93689

Mortandad Canyon: Plant Survey 2005

Randy G. Balice and Leonard F. Sandoval

LA-UR-06-0390

January 19, 2006

To support the Mortandad Canyon Biota Investigation Work Plan, plant diversity surveys were conducted in eight riparian reaches of Mortandad Canyon and in one riparian reach of Los Alamos Canyon. "Plant surveys to determine species composition and abundance will provide a measure of effect (abundance and diversity) for plants and a measure of receptor characteristics for other assessment endpoints" (Environmental Stewardship Division 2005:15). To accomplish this, eight reaches in Mortandad Canyon were selected to evaluate the effects of plant toxicity (see Environmental Stewardship Division 2005:D-50). Three of these reaches (E-1W, M-2W and M-3) were also selected to correlate plant diversity with small mammal trapping, and one reach (M-2W) is of interest because it contains high levels of perchlorate. Finally, a ninth reach in upper Los Alamos Canyon (LA-BKG) was included in this analysis to provide data from a background location.

Teams of two to three plant specialists conducted ocular surveys within the riparian areas of each of these reaches for the presence and canopy cover of all vascular plant species. Basic training for the field teams was provided through the wildfire hazard assessment program (Balice 2005). Plants were identified by their basic growth form; trees, shrubs forbs, cacti and graminoids. Then, each plant was identified to species, if possible. Next, the percent canopy cover for each observed species of tree, shrub, forb, cactus, and graminoid was categorized as approximately 1 percent, greater than 1 percent but less than 12.5 percent, 12.5 percent to 25 percent, 25 percent to 50 percent, 50 percent to 75 percent, and greater than 75 percent. Finally, representative photographs were obtained for each of the selected reaches. All surveys were conducted during the peak of the growing season (between July 20 and August 3, 2005). The original field data are included in Appendix A.

In the office, two measures of diversity were used to analyze the data. These included species richness and the Shannon diversity function. The analysis of species richness was modeled after Marsh (2003). Species richness was reported for trees, shrubs, forbs, cacti, and graminoids (Table 1). Unknown plant species were listed according to their growth form category. An overall total of unknown plant species for each reach was also provided in Table 1.

For comparison purposes, the average species richness was calculated for the data collected in 2005 (Table 1). The values reported for 2003 were also included here (see also Marsh 2003). In comparison with 2003, more species were encountered and fewer numbers of unknown species were encountered in 2005. These results can be partially attributed to the more conducive growing conditions that occurred recently as Los Alamos emerged from the 2002 drought.

The Shannon function measures the ecological diversity in a many-species population (Pielou 1977). For a collection or a community of plant species where p_j is the probability that a randomly selected individual will be a member of species j, the Shannon function for all the species in the community may be written as

14479

$$H' = -\sum_j p_j \log p_j$$

where log is the natural log to base e.

Within each of the selected reaches, Shannon diversity values were calculated for trees, shrubs, forbs, graminoids, and for all species combined (Table 2). Since unknown species could be identified as being either a tree, shrub, forb or graminoid, these incompletely identified plants were not considered independently here. Also, species of cacti were grouped according to their relative woodiness as either shrubs or forbs. The overall species diversity for each reach and the average values for each growth form and the overall results were also reported in Table 2.

The percent canopy cover for trees, shrubs, forbs, cacti and graminoids were calculated and reported in Table 3. Unknown species were grouped by their membership as trees, shrubs, forbs, cacti or graminoids. The total canopy cover for each reach and averages for each category were also calculated and reported in Table 3.

Literature Cited

Balice, R.G. 2005. Fire hazard assessment field methods; 2005. LANL-ENV-ECO-ERR-FM-001, R7, Ecology Group, Los Alamos National Laboratory, Los Alamos, New Mexico.

Environmental Stewardship Division. 2005. Mortandad Canyon Biota Investigation Work Plan. LA-UR-05-2231 (D. Katzman, Responsible Project Leader, Environmental Remediation and Surveillance Program, May 2005), Los Alamos National Laboratory, Los Alamos, New Mexico.

