Committee on the Status of Endangered Wildlife in Canada

Comité sur le statut des espèces menacées de disparition au Canada

Ottawa, Ont. K1A 0H3
(819) 997-4991

STATUS REPORT ON THE SAND VERBENA

ABRONIA MICRANTHA TORR.

BY

BONNIE SMITH

AND

CHERYL BRADLEY

STATUS ASSIGNED IN 1992

THREATENED

REASON: FEW SITES AND THREATS TO POPULATIONS FROM STABILIZATION OF SAND DUNE HABITATS DUE TO FIRE AND GRAZING CONTROL.

OCCURRENCE: ALBERTA AND SASKATCHEWAN

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STATUS REPORT ON ENDANGERED WILDLIFE IN CANADA

Sand Verbena

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA

COSEWIC

Committee on the Status of Endangered Wildlife in Canada

Comité sur le statut des espèces menacées de disparition au Canada

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STATUS REPORT ON THE SAND VERBENA

ABRONIA MICRANTHA TORR.

IN CANADA

BY

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THREATENED

Abstract

Sand verbena is a succulent annual herb generally of active sand dune habitats. It has been found at five sites in Alberta and one in Saskatchewan. A total of about 1000 plants occur at these sites. Because of the few populations known and threats from stabilization of the sand dune habitats due to fire and grazing control, a status of threatened is proposed for this species.

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I. Species Information

1. Classification and Nomenclature

The scientific name for sand verbena or sandpuffs is Abronia micrantha Torr. Abronia (from "abros", the Greek work for "delicate") micrantha (which means "small-flowered" belongs to the family Nyctaginaceae in the order Nyctaginales. (Porter 1967) The Nyctaginaceae is known as the "Four-O'Clock Family" because the flowers tend to open in late afternoon (Johnson and Hallworth 1975). "Nyct" is Greek meaning "pertaining to night", another reference to the late opening of the flowers. The Nyctaginaceae is composed of 30 genera containing about 300 species of herbs, shrubs, and trees of wide distribution in warmer regions of both hemispheres, but most abundant in America (Rendle 1963, Bailey 1951, Payne Smith 1977). Porter (1967) recognizes only 20 genera and 160 species. Fifteen genera are native to the United States (Payne Smith 1977). Only two genera are indigenous to the Old World.

The family Nyctaginaceae is restricted in the United States mostly to the southern and Pacific regions. The largest genera of the family are Mirabilis, 60 species, and Abronia, 33 species, (Lawrence 1951). Only Mirabilis, 2 species, and Abronia, 2 species, occur in Canada (Scoggan 1978). Abronia micrantha Torr. occurs only in Alberta and near the Alberta/Saskatchewan border in Saskatchewan in Canada (Moss 1983, Hudson 1982). Abronia latifolia Eschsch., the yellow sand-verbena, is restricted to western British Columbia in Canada (Scoggan 1978).

The family Nyctaginaceae is recognized as composed of five tribes; namely, Mirabileae, Pisoneae, Boldoeae, Colignoneae, and Leucastereae. Abronia belongs to the tribe Mirabileae, subtribe Abroniinae (Lawrence 1951, Heimerl 1934). The Mirabileae is distinguished through reference to the following features: ovaries glabrous and stamens more or less connate basally, straight embryo, and large cotyledons (Lawrence 1951). The Abroniinae is unique among the four subtribes of the Mirabileae in possessing a linear stigma. The Abroniinae is confined to western North America. Heimerl (1934) considered the Abroniinae to consist of a single genus, Abronia Juss.

Abronia micrantha Torr. has had a complicated taxonomic history. The species was first described by Torrey in 1843 (Galloway 1975). Torrey (1796-1873) was an American botanist, chemist, and practicing physician. He was the first president of the Torrey Botanical Club (Stafleu 1981). In describing Abronia micrantha Torrey suggested that the plant was sufficiently distinct from other members of the genus to be given at least sub-generic status and proposed the name Tripterocalyx (Galloway 1975). Hooker elevated the taxon to generic rank (Hooker's J. Bot. Kew Gard. Misc. 5:261.1853). By typographical error the species was first listed as Tripterocalyx macranthus not T. micranthus. No type was cited but the locality is given as "Near mouth of Sweetwater River (Natrona Co.), Wyoming, August 1" (Galloway 1975).

Standley (1909, 1918), Tidestrom (1925), Rydberg (1971), Harrington (1954), Kearney and Peebles (1964), and Porter (1967) have since treated the Abroniinae as containing two genera, Abronia and Tripterocalyx (Torr.) Hook. On the other hand, Coulter and Nelson (1937), Abrams (1944), Johnston (1944), Munz and Keck (1959), Hitchcock et al. (1964), and Reed (1969) have included all species in the single genus Abronia. The last comprehensive taxonomic treatments of the subtribe Abroniinae were Standley's monographs in 1909 and 1918. Subsequently, a detailed investigation of the West Coast species was made by Tillett in 1967 (Galloway 1975).

According to Galloway (1975) Tripterocalyx should be given generic rank because of differences in anthocarp structure, flower maturation, receptacle structure, the connective area between the upper and lower perianth, and, apparently, embryology. There is also pollen study evidence supporting the assignment of Tripterocalyx to separate generic status.

All species of Tripterocalyx occasionally occur with at least one species of Abronia but there is no indication of hybridization even though plants of both genera bloom simultaneously. Abronia micrantha Torr. is the type species of the genus Tripterocalyx (Galloway 1975).

Tripterocalyx micranthus f. albus Moldenke (Phytologia 9:266) was recognized from New Mexico in 1963. Abronia micrantha var. pedunculata Jones (Proc. Cal. Acad. ser. 2, 5:716.1895) from Utah was also recognized. This taxon was listed as Abronia pedunculata Rydberg (Bull. Torr. Bot. Club, 29:686) in 1902 and then as Tripterocalyx pedunculatus Standley in Contrib. U.S. Nat. Herb. 12:328 in 1909. Galloway (1975) recognizes these and other names as synonyms of Tripterocalyx micranthus (Torr.) Hook.

It is obvious that the taxonomic history of Abronia micrantha is rather complicated. The treatment of the taxon in this report will be based on Scoggan's (1978) treatment in the Flora of Canada, namely, Abronia micrantha Torr.

2. Description

Members of the genus Abronia are attractive plants with bright pink to white rather fragrant flowers which are conspicuous in the spring in sandy places especially in Arizona and California (Johnson and Hallworth 1975). Abronia micrantha is a glandular-puberulent to subglabrous annual. The much-branched plant is 2-5 dm high with decumbent, trailing branches up to 6 dm long, the tips ascending (Figure 1). The succulent, pale stems are enlarged at the nodes. The paired leaves are petiolate, entire, lanceolate to ovate, farinose below, and have prominent veins. The blades are 2-6 cm long and 1-3 cm wide. Leaf blades are generally somewhat longer than the petioles. Sheathing stipules (ochrea) are absent but are present in the similar Sand Dock.

The tiny greenish-white flowers are quite showy as they are arranged in dense umbellate clusters or "heads" with a ring of bracts (usually 5-10 mm long) underneath. Involucral bracts are mostly narrowly to broadly lanceolate, long-tapered at the tip. The flowers

themselves are very interesting as they lack petals but have a petalloid calyx (10-12 mm long, the limb 5 mm broad and glandular-pubescent) in the form of a long tube which is constricted above the ovary and ends in 5 petal-like lobes (Figure 2).

