – Provincial Museum of Alberta herbarium

Note: Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little exchange (typically one successful migrant individual or gamete per year or less) (IUCN 2001). Based on her field observations and review of literature, C. Bradley concludes tiny cryptanthus nutlets or pollen are unlikely to be dispersed more than a few hundred metres from the parent plant in any given year, and hence defines the occurrence of a subpopulation as groups of plants separated by no more than 200 metres. In the absence of genetic information, however, ANHIC maps plant populations separated by roughly 1 km or more as separate element occurrences. According to ANHIC's definition there are 13 element occurrences of tiny cryptanthus in Alberta. According to C. Bradley's definition of occurrence there are 18 subpopulations of tiny cryptanthus in Alberta, although it could be argued that SS2 and SS3 should be considered one subpopulation as should SS16 and SS17 since these are separated by slightly less than 200 metres. In addition for some occurrences (e.g. SS7 and SS8) it cannot be stated with certainty that there is not a seedbank of tiny cryptanthus in apparently suitable habitat between the two occurrences.

**Appendix 3.** 2003 *Cryptantha minima* survey: search effort and summary botanical notes by C. Bradley (30 July – 13 August).

| Location  | Search Effort  | Summary Botanical Notes   |
|---|--|---|
| Lower Bow Dunes (north of confluence of Oldman and Bow rivers) (BR1)  | 30-31 Jul (7 hours). Searched three areas on foot. Area 1 is a large stabilized sand dune. Area 2 is a sandy slope on the west side of a valley carrying irrigation return flow. Area 3 is a large partially stabilized dune matching the description of a previously reported occurrence of <i>Cryptantha minima</i> . Found patches of <i>C. fendleri</i> but not <i>C. minima</i> .   | A survey of Lower Bow dunes by C. Wallis and C. Wershler in 1987 and by B. Smith in 2001 did not report <i>Cryptantha minima</i> . <i>C. minima</i> was reported here by B. Smith and I. Macdonald in 2002. In 2003, C. Bradley did not find <i>C. minima</i> . Prickly milk vetch ( <i>Astragalus kentrophyta</i> ) and small-flowered sand-verbena ( <i>Tripterocaryx micranthus</i> ) were found and two ANHIC element occurrence reports were completed for these species.                    |
| South Saskatchewan River (km 0-1) <sup>1</sup> , Grand Forks  | 6 Aug (2 hours). Searched on foot the river terrace with needle-and-thread ( <i>Stipa comata</i> ) grasslands on south side of river. No <i>Cryptantha</i> spp. found. Meander lobe upstream is cultivated and invaded by crested wheat grass. Briefly surveyed sand hills (Purple Springs Dunes) on upland south of Grand Forks and found lots of <i>C. fendleri</i> , but no <i>C. minima</i> .  | A survey of Purple Springs dunes by C. Wallis and C. Wershler in 1987 and by B. Smith in 2002 did not report <i>Cryptantha minima</i> . In 2003, C. Bradley did not find <i>C. minima</i> .   |
| South Saskatchewan River (km 2-105)   | This area was not searched, as there appears to be low potential for suitable habitat. Except for the Grand Forks area with fluvial/aeolian deposits, surficial deposits on the upland elsewhere along this reach are predominantly till and most upland areas have been cultivated. The South Saskatchewan River valley is narrow and the channel is of low sinuosity and confined by bedrock. There are a few meander lobes with fluvial terraces of low slope; however, these are mostly cultivated due to ready access and ease of irrigating. | C. Bradley did not search as the habitat was determined to be of low suitability for <i>Cryptantha minima</i> due to unsuitability of surficial deposits on the upland, narrow river valley and cultivation of river terraces.  |
| South Saskatchewan River (km 105-109), Police Point Park in Medicine Hat and river valley north of the city | 6 Aug (2 hrs). Searched on foot the open grassland areas on the river terrace near the visitor centre in Police Point Park in the City of Medicine Hat. No <i>Cryptantha</i> spp. found. Higher elevations of the meander lobe support needle-and-thread ( <i>Stipa comata</i> ) grassland on sandy soil whereas depressions support sagebrush ( <i>Artemisia cana</i> ) and buckbrush ( <i>Symphoricarpos occidentalis</i> ) on more clay-rich soils. Most of the remainder of the meander lobe supports tall shrublands and cottonwood forests.  | A <i>Cryptantha</i> species collection from the police barracks in Medicine Hat in 1894 was identified as <i>Krynitzia crassisepera</i> (now known as thick sepal cryptanthine [ <i>Cryptantha crassiseperata</i> ]), revised to <i>C. minima</i> in part and <i>C. kelseyana</i> in part and then revised to <i>C. fendleri</i> . Botanical surveys of Police Point Park since have not reported <i>C. minima</i> . In 2003, C. Bradley found neither <i>C. minima</i> nor <i>C. kelseyana</i> . |