Marsh, L.K. 2003. Quantitative habitat analysis vegetation summary: Preliminary report for the Environmental Restoration Project, Los Alamos National Laboratory. LA-UR-03-2910, Los Alamos National Laboratory, Los Alamos, New Mexico.

Pielou, E.C. 1977. Mathematical Ecology, second edition. John Wiley & Sons, Inc., New York, New York.

Table 1. Summary of plant species richness in selected reaches of Mortandad and Los Alamos Canyons. Averages reported for 2003 are from Marsh (2003).

Site	Tree	Shrub	Forb	Forb Unknown	Graminoid	Graminoid Unknown	Cactus	Unknown Total	Overall Total
LA-BKG	9	21	20	1	4			1	55
E-1E	4	9	2		5	1		1	21
E-1FW	2	9	13	1	7			1	32
E-1W	4	6	6		1	1		1	18
M-2W	3	7	4		2			0	16
M-3	3	6	20	2	4			2	35
M-4	7	6	28		4			0	45
TS-1C	7	15	16	2	15	1		3	56
TS-2C	2	12	18	2	8		1	2	43
Avg	4.56	10.11	14.11	0.89	5.56	0.33	0.11	1.22	35.67
Avg 2003	3.92	3.33	9.58		3.58		0.42	3.75	24.58

Table 2. Shannon diversities for selected reaches of Mortandad and Los Alamos Canyons.

Site	Tree	Shrub	Forb	Graminoid	All Species
LA-BKG	1.66	2.31	2.35	1.05	3.19
E-1E	0.52	1.50	0.26	1.14	2.23
E-1FW	0.69	1.75	1.93	1.30	2.52
E-1W	0.52	1.19	1.01	0.01	2.15
M-2W	0.74	1.42	0.73	0.56	2.27
M-3	0.65	1.38	2.40	0.31	2.10
M-4	1.06	1.20	2.20	0.39	2.32
TS-1C	0.89	1.55	2.31	2.04	2.61
TS-2C	0.12	1.58	2.35	0.92	2.57
Avg	0.76	1.54	1.73	0.86	2.44

Table 3. Percent canopy cover for selected reaches of Mortandad and Los Alamos Canyons.

Site	Tree	Shrub	Forb	Graminoid	Cactus	Total
LA-BKG	83.25	68.5	39.25	44.25	0	235.25
E-1E	44.75	40	6.75	32.75	0	124.25
E-1FW	75.00	76.50	24.25	15.00	0	190.75
E-1W	44.75	69.75	94.75	38.00	0	247.25
M-2W	50.00	107.25	26.00	25.00	0	208.25
M-3	25.50	51.50	22.50	94.75	0	194.25
M-4	8.75	33.25	43.75	69.75	0	155.50
TS-1C	82.75	49.75	14.75	30.50	0	177.75
TS-2C	19.25	54.00	22.00	52.00	0.50	147.75
Avg	48.22	61.17	32.67	44.67	0.06	186.78

Appendix A

Original list of plant species and percent cover, by reach.

Table A-1. Original list of plant species and percent cover; E-1E.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pseudotsuga menziesii	37.5	*Jamesia americana*	18.75	*Smilacina stellata*	6.25	*Dactylis glomerata*	18.75
Abies concolor	6.25	*Quercus gambelii*	6.25	*Juncus balticus*	0.5	*Elymus canadensis*	6.25
Pinus flexilis	0.5	*Rubus idaeus*	6.25		**6.75**	*Eragrostis stolonifera*	6.25
Pinus ponderosa	0.5	*Parthenociscus quinqufolia*	6.25			*Agropyron trachycaulum*	0.5
	44.75	*Berberis fendleri*	0.5			*Carex geophila*	0.5
		Ribes cereum	0.5			*Unknown grass*	0.5
		Prunus virginiana	0.5				**32.75**
		Toxicodendron radicans	0.5				
		Salix exigua	0.5				
			40				