The perianth is uniseriate, composed of a petaloid calyx of five connate sepals (seemingly a corolla). The filaments of the five stamens are connate basally in a tube, unequal, the anthers 2-celled, dehiscing longitudinally. There is one pistil, the ovary superior, unilocular, 1-carpelled, the ovule 1, basal, inverted, the style one and slender, the stigma 1. Members of the family Nyctaginaceae are distinquished by the often coloured sepaloid bracts and petaloid calyx, and by the unicarpellate ovary.

A curious thing happens when the ovary becomes a fruit. The base of the calyx tube becomes transformed into a winged structure, closely enclosing the fruit and aiding in its dispersal. These winged fruits are characteristic and look quite attractive as they are pale green with a pink blush (Figure 1). The fruit is mostly about 2 cm long with 2-3 thin, papery, longitudinally, strongly veined wings. The wings are broadest near the middle. The body is spongy-reticulate and lacks nerves. The fruit is an achene (Moss 1983, Scoggan 1978, Johnson and Hallworth 1975, Lawrence 1951).

Flowering occurs from May to July (Hitchcock 1964, Rydberg 1971).

The only two species of Abronia that occur naturally in Canada are A. micrantha Torr. and A. latifolia Eschsch., the yellow sand-verbena. The two species are separated geographically. Abronia micrantha occurs only in Alberta and western Saskatchewan while A. latifolia is restricted and rare in western British Columbia. The two species may be distinquished using the following characteristics. Branches of A. micrantha grow to 6 dm in length. The tips of the branches are ascending. Fruits average about 2 cm long. Branches of A. latifolia grow to 1 metre in length. The tips of the branches are appressed to the ground. Fruits are less than 1.5 cm long. Abronia latifolia is a perennial while A. micrantha is an annual (Scoggan 1978).

Abronia micrantha somewhat resembles Rumex venosus (Polygonaceae), the sand dock, because of the large wings around its fruit but the brittle stems and annual roots of A. micrantha differentiate the two plants (Johnson and Hallworth 1975). The 3-winged fruits of A. micrantha are a trifle smaller and less red than those of sand dock, but are wholly similar in form. The fruits of the two species are plainly evolved in parallel for dispersal by rolling before the gusty winds of sand dunes (Hudson 1982).

Young plants of A. micrantha may look like those of the goosefoot group (Chenopodiaceae) in the shape, colour and mealiness of the underside of their leaves.

A more familiar member of the family Nyctaginaceae in Alberta is umbrellawort or Mirabilis hirsuta (Pursh) MacM. and Mirabilis nyctaginea (Michx.) MacM. The two genera are very distinct, though, with A. micrantha having sessile flowers, conspicuously winged fruit and

free involucral bracts. Mirabilis has pedicellate flowers, wingless fruit, and fused involucral bracts (Moss 1983).

3. Biological and Economic Significance

Economically the Nyctaginaceae are of little importance except for such ornamentals as the garden annuals, four-o'clock, Mirabilis, and sand verbena ,Abronia, and the woody subtropical vine, Bougainvillea, (Lawrence 1951). Although no data is available on the horticultural use of A. micrantha, specifically, several members of the genus Abronia have been grown in borders, rockeries, and baskets. The most popular species of Abronia in use horticulturally is the pink sand verbena, Abronia umbellata Lam., a native of the coast of California. Other species of Abronia used ornamentally include A. maritima (southern California), A. villosa (southwestern United States) and A. pogonantha (California to Nevada).

Garden uses of sand verbenas include use in flower beds, rock gardens, and hanging baskets. Except in very mild climates they are invariably treated as annuals and with little trouble make colourful displays and bloom throughout the summer. Under glass, the plant is nearly perennial. Many are pleasantly scented, their fragrance becoming more intense in the evening. Their flowers are quite charming when cut and last well in water. These plants grow in any ordinary porous garden soil, with a preference for soils that are sandy. They need full sun (Everett 1981, Bailey 1930).

The yellow sand verbena, A. latifolia, is a native of seashores from California to British Columbia (Everett 1981). Its stout roots were used as food by the Chinook Indians (Uphof 1968). The large roots were eaten by both Klallam and Makah. The Klallam compared them to sugar beets. The Makah eat them in the fall (Gunther 1945).

4. Distribution

The genus Abronia is confined in the wild to western North America (Everett 1981). Abronia micrantha is distributed in widely scattered localities in mixed grassland from southeastern Alberta to southwestern Saskatchewan south to eastern Montana, Utah, Nevada, New Mexico, South Dakota, western Kansas, and northern Texas (Moss 1983, Hitchcock et al. 1964, Scoggan 1978). Johnson and Hallworth (1975) include California and Arizona in the distribution. Specifically, A. micrantha occurs in the following states: Montana, North Dakota, South Dakota, Wyoming, Nevada, Utah, Colorado, Kansas, Arizona, New Mexico, Texas, and California (Map 1).

4.1 Alberta

Abronia micrantha is restricted to the Milk River area in southeastern Alberta; namely, the area east of Lethbridge, northeast to south of Empress, and south to the Manyberries area. Specifically, A. micrantha occurs at the following sites(Map 2): Lost River, Lower Bow,

Purple Springs, South Saskatchewan River, and Wolf Island (Wallis and Wershler 1988).

4.2 Saskatchewan

The only site found outside Alberta in Canada is located in far southwestern Saskatchewan, south of Empress, Alberta (Map 2) where the South Saskatchewan River bends into Saskatchewan and out again before returning to Saskatchewan to join the Red Deer River (Hudson 1982).

4.3 Historical Populations of Unknown Status

Rydberg's 1922 and 1932 inclusion of Saskatchewan in the range assigned to A. micrantha requires confirmation as this location was not listed by Breitung in 1957 (Scoggan 1978).

5. General Environment and Habitat Characteristics

Abronia micrantha populations occur in the mixed grassland (prairie) natural region in Alberta and Saskatchewan. This species is of interest as it is associated with desert or semi-arid conditions (Johnson and Hallworth 1975). Populations are found in dry habitats, particularly in loose alluvial sands of dune and sand-hill areas. Some element of active sand is usually required. The largest populations are on hard packed finer sand on level terrain but it also occurs on south, west, and east-facing slopes and along dune ridge tops (Wallis and Wershler 1988, Argus and White 1977).

Most Alberta sites are on the uplands, however, there are two occurrences in the valleys of the Lost and South Saskatchewan Rivers where sand dunes extend down into the valleys (Wallis and Wershler 1988). The Alberta site on the South Saskatchewan River valley was an area of silty sand that had been cleared in early 1971 to make a small emergency landing strip (Johnson and Hallworth 1975).

The Saskatchewan site was situated 70 feet above the water. Hudson made several assumptions in searching for Saskatchewan localities. He assumed A. micrantha would be found in generally sandy country, deep down in the valley in a hot microclimate, and on the inner or convex side of a bend of the river, and therefore on the slip-off slope where the soil would be alluvially deposited sand (Hudson 1982).

5.1 Climate

The Prairies Climatic Region, encompassing both the Alberta and Saskatchewan populations, are characterized by low winter precipitation. Soil moisture is not always restored to capacity in an average year and water surplus averages only 7 mm. The southeastern Alberta, southwestern Saskatchewan, and the southern interior of British Columbia have a very high average annual water deficiency, the highest in Canada (Sanderson 1988).

