ROUND RIVER
Conservation Studies

Report on Herbaceous Plant Inventory in Valle Chacabuco Grassland Areas

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Fieldwork conducted by Round River spring 2012 student program[1]
Botanical Identifications by Fernan Silva Labbe

Introduction

In January of 2012, Round River Conservation Studies (RR) partnered with Conservación Patagónica (CP) to initiate a field student program in Valle Chacabuco, in the Aysen region of Chile. One of the goals of the student program was to conduct field research that would assist Conservación Patagónica with their work of creating the future Patagonia National Park. Among CP's primary goals in creating the PNP is the restoration of native habitat and wildlife throughout the valley. With this in mind, RR staff had conversations with CP about a variety of restoration and habitat/wildlife assessment field research projects to which the students could contribute. For the spring of 2012, all agreed that an appropriate and useful research project would be to begin an inventory of grassland herbaceous plant species. According to Cristian Saucedo, CP Conservation Director, no comprehensive inventory of grassland plant species had been conducted in the valley and the baseline information that could result from such an inventory would be helpful for planning, restoration, and interpretive purposes.

Goals of the Inventory

RR science staff designed a pilot sampling regime for the leaders and students to use in to carry out a pilot inventory of herbaceous plant species in the grassland areas of the valley bottom (Figure 1). This first inventory is considered a "pilot" study aimed at gathering initial baseline information about herbaceous plant species diversity and distribution patterns found in the valley. Given that we currently know very little about the grass species present or their distribution, or the prevalence of exotic herbaceous species, our primary goal with this study is to sample herbaceous plants broadly across the study area and then subsequently summarize and analyze those data to inform a more permanent and comprehensive sampling and monitoring regime.[2]

The ecosystems within the Chacabuco Valley are experiencing rapid changes due to several factors. First, one of the initial actions carried out by CP was to remove all but a few of the domestic livestock (cows and sheep), one of the greatest disturbance regimes in the. The singular act of removing this major disturbance regime, even if it were not followed by active restoration (erosion control, reseeding of native plants, removal of exotic plants, etc.), would alone promote positive

[1] Spring 2012 Student Program: Leaders: Joshua Porter and Kari Signor; Students: Kelly Davis, Brianna Rainville, Max Krieger, Ben Micek, Tom Murphy, Michael Lawlor, and Eli Gaucin-Fox

[2] Our plan is to develop a long-term sampling and monitoring design to be used to resurvey the grassland herbaceous plant species in spring, 2013.

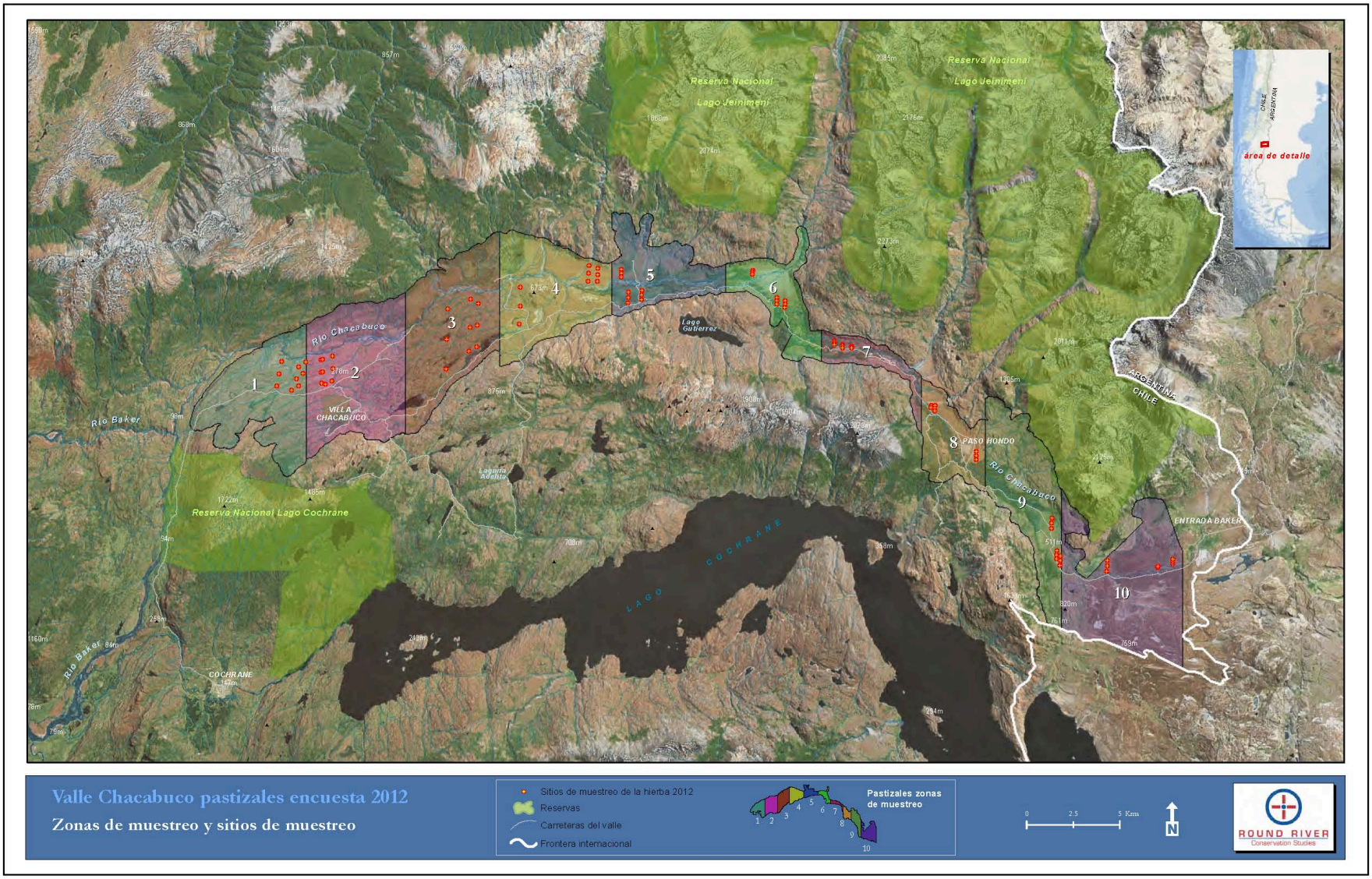

Figure 1. Map of Chacabuco Valley with Grassland Inventory Zones

ecological changes in the native ecosystems through natural processes – creating habitat and food resources for returning wildlife populations, allowing natural processes, such as predator-prey interactions, to take place unimpeded, etc. disturbances such as floods, fire, and wind erosion, etc. Secondly, CP is conducting active restoration in the most impacted areas, which in the grassland areas has largely concentrated on reseeding natives, removing exotics, barrier removal, and erosion control). Third, scientists and land managers anticipate landscapes such as this one to begin showing ecological and physical changes resulting from climate change. Thus, a long term goal of this study is to be able to monitor changes in vegetation composition and distribution that are occurring not only due to active and passive restoration of the native ecological communities, but due to impacts of climate change and less frequent but often significant natural disturbance regimes.

