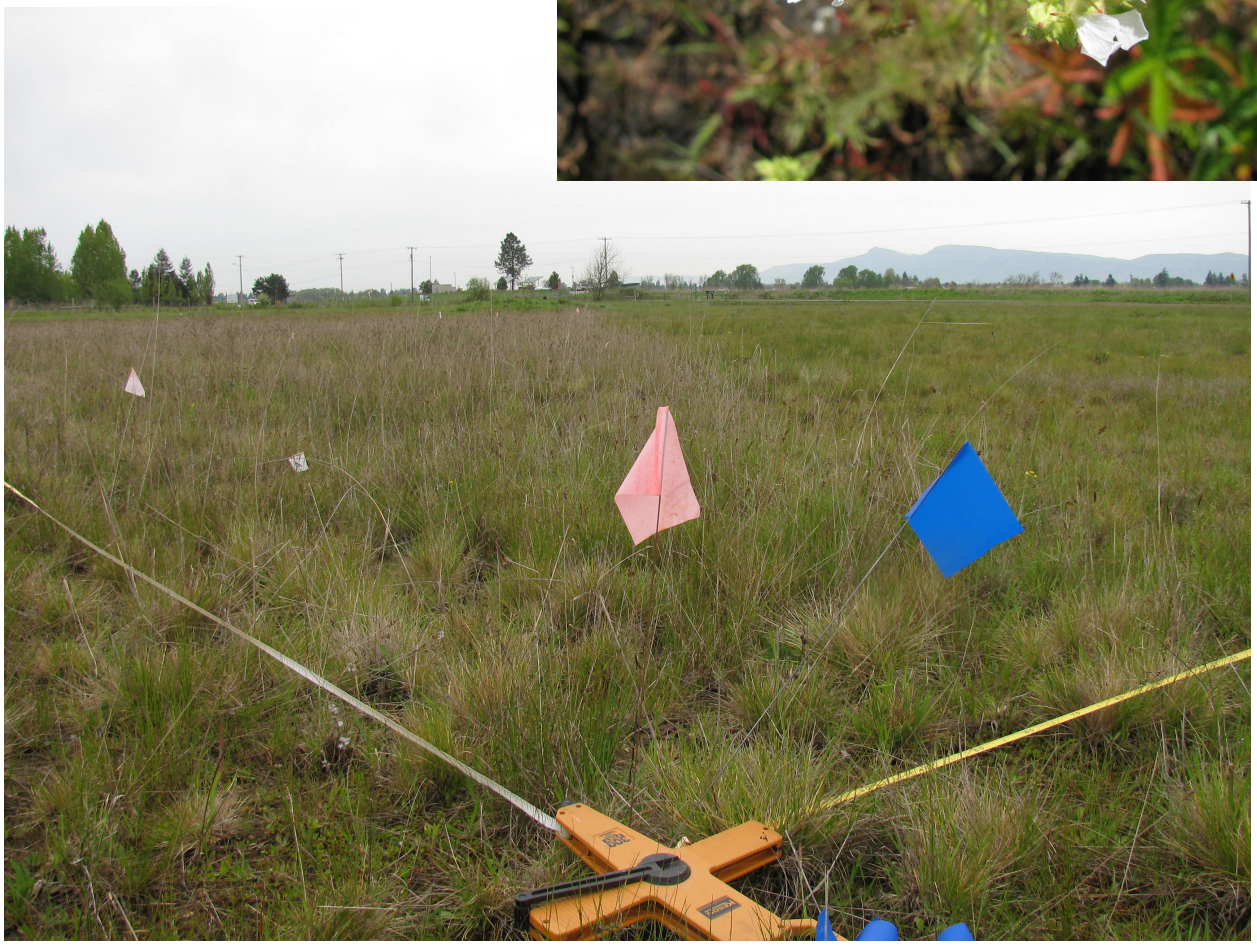
STATUS OF INTRODUCED BUREAU SENSITIVE, THREATENED, AND ENDANGERED SPECIES AT GREENHILL: ASSESSMENT OF MOWING DAMAGE

