

DISTRIBUTION OF PRAIRIE PASQUEFLOWER IN SASKATCHEWAN

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Introduction

Identifying and mapping new locations of sensitive species is an essential component of the biodiversity conservation process. Recently, we have developed a new approach for mapping distribution of vascular plant species in Saskatchewan, which contributes to biodiversity assessment at different spatial and temporal scales (Kricsfalusy et al. 2015).¹ The suggested approach demonstrates on the model species — prairie

pasqueflower (*Pulsatilla nuttalliana* (de Candolle) Berchtold ex J. Presl, syn. *Anemone patens* L. subsp. *multifida* (Pritzel) Hultén) — how to combine traditional research records (herbarium collections and field surveys) and citizen science (phenological observations) with modern technologies (GIS, GPS, and online databases) to map plant species distribution and analyze their habitats affinities¹.

Precise data about distribution of prairie pasqueflower, which were lacking for many areas in Saskatchewan, was a vital part of the above-mentioned approach. Due to the size limit for a journal article, we were not able to publish detail distribution data, i.e. list of locations of prairie pasqueflower

in Saskatchewan, in our previous paper.¹ Therefore, in this paper we aim to fill the information gap on distribution of prairie pasqueflower by providing existing but previously unpublished data (herbarium records, phenological observations and field occurrences). Overall, these baseline data can be used to establish effective population monitoring which will provide conservationists with important insights into how prairie pasqueflower may respond to the increasing anthropogenic impact.

Methods

Distribution records of prairie pasqueflower (Figure 1) were obtained from 1) herbarium specimens collected in the period from 1920 to 2000, 2) phenological observations reported by citizen scientists (2001–2010), and 3) our field surveys (2011–2013, with some locations registered in 2014–2018). For detailed description of the methods used for collecting data and quality assurance processes, analyzing and mapping distribution of prairie pasqueflower, please see our previous paper.¹ Below we provide only key methodological points.

The primary sources of herbarium data were specimens of prairie pasqueflower from the collections in the W.P. Fraser Herbarium at the University of Saskatchewan (SASK)² and the G.F. Ledingham Herbarium at the University of Regina (USAS).³ Based on those data, 168 locations were selected for distribution analysis. In addition, 9 records were compiled from specimens obtained from three other Canadian herbaria.¹ Phenological



FIGURE 1. Prairie pasqueflower in full bloom in Northeast Swale, Saskatoon. Photo credit: V. Kricsfalusy

observations on prairie pasqueflower recorded by citizen scientists are available in the SK PlantWatch⁴ database from which through quality assurance processes 23 observation records were used in our study. The georeferenced species locations collected during our field surveys generated the largest source of data. A total of 248 point occurrences of prairie pasqueflower were selected from these georeferenced data for distribution analysis.

Maps depicting the distribution of prairie pasqueflower were prepared using the GIS program ArcMap 10.5. To develop the species distribution map we used a new approach for mapping flora of Saskatchewan.¹ The grid template was divided into mapping cells of 50 km x 50 km. For mapping prairie pasqueflower in Saskatoon we used an approach previously applied in Toronto, Ontario.⁵ In this case, the grid template was divided into mapping cells of 2 km x 2 km.

Results and Discussion

Analysis of the distribution of prairie pasqueflower in Saskatchewan allowed us to identify spatial patterns of species range.¹ The most important of them is the gradual decrease in the number of species locations within the province as we move from south to north and from west to east. The center of the prairie pasqueflower latitudinal range in Saskatchewan was found to roughly overlap with the northern and southern boundaries of the Prairie ecozone (Figure 2). Lists of the 448 locations of prairie pasqueflower – herbarium records (168), phenological observations (23), and author’s field surveys (248) – which were not published in our previous paper¹ are presented in Tables 1-3.

In addition to these findings, collected information allows us to

shed light on some temporal and spatial patterns of the distribution of prairie pasqueflower which wasn’t elaborated in our previous paper.¹ Below we describe historical collections of prairie pasqueflower in Saskatchewan (temporal patterns at regional scale) and features of species distribution in Saskatoon (spatial patterns at local scale).

Historical collections in Saskatchewan

It turns out that specimens of prairie pasqueflower deposited in the W.P. Fraser Herbarium at the University of Saskatchewan (SASK) provide a unique opportunity not only for the species distribution analysis but also to look at history of botanical explorations in the

province. According to our analysis, a total of 75 collectors deposited 137 specimens of the prairie pasqueflower in the SASK herbarium from 1920 to 2000 (Figure 3). Given the amount and character of the available information, we divided these distribution data into 9 decades and after that grouped them into three periods.

The first period, from 1920 to 1950, is characterized by scarcity of information. The distribution data for the initial two decades (1920–1940) include only 14 specimens of prairie pasqueflower deposited by 10 collectors. This could be largely due to the small number of collectors, concentration of their activity in more approachable areas of the province

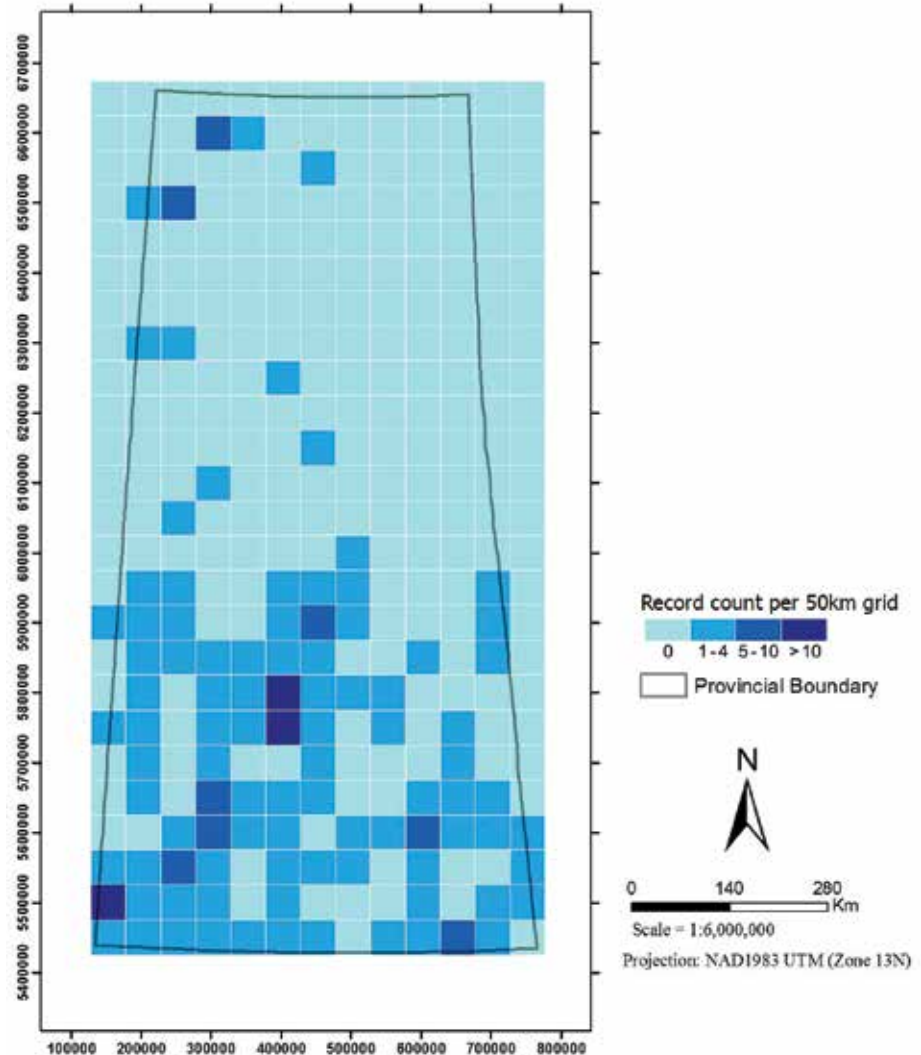


FIGURE 2. A distribution map of prairie pasqueflower in Saskatchewan (from Kricsfalusy et al. 20151).

TABLE 1. List of herbarium specimens (n=168) of prairie pasqueflower collected in Saskatchewan (SASK and USAS, 1920–2000).