The climate of the mixed grassland natural region is continental, characterized by extremes in temperatures with warm summers and cold winters. The mean annual temperature ranges from 6°C in the hotter parts to 0°C in the cooler areas. The growing season is relatively short, with an average of 105 to 130 frost-free days. There is comparatively low annual precipitation, ranging from about thirty centimetres in extreme south-eastern Alberta and south-western Saskatchewan to forty centimetres along the western and northern fringes. Dry summers and winters are typical. Spring is the wettest season with about two-thirds of the annual precipitation falling as rain, the peak occurring in June. Because of the warm temperatures and high average wind speed, the rate of evaporation is high through the summer months (Wallis 1982).

The Alberta and Saskatchewan sites lie in the northern cool-termperate zone characterized by low annual precipitation, high evaporation rates and fast runoff. These factors lead to chronic water deficits with severe shortages in the short-grass prairie area. In southern Alberta the mean temperature is -8 C in January and 20°C in July (Stamp 1988).

5.2 Physiography, Hydrology, and Edaphic Factors

The Alberta and Saskatchewan populations occur in sand dune areas of the Interior Plains physiographic region (Brookes 1988). The sand dune areas occurring in southern Saskatchewan are aeolian deposits derived from glacial alluvial and lacustrine sediments. Glacial ice retreated from the region 10,000 to 13,000 B.P. Since the general inclination of the land surface was to the north and east and the ice obstructed water flow to the northeast, the melt water moved southeastward along the ice front until it was impounded in one of several glacial lakes. When it flowed into a lake the load capacity of the water decreased. The larger particles (sand) were deposited first in deltas, the finer materials being carried farther to be deposited lakeward. Subsequent exposure of the sand in extensive deltas has permitted modification of the surface by wind to form parabolic dunes. These are characteristic of semiarid climates where a partial cover of vegetation is present during dune formation. Since the effective wind direction in southwestern Saskatchewan is from the northwest, most of the present dunes tend to be oriented in a northwest to southeast direction. Rates of movement of partially denuded dunes reported in other areas vary from 2 to 22 ft. (0.6 to 6.6 m) per year (Hulett et al. 1966).

5.3 Dependence on Dynamic Factors

Abronia micrantha is restricted to sand dune areas. It appears to require some element of active (drifting) sand. Annual water deficiency and wind erosion cause considerable soil drifting in sand dunes. Populations of Abronia micrantha are dependent, as are numerous rare, threatened, and endangered species of plants and animals, on major active sandy areas which now have been almost completely cultivated. However, Wallis (1988) in his study of sand dune areas in southern Alberta note sand dunes are stabilizing and attribute it to lack of fire. Large areas of once active sand have become stabilized over the last forty years (Wallis 1988).

5.4 Biological Characteristics

Alberta and Saskatchewan sites are located in the Western Grassland vegetation region in Canada, specifically, the mixed grassland natural region. Plants are perennials on prairies being composed mostly of grasses associated with sedges, forbs, and a few dwarf shrubs. Before European settlement, this vegetation occupied valleys of southern interior British Columbia and much of southern Manitoba, Saskatchewan and Alberta. The nature of grassland vegetation depends on climate and soil (Bird 1988).

Sand dunes exhibit a range of habitats from active dunes to stabilized sites with spear grass (Stipa comata) and sand grass (Calamovilfa longifolia); a variety of low shrubs, primarily buckbrush (Symphoricarpos occidentalis) and rose (Rosa acicularis) tall shrubs, mainly chokecherry (Prunus virginiana), silverberry (Elaeagnus commutata), and water birch (Betula occidentalis) and trees, including clones of aspen (Populus tremuloides) and scattered cottonwoods (Populus deltoides). These dune areas support some of the largest upland bird and ungulate populations in the mixed grasslands (Wallis 1982), as well as some rare small mammals and birds, for example, Ord's Kangaroo Rat (Dipodomys ordii) and Grasshopper Sparrow (Ammodramus savannarum).

The southeastern Alberta populations and the southwesern Saskatchewan population occurs in the mixed grassland natural region populated by relatively drought resistant grasses such as blue grama and spear grass (Bird 1988). The dominant associated plants noted for the Alberta locations include the following: Oryzopsis hymenoides, Psoralea lanceolata, and Stipa comata as well as Koeleria cristata, Bouteloua gracilis, Sporobolus cryptandrus, Polansia trachysperma, Heterotheca villosa, and Helianthus petiolaris (Wallis and Wershler 1988, Johnson and Hallworth 1975).

6. Population Biology and Ecology

A. Phenology

Sand verbenas are "ephemerals", i.e., they cover the desert in the spring with a blaze of colour, then set seed and die. This is an adaptation to desert conditions, and a very successful one, as the plants survive the torrid heat of midsummer as dormant seeds. Indeed, Hudson (1982) noted how ripe the fruits of the plants already were by July 11 (1981) at the time of his visit to the Saskatchewan site. Specimens collected from the South Saskatchewan site in Alberta were in fruit by July 22 (1973).

B. Alberta

The total Alberta population is estimated to be under 1000 plants. The population is distributed amongst the widely scattered southeastern Alberta localities as follows: Lost River - 200 plants, Lower Bow - 265 plants (in three sites of 12, 250, and 3 plants each), Purple Springs - 30 plants, South Saskatchewan River - less than 100 plants, Wolf Island -

110 plants, in two sites of 100 and 10 plants each (Wallis and Wershler 1988, Johnson and Hallworth 1975).

The Lost River population of A. micrantha appears to be very stable. It was first recognized by Johnson (1975) from slides taken in the early 1970's by a participant in an Opportunities for Youth Project (OFY) from the Lost River area. Smoliak discovered the actual site in 1977 and Wallis and Wershler (1988) rediscovered the population in 1987. It would appear to be fairly stable. The same can be assumed for the Macoun (1895) population in the Manyberries which Johnson (1975) rediscovered in 1973 just northeast of its 1895 location. She found numerous plants at this site.

C. Saskatchewan

There is no population data available for the Saskatchewan site.
[The site SE of Empress, SK, contained fewer than 10 plants at the time the collection was made by Hudson in 1981 (pers. com. from V. Harmes to E. Haber, chairman, Plants Subcommittee (COSEWIC))].

6.1 Reproductive Ecology

Abronia micrantha is an annual species. The fruit, an achene, is enveloped by the persistent calyx in the form of 2-3 thin wings which facilitate dissemination.

6.2 Population Ecology

Both Hudson (1982) and Johnson (Johnson and Hallworth 1975) theorized that since A. micrantha was an annual and would not likely be found in exactly the same location from year to year it was probable to expect establishment of the seeds downwind or downstream from the original sites as a result of wind or water dissemination of the seeds. Both Hudson and Johnson located additional populations by following this logic.

7. Land Ownership and Management Responsibility

All Alberta sites are on crown land. The Saskatchewan site is likely also on crown land although this must be verified. It is probable that several, if not all of the sites, are under grazing leasehold (Wallis and Wershler 1988).

8. Management Practices and Experience

Mixed prairie is so named because it includes both mid and short grasses. This the most extensive grassland region found in North America. The area of uncultivated mixed prairie is declining rapidly. Some 23% of the rangeland still existing in 1956 had been plowed by 1981. Much of the remaining rangeland exists in areas unsuitable for cultivation. At the

same time, greatly increased grazing pressure on the remaining rangeland has changed the plant composition in all types of habitats. About 24% of the original mixed prairie remains in its native state. One national park, Grasslands National Park in southwesern Saskatchewan, several provincial parks and natural areas exist within the mixed prairie zone, but further protection is necessary (World Wildlife Fund 1988).

