Senator Beck Basin Long-term Vegetation Study
2009 Re-Survey

Final Report Presented to the
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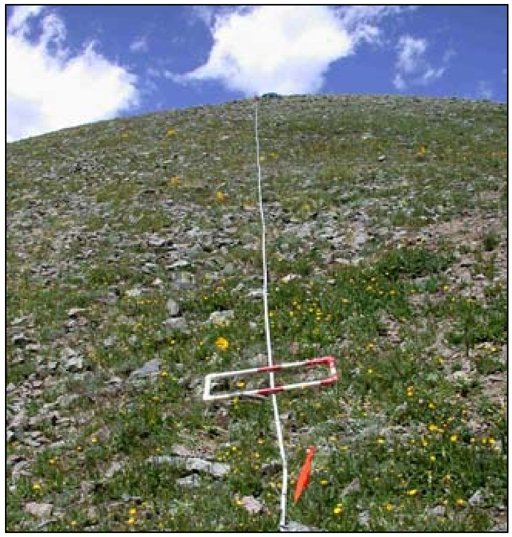

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Abstract
Climate greatly influences vegetation composition, abundance, and distribution. Predicted climate change in the Rocky Mountains of the western United States may lead to the reduction of snow pack and stream flow, and increase land surface drying. These events, as well as the movement of plant species upslope in response to warming, and the reduction of endemic species at the exterior of their ranges have already been documented. In southwest Colorado, there have been overall increases in mean temperature and decreases in total precipitation over the last century. In addition to the impact of these long-term trends, vegetation also has an immediate response to short-term fluctuations in water availability. Repeated measures of permanently placed vegetation plots can show the impacts of both long- and short-term climate patterns on vegetation. In 2004, a long-term vegetation study was initiated in Senator Beck Basin in the San Juan Mountains of southwestern Colorado. These permanent vegetation transects were read again in 2009 and a comparison of the two readings is presented here. Results show a significant difference in the vegetation of the basin in the five-year period since initial transect set-up. An additional 39 species were recorded from the transects in 2009, while 26 species found in 2004 were not recorded in 2009. Mean total cover of vegetation and mean diversity increased greatly from 2004 to 2009 throughout the study area. The differences can largely be explained by higher total precipitation in each of the years since the first reading, especially during the winter of 2008-2009.

Introduction

In 2004, the Center for Snow and Avalanche Studies solicited a baseline survey of the vegetation and soil surface characters of Senator Beck Basin, Ouray County, Colorado. In July and August of that year, Peggy Lyon, Julia Hanson, Maggie March, and Sara Eastin of the Colorado Natural Heritage Program, and Julie Crawford, independent researcher, collected data in 23 transects from three elevational belts representing six habitat types (see Crawford 2004). Analysis of baseline data suggested that the vegetation of the Upper and Lower belts were different from one another, while that of the Middle elevation belt, due to geographic proximity to both Upper and Lower belts, was similar to both Upper and Lower belt vegetation. The Middle belt was also the richest in species composition and had the greatest species diversity. In July of 2009, Peggy Lyon, Dawson White, and Sara Simonson read the transects for a second time. The objective of the second reading was to document changes in the vegetation over a five-year period. The data were analyzed and are reported on herein by Julie Crawford.

Methods

Initial set-up in early July 2004 consisted of subjective placement of 23 transects within 3 north-south oriented belts (Upper, Middle, Lower) located across upper, mid-, and lower-slopes on north, east, and south-facing aspects of Senator Beck Basin. The three belts covered an elevational range from 11,040’ (3,365m) to 13,040’ (3,975m), with transects in the Upper belt completely above treeline, those in the Lower belt completely below, and those in the Middle belt spanning both. Transects were placed to ensure comprehensive sampling from many habitats: spruce-fir forest, krummholz, wetlands, wet meadows, rock outcrops, and dry tundra.

Figure 1: Example of microframe and transect tape.

Transects were 100 feet (30.5m) in length and permanently marked at each end and then photo-documented. Each transect contained ten Daubenmire microframes placed with the 5dm side of the frames dividing the tape (Figure 1); they were placed ten feet (3m) apart beginning at the 5 foot (1.5m) mark for a total of 10 microframes per transect. Percent cover of vegetation by species, and the soil surface characteristics bare - soil, rock, standing water, and litter - were measured using a cover class scale of trace=0-0.99%, 1=1-5%, 2=6-25%, 3=26-50%, 4=51-75%, 5=76-95%, and 6=96-100%. For analysis, these cover classes were replaced with median cover (trace=0.5, 1=3, 2=15.5, 3=38, 4=63, 5=85.5, and 6=98) and averaged across the 10 microframes for a single cover record for each species and abiotic factor in each transect. See Crawford (2004) for a full description. Nomenclature follows Weber, 1987.

Species richness (Moore and Capman 1986) and Shannon Species Diversity Index (Kent and Coker 1992) were calculated for each transect. Floristic composition among transects was explored using Non-metric Multidimensional Scaling using the program PC-ORD (McCune and Mefford 1999). Dissimilarity in floristic composition between transects was calculated using the Relative Euclidean measure of dissimilarity. The program SYSTAT was used to create 90% confidence ellipses around transects of the three belts for each year of study (Systat 2002). Indicator Species Analysis (McCune and Mefford 1999) was used to identify species indicative of the three belts for each year of study by calculating an importance value and associated p-value (Monte Carlo test) for each species. Indicator values are calculated by combining relative abundance and relative frequency following the method of Dufrene and Legendre (1997). Repeated Measures Analysis of Variance was performed on mean total cover, mean species richness, and mean Shannon Diversity by belt and year using the program R (R Development Core Team 2008).

RESULTS

Species

There were a total of 131 identified vascular plant species in the 2004 and 143 identified vascular plant species in the 2009 readings of the Senator Beck Basin long-term vegetation transects (Appendix One). Twenty-six species recorded in 2004 were not recorded in 2009, while 39 species were recorded for the first time in 2009. Among the species recorded in 2009, two are exotic: *Taraxacum officinale* G.H. Weber ex Wiggers (dandelion) and *Poa pratensis* L. (Kentucky bluegrass). These species both had minimal cover; *T. officinale* was found in four transects and within all three belts, its cover increased since 2004. *Poa pratensis* was found for the first time in 2009 in just one transect of the Lower belt. There were five Colorado endemics: *Besseya ritteriana* (Eastw.) Rydb., *Draba graminea* Greene (Figure 2), *Draba streptobrachia* Price, *Polemonium confertum* Gray, and *Trifolium salictorum* Greene, and eight communities / 13 species of conservation concern tracked by the Colorado Natural Heritage Program recorded within the study area (Table 1).

Figure 2. Colorado endemic *Draba graminea* – Photo copyright Al Schneider.

Plant Community	Status	Plant Species	Status
Caltha leptosepala	G4S4	*Besseya ritteriana*	G3G4S3S4
Acomastylis rossii herbaceous vegetation	G4SU	*Draba crassa*	G3S3
A. rossii / *Bistorta bistortoides*	G4G5S4	*Draba graminea*	G2S2
A. rossii / *Trifolium* sp.	G3S3S4	*Draba streptobrachia*	G3S3
Ligusticum porteri / *Vicia americana*	G3S3	*Erigeron melanocephalus*	G4S4
Picea engelmannii / *A. rossii* krummholz	G3?SU	*Erigeron pinnatisectus*	G4S4
Salix arctica / *A. rossii*	G4S4	*Minuartia macrantha*	G3S3
Salix planifolia / *Caltha leptosepala*	G4S4	*Packera crocata*	G4S3S4
		Packera dimorphophylla	G4S4
		Podistera eastwoodiae	G3S3
		Potentilla subjuga	G4S3?
		Ranunculus macauleyi	G4S3S4
		Trifolium attenuatum	G3G4S3S4

Table 1 (NatureServe 2009). Plant communities and species tracked by the Colorado Natural Heritage Program found within the Senator Beck Basin long-term vegetation transects during the 2009 survey. Conservation status is designated by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, S = Subnational), followed by a number from 1 to 5 (1 = critically imperiled, 2 = imperiled, 3 = vulnerable to extirpation or extinction, 4 = apparently secure, and 5 = demonstrably widespread, abundant, and secure).

There were 20 recorded species requiring alpine conditions found within the above treeline transects (all transects of the Upper belt and transects 2, 3, 4, and 6 of the Middle belt) of Senator Beck Basin (Table 2; Harrington 1954; Hultén 1968; Weber 1987; Hogan 1992; Flora of North America Editorial Committee 1993+; Welsh and others 1993; Michener-Fote and Hogan 1999). Species that are alpine obligates and occur in no other location, e.g. Colorado endemics (*Draba graminea*) or that are at the lower latitudinal limits of their distribution (*Draba borealis* D.C., *Draba crassifolia* Graham, *Lloydia serotina* (L.) Salisb. ex Rchb., and *Potentilla uniflora* Ledeb.), are at greatest risk of extinction, at least locally, due to earlier snow melt, extended drought, and warming temperatures.

Besseya alpina	*Erigeron simplex*
Castilleja haydenii	*Lloydia serotina*
Castilleja occidentalis	*Oreoxis bakeri*
Cerastium beeringianum ssp. *earlei*	*Potentilla subjuga*
Chionophila jamesii	*Potentilla uniflora*
Draba borealis	*Salix reticulata* ssp. *nivalis*
Draba crassa.	*Silene acaulis* ssp. *subacaulescens*
Draba crassifolia	*Tetraneuris grandiflora*
Draba graminea	*Tonestus pygmaeus*
Erigeron pinnatisectus	*Trifolium nanum*

Table 2. Alpine obligate species found in above treeline transects of the Senator Beck Basin long-term vegetation study area in 2009.