2010 Report, REVISED

Andrea S. Thorpe, Ph.D.
Institute for Applied Ecology



Report to the* Bureau of Land Management, Eugene District *by
Institute for Applied Ecology

PREFACE

This report is the result of an agreement between the Institute for Applied Ecology (IAE) and a federal agency. IAE is a non-profit organization with a mission to conserve native species and habitats through restoration, 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:

Andrea S. Thorpe, Ph.D.
Conservation Research Program Director
Institute for Applied Ecology
PO Box 2855
Corvallis, Oregon 97339-2855

phone: 541-753-3099, ext. 401
fax: 541-753-3098
email: andrea@appliedeco.org

ACKNOWLEDGEMENTS

The authors gratefully acknowledges the contributions and cooperation by the Eugene District Bureau of Land Management, especially Nancy Sawtelle and Sally Villegas. In 2010, work was supported by IAE staff and interns, Michelle Allen, Andrew Dempsey-Karp, Olivia Duren, Kristen Emmett, Geoff Gardner, Tom Kaye, and Shell Whittington.

Cover photographs: Matrix plot and flowering *Horkelia congesta*, June 2010.

REFERENCE

Thorpe, A.S. 2010. Status of introduced Bureau Sensitive, Threatened, and Endangered species at Greenhill: Assessment of mowing damage. Report to the Eugene District Bureau of Land Management. Institute for Applied Ecology, Corvallis, Oregon, USA.

EXECUTIVE SUMMARY

In 1999 and 2000, *Erigeron decumbens* (Willamette daisy, Asteraceae, Federal endangered species), *Horkelia congesta* (Shaggy horkelia, Rosaceae Federal Species of Concern), *Lomatium bradshawii* (Bradshaw's desert parsley, Federal endangered species), and *Sericocarpus rigidus* (*Aster curtus* nom., Columbian white topped aster, Federal Species of Concern) individuals were planted and seeded into multiple plots at North Greenhill (managed by the Eugene District Bureau of Land Management). On June 16, 2009, unauthorized mowing by the Oregon Department of Transportation occurred at Greenhill on a large portion of the reintroduction area. The effects of this mowing included damaging foliar cover, cutting mature inflorescences, covering plants with thick clumps of thatch, and scalping the ground. In 2010, we monitored all plots and compared the number of individuals, size, and reproduction of each species in the mowed versus unmowed portions of the site to the most recently available data (2004 and 2009). Mowing appears to have had a negative effect on *Sericocarpus*; there was a 10% loss of this species from 2009 to 2010 in the unmowed portion of the plot, compared to a 56% loss in the mowed portion of the plot. We did not observe negative effects of mowing on *Erigeron*, *Horkelia*, nor *Lomatium*. We recommend continued monitoring of the site to track ongoing changes in these populations.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In 1999 and 2000, *Erigeron decumbens* (Willamette daisy, Asteraceae, Federal endangered species), *Horkelia congesta* (Shaggy horkelia, Rosaceae Federal Species of Concern), *Lomatium bradshawii* (Bradshaw's desert parsley, Federal endangered species), and *Sericocarpus rigidus* (*Aster curtus* nom., Columbian white topped aster, Federal Species of Concern) individuals were planted and seeded into multiple plots at North Greenhill (managed by the Eugene District Bureau of Land Management). Plants were introduced in one 20m x 30m gridded plot, 12 planting arrays, and 10 seeding plots.

In 2009, reintroduced plants of all species remained. On June 16, 2009, unauthorized mowing by the Oregon Department of Transportation occurred at Greenhill on a large portion of the reintroduction area. The effects of this mowing included damaging foliar cover, cutting mature inflorescences, covering plants with thick clumps of thatch, and scalping the ground. Up to 50% of the plants in each population were estimated to be damaged, however, it was not possible to quantify the full effects of the mowing on the plants at the time.