| Location  | Search Effort  | Summary Botanical Notes   |
|---|--|---|
| South Saskatchewan River (km 109-147)   | 6 Aug (1 hour) and 13 Aug (2 hours). On 6 Aug drove north of Medicine Hat on 11 Ave NE, which provides views of the river valley up to km 125. Observed that river valley terraces on meander lobes from km 110 to km 127 on both sides of the river have been cultivated. On 13 Aug drove north on Rge Rd 53 to a viewpoint at km 136 (Mitchell Bluff). Observed that river valley terraces on meander lobes from km 131 to km 141 have been cultivated.  | River valley terraces on meander lobes have been cultivated. Uplands on both sides of the river are mapped as very coarse-textured fluvial or aeolian.  |
| South Saskatchewan River (km 148-156), W. Davies lease and Ellis Ranching property                              | 13 Aug (3 hours) Drove to Davies residence at km 149. Searched on foot the meander lobe south of the residence. Private land on the upper portion of the terrace has been converted to irrigated cropland. Public land on tip of meander lobe disturbed and occupied by weedy species: summer-cypress ( <i>Kochia scoparia</i> ), green tansy mustard ( <i>Descurainia pinnata</i> ) and cocklebur ( <i>Xanthium strumarium</i> ). No <i>Cryptantha</i> species found. Drove north of Davies feedlot on river valley trail and then southwest to lower portion of meander lobe (km 153). Public land in the upper portion of the extensive terrace has been converted to irrigated cropland. Searched on foot the lower terrace (<10 m above river level), which has patches of needle-and-thread grasslands on sandy knolls but is predominantly occupied by sagebrush shrubland on clay-rich substrate. This area is influenced by irrigation and is invaded by non-native species including crested wheat grass ( <i>Agropyron pectiniforme</i> ), smooth brome ( <i>Bromus inermis</i> ) and sweet clover ( <i>Melilotus</i> spp.). No <i>Cryptantha</i> species found. Observed that meander lobe on west side of river is also cultivated. | In 2003, no <i>Cryptantha minima</i> was found by C. Bradley. River valley terraces have been converted to irrigated cropland, and uncultivated areas on lower portion of meander lobes have been influenced by irrigation.   |
| South Saskatchewan River, east side <sup>2</sup> (km 157-158), Drowning Ford Grazing Lease (SS1, SS2, SS3, SS4) | 1 Aug (8 hours) and 4 Aug (8 hours x 2 people). On 1 Aug parked truck and walked 2.5 km west-southwest to a location in the river valley at km 157 where <i>Cryptantha minima</i> was previously reported. Found <i>C. minima</i> and inventoried population. From here walked 1 km northeast to bench on valley slope where <i>C. minima</i> previously reported. Found <i>C. minima</i> and marked population. Walked on an easterly bearing and in a few hundred metres encountered more <i>C. minima</i> . Marked population. Walked 1.5 km east to truck and encountered no additional populations. On 4 Aug returned to two valley edge sites marked on 1 Aug. Inventoried populations. Drove north along trail that follows river valley edge and found <i>C. minima</i> at 700 m. Marked location but did not inventory. Drove north along trail another 1.5 km to junction with trail into river valley and found no additional populations.  | <i>Cryptantha minima</i> was reported here by D. Bush at one location in 1998 and at two in 2002. In 2003, C. Bradley found <i>C. minima</i> at four locations: on river valley terrace, on valley slope bench and two on upland sites at edge of valley. Four ANHIC element occurrence reports were completed for <i>C. minima</i> . |