Of the 144 species occurring in the above treeline transects in both years of study combined, 12 (8.3%) are known primarily from subalpine environments (Table 3; Harrington 1954; Hultén

1968; Weber 1987; Hogan 1992; Flora of North America Editorial Committee 1993+, Welsh and others 1993; Michener-Fote and Hogan 1999). The presence of these species may be an indicator of climate change already in progress. Also of interest is a small cover reading of *Ligusticum porteri* Coult. & Rose, a common subalpine species, recorded in 2009 but not in 2004 from transect one of the Middle belt. This transect is in the transition zone between krummholz and lower alpine and contains predominantly species typical of alpine tundra.

Plant Species	Belt – Transect(s)	Elevation
Calamagrostis canadensis	Upper - 12	12,150’ (3,703m)
Carex microptera	Upper - 11	12,320’ (3,755m)
Carex rossii	Middle - 6	12,080’ (3,682m)
Descurainia incana	Middle - 3	12,020’ (3,664m)
Dugaldia hoopsii	Middle - 4	12,040’ (3,670m)
Geranium richardsonii	Middle - 6	12,080’ (3,682m)
Ligusticum porteri	Middle 2 & 4	12,070’ (3,679m), 12,040’ (3,670m)
Luzula parviflora	Upper - 7, 8, 10 Middle - 4	12,670’ (3,676m), 12,730’ (3,880m), 13,030’ (3,972m), 12,040’ (3,670m)
Oxypolis fendleri	Middle - 3 & 4	12,020’ (3,664m), 12,040’ (3,670m)
Ranunculus inamoenus	Middle - 4	12,040’ (3,670m)
Stellaria crassifolia	Upper - 12 Middle - 3 & 6	12,150’ (3,703m), 12,020’ (3,664m), 12,080’ (3,682m)
Thalictrum fendleri	Middle - 3	12,020’ (3,664m)

Table 3. Species found in above treeline transects of the Senator Beck Basin long-term vegetation study area in 2004 and/or 2009 that are known primarily from subalpine environments; locations where they were recorded.

Indicator Species Analysis was run for both 2004 and 2009 datasets following discovery of two errors in the 2004 dataset and analysis. These errors were: 1) a misidentification of *Vaccinium cespitosum* Michx. (previously reported as *V. myrtillus* L.) and 2) an inadvertent omission of *Acomastylis rossii* (R. Br) Greene ssp. *turbinata* (Rydberg) Weber data that was collected in 2004, but not analyzed. These two errors were remedied in 2009. In all belts, at least three indicator species were the same between the two years of study (Table 4). Both Upper and Lower belts contained greater numbers of indicator species in 2009, while the Middle belt contained fewer.

Belt	2004 Species	IV	*p*-value	2009 Species	IV	*p*-value
Upper	*Poa alpina*	87	**0.001**	*Poa alpina*	89	**0.001**
	Bistorta bistortoides	69	**0.027**	*Bistorta bistortoides*	85	**0.001**
	Acomastylis rossii	68	**0.002**	*Deschampsia cespitosa*	76	**0.001**
	Festuca brachyphylla	59	0.086	*Acomastylis rossii*	74	**0.001**
	Micranthes rhomboidea	51	0.099	*Sibbaldia procumbens*	72	**0.005**
	Artemisia scopulorum	49	0.064	*Potentilla diversifolia*	64	**0.029**
	Carex nova	49	0.079	*Carex haydeniana*	58	**0.014**
				Castilleja occidentalis	50	**0.047**
				Trifolium parryi	50	0.054
				Lloydia serotina	42	0.074
				Oreoxis bakeri	42	0.097
				Erigeron melanocephalus	41	0.088
Middle	*Vaccinium cespitosum*	76	**0.003**	*Vaccinium cespitosum*	89	**0.001**
	Viola labridorica	67	**0.007**	*Salix brachycarpa*	50	**0.021**
	Trifolium salictorum	58	**0.013**	*Picea engelmannii*	48	**0.027**
	Potentilla sp.	55	**0.01**	*Allium geyeri*	43	0.061
	Allium geyeri	55	**0.015**	*Oreoxis alpina*	33	0.086
	Draba aurea	50	**0.014**	*Danthonia intermedia*	33	0.094
	Aquilegia coerulea	50	**0.016**	*Primula parryi*	33	0.094
	Minuartia macrantha	50	**0.019**			
	Salix planifolia	44	0.079			
	Packera dimorphophylla	41	0.079			
	Primula parryi	33	0.092			
	Antennaria rosea	33	0.095			
Lower	*Fragaria virginiana*	60	0.069	*Dugaldia hoopsii*	80	**0.005**
	Aconitum columbianum	40	**0.011**	*Ligusticum porteri*	76	**0.002**
	Arnica cordifolia	40	**0.043**	*Mertensia ciliata*	66	**0.009**
	Achillea lanulosa	40	**0.045**	*Chamerion danielsii*	60	**0.007**
	Ligusticum porteri	40	**0.048**	*Fragaria virginiana*	60	**0.007**
	Dugaldia hoopsii	40	0.054	*Delphinium barbeyi*	60	**0.008**
	Draba spectabilis	40	0.093	*Ligularia bigelovii*	60	**0.012**
	Cardamine cordifolia	38	0.084	*Thalictrum fendleri*	60	**0.012**
	Ranunculus inamoenus	33	0.091	*Poa cusickii*	57	**0.02**
				Draba spectabilis	52	**0.022**
				Luzula parvifolia	47	**0.024**
				Achillea lanulosa	40	**0.039**
				Carex geyeri	40	**0.039**
				Arnica cordifolia	40	**0.04**
				Carex aquatilis	40	**0.04**
				Epilobium hornemannii	40	**0.04**
				Vaccinium myrtillus	40	**0.04**
				Cardamine cordifolia	40	**0.046**
				Veratrum tenuipetalum	40	**0.048**
				Geranium richardsonii	37	**0.045**
				Senecio triangularis	31	0.09

Table 4. Significant ($p \leq 0.1$) results from Indicator Species Analysis of the Senator Beck Basin long-term vegetation study area data for 2004 and 2009, respectively. Indicator value (IV); *p*-values significant at the 0.05 level are in bold.

Communities

Mean species richness by transect was higher in the Upper and Lower belts in 2009, but was lower in the Middle belt in 2009 (Figure 3). Repeated Measures Analysis of Variance (ANOVA) showed significant difference (*p*=0.0129) in mean species richness between the two years and showed that vegetation of the belts are not all behaving in the same way (*p*=0.001; Figure 4). Mean species diversity increased in all belts in 2009 (Figure 5); these changes were significant (*p*<0.001) in Repeated Measures ANOVA (Figure 6). In addition to the changes in species composition between the two readings, mean total vegetation cover increased greatly from 2004 to 2009 in all three belts (Figure 7). Repeated Measures Analysis of Variance verified these differences (*p*<0.0001; Figure 8).

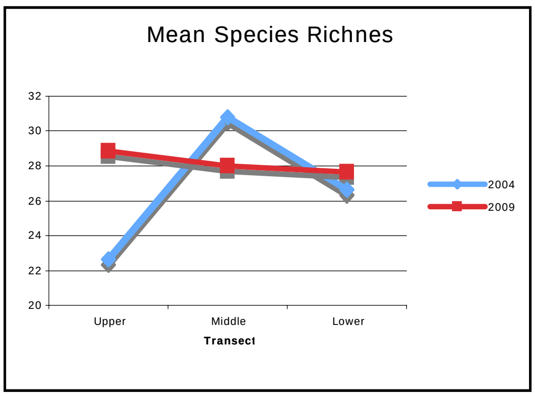

Figure 3. Mean species richness by transect in 2004 and 2009 in the Senator Beck Basin long-term vegetation transects.

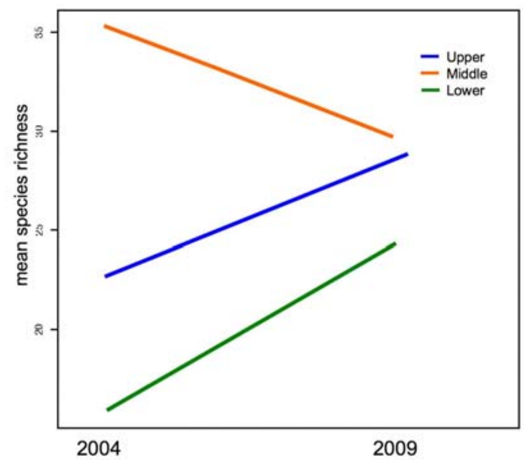

Figure 4. Repeated measures ANOVA showing mean species richness changes from 2004 to 2009 in the Senator Beck Basin long-term vegetation transects.

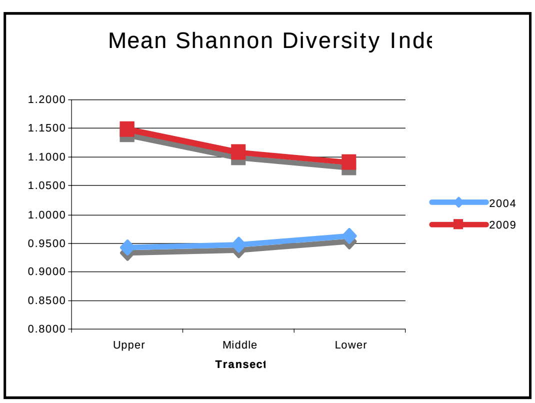

Figure 5. Mean Shannon Diversity Index by transect in 2004 and 2009 in the Senator Beck Basin long-term vegetation transects.

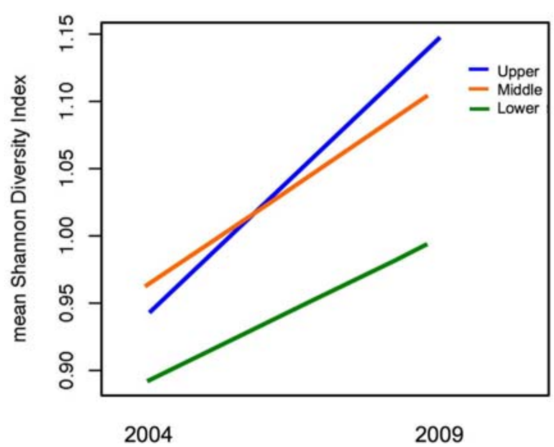

Figure 6. Repeated measures ANOVA showing mean Shannon Diversity Index changes from 2004 to 2009 in the Senator Beck Basin long-term vegetation transects.