Native grasslands continue to be broken and seeded to tame pasture and crops. The majority of short-grass and mixed-grass prairie has been lost or converted in Alberta. Within the grasslands natural area several major sand dunes have also been mostly lost through cultivation. A southern Alberta study of rare wildlife and plants in sandhill and sand plain habitats indicates that these areas contain a concentration of significant features, including numerous rare, threatened, and endangered species of plants and animals (Wallis and Wershler 1988). Loss of primary habitat as well as destruction of specific habitats via stabilization of active sand has contributed to a weaker position for the rare entities within these areas.

8.1 Habitat Management

The grasslands natural region in Albeta is considered to be among the most threatened of Alberta's natural regions. They are being lost or converted at an extremely rapid rate (Wallis 1987). Several major sand plains have been almost completely cultivated and a major threat to the remaining habitats exists. Alberta is not alone in the problem of loss of active sand habitats. Nebraska sandhill plants have been placed on the United States endangered species' list. Ironically, stabilization of the active sand was seen as good conservation practice. Land managers went to great lengths to stabilize active blowouts, extinquishing fires, modifying their grazing patterns and even placing old tires in the blowouts (Wallis and Wershler 1988). This needs to be studied.

8.2 Cultivation

Propagation is by seeds sown in spring where the plants are to remain or earlier in a greenhouse of 60 to 65 F. In mild climates, they may be sown outdoors in fall for flowering the following summer. The plant may volunteer from self-sown seeds. Germination is hastened if the husks surrounding the seeds are removed or the seeds are soaked in water for twenty-four hours before sowing. Seedlings from outdoor sowings are thinned to about 9 inches apart, those from indoor sowings are transplanted 2 inches apart in flats of porous soil and are grown in a sunny greenhouse in a night temperature of 50 to 55 F and day temperatures five to ten degrees higher until planting out time, after all danger of frost has passed.. Indoor seeding is done about ten weeks before the plants are to be transferred to the garden, where they are set nine inches to one foot apart. Summer care is minimal. The taller kinds of Abronia may require staking. Brushwood inserted among them gives satisfactory support. For early and continuous summer bloom, seeds may be sown in pots of sandy earth the previous autumn and wintered in a frame. Under glass the plant is nearly perennial (Everett 1981, Bailey 1930; data is for all species of Abronia).

9. Evidence of Threats to Survival

The Grasslands Natural Region is one of the most threatened natural regions in Alberta. Over two-thirds of the Mixed Grassland has been lost to cultivation or other development (Wallis 1987). Many major sand plains (critical habitat for Abronia micrantha) have been lost and many others are threatened (Wallis 1988). Critical habitat is defined by Wallis (1987) as "most crucial to the survival of population, species, races or form. When these critical habitats are disturbed there will be major effects on the plants and animals that depend upon them." Over half of the birds and mammals now listed by COSEWIC are found in the three prairie provinces as a result of habitat loss in Western Canada (Hummell 1987). The government of Alberta has priorized the threatened grassland region for representation and protection in the form of ecological reserves but overall representation of ecological reserves in this region of Alberta is very poor to date.

In Alberta, about 20% of the rare plants in the grassland and parkland regions are found in sandy soils, principally in sand hill areas. Sand hill areas are locally distributed, and diverse sand hill areas are rare. Principal threats to these habitats relate to cattle grazing and invasion of non-native species as a result of vegetation reclamation along oil and gas access roads and well-sites (Wallis 1987).

The main limiting factors affecting Abronia micrantha are its natural narrow preference for unstabilized sites within dune fields and loss of natural habitat through management intervention as a result of grazing and fire control. It would appear unstabilized sites within sand hills depend on a continued regimen of grazing and fire working cooperatively. A management dilemma presents itself as the increasing pressure of grazing by livestock is causing a deterioration in the Mixed Prairie Grassland surrounding azonal areas such as sand hills.

9.1 Conversion to Tame Pasture and Cropland

More than two-thirds of the Mixed Prairie Grassland region has been destroyed by cultivation. Some clearing continues but it is not as prevasive a problem as in the Parkland Region (Wallis 1987).

The proportion of farmland occupied by rangeland declined from 53% to 41% between 1956 and 1981 in Alberta (Mixed Prairie Census Districts). About one-third of the disappearing rangeland has been converted to seeded pasture in the Mixed Prairie Region of Alberta. The area of uncultivated grassland in Saskatchewan and Alberta is declining at a rapid rate. The surviving untilled area contains a smaller proportion of typical grassland and a large proportion of azonal types (saline flats, sloughs, sandhills, badland) as time goes by, because the typical upland situations are being converted to cropland (Coupland 1987). Based on the experience in the United States with sand hill areas, the potential for cultivation exists but has not been developed to a significant degree in Alberta (Wallis 1987).

9.2. Dune Stabilization

Rare, threatened and endangered plants were studied to map distribution and assess the degree to which dune stabilization was occurring and how this was affecting native plants. While the exact mechanisms are unclear, it appears that large areas of once active sand have become stabilized over the last forty years. If the current trends continue, rare native plants which now have dangerously low populations could be eliminated entirely. Principal threats relate to encroachment of vegetation on active dunes. This process could eliminate major and minor populations of A. micrantha. This is a long-term process which could be reversed with climatic changes or through human interference with selective dune destabilization. The Lower Bow dune at one site is being stabilized by Salsola kali, Cleome serrulata, and Hordeum jubatum (Wallis and Wershler 1988).

Particular data showing the trend towards dune stabilization is presented. From 1950 to 1987, there has been a 30 to 40% reduction in active sand at Dune Point with invasion by russian thistle into the gravelly sands. A series of active dunes stretched virtually unbroken for 2 km along the South Saskatchewan River in 1950 - today all these dunes are stabilized and there are only minor active blowouts. All 16 sand blowouts at Remount Community Pasture, which were active in 1950, are now stabilized. Of 51 blowouts active in 1950 in the Middle Sand Hills, only 20 are still active and, of these, 10 are partly stabilized and 7 are mostly stabilized, 90% of the sand which was active in 1950 is now stabilized, (Wallis 1988).

Other examples of the trend towards dune stabilization on the prairies are presented. The Dundurn Sand Hills near Saskatoon, Saskatchewan have mostly been stabilized by vegetation. Small areas still exist where wind erosion and deposition are altering landforms particularly under disturbed conditions such as those incurred under heavy grazing in times of drought. Earlier aerial photographs (1944) reveal areas of active dune complexes more extensive in the past (Pylypec 1989).

The Harris Sand Hills, 80 km southwest of Saskatoon, are surrounded by cultivated land mostly in cereal grains. There are only three small active areas remaining in the southwest part of the dune surrounded by a larger aspen forest. The vast majority of the dunes are stabilized. The Harris Sand Hills area an oasis for native flora and fauna which inhabit both the grasslands and parklands of central Saskatchewan (Epp 1982).

The Great Sand Hills of Saskatchewan are located west of Regina near the Manitoba border and northeast of Cypress Hills. High stabilized dunes cover the largest area - 50% of the dune field - and are the most sensitive to disturbance. Active complexes are the least extensive (0.4%). The Great Sand Hills form a varied natural ecosystem that is sensitive to disturbance and is a genetic reservoir for rare and common species (Epp 1980).

9.3 Grazing and Fire Control

The large tracts of uncultivated grassland east of the mountains, mostly community pasture or crown land leased by ranchers, are grazed by domesticated livestock (Bird 1988) While the dynamics of dune destabilization are poorly understood, a consensus is emerging that it is a combination of fire and grazing during appropriate seasons that keeps blowouts active. Dunes have been stabilizing in the Middle Sand Hills where there have been repeated fires but little grazing; and in other areas where there has been grazing but few fires (Wallis 1988). The condition of surviving Mixed Grassland in Alberta is deteriorating because of increased grazing (Coupland 1987). This presents a management dilemma.