| Location   | Search Effort  | Summary Botanical Notes   |
|--|--|---|
| <p>South Saskatchewan River, east side (km 159-171), Drowning Ford Grazing Lease, Brush Flats (SS5, SS6, SS7, SS8)</p> | <p>5 Aug (5 hrs x 2 people). Drove to meander lobe in river valley at km 160 and followed trail southwest on meander lobe. Found <i>Cryptantha minima</i>. Inventoried population. Much of meander lobe has been converted to crested wheat grass. Drove vehicle trail north for 2 km along valley edge and descended into river valley at Brush Flats (km 164). Drove trail southwest on meander lobe and found <i>C. minima</i>. Inventoried portion of population. Drove vehicle trail west and north on meander lobe and found <i>C. minima</i> 700 m west of previous population. Marked location but did not inventory.</p>  | <p>In 1973, <i>Cryptantha minima</i> was reported in this area but probably on the west side of the river (Bull Pen) by H. Johnson. In 2003, C. Bradley found <i>C. minima</i> at two locations, both on river valley terraces. Two ANHIC element occurrence reports were completed for <i>C. minima</i>.</p>   |
| <p>South Saskatchewan River, east side (km 172-176), Drowning Ford Grazing Lease, Minor Flats (SS9)</p>                | <p>5 Aug (4 hrs x 2 people) and 10 Aug (3 hrs). On 5 Aug drove vehicle trail north in river valley across Minor Flats to river access at km 174. Much of the flats are converted to crested wheat grass and no <i>Cryptantha minima</i> found. Drove east on vehicle trail to inner portion of the flats in vicinity of cutoff channel. Searched on foot a 100-m-radius area near well site and did not find <i>C. minima</i>. Followed vehicle trail 800 m west to gravel mining site and found <i>C. minima</i>. Inventoried population. On 10 Aug drove to valley edge above gravel mining site. Site is needle-and-thread grassland on undulating sandy substrate. Searched on foot along 100-m stretch of trail, 50 m each side. No <i>C. minima</i> found. Drove north 1 km to well site near valley edge. Found <i>C. kelseyana</i> on open sand disturbed by well site construction but no <i>C. minima</i> in vicinity. Drove north along valley edge trail and searched on foot an exposed valley edge site underlain by sand and gravel. Found cocks-comb cat's eye (<i>C. celesoides</i>) but no <i>C. minima</i>.</p> | <p>In 2003, C. Bradley found <i>Cryptantha minima</i> at one location on river valley terrace. C. Bradley did not find <i>C. minima</i> on the valley edge in this reach. <i>C. kelseyana</i> was found on the upland near a well site. Two ANHIC element occurrence reports were completed for <i>C. minima</i> and <i>C. kelseyana</i>.</p>   |
| <p>South Saskatchewan River, east side (177-179), Drowning Ford Grazing Lease (SS10)</p>                               | <p>10 Aug (5 hours). Drove to meander lobe and parked at well site. Walked along the edge of a break in slope parallel to the river and in 500 m encountered <i>Cryptantha minima</i>. Inventoried population that extended about 150 m east along the break in slope. In 500-m transect northwest back to truck marked three locations of <i>C. minima</i> but did not inventory. On edge of valley at junction of river valley and valley edge trails, searched on foot an area with radius about 50 m in rolling sandy site. <i>Cryptantha minima</i> was not found. Observed false buffalo grass (<i>Munroa squarrosa</i>) here, along the valley edge vehicle trail for about 2 km to north, and on a reclaimed pipeline right of way.</p>  | <p>In 2003, C. Bradley found <i>Cryptantha minima</i> at four locations within 500 m of each other on the river valley terrace. One ANHIC element occurrence report was completed for <i>C. minima</i>. Also observed was <i>Munroa squarrosa</i>, which is on ANHIC tracking list, but an element occurrence report was not completed as it was abundant and appears to have been seeded in reclamation.</p> |