The objective of this project was to monitor *Erigeron, Horkelia*, *Lomatium*, and *Sericocarpus* in the reintroduction plots in order to determine if there were adverse impacts of mowing. We monitored all plots for presence, size, and reproduction of introduced species and compared that the number of individuals of each species in 2009 and average plant size and reproduction in 2004.

METHODS

Background

Transplant grid: Sericocarpus*,* Erigeron*,* Horkelia*, and* Lomatium

A transplanting experiment was initiated with *Aster curtus*, *Erigeron decumbens*, *Horkelia congesta*, and *Lomatium bradshawii* in 2000 at Greenhill Road. The goals of this experiment were to measure the effects of source population, fertilizer, planting season (spring or autumn 2000), cover of competing vegetation, and microsite on plant establishment and size. A 20 x 30 m grid was established and plants were planted on 1-m centers. Each transplant was randomly assigned to a position in the experimental area. Transplants were monitored in 2000-2004 to record plant establishment, size, and reproduction. The number of seedlings present around each reproductive transplant was recorded in 2003 and 2004. Detailed methods and results of this experiment were reported in Kaye and Brandt (2005).

Erigeron *and* Horkelia *arrays*

To evaluate the effects of mixed source populations on seed set and long-term seedling recruitment, we initiated a pilot study with *Erigeron decumbens* and *Horkelia congesta* on 10/26/00 (Kaye and Brandt 2005). Plants were placed in arrays dispersed throughout the restoration site, each array no closer than 30 m to each other or the other transplant plots at this site. Arrays consisted of 6 plants of each species planted in a ring (on the points of a hexagon) with 0.75 m between adjacent plants so that each plant was the same distance to all others. Nine arrays were established containing *Horkelia* and

Figure 1. *Sericocarpus* (upper left), *Horkelia* (upper right), *Lomatium* (lower left), and *Erigeron* (lower right) at Greenhill in May and June 2010.

Erigeron and three arrays with *Horkelia* only. Arrays were marked in the center by a wood post. Measurement data and number of inflorescences was recorded from these transplants in 2001-2004 and number of seedlings around each reproductive transplant was recorded in 2003 and 2004. Detailed methods and results of this experiment were reported in Kaye and Brandt (2005).

Direct seeding: Sericocarpus, Erigeron, Horkelia, *and* Lomatium

To assess the efficiency of direct seeding and site preparation for *Sericocarpus*, *Erigeron*, *Horkelia*, and *Lomatium*, 10 plots were established at Greenhill in November 1999. Each plot was 1 x 4m and each species was assigned to a 1 x 1m portion of each plot. Seedlings were counted in each plot in 2000-2004 and measurements were taken in 2003 and 2004. *Lomatium* plants were described by growth stages: seedling = cotyledons present, V1-V2 = 1-2 leaves, V3+ = 3 or more leaves, R1 = 1 inflorescence,

R2 = 2 inflorescences, R3 = 3 or more inflorescences. Detailed methods and results of this experiment were reported in Kaye and Brandt (2005).

2010 Monitoring

Due to the differing phenology between the species, we monitored the plots in May and June 2010. In May, we monitored *Lomatium* in the 20x30m grid and direct seeding plots. In June, we monitored the 20x30m grid, direct seeding plots, and arrays for *Sericocarpus*, *Erigeron*, and *Horkelia.*

Transplant grid: Sericocarpus*,* Erigeron*,* Horkelia*, and* Lomatium

In the transplant grid, our focus was on relocating previously identified individuals in order to determine if there had been damage caused by mowing. However, we also noted new individuals if they were observed during monitoring. These recruits were only considered in comparisons of plant since in 2010 versus 2004.