Table A-2. Original list of plant species and percent cover; E-1FW.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pseudotsuga menziesii	37.5	*Jamesia americana*	18.75	*Verbascum thapsus*	6.25	*Eragrostis stolonifera*	6.25
Pinus ponderosa	37.5	*Quercus gambelii*	18.75	*Cirsium vulgare*	6.25	*Carex geophila*	6.25
	75	*Berberis fendleri*	18.75	*Juncus balticus*	6.25	*Bromus anomalus*	0.5
		Yucca angustissima	6.25	*Thermopsis rhombifolia*	0.5	*Agropyron trachycaulum*	0.5
		Ribes cereum	6.25	*Artemisia ludoviciana*	0.5	*Koeleria cristata*	0.5
		Parthenociscus quinqufolia	6.25	*Chenpodium fremontii*	0.5	*Schizachyrium scoparium*	0.5
		Rosa woodsii	0.5	*Clematis pseudoalpina*	0.5	*Poa pratensis*	0.5
		Cercocarpus montanus	0.5	*Bahia dissecta*	0.5		**15**
		Arceuthobium douglasii	0.5	*Conyza canadensis*	0.5		
			76.5	*Cirsium undulatum*	0.5		
				Antennaria marginata	0.5		
				Conyza schiedeana	0.5		
				Pericome caudata	0.5		
				Antennaria parvifolia	0.5		
					24.25		

Table A-3. Original list of plant species and percent cover; E-1W.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pinus ponderosa	37.5	*Salix exigua*	37.5	*Typha latifolia*	62.5	*Eragrostis stolonifera*	37.5
Pseudotsuga menziesii	6.25	*Rosa woodsii*	18.75	*Toxicodendron radicans*	18.75	*Unknown grass*	0.5
Betula occidentalis	0.5	*Quercus gambelii*	6.25	*Cirsium vulgare*	6.25		**38**
Elaeagnus angustifolia	0.5	*Berberis fendleri*	6.25	*Parthenociscus quinqufolia*	6.25		
	44.75	*Rhus trilobata*	0.5	*Pterospora andromedia*	0.5		
		Arctostaphylos uva-ursi	0.5	*Juncus balticus*	0.5		
			69.75		**94.75**		

Table A-4. Original list of plant species and percent cover; LA-BKG.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Abies concolor	18.75	*Rubus idaeus*	6.25	*Equisetum hiemale*	6.25	*Bromus inermis*	18.75
Populus tremuloides	18.75	*Rubus parviflorus*	18.75	*Senecio wootonii*	6.25	*Carex occidentalis*	18.75
Betula occidentalis	18.75	*Pachystima myrsinites*	6.25	*Pteridium aquilinum*	6.25	*Bromus anomalus*	6.25
Picea engelmannii	18.75	*Ribes inerme*	6.25	*Geranium richardsonii*	6.25	*Poa pratensis*	0.5
Acer glabrum	6.25	*Sambucus microbotrys*	6.25	*Rudbeckia laciniata*	6.25		**44.25**
Pseudotsuga menziesii	0.5	*Lonicera involucrata*	6.25	*Viola canadensis*	0.5		
Pinus ponderosa	0.5	*Jamesia americana*	6.25	*Cystopteris fragilis*	0.5		
Ulmus parvifolia	0.5	*Quercus gambelii*	6.25	*Fragaria ovalis*	0.5		
Populus angustifolia	0.5	*Robinai neomexicana*	0.5	*Galium aparine*	0.5		
	83.25	*Juniperus communis*	0.5	*Fragaria americana*	0.5		
		Parthenociscus quinqufolia	0.5	*Osmorhiza obtusa*	0.5		
		Sorbus americana	0.5	*Achillea lanulosa*	0.5		
		Berberis repens	0.5	*Thalictrum fendleri*	0.5		
		Rosa woodsii	0.5	*Pericome caudata*	0.5		
		Cornus stolonifera	0.5	*Oenothera hookeri*	0.5		
		Brickellia californica	0.5	*Artemisia ludoviciana*	0.5		
		Prunus virginiana	0.5	*Cirsium vulgare*	0.5		
		Mahonia aquifolium	0.5	*Pseudocymopterus montanus*	0.5		
		Amaranthus albus	0.5	*Verbascum thapsus*	0.5		
		Salix bebbiana	0.5	*Monotropa latisquama*	0.5		
			68.5	*Urtica gracilis*	0.5		
					39.25		

