

---

***Erigeron decumbens* spp. *decumbens* (Willamette daisy):  
Population monitoring and evaluation of mowing and  
burning at Oxbow West (West Eugene Wetlands)**

---

**2007 PROGRESS REPORT**

**Andrea S. Thorpe, Ph.D. and Thomas N. Kaye, Ph.D.  
Institute for Applied Ecology**



***A Cooperative Challenge Cost Share Project funded jointly by:  
Bureau of Land Management, Eugene District  
and  
Institute for Applied Ecology***

---

---

## PREFACE

This report is the result of a cooperative Challenge Cost Share project between the Institute for Applied Ecology (IAE) and a federal agency. IAE is a non-profit organization dedicated to natural resource conservation, research, and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships. Our current activities are concentrated on rare and endangered plants and invasive species.

Questions regarding this report or IAE should be directed to:

Thomas N. Kaye or Andrea S. Thorpe  
Institute for Applied Ecology  
PO Box 2855  
Corvallis, Oregon 97339-2855

phone: 541-753-3099  
fax: 541-753-3098  
email: [kayet@peak.org](mailto:kayet@peak.org), [athorpe@peak.org](mailto:athorpe@peak.org)

---

## ACKNOWLEDGEMENTS

The authors gratefully acknowledge contributions to this project in 2007 by the Eugene District BLM. In 2007, work was supported by IAE staff and interns, Laila Bryant, John Grotendorf, Tom Kaye, Karin Rohland, Ryan Sheean, Jim Steitz, and Shell Whittington.

**Cover photographs:** *E. decumbens* ssp. *decumbens*. by T.N. Kaye

## TABLE OF CONTENTS

Preface.....	i
Acknowledgements.....	i
Table of Contents.....	ii
List of figures.....	iii
List of tables.....	iii
List of appendices.....	iii
Introduction.....	1
Species status.....	1
Background information.....	1
Reproduction and population biology.....	1
Objectives.....	2
Methods.....	2
Study site.....	2
Plot design and management treatments.....	2
Data analysis.....	5
Results and Discussion.....	7
Growth and reproduction of <i>E. decumbens ssp. decumbens</i> at Oxbow West.....	7
The effects of mowing and burning at Oxbow West.....	7
Conclusions.....	8
Literature Cited.....	13
Appendix A. Gear list and directions for ERDE, Oxbow West.....	14
Appendix B. Summary data for <i>Erigeron decumbens ssp. decumbens</i> monitoring at Oxbow West, 1999 - 2007.....	15
Appendix C. Data sheets for monitoring <i>Erigeron decumbens ssp. decumbens</i> at Oxbow West.....	24

## LIST OF FIGURES

- Figure 1.** *Erigeron decumbens* ssp. *decumbens* at Oxbow West.
- Figure 2.** Plot layout at Oxbow West.
- Figure 3.** Counting and measuring of *E. decumbens* ssp. *decumbens* at Oxbow West.
- Figure 4.** The total number of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007.
- Figure 5.** Average elliptical crown cover of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007.
- Figure 6.** Average height of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007.
- Figure 7.** Average number of capitula per plant in *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007.
- Figure 8.** Control plots tended to increase in the relative number of plants more than mow and burn plots at Oxbow West in 2007, relative to prior to the initiation of treatments.
- Figure 9.** Burned and mowed plots tended to have less of a reduction in average crown cover at Oxbow West in 2007, relative to prior to the initiation of treatments.
- Figure 10.** There was no difference in the proportional change in height between different treatments at Oxbow West in 2007, relative to prior to the initiation of treatments.
- Figure 11.** There tended to be a negative effect of mowing on the proportional change in capitula per plant at Oxbow West in 2007, relative to prior to the initiation of treatments.

## LIST OF TABLES

- Table 1.** Location of transect origination posts (rebar) in plots that are sub-sampled.
- Table 2.** Plot assignments for experimental management treatments at Oxbow West.
- (Appendix B) Table 3 (1999-2007)** Yearly data summaries for the Oxbow West *E. decumbens* ssp. *decumbens* population.

## LIST OF APPENDICES

- Appendix A.** Gear list and directions for ERDE, Oxbow West
- Appendix B.** Summary data for *Erigeron decumbens* ssp. *decumbens* monitoring at Oxbow West, 1999 – 2007
- Appendix C.** Data sheets for monitoring *Erigeron decumbens* ssp. *decumbens* at Oxbow West

## INTRODUCTION

### Species status

*Erigeron decumbens* ssp. *decumbens* (Willamette daisy, Asteraceae; cover photo and Fig. 1), is listed by the USFWS and Oregon Department of Agriculture as an endangered species (ORNHIC 2004). It is also considered a Special Status Species by the Bureau of Land Management (BLM).

### Background information

*Erigeron decumbens* ssp. *decumbens* is endemic to prairies in the Willamette Valley, Oregon. The population at Oxbow West is owned by the Eugene District BLM and is currently managed primarily for the *E. decumbens* ssp. *decumbens* and other native plant species. The overall habitat quality of this remnant prairie is good, and ongoing management efforts have helped reduce encroachment by feral *Pyrus communis* (cultivated pear trees), *Fraxinus latifolia* (Oregon ash), *Populus trichocarpa* (cottonwood), and various shrubs. Likewise, efforts are being made to eradicate the invasive grass, *Phalaris arundinacea* (reed canary grass) that is expanding into the prairie from adjacent wet areas.

In addition to *E. decumbens* ssp. *decumbens*, other rare plants at the Oxbow West site include *Aster curtus*, *Cicendia quadrangularis*, and *Sidalcea cusickii*, and the habitat has been noted as having high potential for reintroduction of *Lomatium bradshawii*. *Erigeron decumbens* ssp. *decumbens* is the most abundant rare plant at Oxbow West, occupying approximately five acres of the site. Maintaining and improving the prairie habitat is the main objective for management at the Oxbow West site. The current monitoring project was initiated in 1999 to evaluate the response of *E. decumbens* ssp. *decumbens* to mowing (treated in fall 2002 and 2004) and burning (treated in September 2005).

### Reproduction and population biology

*Erigeron decumbens* ssp. *decumbens* is an herbaceous perennial that reproduces by seed. Plants form clumps of basal leaves and produce one or more flowering stems. The plants also appear to spread vegetatively over very short distances (<10 cm). The primary pollinators of the species include *Phycoides campestris* (field crescent, butterfly), halictine bees (sweat bees), and *Toxomerus occidentalis* (a syrphid fly) (Jackson, 1996). Seed dispersal has been estimated at an average distance of 94 cm (Jackson, 1996).



