# Long-term monitoring and experimental manipulation of a Chihuahuan Desert plant community near Portal, Arizona (1981 – 2013).

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# INTRODUCTION

The plant community has been surveyed at the Portal Project since 1977. Because there are two distinct annual blooms each year (winter and summer), plant surveys occur twice each year. Initially, only common species were counted, and often perennial species were ignored. By 1989, though possibly prior to 1989 as well, all plants within permanently marked quadrats were identified and counted. The data are separated into two files to account for the difference in methodology. This plant community data has been used to address a variety of questions including 1) the effects of the granivore guild on plant community structure and 2) the effects of biotic interactions on macroecological patterns. This metadata file describes the field data collection techniques and data structure for the plant datasets.

# METADATA CLASS I. DATA SET DESCRIPTORS

A. Data set identity:

**Title:** Long-term monitoring and manipulation of summer and winter desert annual and herbaceous perennial plant communities in the Chihuahuan Desert near Portal, AZ (1981 – 2013).

B. Data set identification codes: Portal\_plants\_19811988.csv

Portal\_plants\_19892013.csv

Portal\_plant\_species.csv

Portal\_plant\_censuses.csv

C. Data set description

Principal Investigators:

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**Abstract:** The data set covers a 33 year period (1981-2013) of detailed annual and perennial plant sampling of an arid ecosystem in near Portal, Arizona. Each year rooted plants are counted within 16 fixed quadrats on each of 24 experimental plots. The data set should prove useful for studying population dynamics and species interactions. Sampling is ongoing and data will be added over time.

**D. Key words**: annual plants, arid ecosystem, climate, competition, granivory, perennials

# CLASS II. RESEARCH ORIGIN DESCRIPTORS

A. Overall project description

**Identity:** Quadrat-based survey data of a desert plant community conducted in winter and summer on the 24 experimental plots at the 20 ha study site in the Chihuahuan Desert near Portal, AZ.

**Originators:** Drs. James H. Brown, Diane W Davidson, James Reichman

**Period of Study**: 1981-2013

**Objectives:** To monitor a) the community- and population-level dynamics of desert plants and b) the effects of granivore manipulation on these communities.

**Source(s) of funding:** Seemain metadata file Metadata\_Portal\_overview.html

B. Specific subproject description (Because survey methods have not changed, most of this description is identical to that reported in Ernest et al 2009. Differences from Ernest et al 2009 are highlighted with italics).

**1. Site description:** Within the 20 ha study area there are 24 experimental plots. Each plot has an area of 0.25 ha and is fenced to regulate rodent access to the plot. Rodent treatments include controls, kangaroo rat removal, and rodent removal. The ant community, which is also predominately granivorous, is also manipulated. Ant treatments include controls and ant removals.

On each plot there are 16 permanent stations marked by rebar stakes forming a 4x4 grid. Rows are numbered 1,3,5,7 going from the most northern row to the most southern. Columns are numbered 1,3,5,7 going from the most western column to the most eastern. Every quadrat on a plot has a unique identifying number denoting the coordinate of that stake on that plot. For example, quadrat 35 is at the fifth stake on the third row. The numbering of the plant stakes reflects that each plant stake is 1 m south of the rodent/ant stake of the same number (see *Portal\_overview\_metadata.html*, Fig 1). *Starting in 2005, quadrat 17 was no longer censused in plot 24, due to changes in plot shape putting 17 outside the plot fence*.

**Description of Winter Communities:** The first winter annuals typically germinate in response to the first autumn rains in October or November but there tends to be considerable variation among winter species in the timing of germination and initial growth. Maximum flowering occurs in late spring (late March/early April) and all annual species (except biennials) senesce by May.

**Description of Summer Communities:** Typically, germination of summer annuals begins within a few days of the first summer rains in late June or early July. Maximum flowering typically occurs in late August or early September and annual plants senesce by October.

**Treatments:** See *Portal\_overview\_metadata.html*, Table 1, for details on treatment assignments for each plot. See the previous data publication (Ernest et al 2009) for a history of plot treatments and methods.