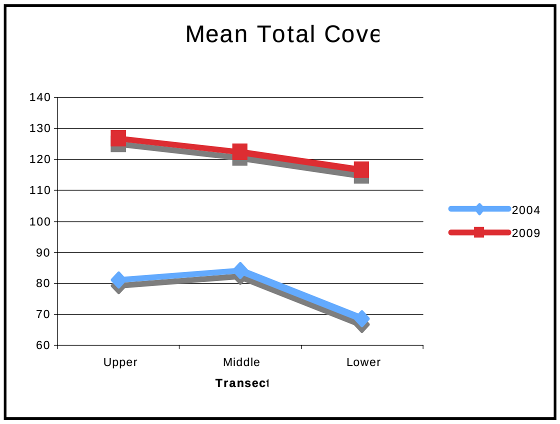

Figure 7. Mean total cover of vascular plant species recorded in 2004 and 2009 in the Senator Beck Basin long-term vegetation transects.

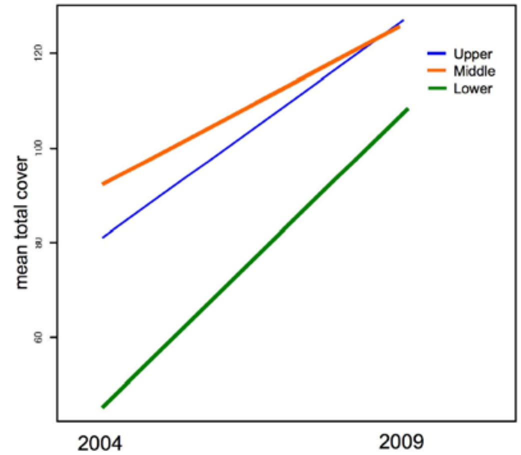

Figure 8. Repeated measures ANOVA showing mean total species cover changes from 2004 to 2009 in the Senator Beck Basin long-term vegetation transects.

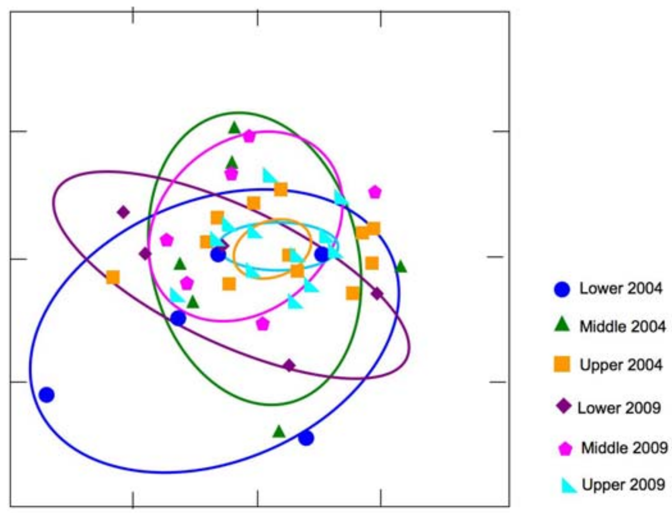

Figure 9. Results from 2004 and 2009 Non-Metric Multi-Dimensional Scaling of floristic data from three belts within the Senator Beck Basin long-term vegetation study area. Circles represent a 90% Confidence Ellipse according to Lower, Middle, or Upper elevation belt.

Results from NMDS show similar patterns in both 2004 and 2009 with respect to the vegetation of the three belts (Figure 9). As reported in 2004, points of the Middle belt spanned both Upper and Lower belts, showing the similarity of species composition and abundance between this transitional belt and both the Upper and Lower belts. Points from the Lower belt in both 2004 and 2009 are widely distributed in ordination space showing the great variety of habitats present there. The Middle belt points, with fair distribution, were very similar in ordination space for the two years, as were the more tightly grouped Upper belt points.

Climate

The nearest long-term (since 1906) climate station to Senator Beck Basin is in the town of Silverton, Colorado roughly 7.75 miles (12.5km) to the east-south-east (Western Regional Climate Center 2009). Graphs of those data, aided by trendlines, reveal an overall increase in mean annual temperature and an overall decrease in total annual precipitation over the period of record (Figures 10 and 11).

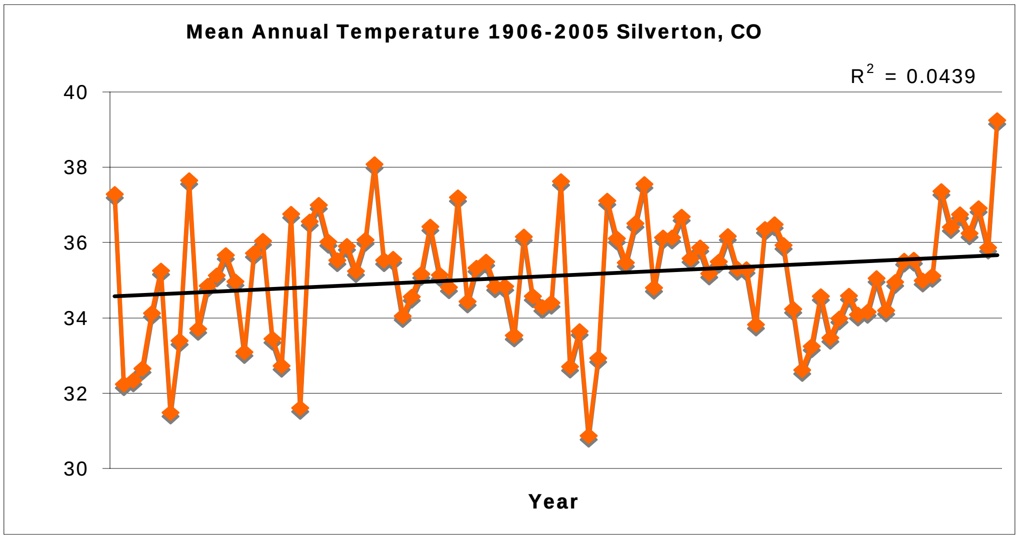

Figure 10. Mean annual temperature (F) recorded in Silverton, Colorado from 1906 through 2005. The trendline (linear regression) indicates an overall increase in mean annual temperature over the period of record.

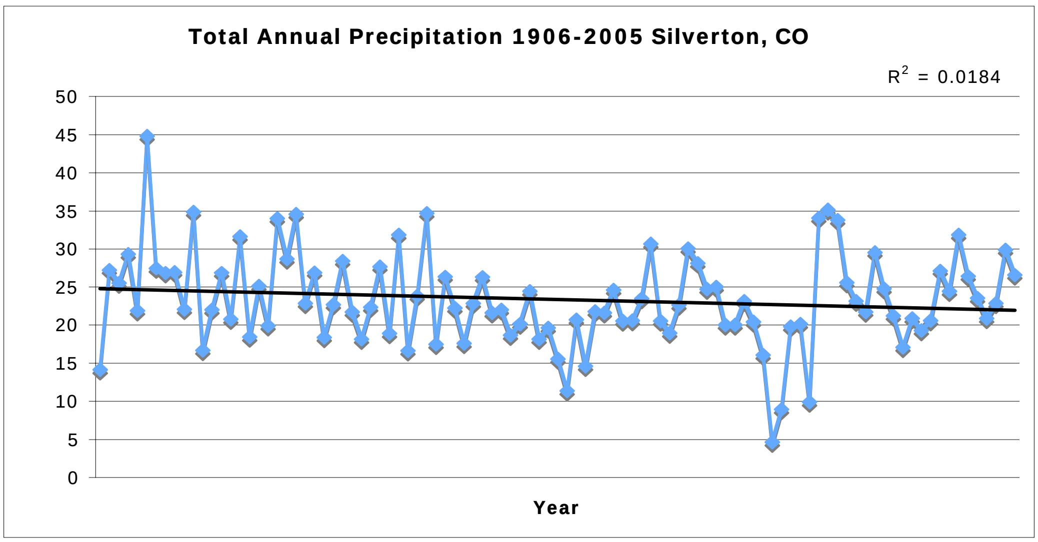

Figure 11. Total annual precipitation (inches) recorded in Silverton, Colorado from 1906 through 2005. The trendline (linear regression) indicates an overall decrease in total annual precipitation over the period of record.

Long-term climate trends may lead to plant species moving up in elevation and possibly local extinctions from loss of suitable habitat or competition; short-term climate impacts can be seen immediately. Yearly fluctuations in available water to seeds and plants greatly influence composition, abundance, and size of individual plants from year to year. The nearby Snotel weather station on Red Mountain Pass has recorded precipitation since 1981 (Figure 12; Natural Resources Conservation Service, 2009). Here, precipitation recorded on a water year basis (October-September), shows wet winters in the early 1980s, the mid 1990s, and again in 2008. Since vegetation transects were measured at the same time of year in both 2004 and

2009 (July), precipitation factors are the next most important consideration in understanding the difference in vegetation response during those years.

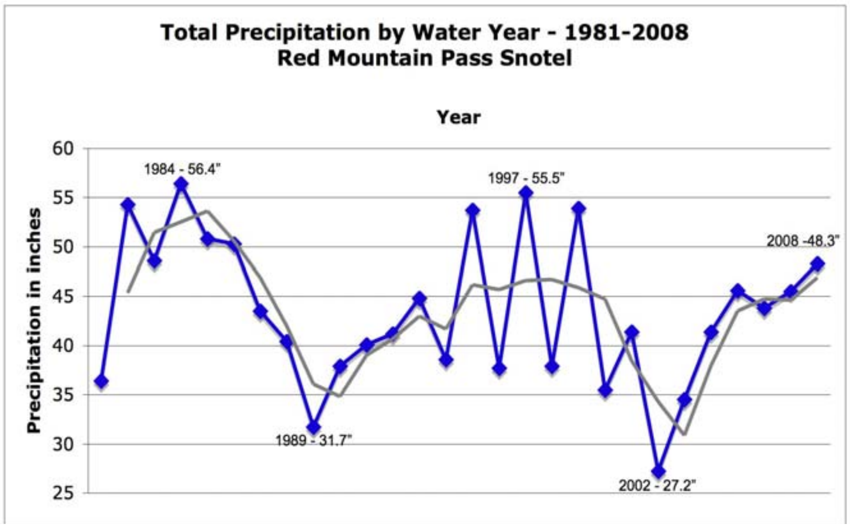

Figure 12. Red Mountain Pass Snotel total yearly precipitation data for the water years 1981 through 2008. A moving average trendline (grey) better shows decadal fluctuations.