Methods

To account for the natural variability in species diversity and composition that occurs along environmental gradients found in the valley (e.g., distance to streams, grazing intensity of herbivores, elevation changes, and variation resulting from other landscape features and natural processes), the inventory was carried out using a stratified random sampling design. The Chacabuco River valley was longitudinally divided into ten zones running horizontal to the river (each transect extending from the south to the north side of the valley) (Figure 2). Within each zone, three north south transects of differing lengths were located at pre-determined random points going west to east.

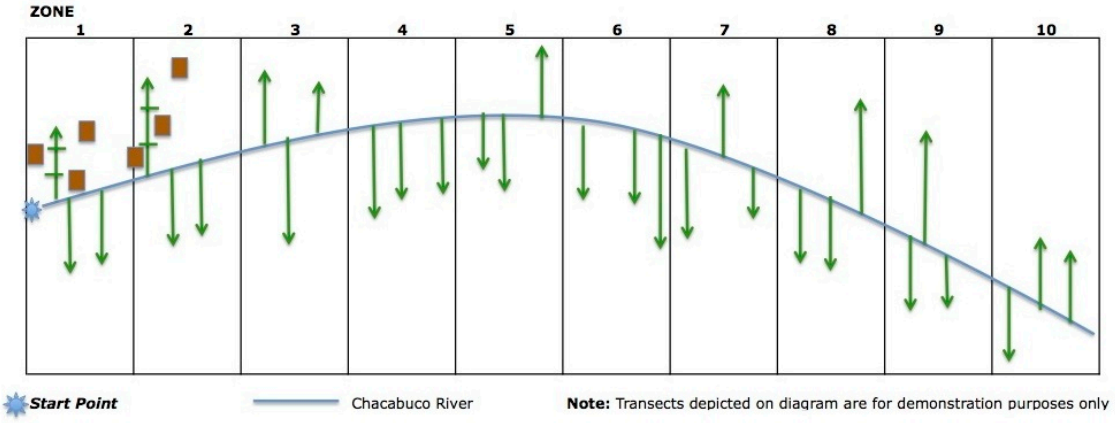

Figure 2: Grassland Sampling Design, general layout of zones, transects, and quadrats.

Each transect was divided into three sections of equal size (one section near the river, one in the middle of the transect, and one at edge of the valley). When possible, at least one of the three transects was to be located on the north side of the river. Within each transect section, a 4m x 1m quadrat was located for data collection (at a random bearing and distance from a predetermined point along the transect). Quadrats were oriented north south. Thus, using this inventory design, data on herbaceous plant species, as well as general information about vegetation and landform, were collected in ninety quadrats throughout the valley.

For each quadrat, students recorded the identity[3] and percent coverage of all herbaceous plant species encountered. They also measured and recorded the slope, aspect, elevation, GPS location (in UTMs), and a physical/vegetation site description. In addition, digital photographs were taken of the quadrat and nearby landscape. For more details on methods, please see Appendix A.

Results

During the grassland inventory fieldwork, students encountered, recorded information for, collected specimens of, and photographed ninety-six different plant specimens from the grassland areas of Chacabuco Valley (Appendix B, Table 1: Herbaceous Plant Inventory Data Sheet). Of the ninety-six plant specimens collected, Fernan Silva, using the specimens and photographs, identified seventy-seven specimens to the species level, nine to the genus, three to the family, four specimens were identified to a close relative (either species or genus), and three specimens were not identifiable (due to lack of flowers or for other reasons)[4] (Appendix B, Table 2: Plant Specimens & Names and Table 3: Index of Quadrat Photographs and Appendix C, Examples of Quadrat Photographs). Mr. Silva identified the plant types of 82 of the specimens. As revealed in Table 2, the specimens included fifty-two forbs, thirty gramanoids (twenty-three grasses, six sedges, and one rush), one moss, two bulbs, and one shrub. Mr. Silva's report can be found in Appendix D.

Table 4 shows the twenty most abundant species, their scientific and common names (English and Spanish), rank in abundance, whether they are native or exotic to the Patagonia region, and geographic origin/distribution. Of the twenty most abundant plant species in our sample: nine are grasses, ten are forbs, and one is a moss. Seven of these top twenty species are native to the region (five grasses, two forbs) and eleven are exotic (three grasses, seven forbs, and one moss). There were two specimens (one identified to the species level and one to the family level) whose origin we have not yet determined. Table 5 and Figures 3a – t (Appendix A) show the distribution across percent coverage classes for of each of the twenty most abundant species.

[3] The best plant guide we were able to obtain for the study region (*Flora Patagonia, Guerrido & Fernandez 2007)* does not have a key for identifying plant species, so we were unable to use it to identify many of the species. As an interim measure, students collected specimens of each species found in the quadrats, secured them in a plant press, and photographed each of those specimens. Dr. Fernan Silva, a Patagonian botanist in Coyhaique, identified all but three of specimens.

[4] Dr Silva discovered that the students labeled specimens of two different species under #84 in the specimen collection. We have labeled the second species as #99 in our final inventory list and in the referenced table.