**Figure 1.** *Erigeron decumbens* ssp. *decumbens* at Oxbow West.

## Objectives

There are three main objectives of this project. The first is to determine yearly population size and reproduction of *E. decumbens* ssp. *decumbens* at Oxbow West. The second objective is to determine if there are long-term trends in population size and reproduction. The final objective of this project is to assess the effects of mowing and prescribed burning on *E. decumbens* ssp. *decumbens*.

## METHODS

### Study site

Oxbow West is located in the West Eugene Wetlands and is managed by the Eugene District BLM (Oregon). The habitat at this site is predominately wetland prairie. As discussed above, the site harbors numerous rare plant species, including one of the largest known extant populations of *E. decumbens* ssp. *decumbens*. Oxbow West is being invaded by numerous exotic species, particularly *Pyrus communis* (feral pear trees) and *Phalaris arundinacea* (reed canary grass).

### Plot design and management treatments

Population monitoring data has been collected annually for *E. decumbens* ssp. *decumbens*, since plots were established in July, 1999. A total of 20 - 15 m x 40 m plots were established at the site within a 210 m x 80 m macroplot encompassing most of the *E. decumbens* ssp. *decumbens* population (Figure 2). The corners of each monitoring plot were marked with steel fence posts, which were labeled with a pre-numbered aluminum tag (Figure 2). The long axis of the plots runs north-to-south, except for plot 20, which has its long axis running east-to-west. This orientation was selected to capture an area with a high density of *E. decumbens* ssp. *decumbens*.

To examine the effects of different habitat management strategies on *E. decumbens* ssp. *decumbens*, the 20 monitoring plots were randomly assigned one of three treatments: unmanipulated control, mowing, or burning (Table 2). Mowing occurred in fall 2002, 2004, and 2006 and scheduled for application every other year through 2008. Previous years' effects of mowing are documented in Kaye et al. 2003, Gisler and Kaye 2004, Kaye and Benfield 2005. In 2006, plot 1, a control plot, was accidentally mowed, so was left out of analyses in 2007. Burning was originally scheduled for 2003, but was postponed until September, 2005.

*This page has been removed from public versions of this report*

### Plot sampling

With the exception of six plots that were sub-sampled along transects (discussed below), all *E. decumbens* ssp. *decumbens* individuals within the monitoring plots were counted and measured. In order to avoid recounting individuals, all plants within each plot were first located and marked with a wire pin flag. The pin flags were removed as individuals were measured. To make plant counting and measuring more manageable, these activities were conducted in 5 m segments, starting at the south end of plots 1 – 19 and east end of plot 20 (Figure 3).

All plants located within one meter of the plot edge were noted as being within the buffer. If needed due to impact on the plot from treating a neighboring plot, these plants can be removed from the data, making each plot 13 m x 38 m.



**Figure 3.** Counting and measuring *E. decumbens* ssp. *decumbens* at Oxbow West.

For each individual, we measured the widest diameter of a plant (the outermost part of an individual, including flowers), the diameter perpendicular to the widest diameter, height, and number of capitula (flower heads). The shape of each plant was assumed to be oval, and the maximum diameter and perpendicular diameter were used to calculate the elliptical crown cover of each plant (Eq. 1).

$$\text{Eq. 1: Elliptical crown cover} = (0.5 * \text{widest diameter}) * (0.5 * \text{perpendicular diameter}) * \pi$$



Plant height was measured as the distance from the base of the plant to the outer tip of its longest part. For reproductive plants, this was the outer edge of the flower on the tallest stem. For vegetative plants, this was the length of the longest leaf. Individual plants are generally easy to distinguish, but occasionally, closely-spaced plants are difficult to distinguish from one another or from parts of a spreading plant. Where it was unclear if two adjacent clumps were united underground, we assumed that plants separated by 7 cm or more were distinct individuals.

Beginning in 2002, six of the monitoring plots that had especially high plant densities were sub-sampled in order to improve sampling efficiency (Fig. 2). Here, all plants within each monitoring plot were counted, but measurements were only made on plants located along two transects. Transects were randomly placed along the narrow end of the plot when subsampling was initiated (Table 1). All plants rooted within one meter east of the transect were measured, thus each transect was 40 m long x 1 m wide. The north and south ends of the transects are marked with steel rebar and copper tags labeled A and B (rebar posts are also accompanied by green pin flags).

### **Data analysis**

For each plot, we determined the mean and standard error for crown cover, number of capitula per plant, and height and the total number of plants and capitula. In order to estimate the total number of inflorescences in plots that were sub-sampled, we multiplied the average number of inflorescences per plant by the total number of plants for each sub-sampled plot. Pearson rank correlation was used to test for relationships between average plant height, average crown cover, the number of capitula per plant, and the number of plants per plot (SPSS 13.0, 2004).

To evaluate the effects of burning and mowing on *E. decumens* ssp. *decumbens*, we calculated the change in plant size and abundance variables described above from before the first mowing treatment (2002) to the current year (2007). Data from plot 1 (control) were excluded from analyses in 2007 as this plot was accidentally mowed in 2006. Differences in these values were compared using an Analysis of Variance (SPSS 13.0, 2004). Prior to the burn in 2006, the burn and mowed treatment plots were treated the same. Thus, in order to determine if there was a burn effect separate from the effect of mowing, we analyzed 2007 size and abundant variables in burn and mow plots, using 2005 data as the covariate.

**Table 1.** Location of transect origination posts (rebar) in plots that are sub-sampled. The location refers to distance east from the southwest corner post of the indicated 15 m x 40 m plots. Plot 13 is proposed to be added to subsampled plots in 2007.

Plot #	Transect Locations	
	A	B
1	7m	6m
2	12m	10m
3	8m	2m
13	3m	6m
14	7m	9m
16	6m	7m
17	5m	12m

**Table 2.** Plot assignments for experimental habitat treatments at Oxbow West. Mowing treatments were conducted in fall of 2002, 2004, and 2006. Burning was implemented in September, 2005.

plot #	treatment	plot #	treatment	plot #	treatment
1	control	3	burn	2	mow
5	control	6	burn	4	mow
7	control	8	burn	10	mow
9	control	12	burn	11	mow
13	control	14	burn	15	mow
16	control	20	burn	17	mow
18	control			19	mow

## RESULTS AND DISCUSSION

### Growth and reproduction of *E. decumbens* ssp. *decumbens* at Oxbow West

In 2007 there were a total of 3,944 *E. decumbens* ssp. *decumbens* plants recorded within the monitoring plots at Oxbow West. This is the highest number recorded and almost twice the number of plants compared to when monitoring began in 1999 (Figure 4, Appendix I). The proportion of reproductive plants in the population has been relatively stable, at 83% of the total population (linear regression,  $R^2 = 0.90$ ).