We compared the number of plants in 2010 to that in 2009, prior to mowing. As sampling effort for new recruits can vary between years, we only considered presence/absence of individuals that were planted in 2000. For *Sericocarpus*, *Erigeron*, and *Horkelia*, we measured the width at the widest point, perpendicular length, length of the longest leaf, and tallest inflorescence. We also counted the number of inflorescences for each individual and number of *Sericocarpus* stems. The majority of the *Sericocarpus* had not yet initiated flowering and thus the number of inflorescences for this species is likely an underestimate. We calculated the area of each plant as (0.5 * width)*(0.5 * lenth) * 3.14. Due to a change in methods after 2004, we compared plant size in 2010 to that measured in 2004. This comparison included newly recruited plants in 2010.

Approximately half of the 20x30m grid was mowed (the east half). Thus, in order to determine if there was an effect of mowing, we compared plant numbers, size, and reproduction between the west and east halves of the plot in each year.

Erigeron *and* Horkelia *arrays*

We could not locate any of the wooden posts for the *Erigeron* and *Horkelia* arrays during our June 2010 surveys. Thus, plants were located by systematically surveying all areas to the east and south of the 20x30 grid that many have contained arrays. When plants were located, they were monitored as above. All of the arrays were mowed, thus we only compared the values in 2010 to those in 2004 (the year from which the most recently collected data was available).

Direct seeding: Sericocarpus*,* Erigeron*,* Horkelia*, and* Lomatium

We monitored the direct seeding plots for each species as above. It was estimated that four of the plots (559, 560, 561, and 562) were not mowed. Thus, we compared the change in number of plants in the mowed and unmowed plots from 2009 to 2010. As different methods were used to estimate plant size in 2009 compared to other monitoring years, we were only able to compare plants numbers, not plant size.

RESULTS

Transplant grid: Sericocarpus, Erigeron, Horkelia, and Lomatium

When considering just the presence or absence of plants originally transplanted in the 20x30 plot, there appeared to only be a negative effect of mowing on *Sericocarpus* (Figure 1). Although there was a 10% loss (1 plant) of *Sericocarpus* from 2009 to 2010 in the unmowed portion of the plot, there was a 56% (5 plants) loss in the mowed portion of the plot. All other species increase slightly in the mowed portions of the plot from 2009 to 2010.

The method used to estimate plant size in 2009 differed from those used in all other sampling years. Thus, we compared plant size in 2010 to that in 2004 (the most recent year from which comparable data was available). These averages include new recruits observed in 2010. In 2010, the *Sericocarpus* in the mowed portion were larger and taller than in the unmowed portion. This species had just initiated flower formation at the time of our sampling, so we were unfortunately not able to count the number of inflorescences. Between 2004 and 2010, there was almost no change in *Erigeron* size and reproduction in the mowed half of the plot, but plants were more than twice the size and produced twice the number of inflorescences in the unmowed portion. In both the mowed and unmowed halves of the plot, *Horkelia* were smaller and produced fewer inflorescences in 2010 compared to 2004.

Erigeron *and* Horkelia *arrays*

Plants were only located in the areas that had not been mowed. However, there were only two fewer individuals located in 2010 (8) compared to 2004 (10). In 2010, *Erigeron* were more than twice as large, taller, and produced more capitula than those in 2004 (Table 3). In contrast, the number of *Horkelia* declined from 23 in 2004 to 1 in 2010. Although the plant found in 2010 was smaller in area than the average in 2004, it was slightly taller and had more than twice the number of inflorescences than the average for 2004 (Table 3).

Direct seeding: Sericocarpus, Erigeron, Horkelia, *and* Lomatium

There appeared to be no negative effects of mowing on any of the species in the seeded plots (Figure 4). Although there was a greater increase of *Sericocarpus* in the mowed seeding plots compared to the unmowed seeding plots, this was primarily due to one large spreading individual in a single plot and is likely unrelated to the mowing.

Figure 2. Greenhill. Portion of the site mowed in June 2009 is marked in yellow.