A. LIST OF REPRESENTATIVE SPECIMENS (N=134) IN THE W.P. FRASER HERBARIUM AT THE UNIVERSITY OF SASKATCHEWAN (SASK)

Moose Mountain Creek Valley, 31 May 1987, *V.L. Harms* (SASK 92761); Saskatoon, Sutherland Beach, 31 May 1997, *B. Wlad* (SASK 145197); SW end of Cluff Lake, 15 June 1977, *V.L. Harms* (SASK 65678); Uranium City area, 2 km W of Uranium City mine operations, 23 August 1981, *V.L. Harms* (SASK 75399); E of Stewart Valley, near Swift Current, 18 April 1969, *J. Looman* (SASK 107921); W of Saskatchewan Landing, 18 April 1969, *J. Looman* (SASK 107922); Wiseton, 22 mi S, L.S.D 4 in S32 T23 R12 W3, 27 May 1978, *J.H. Hudson* (SASK 68070); Gravelbourg, Wood River area, NE 24 T12 R5 W3, 18 June 1981, *A. Schewe* (SASK 73380); Skinner Marsh, SW S23 T19 R12 W3, 8 May 1975, *V.J. Leiffers* (SASK 122444); Cochin, 17 July 1963, *J. Looman* (SASK 107915); S of Rush Lake, Swift Current, 24 May 1963, *J. Looman* (SASK 107914); mi 51, Hwy 155, 11 mi. S of Beauval Forks, Beaver River Valley, 12 July 1972, *V.L. Harms* (SASK 46450); Stony Rapids, 12 August 1960, *J.S. Maini* (SASK 11329); 8 mi. NW of Duck Lake, 20 May 1955, *L.W. Gellata* (SASK 11380); Saskatoon, ?, *O. C. Furniss* (SASK 144311); Cypress Hills, 10 June 1953, *K.F. Best* (SASK 121042); Rock Glen, 4 July 1963, *J. Looman* (SASK 107916); NE end of Cluff Lake, above AMOK exploration site, 13 July 1977, *V.L. Harms* (SASK 65301); Waterhen River Crossing, near Meadow Lake, 17 May 1966, *J. Looman* (SASK 107917); 8 mi. E of Saskatoon, 27 September 1954, *G.W. Selleck & R.T. Coupland* (SASK 11378); Masfield PFRA Community Pasture, 22 April 1969, *J. Looman* (SASK 107920); Saskatoon, 30 May 1933, *W.P. Fraser* (SASK 11375); SE end of Cluff Lake, 12 June 1972, *V.L. Harms* (SASK ?); Katepwa Lake, 6 May 1953, *R.C. Russell* (SASK 82909); Saskatoon, Sutherland, 20 April 1958, *D. Riley* (SASK 82910); Saskatoon, 11 May 1927, *H. Cameron* (SASK 11392); Swift Current, 5 May 1936, *J.L. Bolton* (SASK 108010); Midale, ? May 1940, *G.C. ?* (SASK 43719); Cadillac R. A., Sec8 T7 R13 W3, 28 April 1947, *A.C. Budd* (SASK 108017); Cypress Hills, 16 August 1944, *A.C. Budd* (SASK 108014); Besnard Lake, ca 1–2 km N of Narrows Channel Crossing, 33 km off Besnard Lake Road, 25 June 1992, *V.L. Harms* (SASK 132861); Besnard Lake, T73 R1 W3, 23 June 1992, *V.L. Harms* (SASK 132860); Swift Current, 5 May 1937, *J.L. Bolton* (SASK 11386); Saskatoon, 15 May 1938, *W.P. Fraser* (SASK 11333); Cranberry Flats recreation site, 3.5 mi (5.5 km) S of Saskatoon. Along E shore of South Saskatchewan River, LSD 2,5,6,7 & 8 Sec30 T35 R6 W3, 18 June 1992, *M. Lineman* (SASK 163234); Saskatoon, E shore of South Saskatchewan River, NW of Sutherland subdivision, behind Regional Psychiatric Centre, LSD 7 Sec10 T37 R5 W3, 8 July 1993, *M. Lineman* (SASK 169299); Saskatoon, Silverwood, Sec14 T37 R5 W3, 11 August 1994, *M. Lineman* (SASK 163788); Saskatoon, Silverwood, Sec14 T37 R5 W3, 25 May 1994, *M. Lineman* (SASK 163598); Moose Mountain Creek Valley, 12 August 1987, *V.L. Harms* (SASK 129402); Cypress Hills, 13 May 1952, *K.F. Best & J. White* (SASK 121041); Swift Current, Alexander farm, NE S20 T15 R13 W3, 12 May 1952, *A.C. Best & K.F. Best* (SASK 121040); Saskatoon, 29 May 1933, *R.J. Ledingham* (SASK 82907); Saskatoon, 6 September 1933, *R.C. Russell & R.J. Ledingham* (SASK 82906); Bonefield, NE shore of Lake Athabasca, 19 May 1973, *L. & L. Muller-Wille* (SASK 54469); Saskatoon, 11 May 1949, *G.E. Fraser* (SASK 11379); Lizard Lake, 21 May 1961, *R.C. Russell* (SASK 82903); Saskatoon, 14 April 1938, ? (SASK 11394); Cypress Hills Provincial Park, 7 June 1953, *S. Zilke* (SASK 11385); Prince Albert, 3 May 1940, *O.C. Furniss* (SASK 144238); Rolling prairie, NE of Saskatoon, 13 May 1960, *C. Robert* (SASK 26420); Saskatoon, 27 April 1923, ? *Gios* (SASK 82904); Saskatoon, 3 June 1927, *B.G.S.* (SASK 82905); Chipewyan, 20 May 1981, *R. Marles* (SASK 78520); NE shore of Cluff Lake, 7 June 1993, *J. Ternier* (SASK 169784); 7 mi. N of Birmingham, 10 May 1992, *W. Schatz* (SASK 134977); N shore of Brightsand Lake, ca 22 km E of St. Walburg, S1/2 Sec10 T54 R20 W3, 11 July 1999, *V.L. Harms* (SASK 147229); 4 mi. E of Carlyle, NW 1/4 Sec2 T8 R2 W2, ? 1998, *D. Silcox* (SASK 145264); SE of Tompkins, near Swift Current, 21 April 1969, *J. Looman* (SASK 107899); Souris River Valley, Estevan area, ca 1.5 km S just N of Woodland Regional Park, SW1/4 Sec14 T2 R8 W2, 26 May 1986, *V.L. Harms, D.F. Hooper & L. Baker* (SASK 129857); W of Fort Pitt, 15 May 1973, *J. Looman* (SASK 107873); Frenchman River badlands, 27 May 1969, *J. Looman* (SASK 107905); Pinto Butte, 4 May 1970, *J. Looman* (SASK 107878); 8 mi. E of Swift Current, 18 April 1969, *J. Looman* (SASK 107903); Hansen Lake Road, Narrow Hills Provincial Park, Lower Fishing Lake, 24 June 1964, *G.W. Argus* (SASK 25500); Tompkins, 13 June 1985, *J. M. Perron* (SASK 120007); Uranium City area, Lodge Bay, 8 km E of Lorado area, ca 30.5 km S, 23 August 1981, *V.L. Harms* (SASK 75348); Souris River Valley, Elcott, ca 2 mi. N in local campgrounds area, NW 1/4 Sec25 T1 R3 W2, 28 May 1986, *V.L. Harms* (SASK 129366); Saskatoon, Silverspring Prairie, NW Sec12 T37 R5 W3, 10 July 1990, *V.L. Harms* (SASK 132309); Souris River Valley, N of Roche Percee, NE 1/4 Sec36 T1 R6 W2, 26 June 1986, *V.L. Harms* (SASK 129364); Moose Jaw, Thunder Creek, 19 May 1985, *B. Cooper* (SASK 94775); Wellington P.F.R.A. Community Pasture, near Tyvan, 9 May 1985, *B. Kishchuk* (SASK 90451); 52 km E of Saskatoon along Hgw 5, NW 1/4 Sec33 T36 R28 W2, 22 June 1986, *J. Neufeld* (SASK 140505); N of Saskatoon, Northern Chemical Terraces on NW shore of South Saskatchewan River, NW 1/4 LSD 2 Sec26 T37 R5 W3, 31 May 1993, *M. Lineman* (SASK 169686); ca. 1.5 mi. SE of Dundurn, Sec35 T 32 R4 W3, 16 April 1992, *J. Neudorf* (SASK 134748); Western half of Fort-a-la-Corne area, near confluence of North and South Saskatchewan River, Sec13 T49 R22 W2, 10 July 1980, *B. Godwin & L. Baschak* (SASK 134396); Elbow, LLD NW S13 T 25 R5 W3, 21 May 1992, *B. Wait* (SASK 136141); The Pines, NE S34 T48 R21 W2, 25 May 1995, *B. Wait* (SASK 136140); Besnard Lake, T73 R1 W3, 17 May 1995, *M.M. Hart* (SASK 137584); 9 mi. W of Birsay and 1.75 mi. N, NW 1/4 Sec9 T52 R9 W3, 30 May 1996, *B. Robson* (SASK 137980); Prince Albert National Park, SW 1/4 Sec5 T57 R1 W3, 29 June 1996, *V.L. Harms* (SASK 139720); Sandy Prairie N of Strawberry Lake, 12 mi. S of Indian Head, 13 May 1965, *G.J. Jones, L. Roney & G. Allen* (SASK 32295); Saskatchewan Landing, Swift Current, 13 May 1969, *J. Looman* (SASK 107906); Uranium City area, S side of Hanson Bay at SW end of Beaverlodge Lake, ca 1.5 km S, SW of Lorado Wharf, 22 August 1981, *V.L. Harms* (SASK 75347); N side of Lake Athabasca near Uranium City, ca 1.5 km S, 5 July 1979, *V.L. Harms* (SASK 70252); Prominent dolomite outcrop ridges of carswell formations, about 8 km W of Cluff Lake, 18 July 1977, *V.L. Harms* (SASK 65337); Souris River Valley, ca 5 mi. SE of Estevan, NE 1/4 Sec34 T1 R7 W2, 24 July 1987, *V.L. & R.M. Harms* (SASK 129648); Souris River, ca 1/4 mi. N of Roche Percee campground, NE 1/4 Sec33 T1 R6 W2, 20 May 1988, *V.L. Harms* (SASK 129867); 5 km NW of Bredenbury along Yellowhead Hwy, 18 May 1982, *P. Burton* (SASK 134031); N of Lumsden, 4 May 1985, *A.M. Tuchscherer* (SASK 79537); S of Maidstone, 14 May 1973, *J. Looman* (SASK 107890); Carruthers, 3 May 1973, *J. Looman* (SASK 107872); 0.5 km S of Saskatoon, on Clarence Avenue at junction with freeway, 20 May 1986, *P.A. Ryan* (SASK 898594); Cranberry Flats, 12 May 1985, *W. Chypkowski* (SASK 81435); Otosquen, mi. 27, N of Melfort, 14 May 1970, *J. Looman* (SASK 107887); Moose Jaw–Watrous quad, 28 April 1969, *N.A. Skoglund* (SASK 41756); Duff, near Yorkton, 13 May 1970, *J. Looman* (SASK 107896); N of Whitewood, Qu'Appelle River, 15 May