Specimen Number	Scientific Name	Family	Abundance Rank	Occurrence Frequency[1]	Common Name - English	Common Name - Spanish	Plant Type	Native vs. Exotic[2]	Geographic Distribution/Origin
6	Taraxacum officinale H.F. Wigg.	Asteraceae	1	74	Dandelion	Achicoria, Diente de Leon	Forb	Exotic	Europe
3	Poa compressa L.	Poaceae	2	62	Canadaor Flat-stem blue grass	Pasto mallín	Grass	Exotic	Canada?
11	Rytidosperma virescens (E. Desv.) Nicora	Poaceae	3	60	Wallaby grass (Rytidosperma	Ritidosperma	Grass	Native	South America
8	Cerastium arvense L.	Caryophyllaceae	4	57	Cerastium, field chickweed	Cerastio	Forb	Exotic	Europe
5	Rumex acetosella L.	Polygonaceae	5	52	Common sheep sorrel	Vinagrillo	Forb	Exotic	Europe & Asia
7	Acaena pinnatifida R et P.	Rosaceae	6	49	Biddy-biddy?	Pimpinela	Forb	Native	Peru, Chile, Argentina
9	Trifolium repens L.	Fabaceae	7	45	Dutch clover	Trebol blanco	Forb	Exotic	Europe
13	Funaria hygrometrica Hedw.	Funariaceae	8	43	Funaria moss	Musgo	Moss	Exotic	China
27	Juncus effusus (Gaertn.) Pers.	Juncaceae	9	36	Common rush, lamp rush	Junco	Grass / Rush	Cosmopolitan	Europe, Asia s to Indonesia, N Amer, Atl
18	Agrostis capillaris L. (sin. Agrostis tenuis Sibth)	Poaceae	10	27	Colonial bentgrass	Chépica	Grass	Exotic	Europe
1	Achillea millefolium L.	Asteraceae	11	26	Common yarrow	Mielnrama, Lukas Bridge	Forb	Exotic	Europe, Eurasia
19	Hypochaeris radicata L.	Asteraceae	12	20	Hairy cats-ear, false dandelion	Hierba del chancho	Forb	Exotic	Mediterranean
10	Agrostis glabra (Presl.) Kunth.	Poaceae	13	17	Bentgrass		Grass	Native	Southern South America
20	Luzula alopecurus Desv.	Juncaceae	14	15		Luzula	Grass	Native	South America, Antarctica
32	Holcus lanatus L.	Graminaea	15	12	Yorkshire fog	Pasto miel	Grass	Exotic	Europe, Asia, NAfric, NAmer
39	Viola maculata Cav. var. maculata	Violaceae	18	11	Yellow violet	Triguillo	Grass	Native	S S America, Subantartic Islands
30	Acaena magellanica (Lam.) Vahl	Rosaceae	17	11		Pimpinela	Forb	Native	S S America, Subantartic Islands
14	Elymus angulatus J. Presl.	Poaceae	16	11	Wildrye (genus)	Violeta amarilla	Forb	Native	
47	Armeria maritima (Mill.) Wild.	Plumbaginaceae	19	10	Thrift seapink	Armeria	Forb	Native	Europe or North America?
51	Bromus setifolius J. Presl. y Rytidosperma sp.	Poaceae	20	10		Bromo	Grass	Native	South America

Notes:
1. Occurrence frequency – times this species was encountered in the inventory quadrats.

Table 4: Twenty most abundant herbaceous plant species in inventory sample, scientific and common names, plant type, and origin.

Table 6 contains a list of the vegetation types[5] in which the sample was conducted, and Appendix D contains a portion of the larger data set with vegetation type affiliations.[6]

Bosque Nativo · Achaparrado Denso
Estepa Patagonica
Matorral Abierto
Matorral Arborescente Abierto
Matorral Pradera Abierto
Matorral Semidenso
Praderas Perennes
Vegetacion Herbacea en Orilla

Table 6. Vegetation types sampled in study

Discussion

Given our limited knowledge of the grassland herbaceous plant diversity and distributions patterns at the beginning of this study, our initial sampling design aimed to obtain a baseline of information concerning species diversity, relative abundance of exotic species, and to a lesser extent species distribution patterns (local clumping/patchiness of species). We also employed a stratified approach – segmenting the valley from east to west as a means of looking for possible east-west gradients or patterns in the valley.

Given the preliminary nature of this study and the limited area sampled, it would be inappropriate to draw general conclusions from the data about species distribution patterns outside of the sampled area (i.e., outside of the quadrats). For example, because quadrats sampled only a small portion of each zone, it is not appropriate to summarize the data by zone (e.g., species diversity by zone, etc.) or across zones (e.g., changes in species diversity or relative abundance of exotic species from east to west). Nonetheless, within the sampled area, species diversity, distribution patterns, and relative abundance of native and exotic species, is noteworthy and will help inform the design of a long-term inventory and monitoring protocol. Some of those noteworthy observations[7] include:

- Based on this preliminary sample, it appears that exotic herbaceous plant species are a significant issue in grassland vegetation communities in Chacabuco Valley. Of the twenty most abundant species, more than 50% are not native to the region.[8]

- Looking at the distribution of most abundant exotic herbaceous plants species, it would appear that there might be areas of higher 'infestation' (higher density), which in

[5] Vegetation types here are derived from a map obtained from Conservación Patagónica, "Comunidad Uso"
[6] Full data set to be delivered to CP in form of an excel file.
[7] All of these 'observation' will need to be re-visited once we have re-inventoried the study area. Future inventories will hopefully account for vegetation type and other factors (e.g., landform, historic grazing patterns, access to water sources (domestic livestock), native ungulate grazing patterns, etc.
[8] This includes "cosmopolitan" species, such as the common rush (*Juncus effusus*) as non-native.

turn would warrant prioritization for restoration efforts. We hope to evaluate this question more closely in future inventories.

- These initial results serve to demonstrate how this type of inventory could inform land managers and conservation practitioners of the distributions of native and non-native herbaceous plant species and possible relationships with particular vegetation communities and/or forms of landscape and vegetation disturbance. Such information can be useful when planning and implementing vegetation restoration efforts.

  For example, in Figures 3a through 3t (distribution across percent coverage classes of the most abundant species), one sees in Figure 3a. that, within our sampled area, the exotic dandelion (*Taraxacum officinale*) does not tend to occur in large, dense patches (in the sampled area, 82% of the individuals of *T. officinale* were in the ≤10% coverage range, and another 12% were in the 10-25% coverage range). Looking at the third most abundant species, a native grass species (*Rytidosperma virescens*), we found that this species more often covered a larger portion of the quadrat, with 47% falling in coverage classes of 26-50% or higher (i.e., in our sample, at the scale of the quadrat, this species occurs in larger clumps or patches).

- Information resulting from a long-term monitoring program of this nature would allow managers to tie their restoration and conservation activities more closely to the spatial patterns of exotic plant infestations. For example, if a pattern emerges that shows that certain landforms tend to be more susceptible to colonization by exotics, those could be more closely monitored and might need to be a priority for treatment.

There are additional analyses that we hope to conduct on the study data that may advance our efforts to design an effective long-term monitoring program as well as develop more immediate management recommendations. For example, we may be able to analyze different ways of stratifying the valley (with the existing data) to detect possible patterns of exotic plant infestation or native species strongholds. One possible scenario of further analysis could be that we find landforms where exotic plant species appear to thrive, such as riparian edges or grazed meadows. Following on such leads, we could create, and more intensively sample, a "riparian zone" to get better understand why this is occurring. Other patterns may emerge from this initial data set that may suggest the creation of other zones as well, such as a zone for more intensive sampling corresponding to areas of heaviest human use (e.g., camping and other heavy activity areas, heavily used roads and trails, etc.).