| Location   | Search Effort  | Summary Botanical Notes  |
|--|--|--|
| South Saskatchewan River, east side (km 180-182), Drowning Ford Grazing Lease (SS10) | 11 Aug (3 hours). Searched meander lobe on foot, focusing on needle-and-thread grasslands on sandy substrate. Found <i>Cryptantha minima</i> near base of river valley slope and again 60 m to south. Inventoried population.  | In 2003, C. Bradley found <i>Cryptantha minima</i> at two locations within 60 m of each other on the river valley terrace. One ANHIC element occurrence report was completed for <i>C. minima</i> .  |
| South Saskatchewan River, east side (km 183-188), Drowning Ford Grazing Lease        | 11 Aug (1 hour). Drove trail north for 6 km along eastern edge of river valley. No <i>Cryptantha minima</i> found in grasslands on upland. Observed that the upland is less sandy than further south and that the river valley in this reach is narrow and the channel confined by bedrock.  | In 2003, C. Bradley did not find <i>Cryptantha minima</i> . The upland is underlain by undulating till moraine and the river valley is narrow and the channel confined.  |
| South Saskatchewan River, east side (km 189-192), Drowning Ford Grazing Lease (SS12) | 11 Aug (2 hours). Drove to well site on meander lobe. Searched meander lobe on foot, focusing on needle-and-thread grasslands on sandy substrate. <i>Cryptantha minima</i> found only at one location, 60 m west of well site.   | In 2003, C. Bradley found <i>Cryptantha minima</i> at one location. An ANHIC element occurrence report was completed for <i>C. minima</i> .  |
| South Saskatchewan River (km 193-215), Suffield Military Reserve (SS13, SS14)        | Not included in the 2003 survey <sup>2</sup> .   | I. MacDonald found <i>Cryptantha minima</i> in Ypres area of CFB Suffield in 1994 (1 plant) and in the Koomati area of CFB Suffield in 2003 (1 plant).   |
| Hilda Sandhills  | 11 Aug (1 hour). Visited briefly a sand dune area on the upland east of Hwy 41 north of Hilda. Found <i>Cryptantha fendleri</i> on bare patch in vegetation dominated by common wild rose ( <i>Rosa woodsii</i> ), needle-and-thread grass and pasture sage ( <i>Artemisia frigida</i> ).  | A survey of the Hilda sand hills by C. Wallis and C. Wershler in 1987 reported <i>Cryptantha fendleri</i> but not <i>C. minima</i> . In 2003, C. Bradley found only <i>C. fendleri</i> during a brief visit to sand hills north of Hilda.  |
| South Saskatchewan River (km 216-269)  | 12 Aug (2 hours). The river valley throughout this reach is narrow and the channel is confined by bedrock. There are very few meander lobes with level terraces. On 12 Aug drove west on Twp Rd 202 to river valley (km 263) at site of suspended pipeline river crossing. Searched the valley bottom, which is mostly a narrow fan deposited by a drainage from the east and experiencing slope wash. Vegetation is mainly sagebrush shrubland and reclaimed disturbances with seeded Russian wild rye ( <i>Elymus junceus</i> ) and crested wheat grass; substrate is clay rich with patches of sand and gravel. No <i>Cryptantha</i> species found. | In 2003, this reach was not searched extensively as it was determined that the narrow valley with channel confined by bedrock did not offer suitable habitat for <i>Cryptantha minima</i> . C. Bradley did not find <i>C. minima</i> in a search of one valley bottom site. N. DeCarlo collected a specimen on the west side of the river here in 2002, which has tentatively been identified as <i>C. kelseyana</i> . |

