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TITLE. Plant phenology data for saddle snowfence, 1993 – 1996.

ABSTRACT. The International Tundra Experiment (ITEX) is a consortium of research sites seeking to understand the response of tundra plant populations to changes in growing season temperatures through a simple temperature manipulation and transplant experiment. The research goal is to examine the phenologic and reproductive responses of a set of species to experimentally-induced warming at a network of sites. The ITEX design is hierarchical, with sites participating at whatever level they are able. At the minimum, participation in ITEX requires climate monitoring (using the LTER MSR standards), a temperature manipulation using one of three possible designs, and monitoring phenologic and reproductive variables for at least one designated ITEX species or two other species. The temperature manipulation is achieved through use of conical or hexagonal open-top chambers of solar fiberglass, which have been shown to increase the air temperature at the surface approximately 3 degrees C. ITEX studies at Niwot Ridge, a logical outgrowth of the long-term phenology studies there, uses a factorial design based around the long-term snowfence experiment. Twenty cones are placed behind the snowfence, distributed at 10, 25, 45, and 75 m from the fence; each cone is paired with an adjacent plot. Beginning with the 1995 season, 24 additional plots were implemented outside of the snowfence influence. Twelve cones are distributed beyond both the north and south edges of the snowfence area, at 10, 25, 45, and 75 m behind the line of the snowfence; each cone is paired with an adjacent plot. This results in the following treatments: increased winter snow, increased summer temperature, increased snow and increased temperature, and control. Key phenologic, growth, and reproductive traits are being followed on marked individuals of *Acomastylis* (Geum) *rossii* and *Bistorta* (*Polygonum*) *bistortoides*, and complete species composition is being monitored.

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VARIABLES. first snow-free day, first leaf evident, first flower or inflorescence visible, first flower or inflorescence open, first petal shed, last petal shed, first seed dispersal, first reddening of leaves.

KEYWORDS. ITEX, International Tundra Experiment, warming chamber, saddle snowfence, plant development, phenology, plant growth, disturbance, inflorescence, leaf, petal, seed dispersal, alpine, core_disturbance, *Geum rossii*, *Polygonum bistorta*, increased snow, Niwot Ridge LTER, NWT, plant/vegetation ecology

LOCATION. Study sites were located in the Niwot Ridge saddle snowfence area. Samples and original data are stored with the NWT LTER data manager.

TIMING. begin 16 July 1993, end 1996, approximately daily during the growing season.

CITATIONS.

METHODS. These data were manually entered from field data sheets using an EasyEntry form. The resulting files were processed and archived on niwot (NWT LTER workstation).

Additional ITEX data can be found in the files:

<http://niwot.colorado.edu/exec/.extracttool2?itexdrep.jw.meta.txt>

<http://niwot.colorado.edu/exec/.extracttool2?itexdveg.jw.meta.txt>

<http://niwot.colorado.edu/exec/.extracttool2?itexptqd.mw.meta.txt>

<http://niwot.colorado.edu/exec/.extracttool2?itexquan.mw.meta.txt>

The snowfence was oriented in a north-south direction and all of the study plots were located east of the snowfence. Each of the experimental plots had a control plot associated with it. Each plot had a x coordinate (distance (m) east of the snowfence) and a y coordinate (distance (m) north of the baseline across the southern boundary of the snowfence experimental area). The rows of square meter plots directly east and directly north of (but adjacent to) the snowfence and baseline, respectively, were given x and y coordinates, respectively, of 01.

The plots and their respective coordinates were:

10-1E(10,15), 10-1C(09,14), 10-2E(10,25), 10-2C(09,24), 10-3E(10,30),
10-3C(10,31), 10-4E(10,41), 10-4C(09,40), 10-5E(10,44), 10-5C(09,45),
25-1E(25,23), 25-1C(24,22), 25-2E(25,25), 25-2C(24,24), 25-3E(25,30),
25-3C(24,29), 25-4E(25,32), 25-4C(24,31), 25-5E(25,39), 25-5C(24,38),
45-1E(45,03), 45-1C(44,04), 45-2E(45,06), 45-2C(44,07), 45-3E(45,15),
45-3C(45,16), 45-4E(45,31), 45-4C(44,32), 45-5E(45,47), 45-5C(45,48),
75-1E(75,03), 75-1C(74,04), 75-2E(75,21), 75-2C(74,22), 75-3E(75,24),
75-3C(74,25), 75-4E(75,43), 75-4C(75,42), 75-5E(75,45), 75-5C(74,46).