We plan to re-inventory the grassland herbaceous plant species during the Spring 2012 student program. As we design the spring inventory sampling regime, we will consider all of our findings to date, and will also consider stratifying the inventory by vegetation type, landform, levels of human activity, and/or historic grazing patterns,[9] as some or all of these factors may play a role in the distribution of native and exotic plant species.

[9] For future inventories, we will explore the possibility of utilizing the historic grazing map we received from Nadine Lehrer.

Appendix A. Method Details

Locating zones and quadrats

To locate the starting points of each transect, students traveled along the road to the distance indicated in a table (created by RR technical staff) with predetermined, random points (often preprogrammed into the GPS as a waypoint). Once they arrived that the location, they walked due north until reaching the river's edge. The starting point at the road was marked in the GPS as the south limit of the transect (e.g. the south limit of zone 1, transect 1 was marked as Z1T1S[1]). At this point, students determined if the river was fordable or not. If so, they crossed to extend the transect north of the river, marking the north bank as the south limit of the transect and traversing north to the edge of the valley. If not, they marked this spot on the riverbank, where the grasses ended, as the northern limit of the transect (e.g. the north limit of zone 1 transect 1 was marked as Z1T1N).

After having marked both the south and northern limits of the transect, students determined the length of the transect (in meters) using the GPS. By dividing this length into three equal-sized sections and then finding the midpoint of each of these sections, they determined the distance from the south limit (in meters) to the location of quadrat plots. They then traveled due south, using a compass bearing, to each of these locations. The quadrat farthest to the north was labeled A, the middle quadrat was B, and the quadrat farthest south was C.

At the location for a quadrat, for example, Zone 1 Transect 1 Quadrat A, they would mark the point, along the transect, in the GPS (in this case Z1T1A). Using the table of random number assignments, they determined the compass bearing and distance to deviate from the transect. If the deviation placed the sample plot in an area dominated by something other than grasses (e.g. water, bare ground, shrubs, rushes, etc.) they would deviate in 10 meter increments east until reaching grasses.

This point was then marked in the GPS (in this case Z1T1QA). They arranged the quadrat, defined by a rectangle of PVC piping oriented north south with its northeast corner at the marked location. The 4m edges of the quadrat ran north south.

Photographing the quadrat and surrounding vegetation and landscape

Digital photographs were taken of the quadrat and surrounding vegetation/landscape (see Appendix A, Table 2 for Index of Quadrat Photos). The first photo was taken of the quadrat itself with a PVC pipe marked at 10cm intervals placed vertically to note the height of vegetation. A label depicting quadrat name, date, and orientation was also placed within the quadrat. The second photo depicted the landscape south of the quadrat. The third photo depicted the landscape to the west, then one to the north, and a final photo of the east. These photos were all taken from the same position, the northeast corner of the quadrat. The data manager then recorded the slope, aspect, elevation, GPS location (in UTMs) and a site description, on the data sheet.

[1] Z1T1S, Z=Zone, 1=One, T=Transect, 1=One, S=Southern starting point.

Inventorying herbaceous plant species within quadrats

Within the quadrat students identified the plant species present and determined the percent coverage of each species. The percentages were recorded as falling within one of six ranges (≤10%, 11-25%, 26-50%, 51-75%, 76-90%, >90%). The total percent cover did not have to total to 100% as there were often times overlapping layers of vegetation or bare ground, etc.. The species were distinguished and recorded using numbers, beginning with the first individual found (species 1). When a new species was distinguished a sample was collected, including root base, seed head, and flower (when possible). This sample was placed within a fold of paper along with a label depicting the species number, date, and location collected. This was then placed between two pieces of cardboard within two pieces of fiberboard and secured in a plant press. The purpose of collecting the specimens was to preserve them for later identification by Dr. Fernan Silva, a botanist in Coyhaique.

Appendix B. Inventory Result Tables

Table 1: Herbaceous Plant Inventory Data Sheet
Table 2: Index of Quadrat Photos
Table 3: Plant Specimens and Scientific Names
Figures 3a-3t: Distribution Across Percent Coverage Classes of Twenty Most Abundant Species

Table 1. Grassland Herbaceous Plant Inventory Data Sheet

Round River Conservation Studies Student Program Spring 2012

Zone	Transect	Quadrat	Photo	Species ID	Collected?	% of quadrat covered	UTM Coord X	UTM Coord Y	Date	Elev (m)	Aspect	Slope (degrees)	Data Recorded By (Initials)
1	1	A	558	1	Y	11%-25%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	2	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	3	Y	76%-90%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	4	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	5	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	6	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	7	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	8	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	A	NA	9	Y	Trace to 10%	686720	4781363	1/30/2012	279	S	22	KD
1	1	B	573	1	N	Trace to 10%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	574	3	N	26%-50%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	575	6	N	11%-25%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	576	8	N	Trace to 10%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	NA	9	N	11%-25%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	NA	10	Y	Trace to 10%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	NA	11	Y	11%-25%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	NA	12	Y	Trace to 10%	686581	4780709	1/30/2012	270	F	0	KD
1	1	B	NA	13	Y	11%-25%	686581	4780709	1/30/2012	270	F	0	KD
1	1	C	NA	1	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	589	3	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	5	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	590	6	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	7	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	8	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	10	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	11	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	13	N	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	14	Y	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	15	Y	51%-75%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	16	Y	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	17	Y	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	18	Y	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	1	C	NA	19	Y	Trace to 10%	686452	4780056	1/30/2012	320	U	U	KD
1	2	A	613	1	N	51%-75%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	614	3	N	51%-75%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	5	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	6	N	11%-25%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	7	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	8	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	9	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	11	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	13	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	14	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	A	NA	18	N	Trace to 10%	687642	4781090	1/31/2012	236	U	U	EF
1	2	B	615	1	N	11%-25%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	616	3	N	51%-75%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	617	5	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	6	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	7	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	8	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	9	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	11	N	11%-25%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	12	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	13	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	14	N	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	B	NA	20	Y	Trace to 10%	687513	4780444	1/31/2012	305	S	U	EF
1	2	C	618	1	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	619	3	N	51%-75%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	5	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	6	N	11%-25%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	7	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	8	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	9	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	10	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	11	N	26%-50%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	13	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	16	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	18	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	19	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	20	N	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	21	Y	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	22	Y	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	2	C	NA	23	Y	Trace to 10%	687270	4779815	1/31/2012	312	E	U	EF
1	3	A	640	1	N	51%-75%	688021	4781328	2/1/2012	224	F	0	EF
1	3	A	641	3	N	76%-90%	688021	4781328	2/1/2012	224	F	0	EF
1	3	A	642	6	N	Trace to 10%	688021	4781328	2/1/2012	224	F	0	EF
1	3	A	643	7	N	Trace to 10%	688021	4781328	2/1/2012	224	F	0	EF
1	3	A	644	9	N	Trace to 10%	688021	4781328	2/1/2012	224	F	0	EF
1	3	A	NA	23	N	Trace to 10%	688021	4781328	2/1/2012	224	F	0	EF
1	3	B	646	1	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	647	5	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	648	8	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	649	11	N	26%-50%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	650	14	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	651	19	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	NA	are Groun	N	51%-75%	687881	4780718	2/1/2012	282	N	25	EF
1	3	B	NA	Shrubs	N	Trace to 10%	687881	4780718	2/1/2012	282	N	25	EF
1	3	C	660	1	N	26%-50%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	661	3	N	91%-100%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	662	5	N	Trace to 10%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	663	6	N	11%-25%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	664	7	N	Trace to 10%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	NA	8	N	Trace to 10%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	NA	9	N	Trace to 10%	687627	4780039	2/1/2012	322	S	13	EF
1	3	C	NA	12	N	Trace to 10%	687627	4780039	2/1/2012	322	S	13	EF