1963, *J. Looman* (SASK 107912); E of Matador, 22 May 1969, *J. Looman* (SASK 107904); Monet C.P., Elrose, 21 May 1963, *J. Looman* (SASK 107913); 0.25 mi. N of Mozart, SW of Wadena, 15 km E of Wynyard, T32 R15 W2, 2 May 1982, *S. Weldon* (SASK 134120); S of Tompkins, 23 April 1969, *J. Looman* (SASK 107902); N of Webb, 17 April 1969, *J. Looman* (SASK 107901); 4 mi. N of Cando, 10 May 1971, *J. Looman* (SASK 107987); W of Muddy Lake, 14 May 1973, *J. Looman* (SASK 107898); Rolling prairie NE of Saskatoon, Sec12 T37 R4 W3, 19 April 1960, *R. Connel* (SASK 26421); 3 mi. SE of Coderre, 28 May 1986, *D.G. Huel* (SASK 81286); Clearwater River, near Methy portage, in an open S sloping area with a thin Jack pine canopy, 13 June 1979, *R. A. Wright* (SASK 72376); Beaver Creek, ca 9 mi. S of Saskatoon, 4 June 1978, *A. Doug* (SASK 70969); The Pinehouse, Key Lake Road, ca 23 km E of Orphan Lake, on Haultian River, 24 August 1979, *B. Godwin* & *Z. Abouguendia* (SASK 72011); N side of Lake Athabasca, Langley Bay, ca 2.5 km. N of Gunnar towards S end of Crackingstone Peninsula, 8 August 1981, *V.L. Harms & P.L. Sky* (SASK 75346); Watrous, 20 May 1938, *J. Campbell* (SASK 108012); Saskatoon, 30 May 1936, *W.P. Frazer* (SASK 108011); Cranberry Flats, 12 May 1985, *E. Yaworski* (SASK 81504); Saskatoon, 2 June 1920, *W.P. Fraser* (SASK ?); Cadillac R.A., Sec8 T7 R13 W3, 2 May 1946, *A. C. Budd* (SASK 108015); Souris River Valley, just N of Roche Percee campground, 3.5 km east and 1.5 km N of Roche Percee, NE 1/4 Sec33 T1 R6 W2, 26 May 1986, *V.L. Harms, D.F. Hooper & L. Baker* (SASK 129365); 7 km W of Truax, 29 May 1975, *J. Looman* (SASK 107874); Along Hwy 5, 2.5 mi. E of Quill Lake, 3 June 1959, *C.H. Hood* (SASK 11393); 12 mi. S of Saskatoon, 17 May 1961, *R. Newsome & G. Hulett* (SASK 11387); Moose Jaw – Watrous quad, T20 R13 W3, 16 July 1969, *N.A. Skoglund* (SASK 41929); Upper Rousay Lake, 28 May 1973, *A. Schmidt* (SASK 123367); Near Court, Kindersely, 12 May 1973, *J. Looman* (SASK 107875); N of Murraydale, 3 June 1970, *J. Looman* (SASK 107888); Hearts Hill Community Pasture, 11 May 1972, *J. Looman* (SASK 107889); S of Wiseton, 8 May 1970, *J. Looman* (SASK 107882); 5 km NW of Verlo, S11 R16 T20 W3, 7 May 1970, *J. Looman* (SASK 107883); N of Rosetown, Eagle Creek, 8 May 1970, *J. Looman* (SASK 107884); Near Lady Lake, 15 May 1970, *J. Looman* (SASK 107885); E of Glidden, 27 May 1970, *J. Looman* (SASK 107886); S of Dellard, Frenchman River, 15 May 1970, *J. Looman* (SASK 107879); East of Mawer, 6 May 1970, *J. Looman* (SASK 107880); SE of Roadene, S22 R17 T20 W3, 7 May 1970, *J. Looman* (SASK 107881); Wooded draws of Matador Research Station, NW 1/4 Sec14 T20 R13 W3, 18 June 1991, *D. Lawrence* (SASK 133834); Wooded draws of Matador Research Station, NW 1/4 Sec14 T20 R13 W4, 3 June 1992, *D. Lawrence* (SASK 133772); Lily Plains natural prairie, ca 1 mi. W of Lily Plains (ca 13–14 km W of Prince Albert), ca 1.5 mi. S of North Saskatchewan River, NE 1/4 Sec29 T48 R1 W3, 7 July 1994, *V.L. & R.M. Harms* (SASK 133681); Coteau region, SE1/4 Sec35 T23 R12 W3, about 8 mi. N & 8.5 mi. W of Beechy & 19 mi. W and 1 mi. N of Lucky Lake, 9 June 1996, *R. Salmon & B. Corinne* (SASK 141943); E of Carlyle, NW 1/4 Sec2 T8 R2 W2, ? May 1995, *D. Silcox* (SASK 142755); Biggar, 9 July 1996, *V. Leuschen* (SASK 140382); E of Ridhe Road at Armit River, 5 km S and 5.5 km E of Armit (1–1.5 km W of Manitoba border, SW 1/4 Sec13 T44 R29 W2, 28 June 1983, *V.L. Harms, D.F. Hooper & L. Baker* (SASK 140906); Saskatoon, Silverspring prairie, WC to NW Sec12 T 37 R5 W3, 21 April 1991, *V.L. Harms* (SASK 140756); Close to S Shore of Candle Lake, 8 July 1962, *J.M.A. Swan* (SASK 32595); The Pinehouse - Key Lake Road, ca 23 km E of Orphan Lake, on Haultian River, 28 July 1979, *B. Godwin & Z. Abouguendia* (SASK 68262); The Biddulph Half Section Research Area, ca 21 km S of Saskatoon along Road 219, just N of White Cap Indian Reserve, SE 1/4 LSD 1 Sec12 T34 R6 W3, 3 June 1986, *B. Pylypec* (SASK 97862); The Biddulph Half Section Research Area, ca 21 km S of Saskatoon along Road 219, just N of White Cap Indian Reserve, SE 1/4 LSD 1 Sec12 T34 R6 W, 7 May 1987, *B. Pylypec* (SASK 97953); The Kernen Prairie, ca 2.5 km E of Sutherland subdivision, E Saskatoon, SE 1/4 of Sec16 T37 R4 W3, 17 May 1985, *B. Pylypec* (SASK 97074); The Pinehouse, ca 23 km E of Orphan Lake, on Haultain River, 24 August 1979, *B. Godwin & Z. Abouguendia* (SASK 68282); Near NE end of Cluff Lake, AMOK exploration camp, 19 July 1977, *V.L. Harms* (SASK 65303); N of Antelope, 21 July 1969, *J. Looman* (SASK 107900); NE of Coronach, Sec1 T3 R26 W2, 5 July 1980, *Z. Abouguendia* (SASK 92106); North Battleford, 17 May 1985, *P. Grillz* (SASK 81211); N base of Pasquia Hills at S edge of Carrot River Valley, Near Rice River campsite, 4 km E of Rice River Crossing on Hwy 55, Sec34 T52 R3 W2, 18 July 1984, *D.F. Hooper & L. Baker* (SASK 92713); SE of Little Fishing Lake, NW Sec11 T56 R24 W3, 24 July 1977, *J. Haraldson & T. Rock* (SASK 123368).