A closer look (Figure 13) at monthly Snotel precipitation data from Red Mountain Pass for Water Years 2004 and 2009 reveals more snow precipitation in WY 2009 (33.3" total WY precipitation by the end of May in 2004 vs. 29.9" in WY 2009), and substantially more rain in June 2009 than in June 2004 (3.6" in June 2009 vs. 0.5" in June 2004).

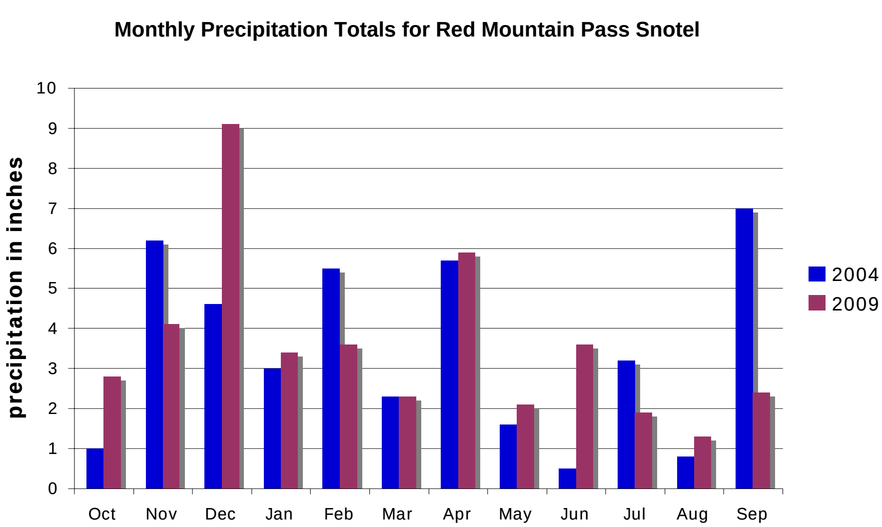

Figure 13. Red Mountain Pass Snotel monthly precipitation data for the water years 2004 and 2009 showing higher total precipitation from October 2008 through June 2009, than the same period in 2003-2004. Vegetation transects were measured during July in both 2004 and 2009.

Discussion

Long-term data collection from permanent plots is a necessary tool to understand vegetation changes over time. The short period of time between the first (July 2004) and second (July

2009) readings of the Senator Beck Basin permanent transects does not allow any interpretation of long-term change. The great differences seen in richness, diversity, cover, and composition can, in all probability, be attributed to yearly fluctuations in precipitation and timing of water availability. Increases in dust deposition in the San Juan Mountains has been shown to cause earlier snowmelt, making water available before temperatures are warm enough to initiate plant leaf-out and flowering (Steltzer and others 2009). Because water that becomes available too early may not be useful to alpine plant development, the greater amount of snow precipitation over the winter in 2009 may be less important than the increased rain precipitation in June of that year. The cool temperatures associated with the wet June, coupled with 4x-5x higher dust-in-snow concentrations in 2009 than in 2004, and a corresponding advance in snowmelt timing (Snow Optics Lab, 2009), may have aided in the observed delay of leafing and flowering of alpine plants in 2009, followed by a period of rapid growth (personal observation, Chris Landry). This combination of delayed but rapid growth may have led to the higher richness, diversity, and cover in the vegetation observed in July 2009 and illustrate the simultaneous leaf-out and flowering associated with dust-induced advances in snowmelt timing described by Steltzer et al. (2009).

Sixty-one of the 65 species occurrences (93.8%) detected in either, but not both, 2004 or 2009 had less than 12.5% total combined cover from all transects. Most readings were individual occurrences or small plants with less than 1% total combined cover; the other larger percentages could possibly be attributed to a few larger individuals. The remaining four species are more problematic: 1) *Carex haydeniana* Olney had over 35% cover across seven Upper belt transects in 2009, but was not recorded in 2004, 2) *Carex microptera* Mackenzie, a subalpine species, had 17.5% cover across two Upper belt transects in 2004, but was not recorded in 2009, 3) *Vaccinium myrtillus* had 22% cover across two Lower belt transects in 2009, but no *Vaccinium* sp. were recorded in any transect of the Lower belt in 2004, and 4) *Salix brachycarpa* Nutt had 19.5% cover over three Middle belt transects in 2009, but was not recorded in any transect of any belt in 2004. One possible cause for these differences could be an artifact of differing plant identification between the two years. Transect by transect, these 2009 data were compared to data of similar species they might have been confused with in 2004, but in no instance did this theory hold. Since a representative collection of all species recorded in each year of survey was not collected, it is impossible to verify identification. Peggy Lyon is a skilled botanist with an affinity for *Carex* species and the proven ability to identify these and other difficult species readily. It is therefore likely, given that Peggy was principal botanist in both 2004 and 2009, that few or no species were misidentified in either year.

Other possibilities for explaining these high cover readings include 1) Daubenmire frames slightly missing / hitting species or being placed in the wrong location in either year, 2) the movement, disappearance, or appearance of species due to variations in available water, seedbank, herbivory and other disturbance, and 3) individual species life history characteristics.

There is no way to investigate the first two possibilities. In terms of life history, both *Carex* species are seed-producers, lacking a rhizome and the ability to "creep" into microframes; any plants would have to have been grown from seed in the five-year period. The *Vaccinium* reproduces both sexually and asexually and is known to create a seedbank; it is doubtful that this shrub could have grown from seed in a five-year period to the proportions required to make 22% cover. The *Salix* is primarily a seed-producer, but does re-sprout due to disturbance, and *Salix* in general are heavily utilized and disturbed by both small and large mammals. Like *Vaccinium*, it is most likely that this species, if truly a new find in 2009, was from asexual reproduction given the five-year time frame. Another possibility for the shrub occurrences is impact of long-term climate warming that has been shown in studies throughout the arctic (e.g. see ITEX) to increase cover of shrub species. Could these phenomena be associated with warming over this short of a time period? Were they from misplacements of the Daubenmire frame in one or both years? Were they from misidentification? There is no way to tell; longer-term research may eventually provide some answers.

Recommendations

Because long-term changes in vegetation communities at Senator Beck Basin will likely not be obvious for many years, it is recommended that key species and transects be observed carefully from reading to reading in the short-term (e.g. next four or five readings). Key species should include alpine obligates (e.g. Have these species reduced in numbers or cover over the years? Are disturbances impacting these species?), subalpine species (e.g. Have those reported herein or other lower elevation species moved into the alpine over time?), and indicator species (e.g. Are the key indicator species changing over time? Do any exotic species ever increase in richness or abundance enough to become indicators [and threats]? Do shrub species increase and herbaceous species decrease in richness or abundance as predicted in numerous climate change studies?). Should funding be short in any year of re-measure, it is recommended that the Middle belt, at a minimum, be re-surveyed. This belt, due to its placement in the transition between treeline and lower alpine will likely be the first location where the long-term impacts of climate change will be seen. For example, the new records of *Ligusticum porteri* in the krummholz of Middle belt transect one suggests a recent movement upslope. Indeed, the presence of subalpine species within many alpine transects suggests that long-term climate warming and drying have influenced vegetation at the site for decades. The reason for the reduction in species richness and indicator values in 2009 in the Middle belt is unknown and warrants further investigation.

Over the next few decades, the then longer-term available weather, snow pack, and hydrologic observations data collected within Senator Beck Basin itself (http://www.snowstudies.org /data.html) should be compared directly with collected vegetation data. In doing so, patterns will likely emerge showing which species are most sensitive to drought or high water availability. It is also recommended that in all future monitoring, funding be in place to make a complete collection of all species recorded that year from areas near, but outside of the transects. These collections should be placed in a regional herbarium or possibly in a professional herbarium case within the offices of the Center for Snow and Avalanche Studies in Silverton. Lastly, it is recommended that previous years data be taken into the field and compared after each transect is read. This kind of self-check while in the field can prevent misplacement of microframes and identification issues when looking at the data later on, and may be a red flag for small plants otherwise missed without in-depth searching. By comparing results after the transects are read, there is no bias introduced and the data will be stronger for direct comparisons.

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APPENDIX ONE: LIST OF SPECIES, family, life form, and what year they were recorded.