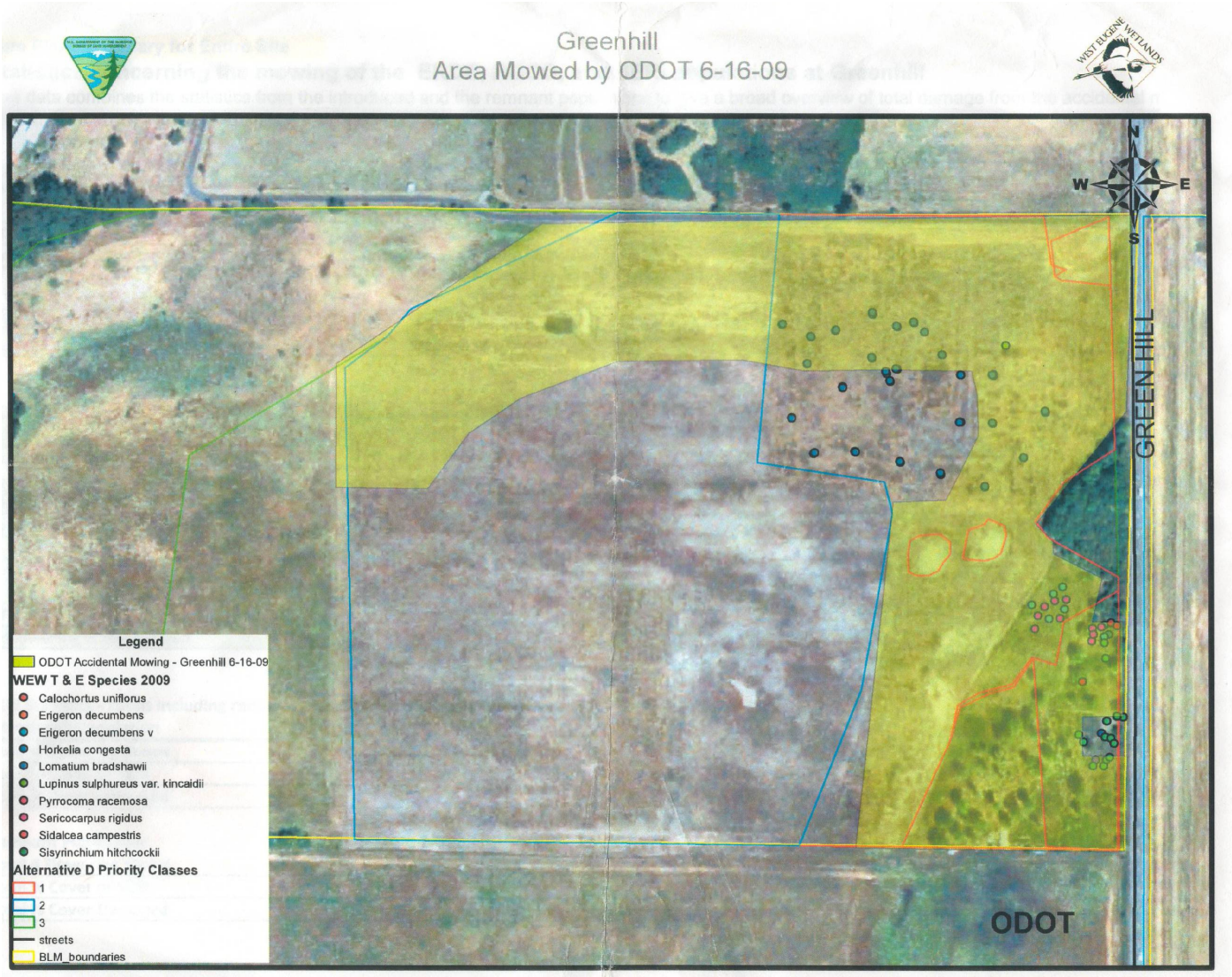


Figure 3. Number of individuals of *Sericocarpus*, *Erigeron*, *Horkelia*, and *Lomatium* in the mowed and unmowed halves of the 20x30 transplant plot at Greenhill in 2009 (before mowing) and 2010 (after mowing).