**Data Collection Period, Frequency:** Plant data were collected nearly continuously from 1978-2013. Because there are two annual plant communities – one in the winter and one in the summer - there are two plant surveys per year. The surveys occur towards the end of the growing season; occurring in spring for the winter community and fall for the summer community. Plant censuses were of sufficient quality by 1981 that data has been provided starting in this year. However, due to concerns that not all species were always identified and recorded, especially perennials, the data from 1981 – 1988 are provided in a separate file. We are certain that by 1989 all species were being identified and recorded, including all perennials occurring on quadrats. *Dates of plant censuses, when known, are listed in Table 5 below. Due to intermittent funding, gaps in data collection exist beginning in 2010. On a quadrat level, the data file Portal\_plant\_censuses.csv provides a record of when each quadrat was censused. Note that the data collection methodology is consistent with the data from the previous publication (Ernest et al 2009), however, the format of these files has changed to be more useable in a relational database.*

3. Research Methods

**Field:** Quadrat dimensions are 0.25 m x 0.25 m. Quadrats are placed at locations permanently marked by a rebar stake. Plants rooted within 16 fixed quadrats in each plot are counted each spring (winter annual survey) and fall (summer annual survey). Several adjacent stems are counted separately when the species is an annual, and as one individual when the species is a perennial. Prior to 1989, perennial species were not systematically included in these counts of abundance. To reflect this difference, pre 1989 and post 1989 data are provided in separate data tables. The species list indicates species that are considered perennial at the site.

**Taxonomy and systematics:** Kearney T.H. and Peebles, R.H. 1960. Arizona Flora. University of California Press. Berkeley, CA.

**4. Project personnel:**  In addition to the authors, many people assisted on a volunteer basis and this work would not have been possible without their help

# CLASS III. DATA SET STATUS AND ACCESSIBILITY

A. Status

Latest Update: December 2013

Latest Archive date: December 2013

**Metadata status**: The metadata are complete and up to date.

**Data verification:** Plant identifications are verified, in the field, by checking a reference collection of plants from the site. Unknown species are collected for later identification. Data entered into the computer are checked by two people to ensure reliable data entry. Voucher specimens for many species were deposited at Garrett Herbarium at the Utah Museum of Natural History.

B. Accessibility

**Storage location and medium:** (Ecological Society of America data archives [Ecological Archives], URL published in each issue of its journals). Original data sheets and data files reside with S.K.M. Ernest.

**Contact person:** S.K. Morgan Ernest, Department of Wildlife Ecology and Conservation, 110 Newins-Ziegler Hall, PO Box 110430, Gainesville, FL 32611. Email: skmorgane@ufl.edu

**Copyright restrictions:** None.

**Proprietary restrictions:** None. However, we do request that authors of publications using the plant database cite the database according to Ecological Archives policy and notify S.K. Morgan Ernest (contact information above) of publication of their study. This allows us to make accurate reports to the National Science Foundation and document that the scientific community finds the data from this study to be useful.

**Costs:** None.

# CLASS IV. DATA STRUCTURAL DESCRIPTORS

### PRE 1989 PLANT SURVEY

A. Data Set File:

**Identity:** Portal\_plants\_19811988.csv

**Size:** 24076 rows (including header), 726 kilobytes.

**Format and storage mode:** ASCII text, comma delimited. No compression scheme used.

**Header information:** The first row of the file contains the variable names below.

Alphanumeric attributes: Mixed.

B. Variable information

**Table 1**. Column information for Portal\_plants\_19811988.csv

Each row contains information on the number of individuals of each species surveyed on a particular quadrat during a particular year.

|  |  |  |  |
| --- | --- | --- | --- |
| *Variable name* | *Variable definition* | *Storage type* | *Variable codes, definitions, and notes* |
| year | Year data collected | Integer | 1981 – 1988 |
| season | Time of year surveyed | Character | “Winter” or “Summer” |
| plot | Plot number surveyed | Integer | 1-24 |
| quadrat | Stake number associated with quadrat | Integer | 11,13,15,17,31,33,35,37,51,53,55,57,71, 73,75,77 |
| species | Species Code | Character | See data file Portal\_plant\_species.csv for species codes and scientific names. |
| abundance | Number of stems counted for that species | Integer |  |

### POST 1989 PLANT SURVEY

A. Data Set File:

**Identity:** Portal\_plants\_19892013.csv

**Size:** 71926 rows (including header), 2163 kilobytes.

**Format and storage mode:** ASCII text, comma delimited. No compression scheme used.

**Header information:** The first row of the file contains the variable names below.

Alphanumeric attributes: Mixed.