The positive or negative impacts of grazing at various seasons are unknown (Wallis and Wershler 1988). A current theory is that late summer or fall fires formerly created lush green areas the following spring. These green patches attracted large herds of grazing animals like bison and resulted in reactivation of the sand dunes. The sandhills were also apparently used as sheltering areas by bison during the winter and this could have been significant in keeping dunes active. Fire control and changes in grazing patterns have completely changed the factors which shape sand dune environments (Wallis 1988).

It is likely that the Alberta and Saskatchewan populations of Abronia micrantha occur within grazing leaseholds.

10. Present Legal or Other Formal Status

No specific legal status is accorded Abronia micrantha in any part of Canada. Alberta has no legislation which covers plants or endangered species.

In Canada, Abronia micrantha naturally occurs only in the southeastern part of Alberta and in one small area along the South Saskatchewan River in southern Saskatchewan near the border with Ablerta (Map 1, 2) so it is considered rare from a national prespective. Argus and White (1977) and Packer and Bradley (1984) identified Abronia micrantha as rare in Alberta. Maher et al. (1979) published on the are plants of Saskatchewan prior to Hudson's 1981 discovery site in Saskatchewan. Wallis and Wershler (1988) identified A. micrantha as a potentially threatened species in Alberta. While it is widespread in the United States (Map 1) it is represented by less than 1000 individuals from scattered localities in southeastern Alberta and fewer than 10 plants at only one site in Saskatchewan. The Nature Conservancy rank is Global G?, Canada N1, Alberta P1, Saskatchewan P1. The United States rank is Kansas S1 and South Dakota sH. Ayensu and DeFilipps (1978) did not list Abronia micrantha in any of their state lists although other species of Abronia were included.

All the lists of rare species for the prairie provinces are relatively long. The most recent Alberta list (Packer and Bradley 1984) contains 360 species, representing 24% of the native flora. Kershaw (1987) acknowledges three major groups of distribution patterns of rare species in prairie provinces. Over 80% of the "rare" species in the prairie provinces appear

to belong to a group composed of species extending into the provinces from nearby (non-disjunct) widespread populations. Such populations add considerably to the species diversity of the provinces, probably accounting for more than 20% of the total floras. The Alberta and Saskatchewan populations of Abronia micrantha probably fall into this category. A second group, composed of species extending into the province as small disjunct populations, accounts for less than 10% of the number of total rare species in the prairie provinces. A third group composed of endemic species is limited to a local area and is restricted geographically (Kershaw 1987).

II. Assessment of Status

11. General Assessment

The following criteria have been used to assess the status of Abronia micrantha in Canada:

taxonomy - Abronia micrantha is one of two species of the genus found in Canada. The other species, Abronia latifolia, is itself rare in British Columbia. As well, the family Nyctaginaceae is represented by only two species of one other genus (Mirabilis); namely, M. hirsuta and M. nyctaginacea.

abundance - Alberta population is estimated at less than 1000 individuals. There is only one site containing limited individuals in nearby Saskatchewan.

distribution - restricted in Canada to scattered localities in southeastern Alberta and nearby Saskatchewan near the Alberta border; known to occur in only one location in Saskatchewan.

habitat distribution - restricted in Canada, Alberta and Saskatchewan.
habitat stability - unstable, ongoing loss of sites and habitat through grazing and fire control.

population trend - too early to recognize trends. The only extensive survey of Alberta sites was conducted in 1987.

reproductive potential - moderate, given habitat restructuring.

international standing - unique in North America, not internationally.

protective status - low, no formal designation, uncertainty about future landowners and management of grazing leases.

All preceding criteria are items of concern in assessing the status of this species. In Canada, Abronia micrantha has experienced ongoing habitat destruction and changes in land use and grazing patterns in the the remaining known and potential habitat placing the future survival

of the species in question. The lack of formal protection for most sites with a viable management plan is a critical problem for the species' survival in Canada. Many sites in this habitat type have been lost through catastrophic destruction by cultivation as well as gradual attrition due to changes in grazing and fire regimes.

12. Status Recommendation

The sand verbena (Abronia micrantha) is proposed for listing as a threatened species in Canada.

13. Recommended Critical Habitat

Several major sand plains have been almost completely cultivated. Designation and appropriate management of the Lower Bow, Wolf Island, and Lost River sites (Map 3A, 3C, 3D) would help protect the most significant populations of this species (Wallis and Wershler 1988). Other smaller sites that should be protected include the Bull Pound area north of Medicine Hat (Map 3B), Purple Springs area (Map 3C), and the South Saskatchewan River area near the border of Alberta in Saskatchewan (Map 3A, No. 1). A major threat to remaining sand plain habitats exists in Alberta.

Other key sandy habitats in Alberta which have highly significant resources or concentrations of features and are worthy of legislated formal protection include Dune Point (west of Bindloss), Empress Dunes, Lost River, Lower Bow Dunes, Bindloss Depression Springs, Middle Sand Hills, Turin dunes and Wolf Island Dunes (Wallis and Wershler 1988).

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15. Collections Consulted

The following botanical collections have been consulted:

University of Calgary, Calgary, AB
University of Saskatchewan, Saskatoon, SK
National Museum of Canada, Ottawa, ON
Department of Agriculture, Ottawa, ON

16. Fieldwork

Clifford A. Wallis and Cleve Wershler (1988) undertook an extensive survey of sand dune areas in southern Alberta during the summer of 1987. During this investigation they identified most of the known Abronia micrantha sites in Alberta including the following populations: Lost River, Lower Bow, Purple Springs, and Wolf Island. Hope Johnson (1975) discovered A. micrantha on the South Saskatchewan River, north of Medicine Hat site in 1972. She also relocated the 1895 Macoun Manyberries collection site. John H. Hudson (1982) discovered a Saskatchewan population of A. micrantha on the South Saskatchewan River in 1981. He purposely set out to discover this species from a Saskatchewan location based on a number of habitat and geographic considerations.

17. Knowledgeable Individuals

1. Cheryl Bradley, 158 Westover Dr., Calgary, AB T3C 2S6. Phone: (403) 246-9127
- has prepared background material on Abronia micrantha.

2. Beryl Hallworth, 3715 Underhill Place N.W., Calgary, AB Phone: 282-7447
- co-author of the article "Further discoveries of sand verbena in Alberta", Blue Jay 33(1):13-15 with Hope Johnson. Identified Abronia micrantha specimens from the Bull Pound site north of Medicine Hat, Alberta.

3. Hope Johnson- principal author of the article "Further discoveries of sand verbena in Alberta", Blue Jay 33(1):13-15 with Beryl Hallworth. Discovered A. micrantha on the Bull Pound site north of Medicine Hat, Alberta. Rediscovered the species on the Manyberries site and identified, from slides, A. micrantha from the Lost River site in the mid-1970's.

4. John H. Hudson, 323 Maple St., Saskatoon, SK S7J 0A6
- author of "Plant finds in Saskatchewan, 1980 and 1981", Blue Jay 40(3):136-138 in which he details his discovery of Saskatchewan specimens of A. micrantha on the South Saskatchewan River.

5. Bonnie Smith, 459-30th Avenue N.W., Calgary, AB T2M 2N5. Phone: (403) 276-9197.
- principal author of COSEWIC report on Abronia micrantha.