Average plant height and average crown cover remain relatively low compared to the initial years of monitoring at this site. In 2007, average crown cover was 22.25 cm<sup>2</sup>, which is 59% of the average value measured in 1999 (Figure 5, Appendix I). The average height in 2007 was 16.6 cm, 74% of that in 1999 (Figure 5, Appendix I). There was a strong negative correlation between measurements of plant size and the number of plants (cover: Pearson correlation = -0.261,  $P < 0.0005$ ; height: Pearson correlation = -0.305,  $P < 0.0005$ ).

In 2007, we counted a total of 17,605 capitula (Figure 6, Appendix I), with each plant having, on average, 5 capitula (Figure 7, Appendix I). Similar to average height and cover, the average number of capitula per plant has decreased as the population has increased (Pearson correlation = -0.243,  $P = 0.001$ ).

There are two possible causes for the observed declines in height, cover, and the average number of capitula as the population has grown. This relationship could be attributed to intraspecific competition caused by increased *E. decumbens* ssp. *decumbens* density within the plots; however, there appears to be a relatively large amount of habitat that is still unoccupied at the site. More likely, these relationships reflect the fact that newly recruited individuals are young and small.

### The effects of mowing and burning at Oxbow West

Experimental management treatments for improving habitat for *E. decumbens* ssp. *decumbens* at Oxbow West are prescribed burning and mowing. The mowing treatments were conducted in September 2002, 2004, and 2006. Burning was implemented in fall of 2005.

In 2006, we reported that average elliptical crown cover of *E. decumbens* ssp. *decumbens* in the burned plots was marginally greater than that in the mowed plots and that there was no effect of treatment on any of the other variables (Thorpe and Kaye 2006). Similarly, there was little effect of mowing measured the year following either the first (Kaye et al. 2003) or second (Kaye and Benfield 2005) mowing.

Treatment effects became more complex in 2007. There was a strong trend for there to be a fewer plants in plots that were mowed and burned compared to control plots ( $P = 0.07$ ; Figure 8). Due to the negative correlation between size and the number of plants, the burned and mowed plots tended to have less of a reduction in average crown cover ( $P = 0.054$ ; Figure 9). There was no effect of treatment on average height ( $P = 0.153$ ; Figure 10). Finally, there tended to be a negative effect of mowing on the average number of capitula, while there was almost no change in the average number of capitula in the control and burned plots ( $P = 0.074$ ; Figure 11).

Until the burn in 2006, the burn plots were mowed every-other-year with mow plots. Thus, to determine if there was an effect of the burn in 2007, separate from the effects of the

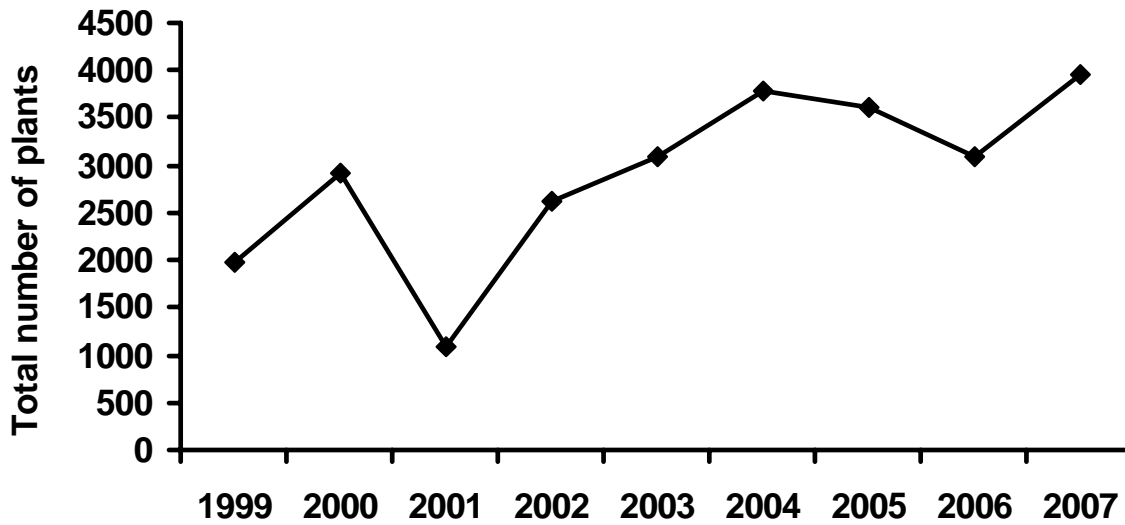
previous years of mowing, we also analyzed the changes in plant numbers, size, and the number of capitula in the mowed and burned plots only, using 2005 (the most recently monitored data prior to the burn) as the covariate. In these analyses, we found no difference between these treatments in the effect on the number of plants or the change in plant height. However, average crown cover increased by 78% in mowed plots, but only 16% in burned plots ( $P = 0.011$ ). Similarly, there was a 30% increase in the average number of capitula per plant in the mowed plots, but no change in the burned plots ( $P = 0.009$ ). Thus, almost years after the burn, there appeared to be a moderately negative impact on plant growth and reproduction. It is possible that these effects may be due in part to changes in the plant community caused by the burn treatment. In 2006 and 2007, we observed that there was a higher percent cover of *Anthoxanthum odoratum* (sweet vernalgrass) in the burned plots, which may compete with *E. decumbens* ssp. *decumbens*.