Note: This table is simply representative of the larger data set (showing all of Zone 1 quadrat entries) a full copy of which will be sent to Conservacion Patagonica with the final version of this report.

Table 2: Index of Quadrat Photos

In progress..

TABLE 3: Plant Specimens: Scientific and Common Names, Plant Type, and Geographic Origin

Spec #	Scientific Name	Abund Rank	Occur Freq	Family	Common Name - English	Common Name - Spanish	Plant Type	Native/Exotic	Origin
1	Achillea millefolium L.	11	26	Asteraceae	Common yarrow		Forb	Exotic	Europe, Eurasia
2	Crepis capillaris (L.) Wallr.			Asteraceae	Smooth hauksbeard	Falsa achicoria	Forb	Exotic	Europe
3	Poa compressa L.	2	62	Poaceae	Canada blue grass, Flat-stem blue grass		Grass	Exotic	Canada?
4	Collomia biflora (R. et P.) Brand.			Polemoniaceae	Colomia roja	Colomia roja	Forb	Native	
5	Rumex acetosella L.	5	52	Polygonaceae	Common sheep sorrel	Vinagrillo	Forb	Exotic	Europe & Asia
6	Taraxacum officinale H.F. Wigg.	1	74	Asteraceae	Dandelion	Achicoria, Diente de Leon	Forb	Exotic	Europe
7	Acaena pinnatifida R et P.	6	49	Rosaceae	Biddy-biddy?	Pimpinela	Forb	Native	Peru, Chile, Argentina
8	Cerastium arvense L.	4	57	Caryophyllaceae	Cerastium, field chickweed	Cerastio	Forb	Exotic	Europe
9	Trifolium repens L.	7	45	Fabaceae	Dutch clover		Forb	Exotic	Europe
10	Agrostis glabra (Presl.) Kunth.	13	17	Poaceae	Bentgrass		Grass	Unknown	
11	Rytidosperma virescens (E. Desv.) Nicora	3	60	Poaceae	Wallaby grass (Rytidosperma gen)		Grass	Native	South America
12	Carduus nutans L.			Asteraceae	Musk thistle	Cardo	Forb	Exotic	Europa
13	Funaria hygrometrica Hugw.	8	43	Funariaceae	Funaria moss	Musgo	Moss		
14	Elymus angulatus J. Presl.	16	11	Poaceae	Wildrye (genus)		Grass	Native	
15	Stipa laevissima (Phil) Spegazzini			Poaceae		coironcillo	Grass	Native	
16	Verbascum thapsus L.			Scrophulariaceae	Common mullein	hierba del paño	Forb	Exotic	Europa, Asia
17	Oenothera stricta Laedeb. Ex Link spp. Stricta			Onagraceae		Diego de la Noche	Forb	Native?	
18	Agrostis capillaris L. (sin. Agrostis tenuis Sibth)	10	27	Poaceae	Colonial bentgrass		Grass	Exotic	Europe
19	Hypochaeris radicata L.	12	20	Asteraceae	Hairy cats-ear, false dandelion		Forb	Exotic	Mediterranean
20	Luzula alopecurus Desv.	14	15	Juncaceae			Sedge	Native	South America, Antartica
21	Gamochaeta spiciformis (Sch. Bib.) Cabrera			Asteraceae		Gamocheta	Forb	Nativa	Chile/Argentina
22	Olsynium junceum (E. Mey. Ex C. Presl.) Goldbatt			Iridaceae		Ñuño		Native	Chile/Argentina
23	Adesmia lotoides Hook. F.			Fabaceae			Forb	Native	
24	Quinchamalium chilense Mol.			Santalacea / scrophulariaceae		Quinchamaly	Forb	Native	
25	Hordeum comosum J. Presl.			Poaceae	Cebadilla	Cola de ratón	Grass	Native	Chile/Argentina
26	Viola maculata Cav. Var. maculata			Violaceae		Violeta amarilla	Forb	Native	
27	Juncus effusus (Gaertn.) Pers.	9	36	Juncaceae	Common rush, lamp rush		Rush	Cosmopolita	
28	Azorella trifurcata (Gaetrn.) Pers.			Apiaceae		Llareta	Forb	Native	
29	Plantago uniglumis Wallr. Ex Wallp.			Plantaginaceae		Hincallantén	Forb	Native	
30	Acaena magellanica (Lam.) Vahl	17	11	Rosaceae			Forb	Native	Southern South America, Subantartic Islands
31	Geranium sp.			Geraniaceae		Core core		Exotic?	
32	Holcus lanatus L.	15	12	Graminaea	Yorkshire fog		Grass	Exotic	Europe, W. & E. Asia, N. Afric, N. America
33	Geum magellanicum Hooker f.			Rosaceae		Canelilla, hierba del clavo	Forb	Native	
34	Astragalus o Melilotus								
35	Cardamine???			Brassicaceae			Forb	Native	
36	Stipa chrisophylla Desv.			Poaceae		Coirón amargo	Grass	Native	
37	Aster vahli (Gaud.) H et A.			Asteraceae			Forb	Native	
38	Erigeron andicola D.C.			Asteraceae		Erigeron	Forb	Native	
39	Viola maculata Cav. var. maculata	18	11	Violaceae	Yellow violet		Forb	Native	Southern South America, Subantartic Islands
40	Bromus stamineus Desv.			Poaceae		Cebadilla	Grass	Native	