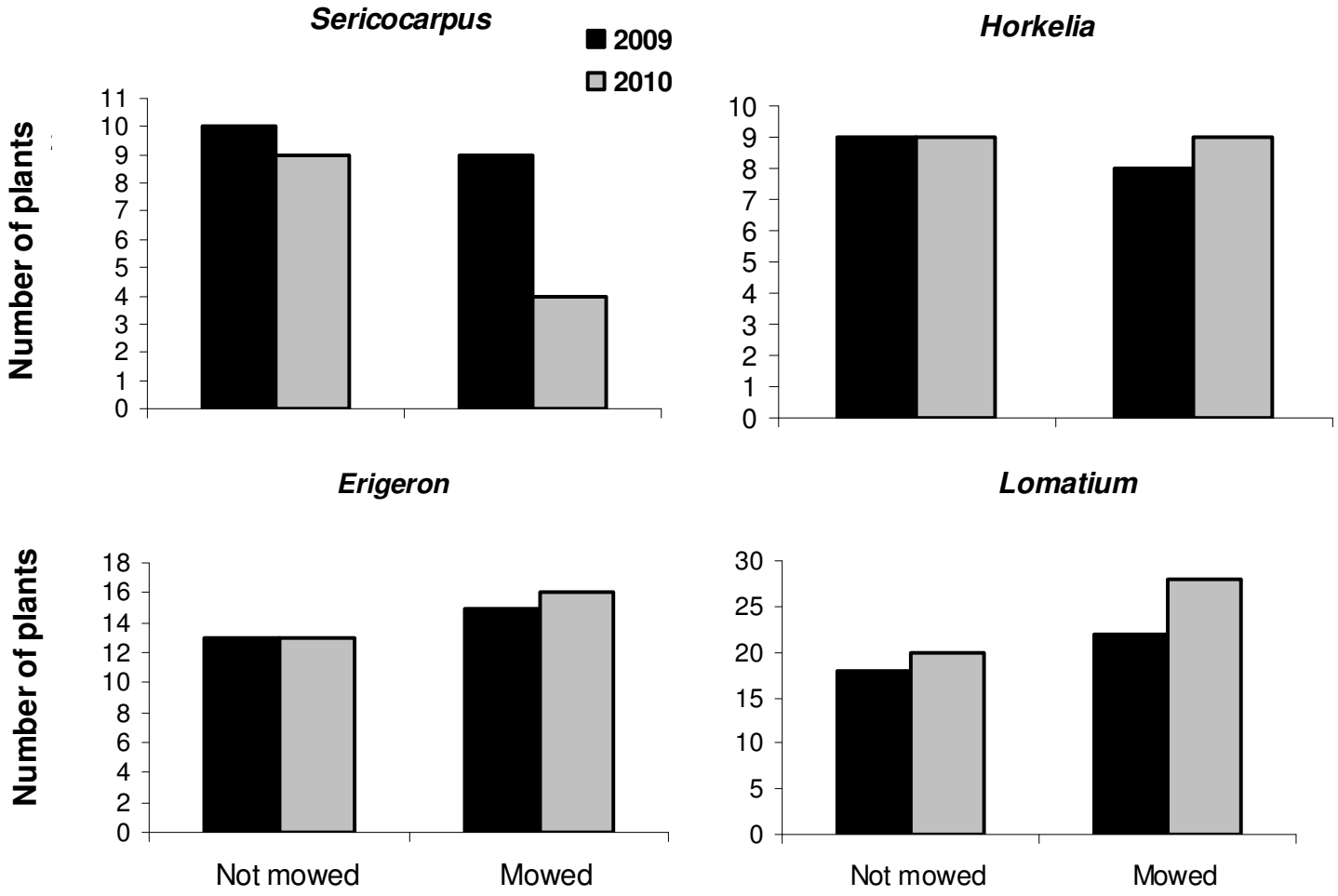


Table 1. Size, and reproduction of *Sericocarpus, Erigeron,* and *Horkelia* in the 20x30m transplant plot at Greenhill in 2004 and 2010.