### CONCLUSIONS

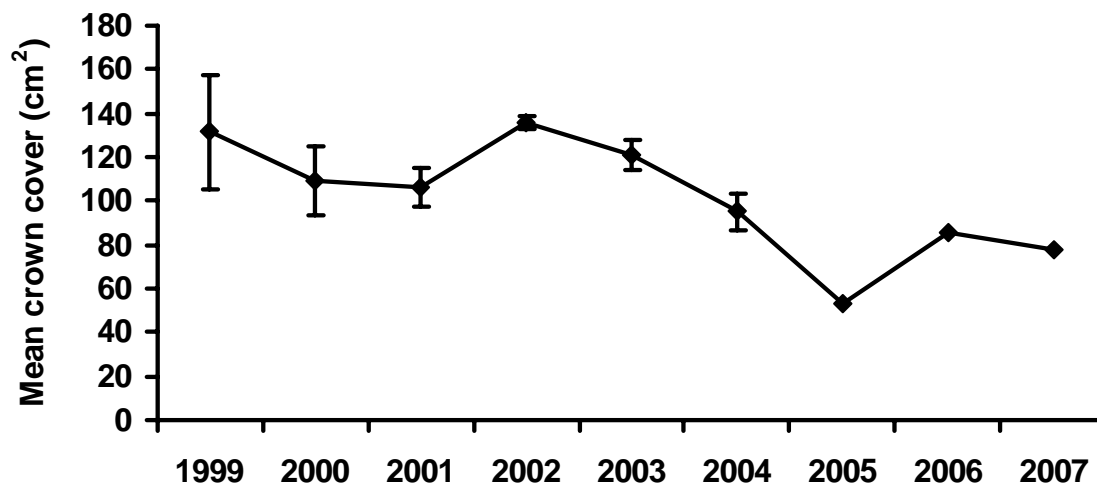
While the population of *E. decumbens* ssp. *decumbens* is growing at Oxbow west, there is significant variability in the total number of plants, reproduction, and growth. We suggest that monitoring using these, or comparable methods, be continued for several years in order to answer the following questions:

1. What is the role of climate in the population growth, plant size, and reproduction?
2. How close is the population to reaching its maximum?
3. As the population nears its climax, will the proportion of reproductive individuals change?
4. As the population nears its climax, will average plant size and reproduction change?

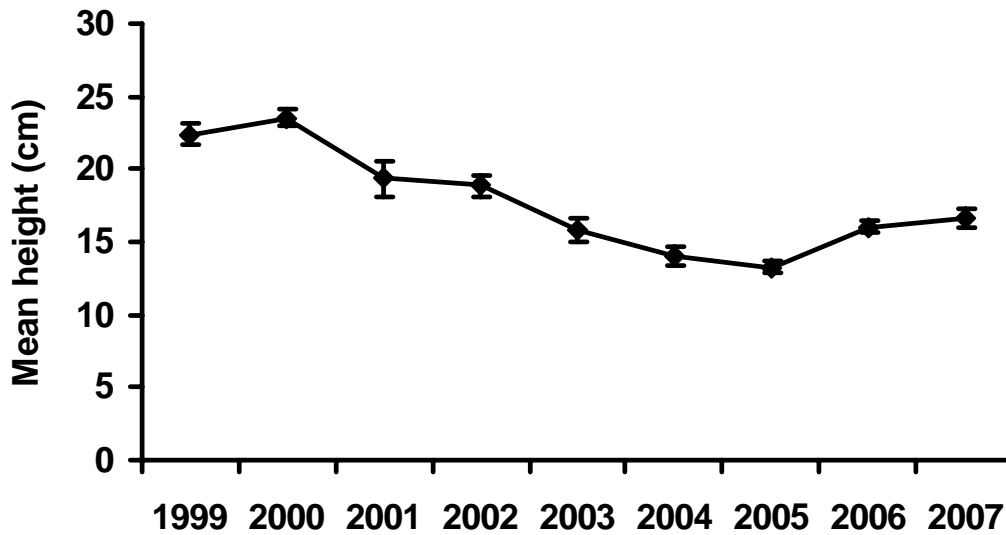
We also suggest that habitat management at Oxbow West may be re-evaluated. Mowing every-other-year appears to be having mild negative effects on *E. decumbens* ssp. *decumbens*. However, mowing is also a useful technique for maintaining open prairie habitat. We recommend altering the mowing treatment to a four year interval. We also recommend that there be no further treatments to the burn plots for at least another two years. Burning can stimulate the seed bank of some species and this type of effect would take several years to become apparent. In order to determine if this is occurring, future analyses should look for an increased proportion of vegetative plants in the burn plots relative to the mowed and control plots.



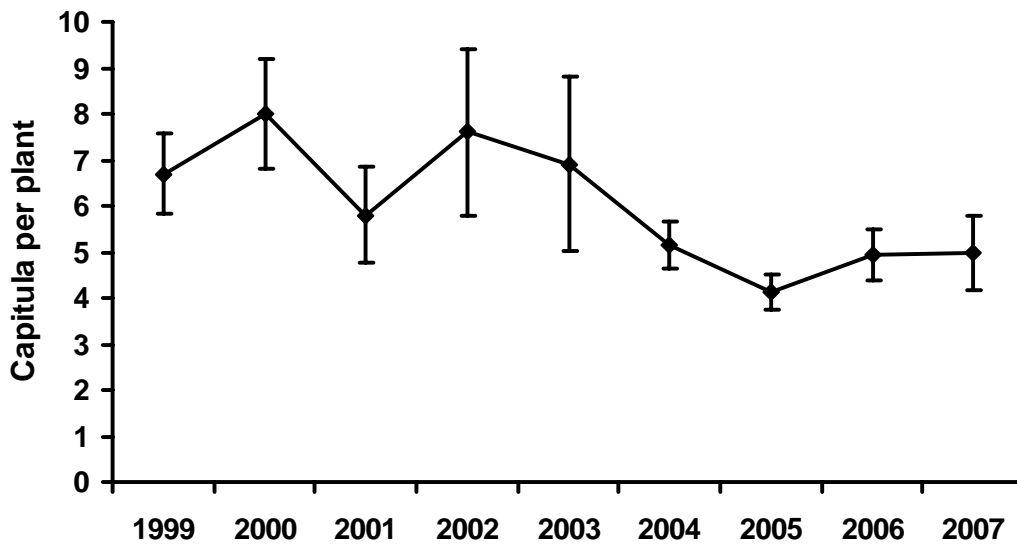
**Figure 4.** The total number of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007. Bars are  $\pm 1$  SE.