B. LIST OF REPRESENTATIVE SPECIMENS (N=34) IN THE G.F. LEDINGHAM HERBARIUM AT THE UNIVERSITY OF REGINA (USAS)

White City, 2 miles N and Pilot Butte natural area N of gravel pits, 16 May 1985, *G.F. Ledingham* (USAS 7982); NW 11, 37, 9ws, Asquith study area, 22 May 1970, *G.W. Pepper* (USAS 7929); West Block of Cypress Hills, N of field station, NE S20 T7 R29 W3, 21 May 1984, *G.F. Ledingham* (USAS 7930); Sommet du Coteau Boise au sud de Tompkins, 13 June 1958, *B. Boivin & J.M. Perron* (USAS 7931); Wiseton, 22 miles S, L.S.D. 4 S33 T23 R12 W3, 27 May 1978, *H. Hudson* (USAS 7932); Dundurn, 27 May 1975, *E.W. Sullivan* (USAS 7933); Bethesda Church, 4 miles W, Dummer 9 miles N, Milestone 15 miles W, 28 April 1980, *G.F. Ledingham* (USAS 7934); Belanger Creek, east end of Cypress Lake, N bank, May 09 1957, *G. F. Ledingham* (USAS 7936); Sissor Creek area in Qu' Appelle Valley, 10 miles of Rocanville, 21 May 1966, *G.F. Ledingham* (USAS 7937); Superme, Twp 2, Rg 26, Sec 35, 01 August 1969, *G. F. Ledingham* (USAS 7938); Crooked Lake in Qu'Appelle Valley, 05 May 1975, *G. Anweiler* (USAS 7939); Prince Albert, 24 April 1955, *M.A. Welsh* (USAS 7941); Prince Albert, 02 May 1955, *M.A. Welsh* (USAS 7942); Prince Albert National Park, 23 May 1955, *M.A. Welsh* (USAS 7942); Regina, 3 miles E, 29 April 1949, *B. Rawlinson & G.F. Ledingham* (USAS 7943); Cypress Hills PP, road to Ranger station, 22 May 1960, *D.R. Wade & D.E. Wade*, 22 May 1960 (USAS 7944); Regina, 6 miles NW, Hungry Hollow, *D.R. Wade & D.E. Wade* (USAS 7945); Estevan, SE & Sec7 T2 R7 W2, 09 July 1971, *M.E. Jonescu* (USAS 7946); Estevan, S31 T1 R8 W2, 31 July 1973, *M.E. Jonescu* (USAS 7947); Indian Head, 9 miles S, 19 May 1949, *G.F. Ledingham* (USAS 7949); Cactus Hills, 8 miles SW of Briercrest, 12 miles W of Hearne, NW S19 T13 R25 W2, 28 July 1987, *G.F. Ledingham* (USAS 7950); Missouri Coteau, Dirt Hills, 6 miles SE of Spring Valley, 25 April 1986, *G.F. Ledingham* (USAS 7951); Strawberry Lakes N, 12 miles S of Indian Head, 13 May 1965, *G.J. Jones & L. Roney & G. Allen*, (USAS 7952); Cactus Hills, Dry Lake N, Strawberry Lakes 12 miles S of Indian Head, N 1/2 S22 T16 R13 W2, 24 May 1979, *G.F. Ledingham* (USAS 7953); Missouri Coteau, Dirt Hills, 6 miles S and 5 miles W of Avonlea, SW S11 T12 R24 W2, *G.F. Ledingham* (USAS 7954); Melaval 2 miles N, 22 April 1969, *G. Walker & N. Walker* (USAS 21062); Melaval 2 miles N, 22 April 1969, *G. Walker & N. Walker* (USAS 21063); Grasslands NP, E side of East Block, 7 miles W of Killdeer & NE S7 T2 R4 W3, 14 May 1990, *G.F. Ledingham* (USAS 31911); Val Marie, West Block; 49 N, 107 W, 05 May 1970, *B. de Vries* (USAS34034); Pheasant Creek coulee, Katepwa, Qu'Appelle Valley, E of Fort Qu'Appelle, 14 May 1960, *B. de Vries* (USAS 34035); Fort Qu'Appelle, 02 June 1959, *B. de Vries* (USAS 34036); Swift Current, 12 May 1952, *A.C. Budd* (USAS 34037); Maryfield, N, Pipestone Valley, 07 May 1967, *B. de Vries* (USAS 34038); Osage, 16 miles E, N end of Goosberry Lake, 21 May 03, *G.F. Ledingham & H. Morrison* (USAS 47122).

and around large towns with research centers (e.g., more than half of all specimens were collected in Saskatoon and its vicinity) and possible economic impact of the Great Depression. During 1941–1950, only two collectors deposited four specimens as this time period coincides with World War II.

The second period, from 1951 to 2000, is characterized by a significant increase in the number of collectors and deposited specimens of prairie pasqueflower. Over the initial decade (1951–1960) of this period number of collectors increased to 13, although adequate change in number of herbarium specimens is not observed (13). The highest number of specimens (36) was deposited in the next decade (1961–1970), most likely due to intensification of agriculture, forestry practices and industrial development in the province which led to an increased interest in floristic surveys. After that, collection efforts plateau for the next decades (1981–2000) with large numbers of collectors (18).

The third period, from 2001 until 2018, is characterized by a sharp decline in both collectors and specimen collections probably due to a decrease in research funding and general interest in botany. There are no specimens of prairie pasqueflower deposited during this period in the SASK herbarium. However, the additional data on distribution of prairie pasqueflower in Saskatchewan were obtained from the phenological observations deposited in the SK PlantWatch database (2001–2010: 23 locations) and our field surveys (2011–2018: 248 locations). In terms of mapped grid cells 50 km x 50 km, these records account for 17 new mapping units (17.3% of total) of prairie pasqueflower in Saskatchewan

(Figure 2). It should be noted that this map represents the record count (herbarium vouchers, phenological observations, and field surveys) and as such is a function of collecting bias. It may not be necessarily representative of true density of prairie pasqueflower in any given area.

Spatial distribution in Saskatoon

To determine how well herbarium and phenological data reflect actual distribution of prairie pasqueflower in the best sampled part of the species

range, i.e. city of Saskatoon and its vicinity, we conducted intense field surveys in this area during a few vegetation seasons. The design of surveys aimed to confirm sites that have already been visited by previous researchers and from which herbarium and literature records are available, as well as to investigate occurrence of prairie pasqueflower in potentially suitable habitats.