2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
X	X	Apiaceae	*Allium geyeri* S. Wats.	*Allium geyeri*	Geyer's onion	Herbaceous
X		Apiaceae	*Angelica grayi* (Coult. & Rose) Coult. & Rose	*Angelica grayi*	Gray's angelica	Herbaceous
X	X	Apiaceae	*Ligusticum porteri* Coult. & Rose	*Ligusticum porteri*	Porter's licorice-root	Herbaceous
X	X	Apiaceae	*Oreoxis alpina* (Gray) Coult. & Rose	*Oreoxis alpina*	alpine oreoxis	Herbaceous
	X	Apiaceae	*Oreoxis bakeri* J.M. Coult. & Rose	*Oreoxis bakeri*	Baker's alpineparsley	Herbaceous
X	X	Apiaceae	*Oxypolis fendleri* (Gray) Heller	*Oxypolis fendleri*	Fendler's cowbane	Herbaceous
X	X	Apiaceae	*Podistera eastwoodiae* (Coult. & Rose) Mathias & Constance	*Podistera eastwoodiae*	Eastwood's podistera	Herbaceous
X	X	Apiaceae	*Pseudocymopterus montanus* (Gray) Coult. & Rose	*Pseudocymopterus montanus*	alpine false springparsley	Herbaceous
X	X	Asteraceae	*Achillea millefolium* L. var. *occidentalis* DC.	*Achillea lanulosa*	western yarrow	Herbaceous
X		Asteraceae	*Agoseris aurantiaca* (Hook.) Greene	*Agoseris aurantiaca*	orange agoseris	Herbaceous
X	X	Asteraceae	*Agoseris glauca* (Pursh) Raf.	*Agoseris glauca*	pale agoseris	Herbaceous
X		Asteraceae	*Antennaria rosea* Greene	*Antennaria rosea*	rosy pussytoes	Herbaceous
X	X	Asteraceae	*Antennaria umbrinella* Rydb.	*Antennaria umbrinella*	umber pussytoes	Herbaceous
X	X	Asteraceae	*Arnica cordifolia* Hook.	*Arnica cordifolia*	heartleaf arnica	Herbaceous
	X	Asteraceae	*Arnica latifolia* Bong.	Arnica latifolia	broadleaf arnica	Herbaceous
X	X	Asteraceae	*Arnica mollis* Hook.	*Arnica mollis*	hairy arnica	Herbaceous
X	X	Asteraceae	*Artemisia scopulorum* Gray	*Artemisia scopulorum*	alpine sagebrush	Herbaceous
X	X	Asteraceae	*Erigeron coulteri* Porter	*Erigeron coulteri*	large mountain fleabane	Herbaceous
X	X	Asteraceae	*Erigeron melanocephalus* (A. Nels.) A. Nels.	*Erigeron melanocephalus*	blackhead fleabane	Herbaceous
X	X	Asteraceae	*Erigeron peregrinus* (Banks ex Pursh) Greene	*Erigeron peregrinus*	subalpine fleabane	Herbaceous
X	X	Asteraceae	*Erigeron pinnatisectus* (Gray) A. Nels.	*Erigeron pinnatisectus*	featherleaf fleabane	Herbaceous
X	X	Asteraceae	*Erigeron simplex* Greene	*Erigeron simplex*	onestem fleabane	Herbaceous
X		Asteraceae	*Erigeron speciosus* (Lindl.) DC.	*Erigeron speciosus*	aspen fleabane	Herbaceous
	X	Asteraceae	*Hieracium gracile* Hook.	*Chlorocrepis tristis* ssp. *gracilis*	slender hawkweed	Herbaceous
X	X	Asteraceae	*Hymenoxys hoopesii* (Gray) Bierner	*Dugaldia hoopsii*	owl's-claws	Herbaceous
	X	Asteraceae	*Oreochrysum parryi (A. Gray) Rydb.*	*Oreochrysum parryi*	Parry's goldenrod	Herbaceous
X	X	Asteraceae	*Packera crocata* (Rydb.) W.A. Weber & A. Löve	*Packera crocata*	saffron ragwort	Herbaceous
X	X	Asteraceae	*Packera dimorphophylla* (Greene) W.A. Weber & A. Löve ssp. *dimorphophylla*	*Packera dimorphophylla*	splitleaf groundsel	Herbaceous
X	X	Asteraceae	*Senecio amplectens* Gray var. *holmii* (Greene) Harrington	*Ligulara holmii*	Holm's ragwort	Herbaceous

2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
	X	Asteraceae	*Senecio bigelovii* A. Gray var. *bigelovii*	*Ligularia bigelovii*	nodding ragwort	Herbaceous
X	X	Asteraceae	*Senecio crassulus* Gray	*Senecio crassulus*	thickleaf ragwort	Herbaceous
X	X	Asteraceae	*Senecio triangularis* Hook.	*Senecio triangularis*	arrowleaf ragwort	Herbaceous
X	X	Asteraceae	*Taraxacum officinale* G.H. Weber ex Wiggers	*Taraxacum officinale*	common dandelion	Exotic Herbaceous
X	X	Asteraceae	*Tetraneuris grandiflora* (Torr. & Gray ex Gray) Parker	*Tetraneuris grandiflora*	graylocks four-nerve daisy	Herbaceous
X	X	Asteraceae	*Tonestus pygmaeus* (Torr. & Gray) A. Nels.	*Tonestus pygmaea*	pygmy goldenweed	Herbaceous
X	X	Boraginaceae	*Mertensia ciliata* (James ex Torr.) G. Don	*Mertensia ciliata*	tall fringed bluebells	Herbaceous
	X	Boraginaceae	*Mertensia lanceolata* (Pursh) DC.	*Mertensia lanceolata*	prairie bluebells	Herbaceous
X	X	Brassicaceae	*Arabis drummondii* Gray	*Boechera drummondii*	Drummond's rockcress	Herbaceous
X	X	Brassicaceae	*Cardamine cordifolia* Gray	*Cardamine cordifolia*	heartleaf bittercress	Herbaceous
X		Brassicaceae	*Descurainia incana* (Bernh. ex Fisch. & C.A. Mey.) Dorn ssp. *incisa* (Engelm.) Kartesz & Gandhi	*Descurainia incisa*	mountain tansymustard	Graminoid
X		Brassicaceae	*Draba aurea* Vahl ex Hornem.	*Draba aurea*	golden draba	Herbaceous
	X	Brassicaceae	*Draba borealis* DC.	*Draba borealis*	boreal draba	Herbaceous
X		Brassicaceae	*Draba crassa* Rydb.	*Draba crassa*	thickleaf draba	Herbaceous
X	X	Brassicaceae	*Draba crassifolia* Graham	*Draba crassifolia*	snowbed draba	Herbaceous
X		Brassicaceae	*Draba graminea* Greene	*Draba graminea*	Rocky Mountain draba	Herbaceous
X	X	Brassicaceae	*Draba spectabilis* Greene	*Draba spectabilis*	showy draba	Herbaceous
	X	Brassicaceae	*Draba streptobrachia* R.A. Price	*Draba streptobrachia*	alpine tundra draba	Herbaceous
X	X	Brassicaceae	*Erysimum capitatum* (Dougl. ex Hook.) Greene	*Erysimum capitatum*	sanddune wallflower	Herbaceous
X	X	Brassicaceae	*Smelowskia calycina* (Steph. ex Willd.) C.A. Mey.	*Smelowskia calycina*	alpine smelowskia	Herbaceous
X	X	Brassicaceae	*Thlaspi montanum* L. var. *montanum*	*Noccaea montana*	alpine pennycress	Herbaceous
X	X	Caryophyllaceae	*Cerastium beeringianum* Cham. & Schlecht.	*Cerastium beeringianum* ssp. *earlei*	Bering chickweed	Herbaceous
X	X	Caryophyllaceae	*Minuartia macrantha* (Rydb.) House	*Minuartia macrantha*	House's stitchwort	Herbaceous
X	X	Caryophyllaceae	*Minuartia obtusiloba* (Rydb.) House	*Lidia obtusiloba*	twinflower sandwort	Herbaceous
	X	Caryophyllaceae	*Sagina saginoides* (L.) Karst.	*Sagina saginoides*	arctic pearlwort	Herbaceous
X	X	Caryophyllaceae	*Silene acaulis* (L.) Jacq. var. subacaulescens (F.N. Williams) Fernald & H. St. John	*Silene acaulis* ssp. *subacaulescens*	moss campion	Herbaceous
	X	Caryophyllaceae	*Silene drummondii* Hook. var. *drummondii*	*Gastrolychnis drummondii*	Drummond's campion	Herbaceous
	X	Caryophyllaceae	*Stellaria crassifolia* Ehrh.	*Stellaria crassifolia*	fleshy starwort	Herbaceous
	X	Caryophyllaceae	*Stellaria umbellata* Turcz. ex Kar. & Kir.	*Stellaria umbellata*	umbrella starwort	Herbaceous