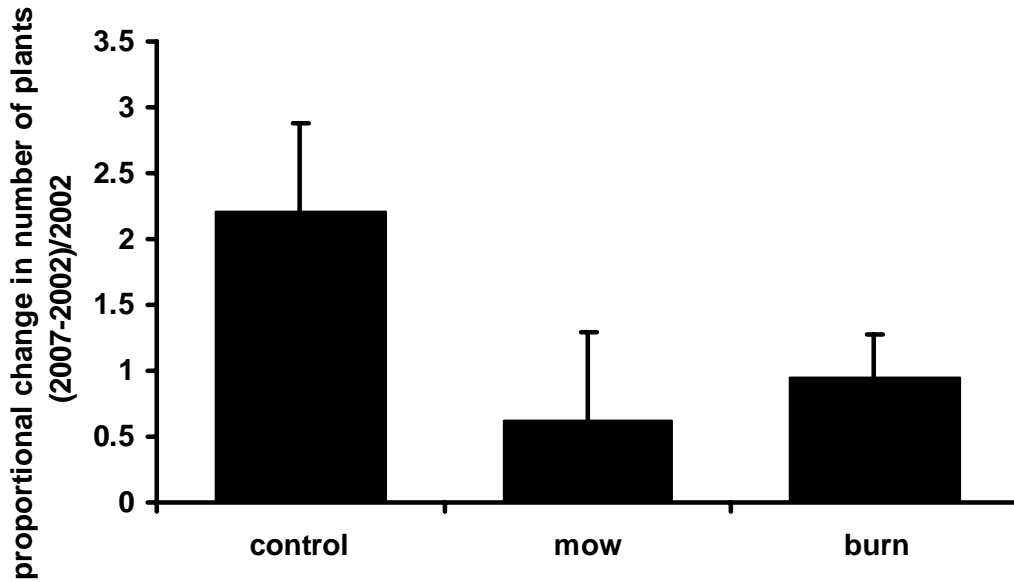
**Figure 5.** Average elliptical crown cover of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007. Bars are  $\pm 1$  SE.



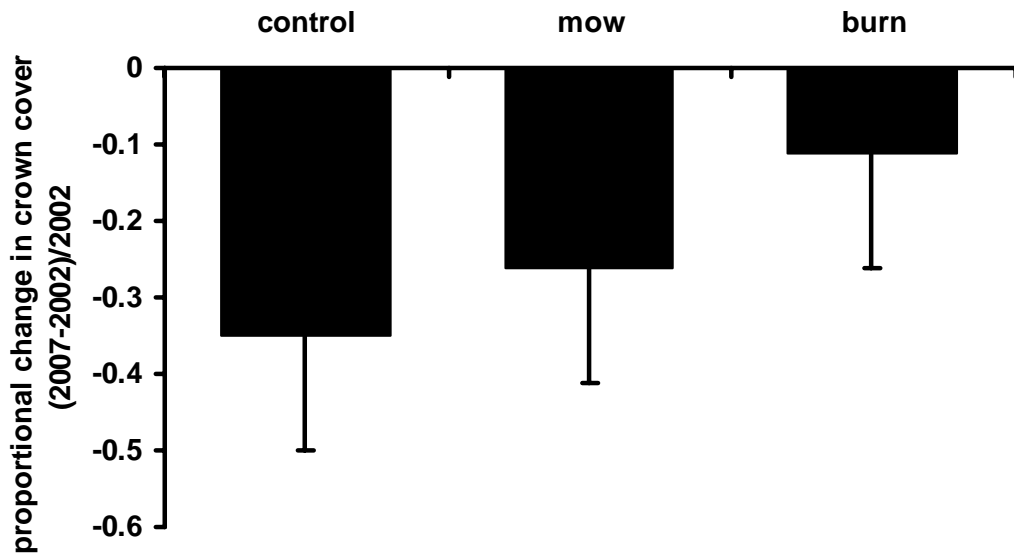
**Figure 6.** Average height of *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007. Bars are mean +1 S.E.



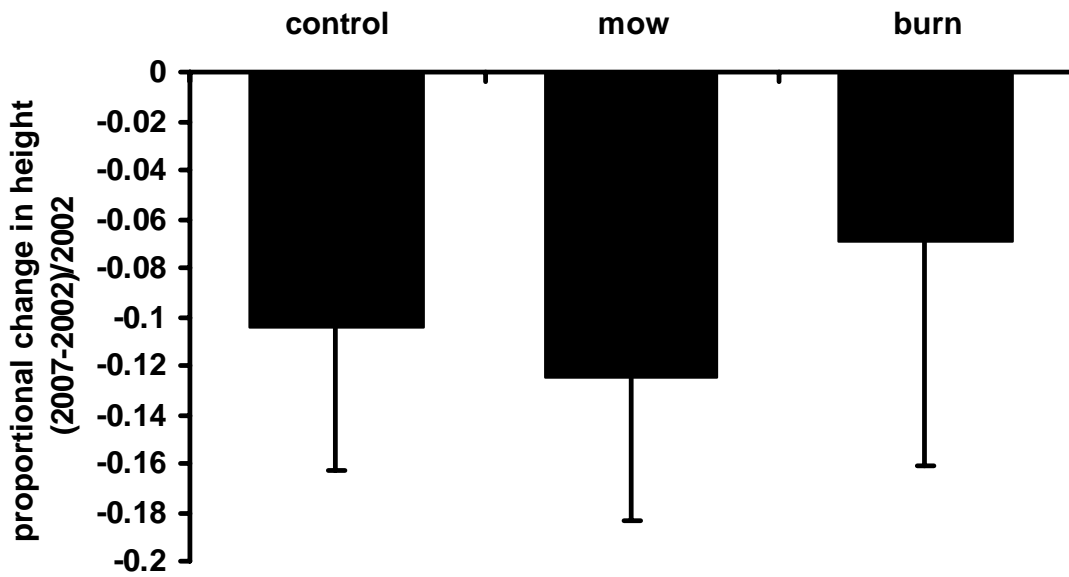
**Figure 7.** Average number of capitula per plant in *E. decumbens* ssp. *decumbens* in monitoring plots at Oxbow West, West Eugene Wetlands from 1999 to 2007. Bars are mean +1 S.E.