	Area (cm^2) (Ave ± 1 SE)	Height (cm) (Ave ± 1 SE)	Inflorescences (Ave ± 1 SE)
Sericocarpus			
2004			
Not mowed	1209.9 ± 637.5	11.6 ± 1.5	2.4 ± 1.8
Mowed	304.7 ± 122.3	17.6 ± 13.1	22.3 ± 13.3
2010			
Not mowed	208.2 ± 75.7	16.9 ± 1.2	--[1]
Mowed	789.2 ± 220.4	18.4 ± 1.3	--[1]
Erigeron			
2004			
Not mowed	73.6 ± 16.1	15.0 ± 1.8	5.5 ± 1.8
Mowed	206.3 ± 34.8	17.9 ± 1.3	17.8 ± 4.0
2010			
Not mowed	176.4 ± 53.8	21.5 ± 2.2	10.0 ± 2.6
Mowed	243.1 ± 56.6	20.0 ± 1.2	14.7 ± 3.3
Horkelia			
2004			
Not mowed	283.2 ± 26.1	35.3 ± 3.1	3.6 ± 0.8
Mowed	310.2 ± 35.8	31.6 ± 2.7	3.3 ± 0.8
2010			
Not mowed	91.5 ± 17.1	24.8 ± 3.7	1.5 ± 0.4
Mowed	142.0 ± 17.2	27.5 ± 2.1	2.5 ± 0.5

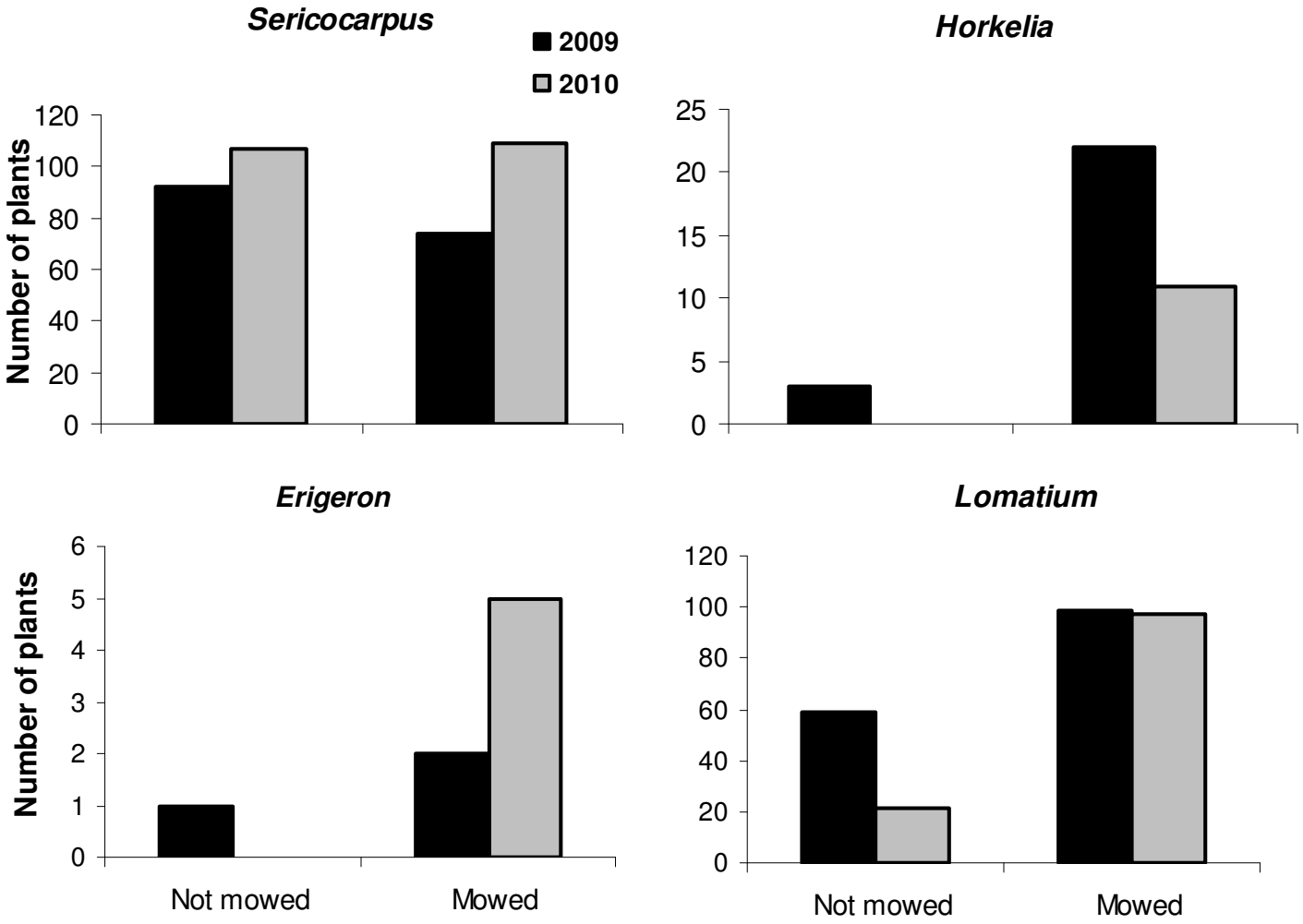
[1]Monitoring in mid-June and it is likely before most *Sericocarpus* were able to flower, thus the inflorescence count in 2010 is likely an underestimate.