| Location   | Search Effort  | Summary Botanical Notes  |
|--|--|--|
| South Saskatchewan River (km 270-276), Sandy Point | 12 Aug (5 hrs). Searched terraces on south side of river at km 270-271 using two 1-km long transects paralleling the river. Focused search on needle-and-thread grasslands on sandy substrate and not on sagebrush shrubland. No <i>Cryptantha</i> species found. Searched terrace just east of campground at Sandy Point (km 272). Grassland invaded by non-native species and no <i>Cryptantha</i> species found. Searched terraces on west side of river at km 274-275 using two 1.5-km long transects paralleling the river. Focused search on needle-and-thread grasslands on sandy substrate. No <i>Cryptantha</i> species found. Briefly searched area around gravel mining site on upland above Sandy Point. No <i>Cryptantha</i> species found. | In 2003, C. Bradley did not find <i>Cryptantha minima</i> in a search of three sites with river terraces that appeared to be suitable habitat.   |
| South Saskatchewan River (km 277-289)              | The river valley throughout this reach is narrow and the channel is confined by bedrock. There are very few meander lobes with level terraces.   | In 2003, this reach was not searched as it was determined that the narrow valley with channel confined by bedrock did not offer suitable habitat for <i>Cryptantha minima</i> .                                  |
| South Saskatchewan River (km 291-295)              | 12 Aug (3 hours). Drove east on Twp Rd 220 and then east and north on vehicle trail. Parked vehicle. Walked 2.5 km in east-northeast direction through rolling sand hills to the river valley, which at this point is a large bend dipping into Saskatchewan, and then walked 2.5 km back to vehicle. River valley is narrow, steep-sided and lacks terraces. Found <i>Cryptantha fendleri</i> on bare sand patches in upland, but not <i>C. minima</i> .  | In 2003, C. Bradley did not find <i>Cryptantha minima</i> along two 2.5-km transects through rolling sand hills in large bend on west side of river. The river valley is narrow, steep-sided and lacks terraces. |
| South Saskatchewan River (km 296-301)              | 13 Aug (3 hours). In Saskatchewan followed gravel roads north of Burtstall to a large bend in the river that dips into Alberta and is the site of the former Empress Ferry. Walked 2 km in westerly direction along base of valley slope to large active sand dune, then north 500 m to river edge and then along southeast bearing for 2.5 km back to vehicle. Meander lobe is composed of wind-worked sand hills. Vegetation is needle-and-thread grassland and sagebrush shrubland on hilltops and upper slopes and various shrublands in swales. Focused on grasslands in search for <i>Cryptantha minima</i> but none was found. Observed <i>Cryptantha fendleri</i> on top of sand ridge paralleling the river about 8-10 m above river level.     | In 2003, C. Bradley did not find <i>Cryptantha minima</i> along a 5-km circuit of the wind-worked terraces on this large meander bend.   |

| Location  | Search Effort   | Summary Botanical Notes  |
|---|---|--|
| Red Deer River, Empress                                   | 31 Jul (3 hours) and 12-13 Aug (2 hours). Searched on foot an area 0.5 km east and 1 km west of the old Empress train station and north to the Red Deer River. Much of the area is a broad abandoned terrace about 10-12 m above river level. Part of the area is a gravel-mining site and part has been converted to crested wheat grass. Focused search near former site of grain elevators 0.5 km WNW of the town where <i>Cryptantha minima</i> had been previously reported and in areas that supported needle-and-thread grassland on sandy substrate at the break in slope along the river.  | <i>Cryptantha minima</i> was reported here in 1996 by B. Smith but was revised in 2003 to <i>C. kelseyana</i> . In 2003, C. Bradley did not find <i>C. minima</i> but did find <i>C. kelseyana</i> on a disturbed river terrace about 500 m west of Empress. An ANHIC element occurrence report was completed. |
| Red Deer River, 3 km upstream of Empress                  | 13 Aug (2 hours). Drove 1.5 km west on old railway right-of-way to large meander lobe on the south side of the Red Deer River 3 km upstream of Empress. Parked vehicle beside trail leading into river valley and walked 1.5 km in a northwest direction across the meander lobe to the river and back. There are rolling sand hills on the meander lobe. Vegetation is a mosaic of grasslands dominated by sand grass ( <i>Calamovilfa longifolia</i> ) and needle-and-thread grass on hill tops, thorny buffalo berry ( <i>Shepherdia argentea</i> ) and water birch ( <i>Betula occidentalis</i> ) shrublands in swales and plains cottonwoods ( <i>Populus deltoides</i> ) on the active flood plain. <i>Cryptantha fendleri</i> was found on the slope of a partially stabilized sand dune. No <i>Cryptantha minima</i> was found. | In 2003, C. Bradley did not find <i>Cryptantha minima</i> .  |
| Cypress Hills, stock watering pond at west end of plateau | 6 Aug (3 hrs x 2 people). Visited site of previous report, which is a stock watering pond at the head of a tributary of Hazzard Creek. Searched the banks of the pond and an area extending 100 m to the west.  | A <i>Cryptantha</i> species with heteromorphic nutlets was collected here in 1999 by R. Ernst. C. Bradley did not find any <i>Cryptantha</i> species here in 2003.   |

<sup>1</sup> River kilometres are the channel distance from the confluence of the Bow and Oldman rivers and are taken from the 1996 guidebook *Prairie River* (Dickinson and Baresco 1996).

<sup>2</sup> Suffield Military Reserve flanks the west side of the South Saskatchewan River from km 157 to km 192 and both sides of the river from km 193 to km 215. Suffield Military Reserve was not included in this field survey; however, the Suffield National Wildlife Area was included in a concurrent survey for rare plants, contracted by the Canadian Wildlife Service.



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