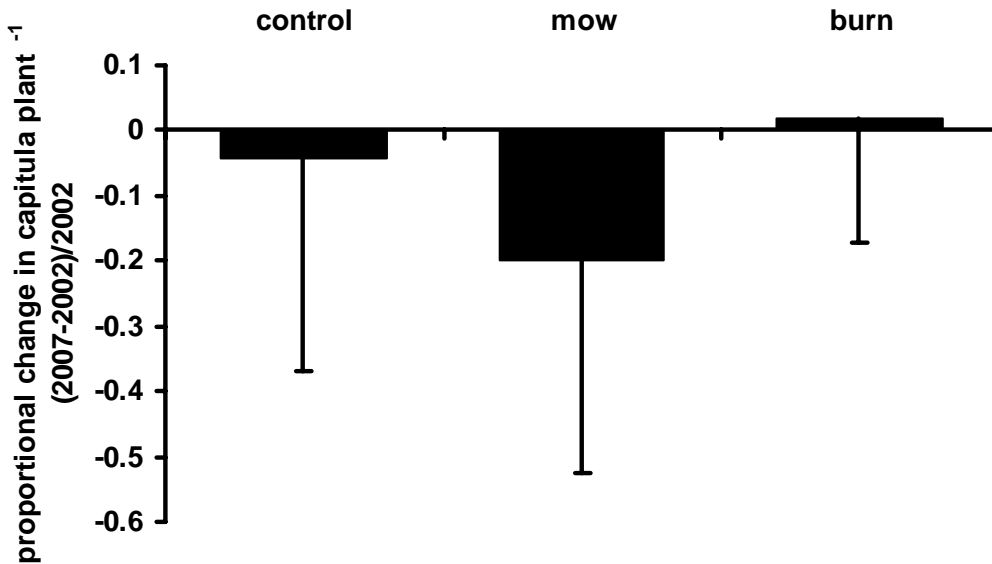
**Figure 8.** Control plots tended to increase in the relative number of plants more than mow and burn plots at Oxbow West in 2007, relative to prior to the initiation of treatments (2002;  $P = 0.07$ ). Bars are mean +1 S.E.



**Figure 9.** Burned and mowed plots tended to have less of a reduction in average crown cover at Oxbow West in 2007, relative to prior to the initiation of treatments (2002;  $P = 0.054$ ). Bars are mean +1 S.E.



**Figure 10.** There was no difference in the proportional change in height between different treatments at Oxbow West in 2007, relative to prior to the initiation of treatments (2002;  $P = 0.153$ ). Bars are mean +1 S.E.



**Figure 11.** There tended to be a negative effect of mowing on the proportional change in capitula per plant at Oxbow West in 2007, relative to prior to the initiation of treatments (2002;  $P = 0.074$ ). Bars are mean +1 S.E.



## LITERATURE CITED

- Gisler, S., and T.N. Kaye. 2004. Population monitoring for experimental habitat manipulation of Willamette daisy Oxbow West site, West Eugene, 2004 Progress Report. Institute for Applied Ecology and Bureau of Land Management, Eugene District, Eugene, Oregon
- Jackson, S.A. 1996. Reproductive aspects of *Lomatium bradshawii* and *Erigeron decumbens* of the Willamette Valley, Oregon. M.Sc. Thesis. University of Oregon, Eugene, Oregon.
- Kaye, T.N., and C. Benfield. 2005. Population monitoring for experimental habitat manipulation of Willamette daisy Oxbow West site, West Eugene, 2005 Progress Report. Institute for Applied Ecology and Bureau of Land Management, Eugene District, Eugene, Oregon.
- Kaye, T.N., J. Cramer, and B.A. Lawrence. 2003. Population monitoring for experimental habitat manipulation of Willamette daisy Oxbow West site, West Eugene, 2003 Progress Report. Institute for Applied Ecology and Bureau of Land Management, Eugene District, Eugene, Oregon.
- Oregon Natural Heritage Information Center. 2004. Rare, Threatened and Endangered Species of Oregon. Oregon Natural Heritage Information Center, Oregon State University, Portland, Oregon. 105 pp.
- Thorpe, A.S., and T.N. Kaye. 2006. *Erigeron decumbens* ssp. *decumbens* (Willamette daisy): Population monitoring and evaluation of mowing and burning at Oxbow West, West Eugene Wetlands. 2006 Progress Report. Institute for Applied Ecology and Bureau of Land Management, Eugene District, Eugene, Oregon.

## APPENDIX A. GEAR LIST AND DIRECTIONS FOR ERDE, OXBOW WEST

This project required approximately six days of field work with a crew of four to five people

### **Gear**

Metal candy cane stakes for anchoring tapes: 4 or more

Meter tapes: 2 100m tapes, 2 50m tapes, 4 30m tapes

One meter PVC poles: one for each person

Pin flags: at least 100

Pencils and lead

Clipboards: 2 - 6

Blank data sheets

Previous year's data sheets

Copy of previous year's report

Rulers: one for each person

Compass

Health and Safety Box

*Directions removed from public copies of this report.*

**APPENDIX B. SUMMARY DATA FOR *ERIGERON DECUMBENS* SPP. *DECUMBENS* MONITORING AT OXBOW WEST, 1999 - 2007**

**Table 3 (1999):** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 1999. The total number of capitula was estimated for the plots that were subsampled.

<b>plot</b>	<b>#plants per plot</b>	<b>crown cover (cm<sup>2</sup>)</b>	<b>height (cm)</b>	<b>capitula per plant</b>	<b># plants in buffer</b>	<b>total capitula per plot</b>
1	310	104.8	19.2	5.1	20	1588
2	490	80.7	19.9	4.1	32	742
3	398	74.6	19.9	3.9	36	1552
4	152	107.2	22.4	5.2	16	794
5	65	100.5	24.0	6.6	2	428
6	7	237.5	28.9	16.4	1	115
7	8	232.3	26.5	17.1	0	137
8	26	107.5	23.7	6.2	1	161
9	2	351.9	29.5	5.5	0	11
10	55	75.6	20.7	5.6	5	309
11	21	100.0	20.0	6.0	1	127
12	88	85.3	20.9	4.8	18	420
13	110	98.6	22.8	6.6	12	723
14	67	114.4	21.8	3.8	4	255
15	20	67.7	17.9	4.1	6	82
16	155	76.9	17.9	3.9	34	610
17	220	90.5	20.6	4.5	24	989
18	76	120.9	22.2	6.0	3	458
19	14	118.4	21.9	5.6	0	78
20	14	282.5	27.6	12.9	4	180
<b>census or mean</b>	1988	131.4	22.4	6.7		
<b>min</b>		1.6	2.0	0.0		
<b>max</b>		1319.5	46.0	87.0		
<b>std</b>		103.8	6.1	5.7		

**Table 3 (2000):** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2000. The total number of capitula was estimated for the plots that were subsampled.