6. Cliff Wallis, Cottonwood Consultants Ltd., 615 Deer Croft Way SE, Calgary, AB T2J 5V4. Phone: (403) 271-1408.
- has conducted detailed initial population surveys of the sand dune areas of southeastern Alberta with Cleve Wershler. Also, prepared management status recommendation reports on Abronia micrantha. Located additional sites at Purple Springs, Lower Bow, and Wolf Island in Alberta and rediscovered the Lost River populations of A. micrantha in Alberta.

7. Cleve Wershler
- has conducted detailed initial population surveys of the sand dune areas of southeastern Alberta with Cliff Wallis. Located additional sites at Purple Springs, Lower Bow, and Wolf Island in Alberta and rediscovered the Lost River populations of A. micrantha in Alberta.

18. Summary of Materials On File

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IV. Authorship

19. Initial Authorship of Status Report

The initial authors of this report were:

Bonnie Smith, 459-30th Avenue N.W., Calgary, AB T2M 2N5. Phone: (403) 276-9197.

Cheryl Bradley, 158 Westover Dr., Calgary, AB T3C 2S6. Phone: (403) 246-912721.

20. Maintenance of Status Report

Bonnie Smith, 459-30th Avenue N.W., Calgary, AB T2M 2N5, phone (403) 276-9197, will be responsible for receiving new information and making revisions and corrections to this status report and passing information on to COSEWIC.

Figure 1. Abronia micrantha Torrey

(Drawing by Hope Johnson, Blue Jay 33(1):13-15. 1975)

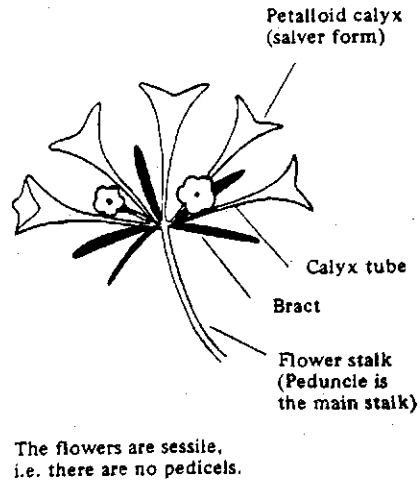
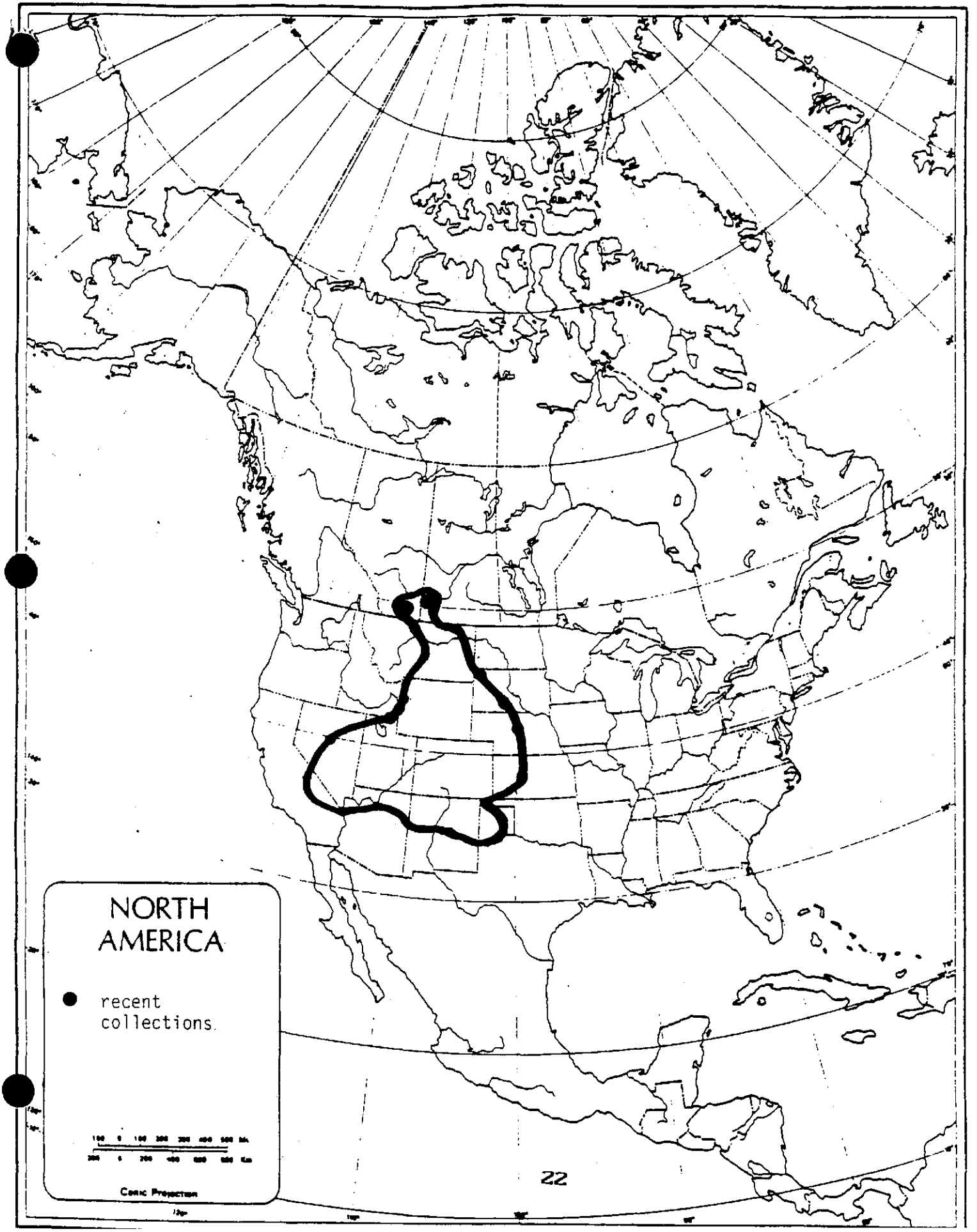