2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
X	X	Crassulaceae	*Rhodiola integrifolia* Raf.	*Rhodiola integrifolia*	ledge stonecrop	Herbaceous
X		Crassulaceae	*Rhodiola rhodantha* (Gray) Jacobsen	*Clementsia rhodantha*	redpod stonecrop	Herbaceous
X	X	Crassulaceae	*Sedum lanceolatum* Torr.	*Amerosedum lanceolatum*	spearleaf stonecrop	Herbaceous
X	X	Cyperaceae	*Carex aquatilis* Wahlenb.	*Carex aquatilis*	water sedge	Graminoid
X		Cyperaceae	*Carex ebenea* Rydb.	*Carex ebenea*	ebony sedge	Graminoid
	X	Cyperaceae	*Carex elynoides* T. Holm	*Carex elynoides*	blackroot sedge	Graminoid
X	X	Cyperaceae	*Carex geophila* Mackenzie	*Carex geophila*	White Mountain sedge	Graminoid
X	X	Cyperaceae	*Carex geyeri* Boott	*Carex geyeri*	Geyer's sedge	Graminoid
	X	Cyperaceae	*Carex haydeniana* Olney	*Carex haydeniana*	cloud sedge	Graminoid
X	X	Cyperaceae	*Carex heteroneura* W. Boott var. *chalciolepis* (Holm) F.J. Herm.	*Carex chalciolepis*	Holm sedge	Graminoid
X		Cyperaceae	*Carex microptera* Mackenzie	*Carex microptera*	smallwing sedge	Graminoid
X	X	Cyperaceae	*Carex nigricans* C.A. Mey.	*Carex nigricans*	black alpine sedge	Graminoid
X	X	Cyperaceae	*Carex nova* Bailey	*Carex nova*	black sedge	Graminoid
X		Cyperaceae	*Carex praeceptorium* Mackenzie	*Carex praeceptorum*	early sedge	Graminoid
X		Cyperaceae	*Carex rossii* Boott	*Carex rossii*	Ross' sedge	Graminoid
	X	Cyperaceae	*Carex vernacula* L.H. Bailey	Carex vernacula	native sedge	Graminoid
X		Dryopteridaceae	*Cystopteris fragilis* (L.) Bernh.	*Cystopteris fragilis*	brittle bladderfern	Herbaceous
X	X	Ericaceae	*Vaccinium caespitosum* Michx.	*Vaccinium cespitosum*	dwarf bilberry	Shrub
	X	Ericaceae	*Vaccinium myrtillus* L.	*Vaccinium myrtillus*	whortleberry	Shrub
X	X	Fabaceae	*Trifolium attenuatum* Greene	*Trifolium attenuatum*	Rocky Mountain clover	Herbaceous
X	X	Fabaceae	*Trifolium nanum* Torr.	*Trifolium nanum*	dwarf clover	Herbaceous
X	X	Fabaceae	*Trifolium parryi* Gray	*Trifolium parryi*	Parry's clover	Herbaceous
X	X	Fabaceae	*Trifolium parryi* Gray ssp. *salictorum* (Greene ex Rydb.) J. Gillett	*Trifolium salictorum*	Parry's clover	Herbaceous
X		Gentianaceae	*Gentiana algida* Pallas	*Gentianodes algida*	whitish gentian	Herbaceous
	X	Gentianaceae	*Swertia perennis* L.	*Swertia perennis*	felwort	Herbaceous
X	X	Geraniaceae	*Geranium richardsonii* Fisch. & Trautv.	*Geranium richardsonii*	Richardson's geranium	Herbaceous
X		Grossulariaceae	*Ribes montigenum* McClatchie	*Ribes montigenum*	gooseberry currant	Shrub
	X	Hydrophyllaceae	*Hydrophyllum fendleri* (A. Gray) A. Heller	*Hydrophyllum fendleri*	Fendler's waterleaf	Herbaceous
X	X	Hydrophyllaceae	*Phacelia sericea* (Graham) Gray	*Phacelia sericea*	silky phacelia	Herbaceous
X	X	Juncaceae	*Juncus balticus* Willd.	*Juncus balticus*	Baltic rush	Graminoid
X	X	Juncaceae	*Juncus drummondii* E. Mey.	*Juncus drummondii*	Drummond's rush	Graminoid
	X	Juncaceae	*Juncus saximontanus* A. Nelson	*Juncus saximontanus*	Rocky Mountain rush	Graminoid
X	X	Juncaceae	*Luzula parviflora* (Ehrh.) Desv.	*Luzula parvifolia*	smallflowered woodrush	Graminoid
X	X	Juncaceae	*Luzula spicata* (L.) DC.	*Luzula spicata*	spiked woodrush	Graminoid
X	X	Liliaceae	*Lloydia serotina* (L.) Reichenb.	*Lloydia serotina*	common alplily	Herbaceous
	X	Liliaceae	*Veratrum tenuipetalum* A. Heller	*Veratrum tenuipetalum*	Colorado false hellebore	Herbaceous

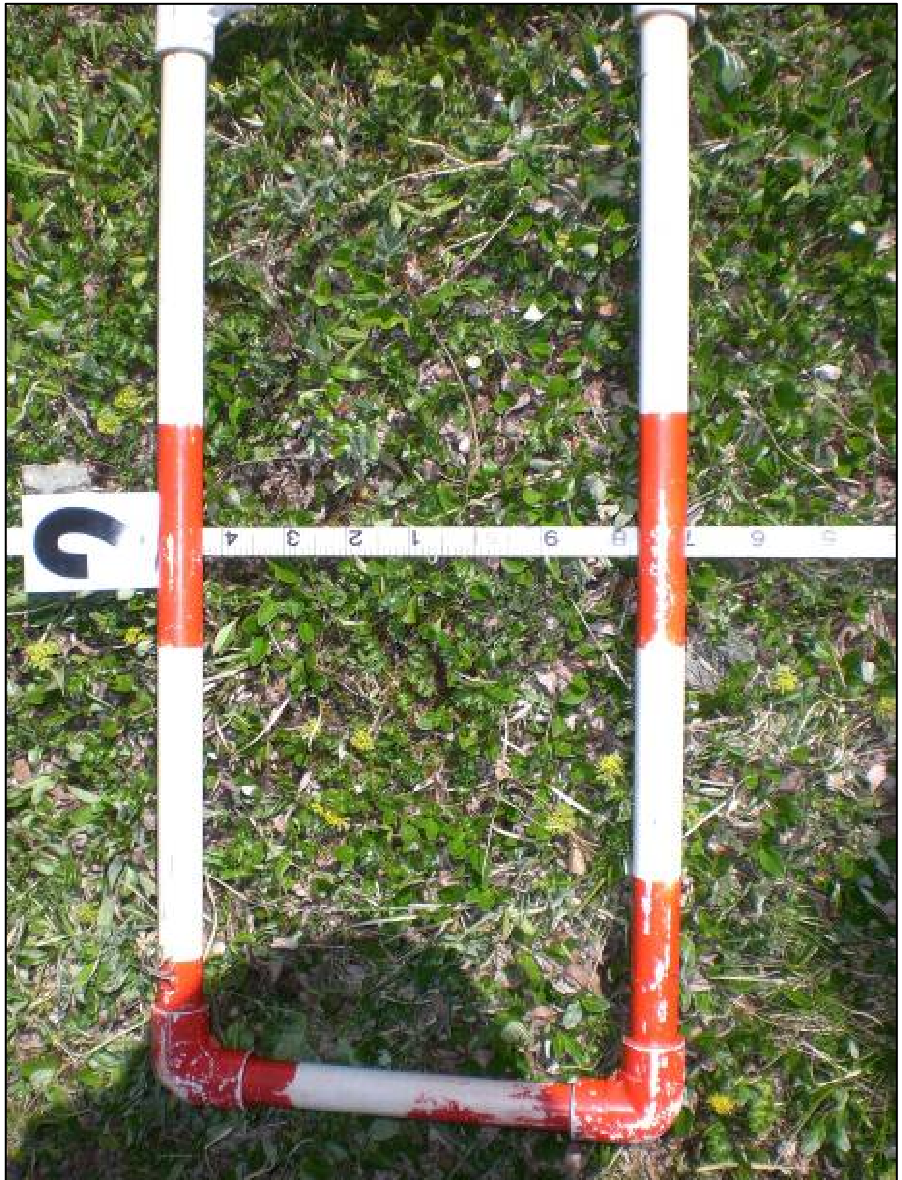
2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
	X	Liliaceae	*Zigadenus elegans* Pursh ssp. *elegans*	Anticlea elegans	mountain deathcamas	Herbaceous
X	X	Onagraceae	*Chamerion angustifolium* (L.) Holub ssp. *circumvagum* (Mosquin) Hoch	*Chamerion denielsii*	fireweed	Herbaceous
X	X	Onagraceae	*Epilobium hornemannii* Reichenb.	*Epilobium hornemannii*	Hornemann's willowherb	Herbaceous
	X	Orchidaceae	*Platanthera aquilonis* Sheviak	*Habenaria hyperborea*	northern green orchid	Herbaceous
X	X	Pinaceae	*Picea engelmannii* Parry ex Engelm.	*Picea engelmannii*	Engelmann spruce	Tree
X	X	Poaceae	*Bromus lanatipes* (Shear) Rydb.	*Bromopsis lanatipes*	woolly brome	Graminoid
X	X	Poaceae	*Calamagrostis canadensis* (Michx.) Beauv.	*Calamagrostis canadensis*	bluejoint	Graminoid
	X	Poaceae	*Danthonia intermedia* Vasey	*Danthonia intermedia*	timber oatgrass	Herbaceous
X	X	Poaceae	*Deschampsia caespitosa* (L.) Beauv.	*Deschampsia cespitosa*	tufted hairgrass	Graminoid
X	X	Poaceae	*Elymus trachycaulus* (Link) Gould ex Shinners	*Elymus trachycaulus*	slender wheatgrass	Graminoid
X	X	Poaceae	*Festuca brachyphylla* J.A. Schultes ex J.A. & J.H. Schultes	*Festuca brachyphylla*	alpine fescue	Herbaceous
X		Poaceae	*Festuca thurberi* Vasey	*Festuca thurberi*	Thurber's fescue	Herbaceous
X	X	Poaceae	*Phleum alpinum* L.	*Phleum commutatum*	alpine timothy	Graminoid
X	X	Poaceae	*Poa alpina* L.	*Poa alpina*	alpine bluegrass	Graminoid
	X	Poaceae	*Poa arctica* R. Br.	*Poa arctica*	arctic bluegrass	Graminoid
X	X	Poaceae	*Poa cusickii* Vasey	*Poa cusickii*	Cusick's bluegrass	Graminoid
	X	Poaceae	*Poa nemoralis* L. ssp. *interior* (Rydb.) W.A. Weber	*Poa nemoralis* ssp. *Interior*	inland bluegrass	Graminoid
	X	Poaceae	*Poa pratensis* L.	*Poa pratensis*	Kentucky bluegrass	Exotic Graminoid
	X	Poaceae	*Poa reflexa* Vasey & Scribn. ex Vasey	*Poa reflexa*	nodding bluegrass	Graminoid
X	X	Poaceae	*Trisetum spicatum* (L.) Richter	*Trisetum spicatum*	spike trisetum	Graminoid
X	X	Polemoniaceae	*Phlox condensata* (Gray) E. Nels.	*Phlox condensata*	dwarf phlox	Herbaceous
X		Polemoniaceae	*Polemonium confertum* Gray	*Polemonium confertum*	Rocky Mountain Jacob's-ladder	Herbaceous
X	X	Polemoniaceae	*Polemonium pulcherrimum* Hook.	*Polemonium pulcherrimum*	Jacob's-ladder	Herbaceous
	X	Polemoniaceae	*Polemonium viscosum* Nutt.	*Polemonium viscosum*	sticky polemonium	Herbaceous
X	X	Polygonaceae	*Polygonum bistortoides* Pursh	*Bistorta bistortoides*	American bistort	Herbaceous
X		Portulacaceae	*Claytonia megarhiza* (Gray) Parry ex S. Wats.	*Claytonia megarhiza*	alpine springbeauty	Herbaceous
X	X	Portulacaceae	*Lewisia pygmaea* (Gray) B.L. Robins.	*Oreobrama pygmaea*	alpine lewisia	Herbaceous
X	X	Primulaceae	*Androsace septentrionalis* L.	*Androsace septentrionalis*	pygmyflower rockjasmine	Herbaceous
X	X	Primulaceae	*Primula parryi* Gray	*Primula parryi*	Parry's primrose	Herbaceous