B. Variable information

**Table 2**. Column information for Portal\_plants\_19892013.csv

Each row contains information on the number of individuals of each species surveyed on a particular quadrat during a particular year.

|  |  |  |  |
| --- | --- | --- | --- |
| *Variable name* | *Variable definition* | *Storage type* | *Variable codes, definitions, and notes* |
| year | Year data collected | Integer | 1989 – 2013 |
| season | Time of year surveyed | Character | “Winter” or “Summer” |
| plot | Plot number surveyed | Integer | 1-24 |
| quadrat | Stake number associated with quadrat | Integer | 11,13,15,17,31,33,35,37,51,53,55,57,71, 73,75,77 |
| species | Species Code | Character | See data file Portal\_plant\_species.csv for species codes and scientific names. |
| abundance | Number of stems counted for that species | Integer |  |

### PLANT SURVEY SPECIES LIST

A. Data Set File:

**Identity:** Portal\_plant\_species.csv

**Size:** 173 rows (including header row), 14 kilobytes.

**Format and storage mode:** ASCII text, comma delimited. No compression scheme used.

**Header information:** The first row of the file contains the variable names below.

Alphanumeric attributes: Mixed.

B. Variable information

**Table 3**. Column information for Portal\_plant\_species.csv. In some cases, old nomenclature is retained in the Genus and Species columns parenthetically to provide an origin for the species code.

|  |  |  |  |
| --- | --- | --- | --- |
| *Variable name* | *Variable definition* | *Storage type* | *Variable codes, definitions, and notes* |
| Species Code | 8 letter code | Character | 8 letter code (first 4 letters of genus and species each), except in cases of unknowns |
| Genus |  | Character | Includes previous and updated genus names |
| Species |  | Character | Includes previous and updated species names |
| Subspecies |  | Character |  |
| Common Name |  | Character |  |
| Family | Taxonomic Family | Character |  |
| Duration | Annual or Perennial | Character | “Annual”, “Perennial” or “Unknown” |
| Community |  | Character | “Summer Annuals”, “Winter Annuals”, “Summer and Winter Annuals”, “Perennials” or “Unknown” |

### PLANT CENSUSES

A. Data Set File:

**Identity:** Portal\_plant\_censuses.csv

**Size:** 24961 rows (including header), 674 kilobytes

**Format and storage mode:** ASCII text, comma delimited. No compression scheme used.

**Header information:** The first row of the file contains the variable names below.

Alphanumeric attributes: Mixed.

B. Variable information

**Table 4**. Column information for Portal\_plant\_censuses.csv

|  |  |  |  |
| --- | --- | --- | --- |
| *Variable name* | *Variable definition* | *Storage type* | *Variable codes, definitions, and notes* |
| year | Year data collected | Integer | 1981 – 2013 |
| season | Time of year | Character | “Winter” or “Summer” |
| plot | Plot number | Integer | 1-24 |
| quadrat | Stake number associated with quadrat | Integer | 11,13,15,17,31,33,35,37,51,53,55,57,71, 73,75,77 |
| censused | Data collected at the stake indicated | Integer | 0 (not censused) or 1 (censused) |
| area | Quadrat area censused | Double | 0.0625 square meters, or 0 when quadrat not censused |