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Spec #	Scientific Name	Abund Rank	Occur Freq	Family	Common Name - English	Common Name - Spanish	Plant Type	Native/Exotic	Origin
41	Acaena integerrima Gillies			Asteraceae		Cadillo	Forb	Native	
42	Berberis microphylla G. Forst. (sin Berberis buxifolia y Berberis heterophylla)			Berberidaceae		Calafate	Shrub	Native	Chile/Argentina
43	Iridaceae			Iridaceae					
44	Carex andersonii Boott in Hook.			Cyperaceae			Sedge		
45	Trisetum phleoides (d'Urv.) Kunth			Poaceae			Grass	Native	Chile/Argentina
46	sin información (no specimen)								
47	Armeria maritima (Mill.) Wild.	19	10	Plumbaginaceae	Thrift seapink		Forb	Exotic	Europe or North America?
48	Calceolaria sp.								
49	Hypochoeris incana (H. ett A.) Maclosk			Asteraceae		Clavelito	Forb	Native	Chile/Argentina
50	nn (no flowers)								
51	Bromus setifolius J. Presl. y Rytidosperma sp.	20	10	Poaceae			Grass	Native	South America
52	Gallium antarcticum Hooker			Rubicaceae	Subantarctic bedstraw		Forb	Native	South America
53	afin Polygala salasiana Gay.			Polygalaceae			Forb	Native	Chile/Argentina
54	Potentilla anserina L.			Rosaceae	Silverweed	Anserina	Forb	Native	Europe-Iceland s. & e. to Iran, Himalayas, Manchuria, Japan
55	sin información (no specimen)								
56	Deschampsia kingii (Hook.f) Desvaux.			Poaceae			Grass	Native	Chile/Argentina
57	Hordeum murinum L.			Poaceae		Flechilla, cebadilla ratonera	Grass	Exotic	Central & N. Amer, Asia, Africa, Europe
58	Cortaderia araucana Stapf.			Poaceae		Cortaderia, cola de zorro	Grass	Native	Chile/Argentina
59	Poaceae, afin Hordeum comosum J. Presl.			Poaceae		Cebadilla-cola de ratón	Grass	Native	Chile/Argentina
60	Vulpia bromoides (L.) Gray (sin. Vulpia dertonensis)			Poaceae	European foxtail fescue, Six Weeks Fescue,	Brome fescue	Grass	Exotic	Europe, N. Africa, Asia Minor, int. to N. Amer, S. Amer, Hawaii, etc.
61	Lathyrus sp			Fabaceae			Forb	Native	Chile/Argentina
62	Veronica serpyllifolia L.			Plantaginaceae/Scrophulariaceae		Veronica de los prados	Forb	Exotic	Europe
63	afin Chaetanthera sp ???			Asteraceae			Forb	Native	
64	Gallium antarcticum Hooker f.			Rubicaceae	Subantarctic bedstraw		Forb	Native	South America
65	Calceolaria sp.			Scrophulariaceae		Zapatito de la Virgen, Topa Topa	Forb	Native	
66	nn (unidentifiable)								
67	Aster vahli (Gaud.) H et A.			Asteraceae	Aster		Forb	Native	Chile/Argentina
68	Carex gayana E. Desv. Var gayana			Cyperaceae		Cortaderia de Gay	Sedge	Native	Chile/Argentina
69	Viola maculata Cav. var. maculata			Violaceae		Violetilla amarilla	Forb	Native	Chile/Argentina
70	Rytidosperma sp.			Poaceae		Coirón blando	Grass	Native	Chile/Argentina
71	Patosia clandestina (Phil.) Buchenau.			Cyperaceae		Patosia, Cojin de las vegas	Sedge	Native	Chile/Argentina
72	Olsynium junceum (E. Mey. Ex C. Presl.) Goldbatt			Iridaceae		ñuño, Huilmo, Quilmo	Bulb	Native	Southern Cone S. Amer.
73	Galium antarcticum Hooker f.			Rubicaceae		Lengua de gato	Forb	Native	Chile/Argentina
74	Euphrasia antarctica Benth.			Escrophulariaceae		Eufrasia	Forb	Native	Chile/Argentina
75	Poa holciformis J. Persl.			Poaceae		Coirón poa	Grass	Native	Chile/Argentina
76	Agrostis pyrogea Spegazzini			Poaceae		Coirón poa	Grass	Native	Chile/Argentina

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Spec #	Scientific Name	Abund Rank	Occur Freq	Family	Common Name - English	Common Name - Spanish	Plant Type	Native/Exotic	Origin
77	Gentienella magellanica (Cav.) Duby			Gencianaceae		Canchanlahua, genciana de cordillera, genciana de Magallanes	Forb	Native	Chile/Argentina
78	Plantago uniglumis Wallr. Ex Wallp.			Plantaginaceae		Huicallantén	Forb	Native	Chile/Argentina
79	Samolus spathulatus (Cav.) Duby			Primulaceae/ Theophrastaceae	Brookweed, or water pimpernel		Forb	Native	Chile/Argentina
80	Plantago uniglumis Wallr. Ex Wallp.			Plantaginaceae		Huicallantén	Forb	Native	Chile/Argentina
81	Werneria pygmeaea Gillies ex Hoook. et Arn.			Asteraceae		Poposa, puposa	Forb	Native	Chile/Argentina
82	Lathyrus sp			Fabaceae		Clarincillo de cordillera	Forb	Native	Chile/Argentina
83	Carex gayana E. Desv. var gayana			Cyperaceae		Cortaderia de Gay	Sedge	Native	Chile/Argentina
84	Gamochaeta nivalis Cabrera			Asteraceae		Gamocheta de las nieves	Forb	Native	Chile/Argentina
85	Silene chilensis (Neud.)Boq.			Cariophyllaceae		Silene	Forb	Native	Chile/Argentina
86	Phleum alpinum L.			Poaceae		Fleo	Grass	Native	Chile/Argentina
87	sin información (no specimen)								
88	Lathyrus sp. afin Lathyrus magellanicus Lam.								
89	Solenomelus segethii (Phil.) Kuntze			Fabaceae		Clarin de Magallanes	Forb	Native	Chile/Argentina
90	Plantago lanceolata L.			Iridaceae		Clavelillo azul	Bulb	Native	Chile/Argentina
91	Poa spiciformis (Steud.) Hauman & Parodi			Plantaginaceae		Lanntén site venas	Forb	Exotic	Europe
92	Lathyrus sp			Poaceae		Coirón poa	Grass	Native	Chile/Argentina
93	Veronica serpyllifolia L.								
94	Dactylis glomerata L.			Plantaginaceae/Scrophulariaceae		Veronica de los prados	Forb	Exotic	Europe
95	Carex gayana E. Desv. Var gayana			Cyperaceae		Pasto ovillo	Grass	Exotic	Eurasia
96	Poaceae			Poaceae		Cortaderia de Gay	Sedge	Native	Chile/Argentina
97	Poaceae			Poaceae					
98	nn (no flowers)								
99	Draba magellanica Lam*			Brassicaceae		Draba	Forb	Exotic	N. America