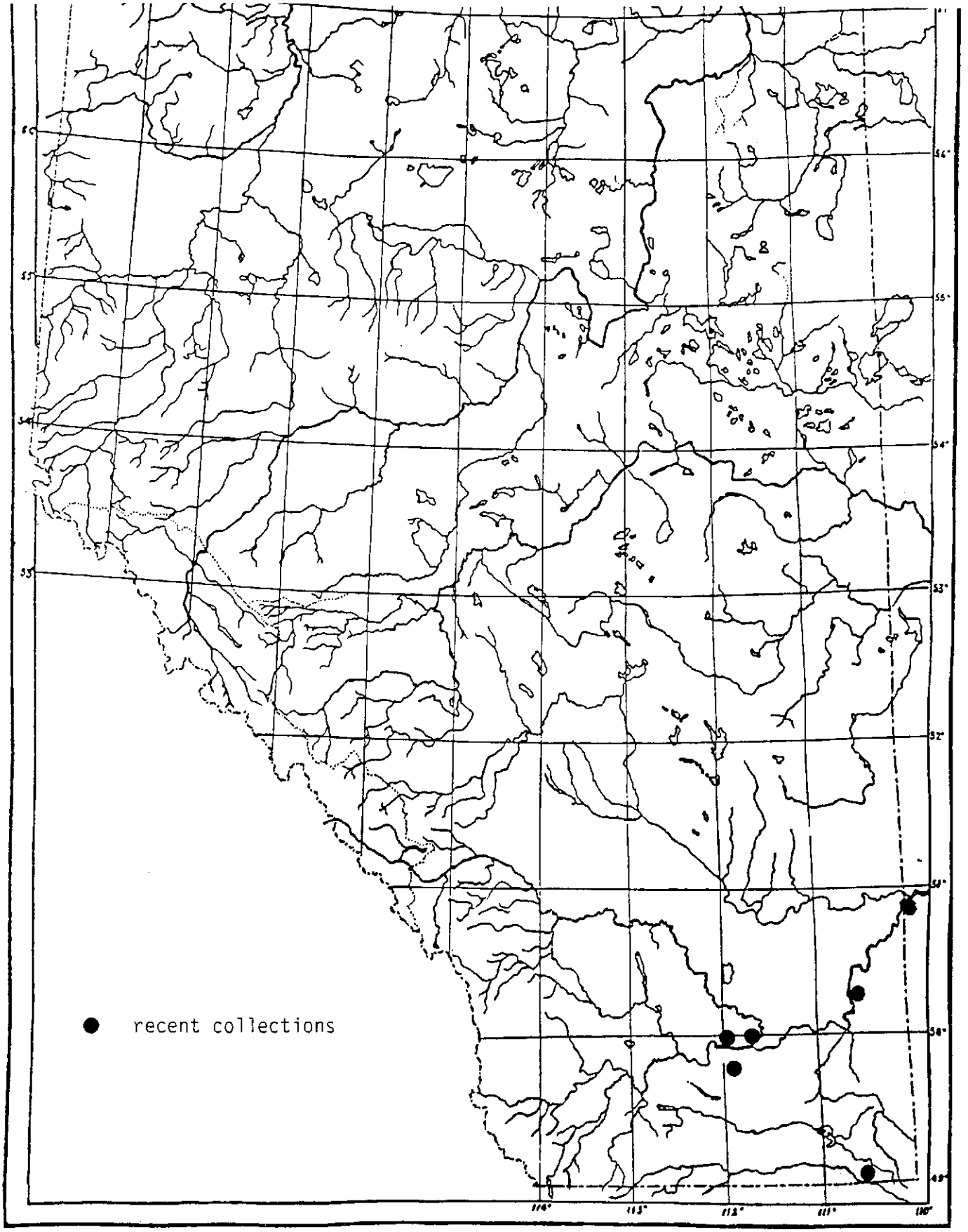
Figure 2. Abronia micrantha Torrey enlarged flower.

(Drawing by B.M. Hallworth, Blue Jay 33(1):13-15. 1975)

Map 1. Distribution of Abronia micrantha Torr.

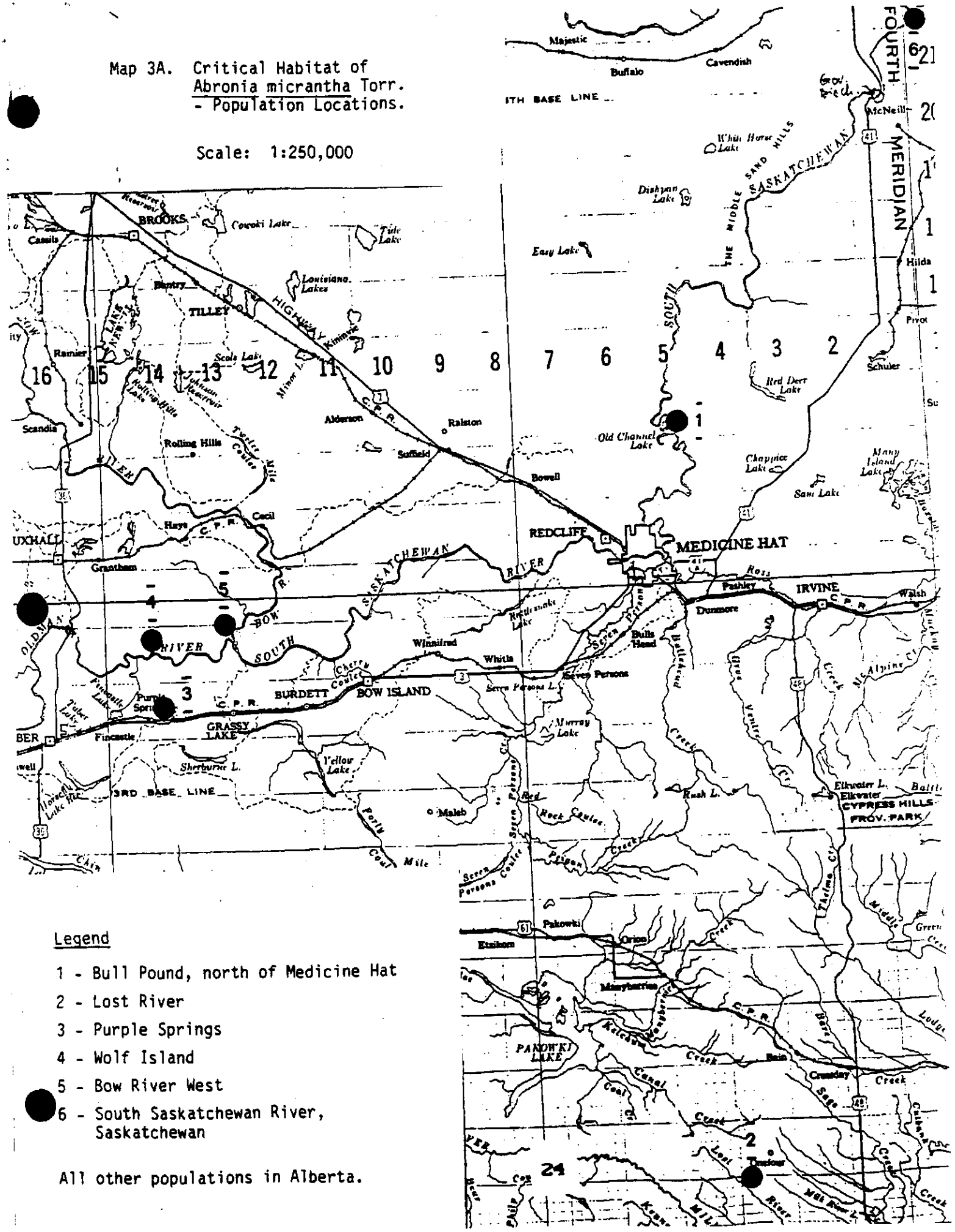


Map 2. Distribution of Abronia micrantha Torr. in Alberta and Saskatchewan.



Map 3A. Critical Habitat of
Abronia micrantha Torr.
- Population Locations.