**Table 5**. List of Plant Census Dates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Season** | **Census Done** | **Census Month** | **Census Days** |
| 1981 | summer | Yes | 10 | 29-31 |
| 1982 | winter | Yes | 5 | 19-20 |
| 1982 | summer | Yes | 9 | 8-11 |
| 1983 | winter | Yes | 8 | 28-30 |
| 1983 | summer | Yes | 4 | 17-23 |
| 1984 | winter | Yes | 3 | 6-14 |
| 1984 | summer | Yes | 9 | 15-16 |
| 1985 | winter | Yes | unknown | unknown |
| 1985 | summer | Yes | unknown | unknown |
| 1986 | winter | Yes | unknown | unknown |
| 1986 | summer | Yes | unknown | unknown |
| 1987 | winter | Yes | unknown | unknown |
| 1987 | summer | Yes | unknown | unknown |
| 1988 | winter | Yes | 4 | 9-15 |
| 1988 | summer | Yes | 9 | 5-15 |
| 1989 | winter | Yes | 3-4 | 28-3 |
| 1989 | summer | Yes | 9 | 3-13 |
| 1990 | winter | Yes | 4 | 25-28 |
| 1990 | summer | Yes | 8 | 13-20 |
| 1991 | winter | Yes | 4 | 20-22 |
| 1991 | summer | Yes | 8 | 17-26 |
| 1992 | winter | Yes | 4-5 | 21-14 |
| 1992 | summer | Yes | 8-9 | 31-8 |
| 1993 | winter | Yes | 4-5 | 24-9 |
| 1993 | summer | Yes | 9 | 11-15 |
| 1994 | winter | Yes | unknown | unknown |
| 1994 | summer | Yes | unknown | unknown |
| 1995 | winter | Yes | unknown | unknown |
| 1995 | summer | Yes | unknown | unknown |
| 1996 | winter | Yes | unknown | unknown |
| 1996 | summer | Yes | unknown | unknown |
| 1997 | winter | Yes | unknown | unknown |
| 1997 | summer | Yes | unknown | unknown |
| 1998 | winter | Yes | unknown | unknown |
| 1998 | summer | Yes | unknown | unknown |
| 1999 | winter | Yes | unknown | unknown |
| 1999 | summer | Yes | 8 | 18-22 |
| 2000 | winter | Yes | 4 | 6-7 |
| 2000 | summer | Yes | 9 | 8-12 |
| 2001 | winter | Yes | 3 | 24-29 |
| 2001 | summer | Yes | 8-9 | 30-3 |
| 2002 | winter | Yes | 4 | 4-7 |
| 2002 | summer | Yes | 8-9 | 28-4 |
| 2003 | winter | Yes | 4 | 2 - 5 |
| 2003 | summer | Yes | 9 | 1 - 4 |
| 2004 | winter | Yes | 3 | 25 - 30 |
| 2004 | summer | Yes | 9 | 3 - 7 |
| 2005 | winter | Yes | 3 | 16 - 18 |
| 2005 | summer | Yes | 9 | 5 - 6 |
| 2006 | winter | Yes | 3 | 22 |
| 2006 | summer | Yes | 9 | 4 - 7 |
| 2007 | winter | Yes | 4 | 4 - 8 |
| 2007 | summer | Yes | 9 | 5 - 9 |
| 2008 | winter | Yes | 3 | 28 - 31 |
| 2008 | summer | Yes | 9 | 12 - 15 |
| 2009 | winter | Yes | 4 | 10 |
| 2009 | summer | Yes | 9 | 21 - 23 |
| 2010 | winter | No | none | none |
| 2010 | summer | No | none | none |
| 2011 | winter | Yes | 3 | 14 - 15 |
| 2011 | summer | Yes | 10 | 1 - 3 |
| 2012 | winter | Yes | 3 | 12 - 14 |
| 2012 | summer | No | none | none |
| 2013 | winter | Yes | 3 | 13 - 14 |
| 2013 | summer | No | none | none |

**Table 6**. List of Blank Abundance Cells, replaced with abundance=1

In five cases, abundance data was mistakenly not recorded, though the species was present on the quadrat. These blank abundances were entered as 1, as that is the most likely abundance value, and to indicate presence.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **year** | **season** | **plot** | **stake** | **species** | **abundance** |
| 2012 | winter | 2 | 33 | erod cicu | blank |
| 2013 | winter | 8 | 35 | erod cicu | blank |
| 2013 | winter | 22 | 15 | astr nutt | blank |
| 2013 | winter | 22 | 15 | erod cicu | blank |
| 2013 | winter | 24 | 77 | lyci torr | blank |

# CLASS V. SUPPLEMENTAL DESCRIPTORS

1. Publications using the data set: See *Portal\_overview\_metadata.html*

# LITERATURE CITED

Ernest, S. K. Morgan, Thomas J. Valone, and James H. Brown. 2009. Long-term monitoring and experimental manipulation of a Chihuahuan Desert ecosystem near Portal, Arizona, USA. Ecology 90:1708.