The plots added in 1995 that are external to the snowfence influence have an EP prefix to their plot codes, and the following coordinates:

EP10-1E(10,-12), EP10-1C(10,-11), EP10-2E(09,087),
EP10-2C(09,088), EP10-3E(09,093), EP10-3C(09,094),
EP25-1E(26,-14), EP25-1C(26,-12), EP25-2E(25,-11),
EP25-2C(26,-10), EP25-3E(25,073), EP25-3C(25,072),
EP45-1E(44,-09), EP45-1C(43,-08), EP45-2E(44,-07),
EP45-2C(45,-06), EP45-3E(44,073), EP45-3C(45,073),
EP75-1E(74,-07), EP75-1C(75,-08), EP75-2E(75,071),
EP75-2C(75,069), EP75-3E(74,074), EP75-3C(75,074).

AR and BB in column 3 of the data section refer to *Acomastylis rossii* and *Bistorta bistortoides* plants, respectively. Experimental and control plots are designated, within the plot code, by the letters E and C, respectively.

Phenological stages with values of 'A' indicate that the plant aborted during that given stage.

If a given phenological state for a plant had already occurred at the time of the first observation, no date was recorded for that state during 1993. In 1994, however, the '<' symbol preceding the date of first observance was used to indicate that a given phenological state had occurred at sometime prior to that date. Thus, there are substantially more "missing" data for 1993. The data received for 1995 did not include any '<' qualifiers. After consultation with field personnel, it was determined that all the 1995 first snow free and first leaf evident dates represent the day on which the respective phenological stage was reached. All other 1995 dates are assumed to indicate that the plant reached the given phenological state on or before the date recorded. The data for 1996 were recorded in the same manner as the 1995 data.

The following specific comments appeared at the bottom of the 1994 hard-copy field data forms:

Chamber on 45-1E 6/6, plot already snowfree.

Chambers up [45-1C, 45-2E, 45-2C, 45-3E, 45-3C, 45-4E, 45-4C, 45-5E, 45-5C, 75-5E, 75-5C, 75-4E, 75-4C, 75-3E, 75-3C, 75-2E, 75-2C, 75-1E] 6/6, plots already snowfree.

Chambers up 75-1C 6 June 1994, plots had been snowfree several weeks.

6/10 45-1E AR-5 bud broke off; 6/14 another visible.

75-2E Ar-2 bud gone on 6/13.

6/15 45-4E AR-1 inf[lorescence] missing; no bud.

6/16 45-2C AR-1 inf[lorescence] missing; bud gone.

10-1E AR-3 & BB-2 <6/21 refers to period from 6/17 to 6/21.

25[-5E, 25-5C, 25-4E, 25-4C, 25-3E, 25-3C, 25-2E, 25-2C, 25-1E, 25-1C] chambers up

6/20.

25-1C BB-3 not in existence 7/1.

75-1C BB-2 bud stem broken off & gone 7/1.

45-4C BB-3 tagged 7/5.

7/5 began recording last petal [45-1E AR-5] this day.

7/5 45-1C AR-3 bud gone.

7/5 45-1C AR-3 inf[lorescence] missing.

7/5 75-4E BB-3 inflorescence is gone.

7/5 chose new BB-1 75-1E.

7/5 75-2C BB-4 inf[lorescence] missing.

7/8 75-5E AR-2 inf[lorescence] gone.

10-1E AR-5 7/8 missing bud found.

7/11 75-2E BB-4 flower head came off.

7/18 10-3C choose a new BB-3.

7/18 chose new BB-3 25-1C.

Clipped 75-5E BB-2, 75-5C BB-3 & BB-5, 75-4E BB-4 & BB-5, 75-4C BB-4 & BB-5, 75-3E BB-1 & BB-2 & BB-4 & BB-5, 75-3C BB-1 & BB-5, 75-2E BB-2 & BB-3, 75-2C BB-1 & BB-2, 75-1E BB-1 & BB-2 7/29.

Clipped [45-1E, 45-1C, 45-2E, 45-2C, 45-3E, 45-3C, 45-4E, 45-4C, 45-5E, 45-5C] BB 8/1.

8/4 45-1C AR-5 flower missing.

8/4 75-3E AR-5 flower missing.

Clipped [25-4E, 25-4C, 25-3E, 25-3C, 25-2E, 25-2C, 25-1E, 25-1C] BB 8/4.