Table A-5. Original list of plant species and percent cover; M-2W.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Abies concolor	37.5	*Quercus gambelii*	37.5	*Pteridium aquilinum*	18.75	*Oryzopsis micrantha*	18.75
Pseudotsuga menziesii	6.25	*Parthenociscus quinqufolia*	37.5	*Smilacina stellata*	6.25	*Agropyron trachycaulum*	6.25
Acer negundo	6.25	*Ribes cereum*	18.75	*Toxicodendron radicans*	0.5		**25**
	50	*Pachystima myrsinites*	6.25	*Verbascum thapsus*	0.5		
		Rubus idaeus	6.25		**26**		
		Jamesia americana	0.5				
		Prunus virginiana	0.5				
			107.25				

Table A-6. Original list of plant species and percent cover; M-3.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pinus ponderosa	18.75	*Rhus trilobata*	18.75	*Artemesia dracunculus*	6.25	*Bromus tectorum*	87.5
Acer negundo	6.25	*Ribes cereum*	18.75	*Sphaeralcea incana*	6.25	*Agropyron trachycaulum*	6.25
Ulmus parvifolia	0.5	*Quercus gambelii*	6.25	*Artemisia ludoviciana*	0.5	*Bouteloua curtipendula*	0.5
	25.5	*Parthenociscus quinqufolia*	6.25	*Viguiera multiflora*	0.5	*Sporobolus cryptandrus*	0.5
		Gutierreza sarothrae	0.5	*Bahia dissecta*	0.5		**94.75**
		Prunus virginiana	0.5	*Cryptantha jamesii*	0.5		
		Forestiera neomexicana	0.5	*Artemesia carruthii*	0.5		
			51.5	*Artemesia franserioides*	0.5		
				Lithosperma spp.	0.5		
				Sisymbrium altissimum	0.5		
				Verbascum thapsus	0.5		
				Tragopogon dubius	0.5		
				Helianthus annuus	0.5		
				Conyza canadensis	0.5		
				Clematis spp.	0.5		
				Monarda fistulosa	0.5		
				Rumex crispus	0.5		
				Oenothera hookeri	0.5		
				Ameranthus retroflexus	0.5		
				Oxybaphus linearis	0.5		
				Croton texensis	0.5		
				Lupinus argenteus	0.5		
					22.5		

Table A-7. Original list of plant species and percent cover; M-4.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pinus ponderosa	6.25	*Rhus trilobata*	18.75	*Menzelia pumila*	18.75	*Bromus tectorum*	62.5
Ulmus parvifolia	0.5	*Robinia neomexicana*	6.25	*Artemesia dracunculus*	6.25	*Bouteloua curtipendula*	6.25
Acer negundo	0.5	*Ribes cereum*	6.25	*Sisymbrium altissimum*	6.25	*Koeleria cristata*	0.5
Populus tremuloides	0.5	*Gutierreza sarothrae*	0.5	*Viguiera multiflora*	0.5	*Poa fendleriana*	0.5
Juniperus scopulorum	0.5	*Atriplex canescens*	0.5	*Clematus ligusticifolia*	0.5		**69.75**
Pinus edulis	0.5	*Amorpha fruticosa*	0.5	*Artemesia carruthii*	0.5		
	8.75	*Quercus gambelii*	0.5	*Helianthus annuus*	0.5		
			33.25	*Conyza canadensis*	0.5		
				Verbascum thapsus	0.5		
				Artemisia ludoviciana	0.5		
				Ipomopsis aggregata	0.5		
				Lupinus argenteus	0.5		
				Cryptantha jamesii	0.5		
				Geranium caespitosum	0.5		
				Penstamon jamesii	0.5		
				Melilotus albus	0.5		
				Oenothera hookeri	0.5		
				Bahia dissecta	0.5		
				Erigeron divergens	0.5		
				Artemesia franserioides	0.5		
				Chrysopsis villosa	0.5		
				Melilotus officinalis	0.5		
				Gaillardia pulchella	0.5		
				Monorda menthafolia	0.5		
				Thelosperma trifidum	0.5		
				Erigeron abertanum	0.5		
				Erodium cicutarium	0.5		
				Helianthus petiolaris	0.5		
					43.75		