We hypothesized that remnant prairie habitats scattered within the urban landscape in Saskatoon may provide suitable niches for prairie

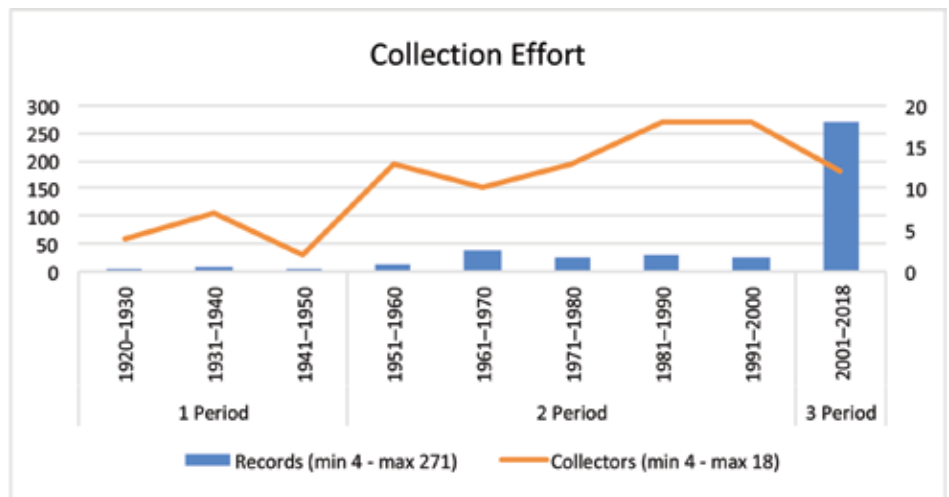


FIGURE 3. Historical collections of prairie pasqueflower in Saskatchewan. Data derived from the SASK herbarium (1920–2000); SK PlantWatch database (2001–2010) and author’s field surveys (2011–2018).

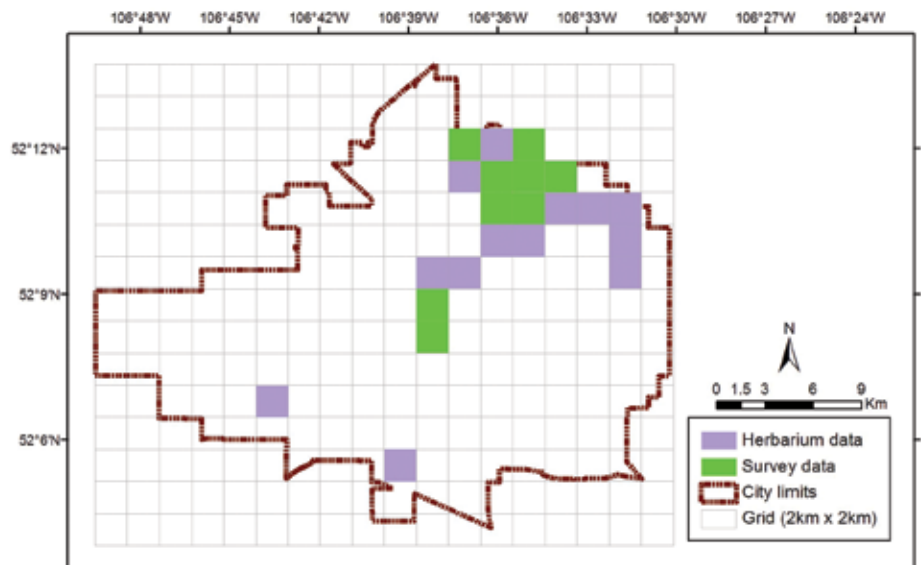


FIGURE 4. A distribution map of prairie pasqueflower in Saskatoon.(from Kricksfalusy et al. 20151). Note: information from primary sources about dates and names of observers is not available in the database.

pasqueflower. Our study identified that the historical data on distribution of prairie pasqueflower in Saskatoon account for 13 grids cells (2 km x 2 km) and our field surveys contributed 9 new mapping units (40.9% of the total) (Figure 4). These results strongly supported our original hypothesis. As it stands now, the number of grid cells for the Saskatoon, occupied by prairie pasqueflower equals 22, which accounts for 13.2% of total for the entire city.

During field surveys, we determined that some locations of prairie pasqueflower are no longer extant in Saskatoon over the last 50 years due to direct habitat destruction. It was found that densely built-up areas affect the survival of this species by reducing the extension of suitable habitat, fragmenting

populations, and increasing edge effects.⁶ A good example of this is one of the study sites in the southern part of Saskatoon, where historical records indicate the presence of prairie pasqueflower. However, no individual plants were found there during our field surveys, due to habitat loss caused by road infrastructure development on the site. This highlights the necessity of preserving large areas of remnant prairies which can support viable populations of native plant species within the urban matrix. It's of particular importance, given that the range of prairie pasqueflower has been contracting in Saskatchewan over the past few decades, especially in the vicinity of major urban centers like Regina and Saskatoon.⁷

TABLE 2. List of phenological observations (n=23) of prairie pasqueflower in Saskatchewan (SK PlantWatch database, 2001–2010).

LOCATION	ID	COORDINATES
Turtle Lake Nature Sanctuary	PW1	N53 36.422 W108 35.160
Tremblay	PW2	N51 35.391 W103 00.599
Township Road 482	PW3	N53 10.998 W109 46.998
South of Hwy 10	PW4	N50 32.046 W104 06.589
Round Lake	PW5	N53 21.131 W105 57.374
North side	PW6	N53 30.955 W105 45.730
Nisbet North	PW7	N53 12.890 W105 44.459
North-east Pinkerton	PW8	N51 49.999 W102 28.998
North-east of Leader	PW9	N50 53.993 W109 32.222
Lookout Point, Cypress Hills	PW10	N49 35.019 W109 29.930
Hjertaas 1	PW11	N49 34.002 W101 42.000
Harvey Zieger 2	PW12	N51 36.000 W109 30.000
Harvey Zieger 1	PW13	N51 55.828 W109 51.412
Gardener Rd. W	PW14	N53 12.433 W105 34.345
Flying Creek	PW15	N50 12.772 W104 54.333
Farmyard	PW16	N51 03.445 W103 06.470
Farmyard	PW17	N50 20.286 W102 52.422
Farmyard	PW18	N50 38.800 W103 49.183
Fairmount	PW19	N51 25.002 W109 18.000
Fahlman Acres	PW20	N53 12.276 W105 52.889
Daisy Meyers 1	PW21	N50 58.516 W109 59.230
Crocus Mountain	PW22	N53 15.990 W109 59.230
Ray's Lake	PW23	N53 32.685 W109 25.731

Conclusions

The obtained results indicate that herbarium collections and phenological observations can be used as baseline data for mapping prairie pasqueflower. However, to obtain more detailed distribution data, specially designed target field surveys or predictive distribution modelling are required. High accuracy species distribution maps could be a powerful tool for population monitoring and effective conservation management.

Acknowledgements

List of people involved in gathering information from herbarium collections, phenology database and assisting with the field surveys, as well as numerous organizations supported this study was provided in our previous publication.¹

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TABLE 3. List of occurrences (n=248) of prairie pasqueflower in Saskatchewan (author's field surveys, 2011–2018).