<b>plot</b>	<b># plants per plot</b>	<b>crown cover (cm<sup>2</sup>)</b>	<b>height (cm)</b>	<b>capitula per plant</b>	<b># plants in buffer</b>	<b>total capitula per plot</b>
1	593.0	84.3	23.7	6.7	45.0	4000.0
2	269.0	69.8	21.8	5.5	33.0	1474.0
3	465.0	60.8	21.8	5.2	40.0	2407.0
4	130.0	63.3	22.0	4.6	9.0	603.0
5	63.0	59.5	23.6	5.1	2.0	320.0
6	5.0	144.2	22.4	10.2	0.0	51.0
7	8.0	229.0	30.3	27.6	0.0	221.0
8	42.0	59.4	22.9	6.0	2.0	252.0
9	4.0	212.3	26.3	12.0	0.0	48.0
10	96.0	93.5	23.8	8.2	7.0	784.0
11	29.0	94.4	23.4	8.8	4.0	255.0
12	132.0	112.6	23.1	7.3	15.0	965.0
13	161.0	152.3	25.0	9.1	15.0	1465.0
14	175.0	94.1	22.3	5.5	23.0	960.0
15	89.0	53.9	21.9	4.3	13.0	382.0
16	225.0	89.5	20.0	4.9	46.0	1104.0
17	267.0	75.8	23.4	5.1	38.0	1357.0
18	119.0	121.1	22.3	6.5	9.0	768.0
19	10.0	55.8	22.2	3.7	5.0	37.0
20	30.0	253.0	28.2	13.5	9.0	405.0
<b>census or mean</b>	2912	108.9	23.5	7.99		
<b>min</b>		0.8	2.0	0.0		
<b>max</b>		1570.8	45.0	133.0		
<b>std</b>		111.3	5.7	7.0		

**Table 3 (2001).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2001. The total number of capitula was estimated for the plots that were subsampled.

<b>plot</b>	<b>#plants per plot</b>	<b>crown cover (cm<sup>2</sup>)</b>	<b>height (cm)</b>	<b>capitula per plant</b>	<b># plants in buffer</b>	<b>total capitula per plot</b>
1	277.0	85.1	15.2	3.0	18.0	833.0
2	72.0	61.4	17.0	3.3	14.0	238.0
3	181.0	67.0	17.1	2.8	6.0	504.0
4	24.0	43.5	18.2	2.9	0.0	69.0
5	30.0	141.2	26.9	10.4	0.0	303.0
6	0.0	–	–	0.0	0.0	0.0
7	24.0	44.1	18.6	3.0	0.0	72.0
8	13.0	207.0	36.6	17.8	0.0	214.0
9	3.0	128.8	18.7	3.0	0.0	9.0
10	39.0	95.3	16.8	5.5	0.0	213.0
11	8.0	29.8	13.3	1.5	1.0	12.0
12	84.0	137.9	17.5	6.3	12.0	531.0
13	21.0	201.2	19.4	11.1	3.0	233.0
14	60.0	117.5	17.1	4.8	8.0	287.0
15	18.0	96.1	16.9	5.0	4.0	90.0
16	103.0	86.7	16.8	4.4	9.0	455.0
17	76.0	86.1	17.3	4.6	5.0	347.0
18	27.0	81.8	17.0	4.4	0.0	119.0
19	10.0	70.8	19.7	6.4	1.0	64.0
20	9.0	234.3	27.2	15.9	0.0	143.0
<b>census or mean</b>	1079.0	106.1	19.3	6.1	81	4736.0
<b>min</b>		0.8	2.0	0.0		
<b>max</b>		1105.8	221.0	73.0		
<b>std</b>		96.6	10.9	6.9		

**Table 3 (2002).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2002. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	control	507	155.14	18.6	5.4	70	2889
2	mow	176	61.6	15.8	2.4	35	421
3	burn	597	75.5	15.0	2.0	32	1217
4	mow	122	61.0	14.5	2.3	6	287
5	control	34	77.7	18.2	3.5	1	123
6	burn	15	106.5	17.6	5.6	0	84
7	control	28	268.5	19.0	17.1	0	479
8	burn	30	106.5	19.9	7.0	0	211
9	control	2	542.3	29.5	39.0	0	78
10	mow	103	107.7	19.1	7.1	7	727
11	mow	15	49.1	17.5	4.1	3	62
12	burn	61	73.0	23.0	6.5	17	397
13	control	120	156.5	19.9	7.2	16	863
14	burn	198	95.2	20.7	4.9	49	970
15	mow	61	89.3	16.8	5.3	13	321
16	control	203	76.3	17.2	5.0	53	1016
17	mow	206	81.7	16.2	4.8	44	984
18	control	80	112.6	17.8	5.1	0	411
19	mow	25	97.8	18.4	5.7	5	142
20	burn	34	328.6	21.8	11.7	14	397
<b>census or mean</b>		2617	136.1	18.8	7.6	18.3	12079.6
<b>min</b>			0	2.0	0.0		
<b>max</b>			3359.9	41.0	162.0		
<b>std</b>			189.6	6.8	10.1		
<b>SE</b>			43.5	1.6	2.3		

**Table 3 (2003).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2003. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	control	747	71.1	14.25	3.5	57	2585
2	mow	154	67.2	12.34	2.5	21	385
3	burn	500	67.7	12.44	1.8	33	882
4	mow	105	58.4	12.5	1.9	5	200
5	control	41	75.5	15.05	3.1	8	128
6	burn	21	111.8	17.71	5.1	0	108
7	control	25	197.0	19.04	19.1	0	478
8	burn	30	119.8	18.37	5.2	0	156
9	control	2	341.3	27.00	39.0	0	78
10	mow	102	107.9	14.74	6.1	14	617
11	mow	18	69.6	13.00	3.4	0	62
12	burn	83	102.1	14.58	5.1	8	420
13	control	181	150.4	17.72	6.1	21	1100
14	burn	150	180.7	14.53	5.5	23	821
15	mow	69	115.1	13.49	4.7	9	323
16	control	232	65.6	13.34	2.5	60	572
17	mow	432	56.7	11.95	2.4	226	1028
18	control	125	90.7	15.37	4.4	20	542
19	mow	14	161.4	17.93	6.7	1	94
20	burn	65	211.2	20.18	10.0	16	651
<b>census or mean</b>		3096	121.05	15.8	6.9	522	11230
<b>min</b>		2	56.7	11.95	1.76	0	62
<b>max</b>		747	341.3	27	39	226	2585
<b>std</b>			70.4	3.62	8.47		
<b>SE</b>			15.7	0	1.89		
				0.81			