2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
X	X	Ranunculaceae	*Aconitum columbianum* Nutt.	*Aconitum columbianum*	Columbian monkshood	Herbaceous
X	X	Ranunculaceae	*Aquilegia caerulea* James	*Aquilegia coerulea*	Colorado blue columbine	Herbaceous
X	X	Ranunculaceae	*Caltha leptosepala* DC.	*Caltha leptosepala*	white marsh marigold	Herbaceous
X	X	Ranunculaceae	*Delphinium barbeyi* (Huth) Huth	*Delphinium barbeyi*	subalpine larkspur	Herbaceous
X		Ranunculaceae	*Ranunculus eschscholtzii* Schlecht.	*Ranunculus eschschultzii*	Eschscholtz's buttercup	Herbaceous
X	X	Ranunculaceae	*Ranunculus inamoenus* Greene	*Ranunculus inamoenus*	graceful buttercup	Herbaceous
X	X	Ranunculaceae	*Ranunculus macauleyi* Gray	*Ranunculus macauleyi*	Rocky Mountain buttercup	Herbaceous
	X	Ranunculaceae	*Thalictrum alpinum* L.	*Thalictrum alpinum*	alpine meadow-rue	Herbaceous
X	X	Ranunculaceae	*Thalictrum fendleri* Engelm. ex Gray	*Thalictrum fendleri*	Fendler's meadow-rue	Herbaceous
X	X	Ranunculaceae	*Trollius laxus* Salisb. ssp. *albiflorus* (Gray) A.& D. Löve & Kapoor	*Trollius albiflorus*	American globeflower	Herbaceous
X		Rosaceae	*Dasiphora floribunda* (Pursh) Kartesz, comb. nov. ined.	*Pentaphylloides floribunda*	shrubby cinquefoil	Shrub
X	X	Rosaceae	*Fragaria virginiana* Duchesne	*Fragaria virginiana*	Virginia strawberry	Herbaceous
X	X	Rosaceae	*Geum rossii (R. Br.) Ser. var. turbinatum (Rydb.) C.L. Hitchc.*	*Acomastylis rossii* ssp *turbinata*	Ross' avens	Herbaceous
X	X	Rosaceae	*Potentilla diversifolia* Lehm.	*Potentilla diversifolia*	varileaf cinquefoil	Herbaceous
	X	Rosaceae	*Potentilla ovina* Macoun ex J.M. Macoun	*Potentilla ovina*	sheep cinquefoil	Herbaceous
X	X	Rosaceae	*Potentilla pulcherrima* Lehm.	*Potentilla pulcherrima*	beautiful cinquefoil	Herbaceous
	X	Rosaceae	*Potentilla subjuga* Rydb.	*Potentilla subjuga*	Colorado cinquefoil	Herbaceous
	X	Rosaceae	*Potentilla uniflora* Ledeb.	*Potentilla uniflora*	oneflower cinquefoil	Herbaceous
X	X	Rosaceae	*Sibbaldia procumbens* L.	*Sibbaldia procumbens*	creeping sibbaldia	Herbaceous
X	X	Salicaceae	*Salix arctica* Pallas	*Salix arctica*	arctic willow	Shrub
	X	Salicaceae	*Salix brachycarpa* Nutt.	*Salix brachycarpa*	shortfruit willow	Shrub
X		Salicaceae	*Salix drummondiana* Barratt ex Hook.	*Salix drummondiana*	Drummond's willow	Shrub
X	X	Salicaceae	*Salix planifolia* Pursh	*Salix planifolia*	diamondleaf willow	Shrub
X	X	Salicaceae	*Salix nivalis* Hook.	*Salix reticulata* ssp. *nivalis*	netleaf willow	Shrub
X	X	Saxifragaceae	*Heuchera parvifolia* Nutt. ex Torr. & Gray	*Heuchera parvifolia*	littleleaf alumroot	Herbaceous
	X	Saxifragaceae	*Mitella pentandra* Hook.	*Mitella pentandra*	fivestamen miterwort	Herbaceous
	X	Saxifragaceae	*Saxifraga hyperborea* R. Br.	*Saxifraga hyperborea*	pygmy saxifrage	Herbaceous
X	X	Saxifragaceae	*Saxifraga odontoloma* Piper	*Micranthes odontoloma*	brook saxifrage	Herbaceous
X		Saxifragaceae	*Saxifraga oregana* T.J. Howell	*Micranthes oregana*	Oregon saxifrage	Herbaceous
X		Saxifragaceae	*Saxifraga platysepala* (Trautv.) Tolm.	*Hirculus platysepalus*	broadsepal saxifrage	Herbaceous
X	X	Saxifragaceae	*Saxifraga rhomboidea* Greene	*Micranthes rhomboidea*	diamondleaf saxifrage	Herbaceous

2004	2009	Family	Plants Database Name	Weber Name	Common Name	Life Form
	X	Scrophulariaceae	*Besseya alpina (A. Gray) Rydb.*	*Besseya alpina*	alpine besseya	Herbaceous
X	X	Scrophulariaceae	*Besseya ritteriana* (Eastw.) Rydb.	*Besseya ritteriana*	Ritter's coraldrops	Herbaceous
X	X	Scrophulariaceae	*Castilleja haydenii* (Gray) Cockerell	*Castillja haydenii*	Hayden's Indian paintbrush	Herbaceous
X		Scrophulariaceae	*Castilleja miniata* Dougl. ex Hook.	*Castilleja miniata*	giant red Indian paintbrush	Herbaceous
X	X	Scrophulariaceae	*Castilleja occidentalis* Torr.	*Castilleja occidentalis*	western Indian paintbrush	Herbaceous
X	X	Scrophulariaceae	*Castilleja rhexiifolia* Rydb.	*Castilleja rhexifolia*	splitleaf Indian paintbrush	Herbaceous
	X	Scrophulariaceae	*Chionophila jamesii* Benth.	*Chionophila jamesii*	Rocky Mountain snowlover	Herbaceous
X	X	Scrophulariaceae	*Pedicularis bracteosa* Benth.	*Pedicularis bracteosa*	bracted lousewort	Herbaceous
X	X	Scrophulariaceae	*Pedicularis groenlandica* Retz.	*Pedicularis groenlandica*	elephanthead lousewort	Herbaceous
	X	Scrophulariaceae	*Pedicularis racemosa* Douglas ex Benth.	*Pedicularis racemosa*	sickletop lousewort	Herbaceous
	X	Scrophulariaceae	*Pedicularis sudetica* Willd. ssp. *scopulorum* (A. Gray) Hultén	*Pedicularis scopulorum*	sudetic lousewort	Herbaceous
X	X	Scrophulariaceae	*Penstemon whippleanus* Gray	*Penstemon whippleanus*	Whipple's penstemon	Herbaceous
X	X	Scrophulariaceae	*Veronica wormskjoldii* Roemer & J.A. Schultes	*Veronica nutans*	American alpine speedwell	Herbaceous
X	X	Selaginellaceae	*Selaginella* spp.	*Selaginella* spp.	clubmoss	Clubmoss
X		Valerianaceae	*Valeriana capitata* Pallas ex Link	*Valeriana capitata*	captiate valerian	Herbaceous
X	X	Violaceae	*Viola labradorica* Schrank	*Viola labradorica*	alpine violet	Herbaceous

Transect 1, Upper Elevational Belt, July 14, 2009

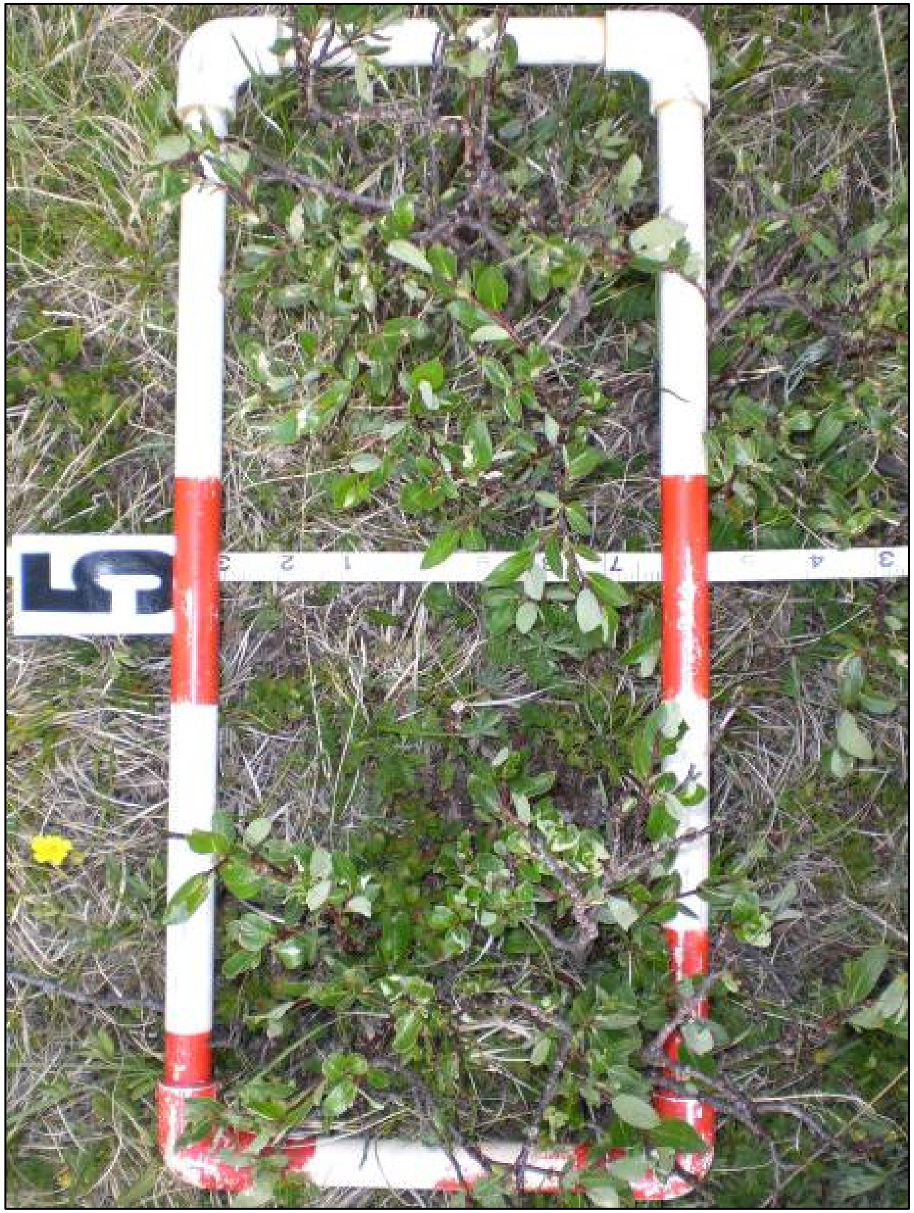
Transect 2, Upper Elevational Belt, July 14, 2009