LOCATION	ID	AUTHOR	DATE	COORDINATES	LOCATION	ID	AUTHOR
Beaver Creek CA	BC1	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.814 W106 43.239	Saskatoon, Northeast Swale	NS8	V. Kricsfalusy,
Beaver Creek CA	BC2	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.742 W106 43.094	Saskatoon, Northeast Swale	NS9	V. Kricsfalusy,
Beaver Creek CA	BC3	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.715 W106 42.672	Saskatoon, Northeast Swale	NS10	V. Kricsfalusy,
Beaver Creek CA	BC4	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.780 W106 42.693	Saskatoon, Northeast Swale	NS12	V. Kricsfalusy,
Beaver Creek CA	BC5	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.747 W106 42.738	Saskatoon, Northeast Swale	NS13	V. Kricsfalusy,
Beaver Creek CA	BC6	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.963 W106 42.838	Saskatoon, Northeast Swale	NS14	V. Kricsfalusy,
Beaver Creek CA	BC7	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.847 W106 42.406	Saskatoon, Northeast Swale	NS15	V. Kricsfalusy,
Beaver Creek CA	BC8	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.806 W106 43.230	Saskatoon, Northeast Swale	NS16	V. Kricsfalusy,
Beaver Creek CA	BC9	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N51 58.807 W106 42.639	Saskatoon, Northeast Swale	NS17	V. Kricsfalusy,
Borden	BO1	V. Kricsfalusy, R. Liu	09-May-18	N52 05.022 W107 10.614	Saskatoon, Northeast Swale	NS18	V. Kricsfalusy,
Chief Whitecap Park	CWP1	V. Kricsfalusy, Y. Ponomarenko	19-May-11	N52 03.508 W106 43.308	Saskatoon, Northeast Swale	NS19	V. Kricsfalusy,
Cranberry Flats CA	CF1	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 01.974 W106 41.824	Saskatoon, Northeast Swale	NS20	V. Kricsfalusy,
Cranberry Flats CA	CF2	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 01.997 W106 41.877	Saskatoon, Northeast Swale	NS21	V. Kricsfalusy,
Cranberry Flats CA	CF3	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 02.005 W106 42.316	Saskatoon, Northeast Swale	NS22	V. Kricsfalusy,
Cranberry Flats CA	CF4	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 02.024 W106 42.372	Saskatoon, Northeast Swale	NS23	V. Kricsfalusy,
Cranberry Flats CA	CF5	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 02.078 W106 42.392	Saskatoon, Northeast Swale	NS24	V. Kricsfalusy,
Cranberry Flats CA	CF6	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 02.060 W106 42.433	Saskatoon, Northeast Swale	NS25	V. Kricsfalusy,
Cranberry Flats CA	CF7	V. Kricsfalusy, Y. Ponomarenko	09-May-11	N52 02.001 W106 42.450	Saskatoon, Northeast Swale	NS26	V. Kricsfalusy,
Cranberry Flats CA	CF8	V. Kricsfalusy, Y. Ponomarenko	19-May-11	N52 01.857 W106 41.735	Saskatoon, Northeast Swale	NS27	V. Kricsfalusy,
Cranberry Flats CA	CF9	V. Kricsfalusy, Y. Ponomarenko	29-Jun-11	N52 01.935 W106 42.352	Saskatoon, Northeast Swale	NS28	V. Kricsfalusy,
Cranberry Flats CA	CF10	V. Kricsfalusy, Y. Ponomarenko	29-Jun-11	N52 01.930 W106 42.375	Saskatoon, Northeast Swale	NS29	V. Kricsfalusy,
Cranberry Flats CA	CF11	V. Kricsfalusy, Y. Ponomarenko	29-Jun-11	N52 02.006 W106 42.389	Saskatoon, Northeast Swale	NS30	V. Kricsfalusy,
Cypress Hills IP	CH1	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 37.200 W109 56.400	Saskatoon, Northeast Swale	NS31	V. Kricsfalusy,
Cypress Hills IP	CH2	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 37.800 W109 56.400	Saskatoon, Northeast Swale	NS32	V. Kricsfalusy,
Cypress Hills IP	CH4	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 37.800 W109 55.800	Saskatoon, Northeast Swale	NS33	V. Kricsfalusy,
Cypress Hills IP	CH5	V. Kricsfalusy, Y. Ponomarenko	28-Jun-12	N49 39.000 W109 51.000	Saskatoon, Northeast Swale	NS34	V. Kricsfalusy,
Cypress Hills IP	CH6	V. Kricsfalusy, Y. Ponomarenko	29-Jun-12	N49 38.400 W109 31.200	Saskatoon, Northeast Swale	NS35	V. Kricsfalusy,
Cypress Hills IP	CH7	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 39.000 W109 31.200	Saskatoon, Northeast Swale	NS36	V. Kricsfalusy,
Cypress Hills IP	CH8	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 38.999 W109 31.188	Saskatoon, Northeast Swale	NS37	V. Kricsfalusy,
Cypress Hills IP	CH9	V. Kricsfalusy, Y. Ponomarenko	27-Jun-12	N49 40.800 W109 33.000	Saskatoon, Northeast Swale	NS38	V. Kricsfalusy,
Prince Albert NP	PA1	V. Kricsfalusy, Y. Ponomarenko	15-Jun-12	N53 52.024 W106 08.469	Saskatoon, Northeast Swale	NS39	V. Kricsfalusy,
Prince Albert NP	PA2	V. Kricsfalusy, Y. Ponomarenko	15-Jun-12	N53 13.416 W105 45.629	Saskatoon, Northeast Swale	NS40	V. Kricsfalusy,
Prince Albert NP	PA3	V. Kricsfalusy, Y. Ponomarenko	15-Jun-12	N53 36.135 W106 31.151	Saskatoon, Northeast Swale	NS41	V. Kricsfalusy,
Redberry Lake BR	RBL1	V. Kricsfalusy, Y. Ponomarenko	23-Jun-11	N52 40.203 W107 13.943	Saskatoon, Northeast Swale	NS42	V. Kricsfalusy,
Redberry Lake BR	RBL2	V. Kricsfalusy, Y. Ponomarenko	23-Jun-11	N52 40.218 W107 13.742	Saskatoon, Northeast Swale	NS43	V. Kricsfalusy,
Redberry Lake BR	RBL3	V. Kricsfalusy, Y. Ponomarenko	23-Jun-11	N52 43.282 W107 12.727	Saskatoon, Northeast Swale	NS44	V. Kricsfalusy,
Redberry Lake BR	RBL4	V. Kricsfalusy, Y. Ponomarenko	23-Jun-11	N52 42.456 W107 13.374	Saskatoon, Northeast Swale	NS45	V. Kricsfalusy,
Redberry Lake BR	RBL5	V. Kricsfalusy, Y. Ponomarenko	19-Jul-11	N52 50.547 W107 39.644	Saskatoon, Northeast Swale	NS46	V. Kricsfalusy,
Redberry Lake BR	RBL6	V. Kricsfalusy, Y. Ponomarenko	19-Jul-11	N52 50.458 W107 39.766	Saskatoon, Northeast Swale	NS47	V. Kricsfalusy,
RM Redberry, Hawrysh Farm	HP1	V. Kricsfalusy, Y. Ponomarenko	23-Jun-11	N52 36.249 W107 15.294	Saskatoon, Northeast Swale	NS48	V. Kricsfalusy,
RM Redberry, Hawrysh Farm	HP2	V. Kricsfalusy, Y. Ponomarenko	24-Jun-11	N52 36.197 W107 15.217	Saskatoon, Northeast Swale	NS49	V. Kricsfalusy,
Saskatoon, Agra Road	AR1	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.294 W106 35.570	Saskatoon, Northeast Swale	NS50	V. Kricsfalusy,
Saskatoon, Agra Road	AR2	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.239 W106 35.494	Saskatoon, Peggy McKercher	MK1	V. Kricsfalusy,
Saskatoon, Agra Road	AR3	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.180 W106 35.427	Saskatoon, Peggy McKercher	MK2	V. Kricsfalusy,
Saskatoon, Agra Road	AR4	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.158 W106 35.550	Saskatoon, Peggy McKercher	MK3	V. Kricsfalusy,
Saskatoon, Agra Road	AR5	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.321 W106 35.625	Saskatoon, Petturrson's Ravine	PR1	V. Kricsfalusy,
Saskatoon, Agra Road	AR6	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.368 W106 34.605	Saskatoon, Petturrson's Ravine	PR2	V. Kricsfalusy,
Saskatoon, Agra Road	AR7	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.354 W106 34.687	Saskatoon, Petturrson's Ravine	PR3	V. Kricsfalusy,
Saskatoon, Agra Road	AR8	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.366 W106 34.756	Saskatoon, Petturrson's Ravine	PR4	V. Kricsfalusy,
Saskatoon, Agra Road	AR9	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.336 W106 34.822	Saskatoon, Petturrson's Ravine	PR5	V. Kricsfalusy,
Saskatoon, Agra Road	AR10	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.298 W106 34.888	Saskatoon, Range Road	RR1	V. Kricsfalusy,
Saskatoon, Agra Road	AR11	V. Kricsfalusy, Y. Ponomarenko	05-May-12	N52 10.231 W106 35.136	Saskatoon, Range Road	RR2	V. Kricsfalusy,
Saskatoon, Crocus Prairie	CP1	V. Kricsfalusy, Y. Ponomarenko	05-Jul-12	N52 09.823 W106 36.365	Saskatoon, Range Road	RR3	V. Kricsfalusy,
Saskatoon, Crocus Prairie	CP2	V. Kricsfalusy, Y. Ponomarenko	05-Jul-12	N52 09.934 W106 36.316	Saskatoon, Range Road	RR4	V. Kricsfalusy,
Saskatoon, Crocus Prairie	CP3	V. Kricsfalusy, Y. Ponomarenko	05-Jul-12	N52 09.903 W106 36.257	Saskatoon, Range Road	RR5	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP1	V. Kricsfalusy, Y. Ponomarenko	13-May-11	N52 09.593 W106 31.714	Saskatoon Natural Grasslands	SNG1	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP2	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.592 W106 31.824	Saskatoon Natural Grasslands	SNG2	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP3	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.549 W106 31.908	Saskatoon Natural Grasslands	SNG3	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP4	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.543 W106 31.993	Saskatoon Natural Grasslands	SNG4	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP5	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.582 W106 31.977	Saskatoon Natural Grasslands	SNG5	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP6	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.631 W106 31.998	Saskatoon Natural Grasslands	SNG6	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP7	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.673 W106 31.934	Saskatoon Natural Grasslands	SNG7	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP8	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.694 W106 31.812	Saskatoon Natural Grasslands	SNG8	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP9	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.665 W106 31.706	Saskatoon Natural Grasslands	SNG9	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP10	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.308 W106 31.964	Saskatoon Natural Grasslands	SNG10	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP11	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.214 W106 31.934	Saskatoon Natural Grasslands	SNG11	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP12	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.166 W106 31.933	Saskatoon Natural Grasslands	SNG12	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP13	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.099 W106 31.949	Saskatoon Natural Grasslands	SNG14	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP14	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.955 W106 31.812	Saskatoon Natural Grasslands	SNG15	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP15	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.890 W106 32.139	Saskatoon Natural Grasslands	SNG16	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP16	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 09.939 W106 32.184	Saskatoon Natural Grasslands	SNG17	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP17	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.040 W106 32.282	Saskatoon Natural Grasslands	SNG18	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP18	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.073 W106 32.217	Saskatoon Natural Grasslands	SNG19	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP19	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.120 W106 32.185	Saskatoon, Small Swale	SS1	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP20	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.357 W106 32.052	Saskatoon, Small Swale	SS2	V. Kricsfalusy,
Saskatoon, Kernen Prairie	KP21	V. Kricsfalusy, Y. Ponomarenko	11-May-11	N52 10.352 W106 31.964	Saskatoon, Small Swale	SS3	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS1	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.335 W106 35.863	Saskatoon, Small Swale	SS4	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS2	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.257 W106 35.824	Saskatoon, Small Swale	SS5	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS3	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.255 W106 35.747	Saskatoon, Small Swale	SS6	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS4	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.314 W106 35.700	Saskatoon, Small Swale	SS7	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS5	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.355 W106 35.758	Saskatoon, Small Swale	SS8	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS6	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.430 W106 34.437	Saskatoon, Small Swale	SS9	V. Kricsfalusy,
Saskatoon, Northeast Swale	NS7	V. Kricsfalusy, Y. Ponomarenko	25-May-11	N52 10.477 W106 34.368	Saskatoon, Small Swale	SS10	V. Kricsfalusy,