Table A-8. Original list of plant species and percent cover; TS-1C.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Pinus ponderosa	62.5	*Cercocarpus montanus*	18.75	*Artemisia ludoviciana*	6.25	*Bromus tectorum*	6.25
Populus deltoides	6.25	*Quercus gambelii*	6.25	*Conyza canadensis*	0.5	*Bromus inermis*	6.25
Elaeagnus angustifolia	6.25	*Clematus psuedoalpina*	18.75	*Verbascum thapsus*	0.5	*Poa pratensis*	6.25
Pseudotsuga menziesii	6.25	*Parthenociscus quinqufolia*	0.5	*Artemesia dracunculus*	0.5	*Dactylis glomerata*	6.25
Juniperus monosperma	0.5	*Ribes cereum*	0.5	*Chenopodium leptophyllum*	0.5	*Elymus canadensis*	0.5
Malus pumila	0.5	*Berberis repens*	0.5	*Melilotus albus*	0.5	*Carex geophila*	0.5
Juniperus scopulorum	0.5	*Salix exigua*	0.5	*Antennaria parvifolia*	0.5	*Schizachyrium scoparium*	0.5
	82.75	*Tamarix ramosissima*	0.5	*Pterospora andromedia*	0.5	*Muhlenbergia montana*	0.5
		Fallugia paradoxa	0.5	*Geranium caespitosum*	0.5	*Sitanion hystrix*	0.5
		Robinia neomexicana	0.5	*Cirsium vulgare*	0.5	*Agropyron trachycaulum*	0.5
		Quercus undulata	0.5	*Smilacina stellata*	0.5	*Festuca arizonica*	0.5
		Berberis fendleri	0.5	*Artemesia carruthii*	0.5	*Eragrostis stolonifera*	0.5
		Lonicera involucrata	0.5	*Sphaeralcea incana*	0.5	*Poa fendleriana*	0.5
		Prunus virginiana	0.5	*Thelesperma megapotamicum*	0.5	*Koeleria cristata*	0.5
		Rhus trilobata	0.5	*Lupinus argenteus*	0.5	*Bromus anomalus*	0.5
			49.75	*Potenilla hippiana*	0.5		**30.5**
				Erigeron flagellaris	0.5		
				Juncus balticus	0.5		
					14.75		

Table A-9. Original list of plant species and percent cover; TS-2C.

Trees	% Cover	Shrubs	% Cover	Forbs	% Cover	Grams	% Cover
Juniperus monosperma	18.75	*Ribes cereum*	18.75	*Melilotus albus*	6.25	*Muhlenbergia montana*	37.5
Pinus ponderosa	0.5	*Cercocarpus montanus*	18.75	*Erigeron divergens*	6.25	*Bromus tectorum*	6.25
	19.25	*Quercus gambelii*	6.25	*Artemesia dracunculus*	0.5	*Poa pratensis*	6.25
		Fallugia paradoxa	6.25	*Plantago purshii*	0.5	*Agropyron trachycaulum*	0.5
		Rosa woodsii	0.5	*Verbascum thapsus*	0.5	*Elymus canadensis*	0.5
		Salix exigua	0.5	*Bahia dissecta*	0.5	*Schizachyrium scoparium*	0.5
		Parthenociscus quinqufolia	0.5	*Helianthus annuus*	0.5	*Eragrostis stolonifera*	0.5
		Robinia neomexicana	0.5	*Conyza canadensis*	0.5		**52**
		Berberis fendleri	0.5	*Artemisia ludoviciana*	0.5		
		Prunus virginiana	0.5	*Rumex crispus*	0.5		
		Chrysothamnus nauseosus	0.5	*Artemesia franserioides*	0.5		
		Quercus undulata	0.5	*Cirsium vulgare*	0.5		
			54	*Erodium cicutarium*	0.5		
				Lactuca serriola	0.5		
				Grindelia squarrosa	0.5		
				Opuntia erinacea	0.5		
				Juncus balticus	0.5		
				Ipomopsis aggregata	0.5		
				Oenethera hookeri	0.5		
				Geranium caespitosum	0.5		
				Tragopogon dubius	0.5		
					22		