Clipped [10-1E, 10-1C, 10-2E, 10-2C, 10-3E, 10-3C, 10-4E, 10-4C, 10-5E, 10-5C] ARs & BBs 8/8. Clipped 25-5E & 25-5C [25-3C, 25-2E, 25-2C] ARs 8/8.

The following specific comments appeared at the bottom of the 1996 hard-copy field data forms:

10-4C BB4 herbivorized by 7/30/96.

BB5 from 10-4E eaten 8/15/96.

7/16/96 - 25-3E couldn't find BB1; 45-3E AR5 flower gone.

The warming chambers are placed over the experimental plots which can be identified by coordinates given. In July 2002, Wade Cooper and Mariah Carbone placed 4, 8 inch metal stakes in the ground around the outside of each chamber for easy identification of the experimental plots. Within the plots, there are 4 tags with crosshairs, and 4 plain washers nailed into the ground. Place the chamber within the 4 metal stakes, then align the chamber edges with the plain washers. Each of the crosshair tags should be several inches within the edge of the chamber. Securely nail the chamber into the ground with stakes and wire ties.

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COL1. label=year, type=integer, units=none, missing value
indicator=NaN, minimum=, maximum=, precision=1

COL2. label=plot_code, type=string, units=none, missing value
indicator=NaN, minimum=, maximum=, precision=, definition=plot code

COL3. label=plant_id, type=string, units=none, missing value
indicator=NaN, minimum=, maximum=, precision=, definition=plant
identification code

COL4. label=1st_snowfree, type=string, units=none, missing value
indicator=NaN, minimum=0, maximum=366, precision=1, definition=first
snow-free day

COL5. label=1st_leaf, type=string, units=none, missing value
indicator=NaN, minimum=0, maximum=366, precision=1, definition=first
leaf evident

COL6. label=1st_flower, type=string, units=none, missing value
indicator=NaN, minimum=0, maximum=366, precision=1, definition=first
flower or inflorescence visible

COL7. label=1st_flower_open, type=string, units=none, missing value indicator=NaN, minimum=0, maximum=366, precision=1, definition=first flower or inflorescence open

COL8. label=1st_petal_shed, type=string, units=none, missing value indicator=NaN, minimum=0, maximum=366, precision=1, definition=first petal shed

COL9. label=last_petal_shed, type=string, units=none, missing value indicator=NaN, minimum=0, maximum=366, precision=1, definition=last petal shed

COL10. label=1st_seed_disp, type=string, units=none, missing value indicator=NaN, minimum=0, maximum=366, precision=1, definition=first seed dispersal

COL11. label=1st_red_leaf, type=string, units=none, missing value indicator=NaN, minimum=0, maximum=366, precision=1, definition=first reddening of leaves

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http://niwot.colorado.edu/data_csvs/itexphen.mw.data.csv

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The initial iteration of the documentation section was created by Rick Ingersoll on 18 October 1993, with some sources being a 6 July 1993 email message from Marilyn Walker and a 19 October 1993 email message from Mike Sannes. The data for 1993 were appended to the data section on 21 October 1993 and the file was put under scs control at that time as well. [RCI 21 October 1993] Comments regarding the plot code were added on 22 October 1993. [RCI 22 October 1993] Comments regarding plot locations were provided by Susan Kindig on 5 November 1993 and incorporated into the comments section on 8 November 1993. [RCI 8 November 1993] A minor modification was made to the abstract per instructions of Marilyn Walker on 11 March 1994. [RCI 11 March 1994] Data for 1994 were appended to the data section and comments were added regarding differences in the way data were recorded between 1993 and 1994, on 12 August 1994. [RCI 12 August 1994] Comments from the hard-copy field data forms were added to the comments section on 3 October 1994. [RCI 3 October 1994] Comments were added to both the abstract and comments section regarding the introduction of the plots external to the snowfence, and data for the 1995 season were appended to the data section on 26 March 1996. Comments regarding the differences in the way data were recorded between 1995 and earlier years were also added to the comments section at that time. [MAH 26 March 1996] Data for the 1996 season were appended to the data section and comments from the 1996 hard-copy field data forms were added to

the comments section on 12 November 1996.[MAH 12 November 1996] URL locations for related data were updated on 26 September 2000.[MAH 26 September 2000] Updated contact information.[TMA 14 March 2001] Revised title, keywords, and timing for inclusion in core disturbance data sets.[HCH 14 April 2010] Column labels shortened and definitions added.[HCH 14 February 2016]