	DATE	COORDINATES
Y. Ponomarenko	25-May-11	N52 10.498 W106 34.264
Y. Ponomarenko	25-May-11	N52 10.528 W106 34.217
Y. Ponomarenko	25-May-11	N52 10.572 W106 34.186
Y. Ponomarenko	25-May-11	N52 10.768 W106 34.032
Y. Ponomarenko	25-May-11	N52 10.827 W106 34.077
Y. Ponomarenko	25-May-11	N52 10.812 W106 33.906
Y. Ponomarenko	25-May-11	N52 10.601 W106 33.852
Y. Ponomarenko	25-May-11	N52 10.568 W106 33.987
Y. Ponomarenko	25-May-11	N52 10.554 W106 34.053
Y. Ponomarenko	25-May-11	N52 10.458 W106 34.285
Y. Ponomarenko	25-May-11	N52 10.823 W106 33.463
Y. Ponomarenko	25-May-11	N52 10.800 W106 33.580
Y. Ponomarenko	25-May-11	N52 10.759 W106 33.627
Y. Ponomarenko	25-May-11	N52 10.821 W106 33.633
Y. Ponomarenko	25-May-11	N52 10.819 W106 33.718
Y. Ponomarenko	25-May-11	N52 10.834 W106 33.781
Y. Ponomarenko	25-May-11	N52 10.931 W106 33.824
Y. Ponomarenko	25-May-11	N52 11.036 W106 33.834
Y. Ponomarenko	25-May-11	N52 11.049 W106 33.696
Y. Ponomarenko	25-May-11	N52 11.117 W106 33.660
Y. Ponomarenko	25-May-11	N52 11.228 W106 33.637
Y. Ponomarenko	25-May-11	N52 11.291 W106 33.508
Y. Ponomarenko	07-Jul-11	N52 11.440 W106 33.349
Y. Ponomarenko	07-Jul-11	N52 10.625 W106 34.059
Y. Ponomarenko	07-Jul-11	N52 10.799 W106 34.078
Y. Ponomarenko	07-Jul-11	N52 10.841 W106 33.850
Y. Ponomarenko	15-May-12	N52 10.826 W106 34.464
Y. Ponomarenko	15-May-12	N52 10.810 W106 34.382
Y. Ponomarenko	15-May-12	N52 10.853 W106 34.346
Y. Ponomarenko	15-May-12	N52 10.895 W106 34.279
Y. Ponomarenko	15-May-12	N52 10.955 W106 34.170
Y. Ponomarenko	15-May-12	N52 10.994 W106 34.131
Y. Ponomarenko	15-May-12	N52 10.988 W106 33.984
Y. Ponomarenko	15-May-12	N52 11.106 W106 33.940
Y. Ponomarenko	15-May-12	N52 11.213 W106 33.840
Y. Ponomarenko	15-May-12	N52 11.152 W106 33.813
Y. Ponomarenko	15-May-12	N52 10.980 W106 33.931
Y. Ponomarenko	15-May-12	N52 10.955 W106 33.956
Y. Ponomarenko	15-May-12	N52 10.907 W106 33.972
Y. Ponomarenko	15-May-12	N52 10.925 W106 34.082
Y. Ponomarenko	15-May-12	N52 10.869 W106 34.158
Y. Ponomarenko	15-May-12	N52 10.937 W106 34.248
J. Esparrago	17-May-11	N52 11.099 W106 36.014
J. Esparrago	17-May-11	N52 11.001 W106 35.955
J. Esparrago	17-May-11	N52 10.947 W106 35.951
J. Esparrago	15-May-11	N52 10.013 W106 36.355
J. Esparrago	15-May-11	N52 09.995 W106 36.357
J. Esparrago	15-May-11	N52 10.199 W106 36.194
J. Esparrago	15-May-11	N52 10.081 W106 36.032
J. Esparrago	15-May-11	N52 10.113 W106 35.986
Y. Ponomarenko	05-May-12	N52 12.294 W106 35.829
Y. Ponomarenko	05-May-12	N52 12.151 W106 35.915
Y. Ponomarenko	05-May-12	N52 11.939 W106 35.741
Y. Ponomarenko	05-May-12	N52 11.620 W106 35.790
Y. Ponomarenko	05-May-12	N52 10.898 W106 35.816
Y. Ponomarenko	14-May-11	N52 09.697 W106 35.439
Y. Ponomarenko	14-May-11	N52 09.763 W106 35.450
Y. Ponomarenko	14-May-11	N52 09.741 W106 35.494
Y. Ponomarenko	14-May-11	N52 09.783 W106 35.502
Y. Ponomarenko	14-May-11	N52 09.807 W106 35.538
Y. Ponomarenko	14-May-11	N52 09.839 W106 35.561
Y. Ponomarenko	14-May-11	N52 09.858 W106 35.620
Y. Ponomarenko	14-May-11	N52 09.883 W106 35.595
Y. Ponomarenko	14-May-11	N52 09.835 W106 35.420
Y. Ponomarenko	14-May-11	N52 09.806 W106 35.421
Y. Ponomarenko	14-May-11	N52 09.854 W106 35.294
Y. Ponomarenko	14-May-11	N52 09.927 W106 35.669
Y. Ponomarenko	14-May-11	N52 09.972 W106 35.629
Y. Ponomarenko	14-May-11	N52 10.017 W106 35.630
Y. Ponomarenko	14-May-11	N52 09.927 W106 35.864
Y. Ponomarenko	14-May-11	N52 09.877 W106 35.859
Y. Ponomarenko	14-May-11	N52 09.966 W106 35.622
Y. Ponomarenko	14-May-11	N52 09.774 W106 35.488
S. Zhao	06-Jun-13	N52 11.134 W106 35.841
S. Zhao	06-Jun-13	N52 11.351 W106 35.438
S. Zhao	06-Jun-13	N52 11.486 W106 35.270
S. Zhao	06-Jun-13	N52 11.524 W106 35.049
S. Zhao	06-Jun-13	N52 11.501 W106 35.003
S. Zhao	06-Jun-13	N52 11.689 W106 35.075
S. Zhao	06-Jun-13	N52 11.645 W106 34.919
S. Zhao	06-Jun-13	N52 11.667 W106 34.880
S. Zhao	06-Jun-13	N52 11.706 W106 34.859
S. Zhao	06-Jun-13	N52 11.753 W106 34.824