Transect 3, Upper Elevational Belt, July 14, 2009

Transect 4, Upper Elevational Belt, July 14, 2009

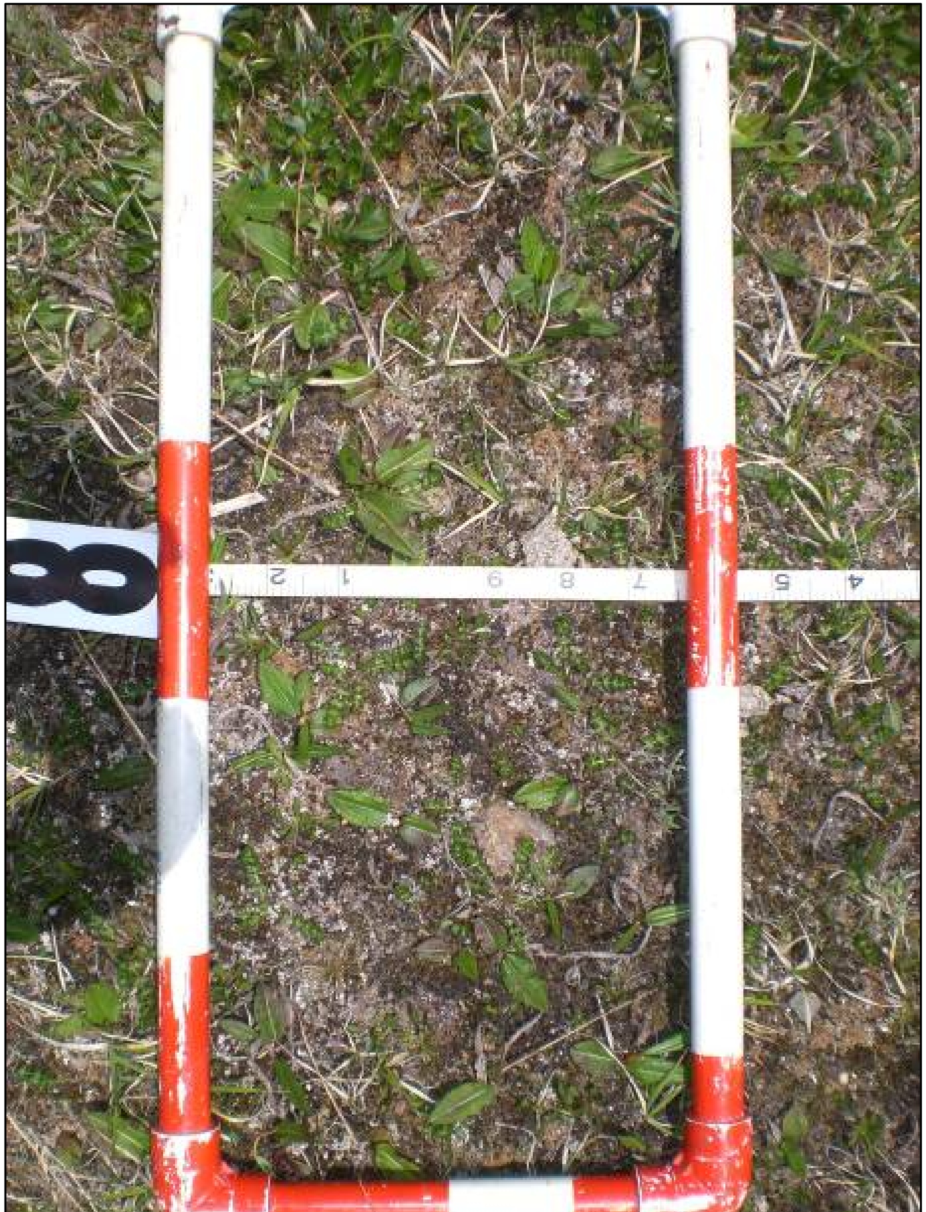
Transect 5, Upper Elevational Belt, July 14, 2009



Transect 6, Upper Elevational Belt, July 14, 2009

Transect 7, Upper Elevational Belt, July 15, 2009

Transect 8, Upper Elevational Belt, July 15, 2009



Transect 9, Upper Elevational Belt, July 15, 2009

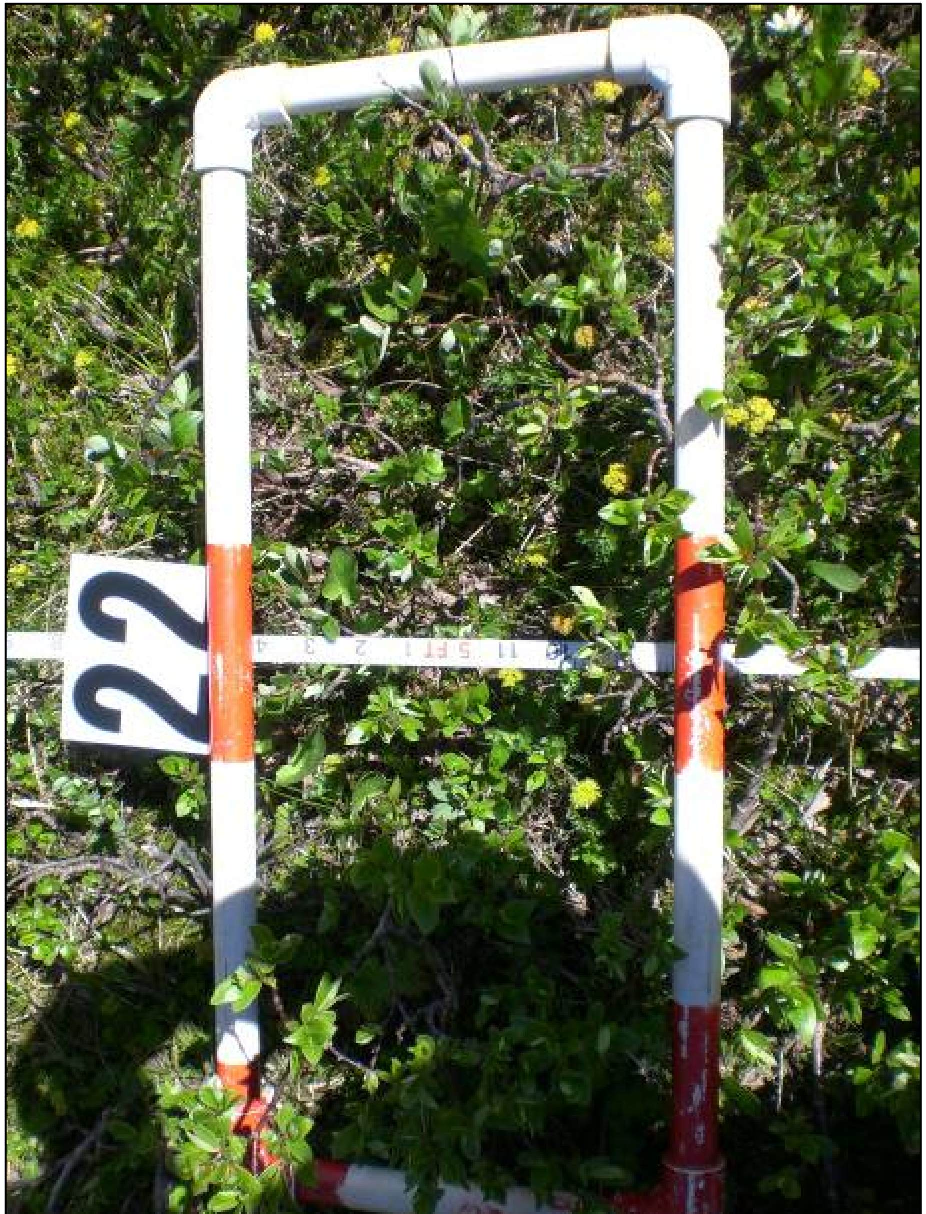
Transect 10, Upper Elevational Belt, July 15, 2009

Transect 11, Upper Elevational Belt, July 13, 2009

Transect 12, Upper Elevational Belt, July 10, 2009

Transect 21, Middle Elevational Belt, July 9, 2009

Transect 22, Middle Elevational Belt, July 9, 2009



Transect 23, Middle Elevational Belt, July 9, 2009

Transect 24, Middle Elevational Belt, July 9, 2009

Long View Missing

Transect 25, Middle Elevational Belt, July 10, 2009

Transect 26, Middle Elevational Belt, July 10, 2009

Transect 31, Lower Elevational Belt, July 8, 2009

No Transect Photos

Transect 32, Lower Elevational Belt, July 8, 2009

Transect 33, Lower Elevational Belt, July 8, 2009

Transect 34, Lower Elevational Belt, July 8, 2009

Transect 35, Lower Elevational Belt, July 8, 2009