* This specimen was originally together with #84, but later identified as different species

Figure 3a. Species #6, Dandelion, Exotic

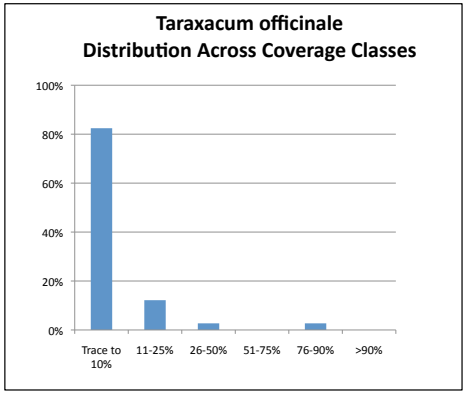

Figure 3b. Species #3, Canada blue grass, Flat-stem blue grass, Exotic

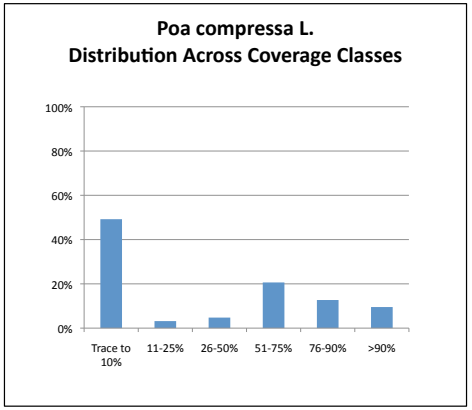

Figure 3c. Species #11, Wallaby grass (Rytidosperma gen), Native

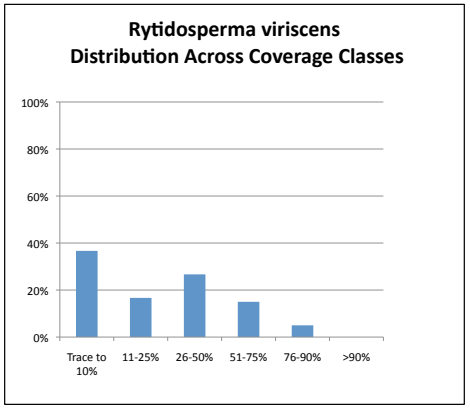

Figure 3d. Species #8, Cerastium, field chickweed, Exotic

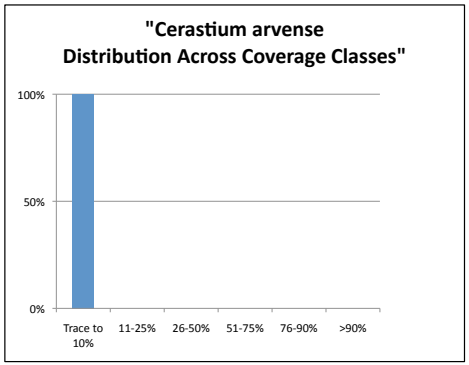

Figure 3e. Species #5, Common sheep sorrel, Exotic

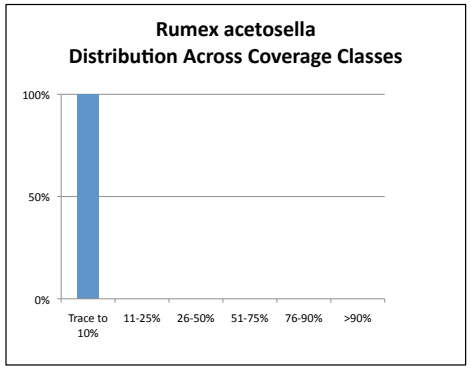

Figure 3f. Species #7, Biddy biddy, Native

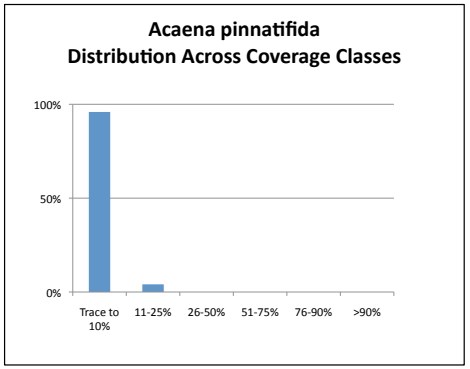

Figure 3g. Species #9, Dutch clover, Exotic

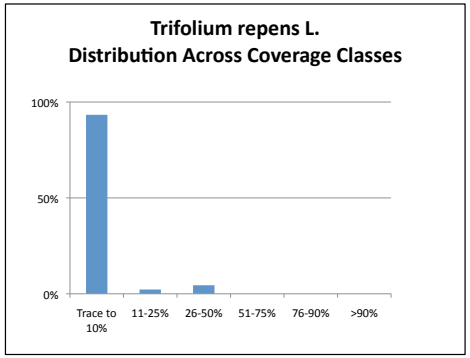

Figure 3h. Species #13, Funary moss, Exotic

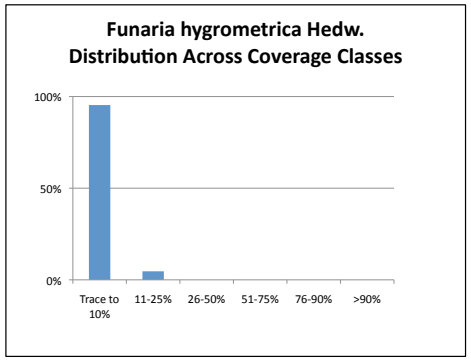

Figure 3i. Species #27, Common rush, Cosmopolitan

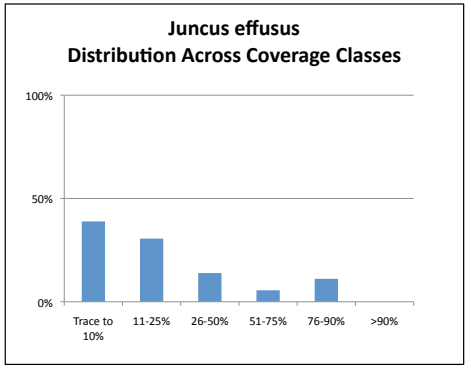