Table 2. Number, size, and reproduction of *Erigeron* and *Horkelia* in Greenhill transplant arrays in 2004 and 2010. The only plants observed in 2010 were in areas that were not mowed in 2009.

	Number of plants	Area (cm^2) (Ave ± 1 SE)	Height (cm) (Ave ± 1 SE)	Inflorescences (Ave ± 1 SE)
Erigeron				
2004	10	164.9 ± 29.8	20.7 ± 2.5	8.0 ± 3.7
2010	8	498.2 ± 197.5	26.6 ± 1.8	44.4 ± 19.1
Horkelia				
2004	23	275.2 ± 26.6	33.3 ± 3.9	2.4 ± 0.4
2010	1	175.9[1]	38[1]	6[1]

[1]SE not reported due to inappropriate sample size.

Figure 4. Number of individuals of *Sericocarpus*, *Erigeron*, *Horkelia*, and *Lomatium* in the mowed and unmowed seeding plots at Greenhill in 2009 (before mowing) and 2010 (after mowing).



CONCLUSION

The only species for which there appeared to be a negative affect of mowing was *Sericocarpus*. There was a 10% loss of *Sericocarpus* from 2009 to 2010 in the unmowed portion of the plot, compared to a 56% loss in the mowed portion of the plot. For all other species, there appeared to be no negative effects of mowing on plants that had originally been established in 2000. While it is possible that there has been some recruitment of individuals since 2000, we did not consider them in these analyses as it is not possible to determine the sampling effort that was used to located new recruits in previous years. We recommend continued monitoring of the site to track ongoing changes in these populations.

LITERATURE CITED

Kaye, T.N., and A. Brandt. 2005. Seeding and transplanting rare Willamette Valley prairie plants for population restoration. Final Report. Prepared by the Institute for Applied Ecology for the Eugene District Bureau of Land Management. vi + 73 pp.