Scale: 1:250,000



Legend

1 - Bull Pound, north of Medicine Hat

2 - Lost River

3 - Purple Springs

4 - Wolf Island

5 - Bow River West

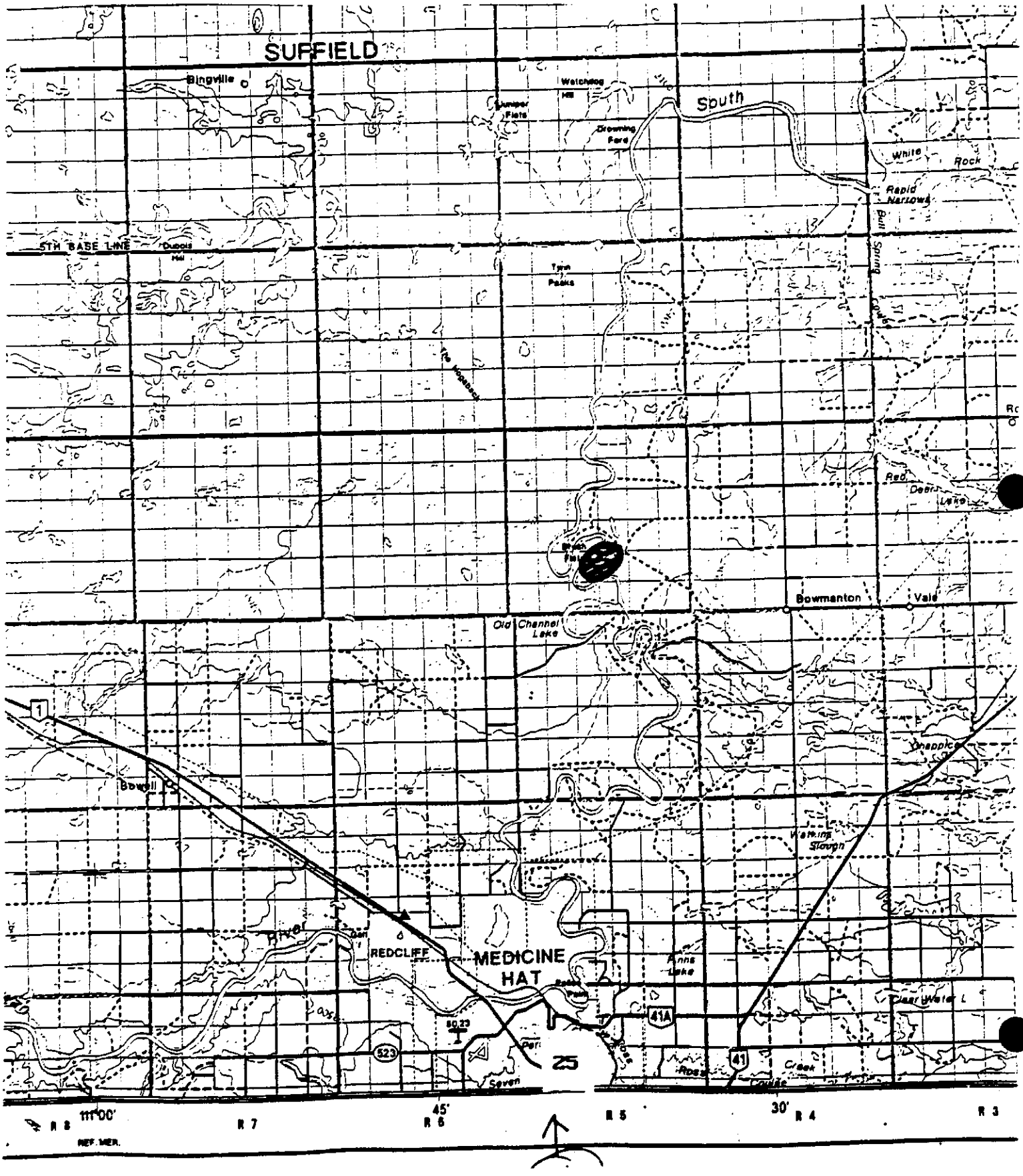
6 - South Saskatchewan River, Saskatchewan

All other populations in Alberta.

Map 3B. Critical Habitat of Abronia micrantha Torr.

Population north of Medicine Hat, Alberta.

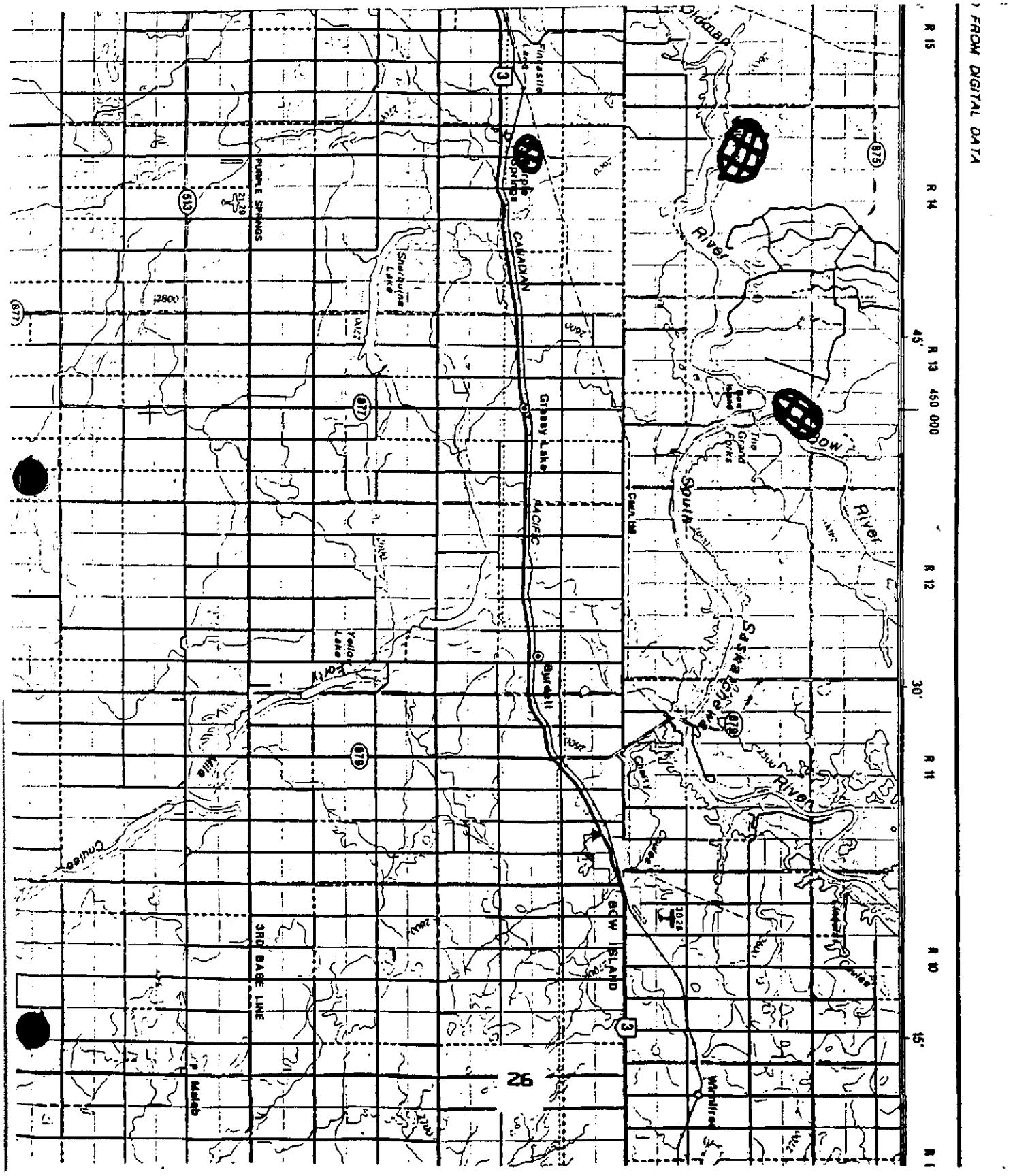
Scale: 1:50,000



Map 3C. Critical Habitat of Abronia micrantha Torr.

Populations west of Bow Island, Alberta.

Scale: 1:50,000



Map 3D. Critical Habitat of Abronia micrantha Torr.

Population southwest of Manyberries, Alberta.

Scale: 1:50,000