Figure 3j. Species #18, Colonial Bentgrass, Exotic

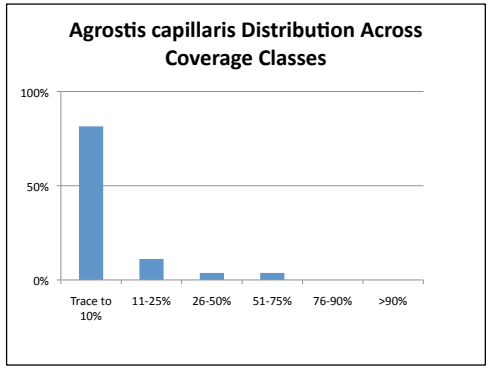

Figure 3k. Species #1, Common yarrow, Exotic

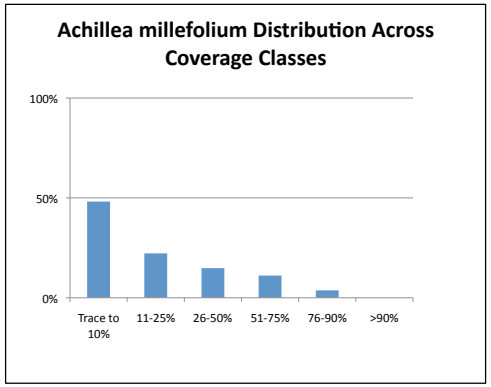

Figure 3l. Species #19, False dandelion, Exotic

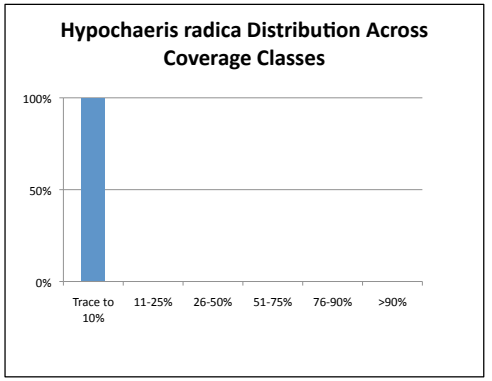

Figure 3m. Species #10, Bentgrass, Native

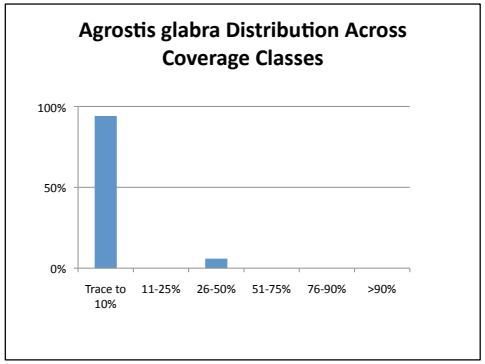

Figure 3n. Species #20, Luzula, Native

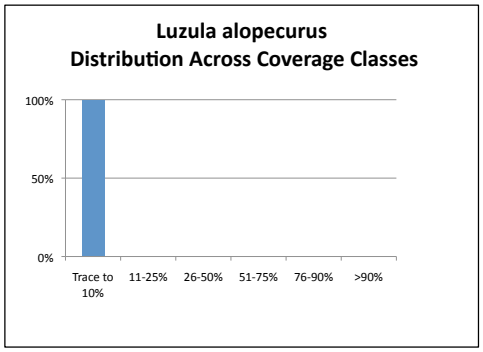

Figure 3o. Species #32, Yorkshire fog, Exotic

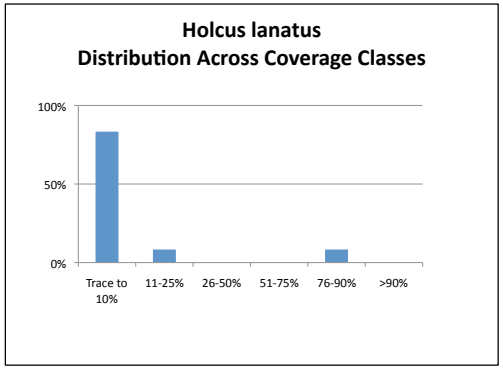

Figure 3p. Species #14, Wildrye, Native

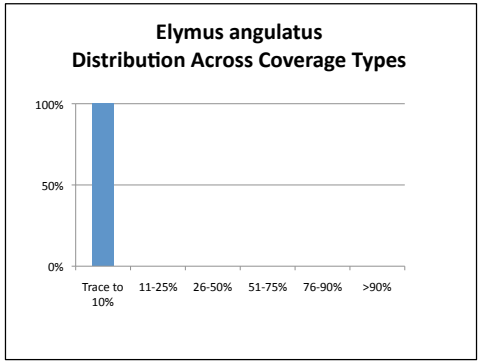

Figure 3q. Species #30, Pimpinela, Native

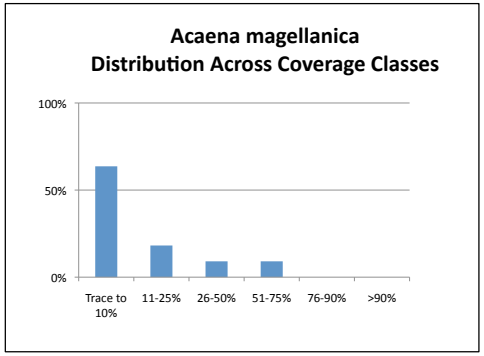

Figure 3r. Species #39, Yellow violet, Native

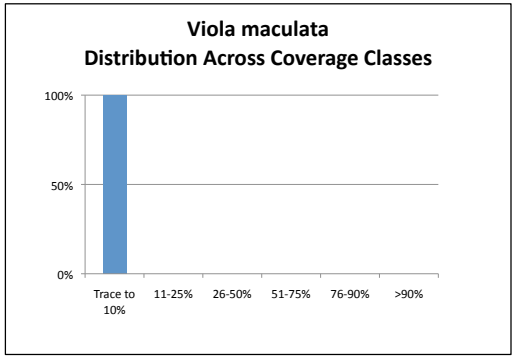

Figure 3s. Species #47, Thrift seapink, Exotic

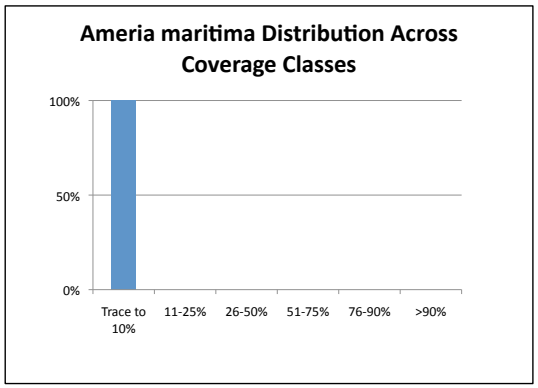

Figure 3t. Species #51, "Bromo", Native