LOCATION	ID	AUTHOR	DATE	COORDINATES
Saskatoon, Small Swale	SS11	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 11.804 W106 34.755
Saskatoon, Small Swale	SS12	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 11.841 W106 34.734
Saskatoon, Small Swale	SS13	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 11.904 W106 34.681
Saskatoon, Small Swale	SS14	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 11.953 W106 34.651
Saskatoon, Small Swale	SS15	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.013 W106 34.642
Saskatoon, Small Swale	SS16	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.106 W106 34.533
Saskatoon, Small Swale	SS17	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 11.090 W106 35.580
Saskatoon, Small Swale	SS18	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.129 W106 34.633
Saskatoon, Small Swale	SS19	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.115 W106 34.735
Saskatoon, Small Swale	SS20	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.129 W106 34.911
Saskatoon, Small Swale	SS21	V. Kricsfalusy, S. Zhao	06-Jun-13	N52 12.068 W106 34.876
Saskatoon	ST1	V. Kricsfalusy, J. Esparrago	10-May-12	N52 10.263 W106 36.182
Saskatoon	ST2	V. Kricsfalusy, J. Esparrago	10-May-12	N52 10.338 W106 36.155
Saskatoon	ST4	V. Kricsfalusy, J. Esparrago	10-May-12	N52 09.742 W106 36.451
Saskatoon	ST5	V. Kricsfalusy, J. Esparrago	10-May-12	N52 09.711 W106 36.489
Saskatoon	ST6	V. Kricsfalusy, J. Esparrago	10-May-12	N52 09.672 W106 36.538
Saskatoon	ST7	V. Kricsfalusy, J. Esparrago	10-May-12	N52 09.517 W106 36.772
Saskatoon	ST8	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.036 W106 38.498
Saskatoon	ST9	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.161 W106 38.492
Saskatoon	ST10	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.768 W106 38.124
Saskatoon	ST11	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.798 W106 38.116
Saskatoon	ST12	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.815 W106 38.099
Saskatoon	ST13	V. Kricsfalusy, J. Esparrago	04-Jun-12	N52 08.839 W106 38.070
Saskatoon	ST14	V. Kricsfalusy, J. Esparrago	05-Jul-12	N52 10.620 W106 35.986
Saskatoon	ST15	V. Kricsfalusy, J. Esparrago	05-Jul-12	N52 10.615 W106 35.986
Saskatoon	ST16	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 11.710 W106 37.140
Saskatoon	ST17	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 11.775 W106 37.184
Saskatoon	ST18	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 11.755 W106 37.131
Saskatoon	ST19	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 11.818 W106 37.157
Saskatoon	ST20	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.277 W106 36.726
Saskatoon	ST21	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.329 W106 36.675
Saskatoon	ST22	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.361 W106 36.647
Saskatoon	ST23	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.514 W106 36.531
Saskatoon	ST24	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.584 W106 36.438
Saskatoon	ST25	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.641 W106 36.407
Saskatoon	ST26	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.260 W106 36.807
Saskatoon	ST27	V. Kricsfalusy, J. Esparrago	26-Apr-12	N52 12.224 W106 36.854
Saskatoon	ST28	V. Kricsfalusy, J. Esparrago	30-Apr-12	N52 06.917 W106 43.794
Saskatoon	ST29	V. Kricsfalusy, J. Esparrago	30-Apr-12	N52 09.646 W106 37.982
Saskatoon	ST30	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.364 W106 36.836
Saskatoon	ST31	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.419 W106 36.886
Saskatoon	ST32	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.471 W106 36.932
Saskatoon	ST33	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.531 W106 36.952
Saskatoon	ST34	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.537 W106 36.961
Saskatoon	ST35	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.580 W106 36.999
Saskatoon	ST36	V. Kricsfalusy, J. Esparrago	05-May-12	N52 11.627 W106 37.036
Saskatoon	ST37	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.711 W106 36.357
Saskatoon	ST38	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.762 W106 36.279
Saskatoon	ST39	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.787 W106 36.266
Saskatoon	ST40	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.863 W106 36.174
Saskatoon	ST41	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.930 W106 36.078
Saskatoon	ST42	V. Kricsfalusy, J. Esparrago	11-May-12	N52 12.993 W106 36.027
Wanuskewin Heritage Park	WHP1	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.503 W106 35.756
Wanuskewin Heritage Park	WHP2	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.492 W106 35.709
Wanuskewin Heritage Park	WHP3	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.571 W106 35.538
Wanuskewin Heritage Park	WHP4	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.644 W106 35.494
Wanuskewin Heritage Park	WHP5	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.542 W106 35.542
Wanuskewin Heritage Park	WHP6	V. Kricsfalusy, J. Esparrago	08-May-12	N52 12.712 W106 36.354
Wanuskewin Heritage Park	WHP7	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.441 W106 35.555
Wanuskewin Heritage Park	WHP8	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.381 W106 35.544
Wanuskewin Heritage Park	WHP9	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.391 W106 35.502
Wanuskewin Heritage Park	WHP10	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.374 W106 35.398
Wanuskewin Heritage Park	WHP11	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.290 W106 35.368
Wanuskewin Heritage Park	WHP12	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.244 W106 35.355
Wanuskewin Heritage Park	WHP13	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.192 W106 35.265
Wanuskewin Heritage Park	WHP14	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.215 W106 35.427
Wanuskewin Heritage Park	WHP15	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.229 W106 35.519
Wanuskewin Heritage Park	WHP16	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.227 W106 35.478
Wanuskewin Heritage Park	WHP17	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.264 W106 35.452
Wanuskewin Heritage Park	WHP18	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.336 W106 35.468
Wanuskewin Heritage Park	WHP19	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.351 W106 35.549
Wanuskewin Heritage Park	WHP20	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.302 W106 35.734
Wanuskewin Heritage Park	WHP21	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.252 W106 35.756
Wanuskewin Heritage Park	WHP22	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.208 W106 35.740
Wanuskewin Heritage Park	WHP23	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.201 W106 35.751
Wanuskewin Heritage Park	WHP24	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.135 W106 35.787
Wanuskewin Heritage Park	WHP25	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.126 W106 35.845
Wanuskewin Heritage Park	WHP26	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.074 W106 35.905
Wanuskewin Heritage Park	WHP27	V. Kricsfalusy, J. Esparrago	08-May-12	N52 12.711 W106 36.351
Wanuskewin Heritage Park	WHP28	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.028 W106 36.095
Wanuskewin Heritage Park	WHP29	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.083 W106 36.023
Wanuskewin Heritage Park	WHP30	V. Kricsfalusy, J. Esparrago	08-May-12	N52 13.285 W106 35.871