**Table 3 (2004).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2004. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	control	710	85	12	4.1	56	310
2	mow	27	97	16	5.0	2	136
3	burn	52	68	14	4.8	0	251
4	mow	139	131	15	5.8	29	803
5	control	239	61	13	3.7	37	143
6	burn	75	207	21	13.1	27	985
7	control	881	77	11	4.3	90	1091
8	burn	52	106	16	3.4	15	179
9	control	62	85	9	6.0	0	371
10	mow	12	113	15	5.0	1	60
11	mow	234	177	17	8.6	12	2012
12	burn	220	62	13	3.5	49	194
13	control	174	93	16	4.9	22	849
14	burn	156	44	11	2.5	45	59
15	mow	159	75	13	2.9	12	460
16	control	140	75	12	5.0	21	695
17	mow	31	76	12	3.7	4	114
18	control	83	73	14	4.7	18	393
19	mow	300	105	16	4.9	113	138
20	burn	27	97	16	6.9	5	187
<b>census or mean</b>		3773	95.28	14.02	5.14	588	14.121
<b>SE</b>			8.76	0.6	0.52		



**Table 3 (2005).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2005. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	control	554	55.3	11.5	3.1	45	1742
2	mow	236	42.0	10.4	2.3	30	539
3	burn	664	57.1	11.5	3.6	60	2392
4	mow	166	39.3	11.4	2.8	19	472
5	control	46	53.8	13.4	4.0	8	184
6	burn	33	53.5	13.1	4.3	0	143
7	control	41	46.2	13.9	4.6	0	188
8	burn	66	46.1	12.6	3.5	0	234
9	control	14	61.0	17.1	4.4	2	61
10	mow	152	51.8	12.3	3.6	17	546
11	mow	30	38.8	13.5	3.9	6	117
12	burn	135	60.4	13.9	5.8	27	784
13	control	271	74.9	15.3	6.7	20	1806
14	burn	160	37.8	14.2	2.5	31	407
15	mow	57	51.1	13.7	4.2	17	238
16	control	212	54.1	12.4	3.1	50	662
17	mow	415	43.1	12.0	2.8	96	1168
18	control	251	47.7	12.2	3.5	28	885
19	mow	37	55.5	12.4	4.0	13	149
20	burn	82	97.4	18.5	9.9	15	808
<b>census/mean</b>		3622	53.3	13.3	4.1	484	13525.7
<b>min</b>		14	37.8	10.4	2.3	0	
<b>max</b>		664	97.4	18.5	9.9	96	
<b>std</b>			13.7	1.9	1.7		
<b>SE</b>			3.1	0.4	0.4		

**Table 3 (2006).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2006. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	control	432	57	15	3.9	31	1689
2	mow	26	102	16	3.5	0	92
3	burn	47	85	16	3.7	0	172
4	mow	127	114	15	6.1	17	778
5	control	175	136	19	3.9	31	679
6	burn	64	155	20	8.7	12	556
7	control	560	48	15	3.7	53	2092
8	burn	53	87	17	4.4	5	231
9	control	51	89	16	7.6	0	387
10	mow	14	137	20	10.4	3	145
11	mow	304	124	17	10.2	13	3089
12	burn	229	56	13	3.1	24	706
13	control	161	68	15	4.1	14	653
14	burn	143	50	15	2.5	25	358
15	mow	196	65	14	3.0	3	590
16	control	103	78	17	5.5	13	571
17	mow	37	72	15	5.0	1	184
18	control	41	71	15	3.6	12	149
19	mow	300	65	16	3.1	52	918
20	burn	29	44	14	2.8	0	82
<b>census/mean</b>		3092	85	16	4.94	588	14.121
<b>SE</b>			7.29		0.54		

**Table 3 (2007).** Summary of the number of plants, mean crown cover, mean height, mean number of capitula per plant, number of plants in the buffer, and total capitula for each of the 20 plots at the Oxbow West site in 2006. The total number of capitula was estimated for the plots that were subsampled.

plot	treatment	# plants per plot	crown cover (cm <sup>2</sup> )	height (cm)	capitula per plant	# plants in buffer	total capitula per plot
1	Control <sup>a</sup>	729	55	15	3	78	1888
2	mow	181	44	15	3	39	526
3	burn	569	60	16	4	26	1904
4	mow	204	60	15	3	7	609
5	control	109	88	18	5	9	541
6	burn	40	113	20	6	2	182
7	control	67	70	15	5	0	310
8	burn	61	68	16	5	1	280
9	control	13	111	19	8	0	92
10	mow	166	44	15	4	27	503
11	mow	46	69	14	3	4	122
12	burn	174	76	13	4	24	551
13	control	406	171	22	18	18	6225
14	burn	222	135	21	7	33	1274
15	mow	51	58	14	3	10	150
16	control	239	52	16	3	44	643
17	mow	357	42	14	2	67	630
18	control	204	60	17	3	14	590
19	mow	35	48	15	2	10	62
20	burn	71	123	22	8	17	522
<b>census/mean</b>		3944	77	17	4.99	430	17,605
<b>SE</b>			7.87	0.62	0.76		

<sup>a</sup>In 2006, plot 1 was mowed. This plot was not used for treatment analyses in 2007.

**APPENDIX C. DATA SHEETS FOR MONITORING ERIGERON DECUMBENS SSP. DECUMBENS AT OXBOW WEST**

*Erigeron decumbens* var. *decumbens* monitoring data, Oxbow West

Name \_\_\_\_\_

Date: \_\_\_\_\_

Plot	5-m interval	plant #	max width (cm)	perp width (cm)	hieght (cm)	inflor #	comments

**Erigeron decumbens data, Oxbow West**  
**Plant counts for subsampled transects**

Name \_\_\_\_\_

Date \_\_\_\_\_

plot	section	inside plot		in buffer		total plants	total buffer	Comments
		# veg	# repro	# veg	# repro			
1	0-5							
1	5-10							
1	10-15							
1	15-20							
1	20-25							
1	25-30							
1	30-35							
1	35-40							
2	0-5							
2	5-10							
2	10-15							
2	15-20							
2	20-25							
2	25-30							
2	30-35							
2	35-40							
3	0-5							
3	5-10							
3	10-15							
3	15-20							
3	20-25							
3	25-30							
3	30-35							
3	35-40							
12	0-5							not sub-
12	5-10							sampled 05, 06
12	10-15							
12	15-20							
12	20-25							
12	25-30							
12	30-35							

12	35-40							
13	0-5							
13	5-10							
13	10-15							
13	15-20							
13	20-25							
13	25-30							
13	30-35							
13	35-40							
14	0-5							
14	5-10							
14	10-15							
14	15-20							
14	20-25							
14	25-30							
14	30-35							
14	35-40							
16	0-5							
16	5-10							
16	10-15							
16	15-20							
16	20-25							
16	25-30							
16	30-35							
16	35-40							
17	0-5							
17	5-10							
17	10-15							
17	15-20							
17	20-25							
17	25-30							
17	30-35							
17	35-40							