Tables

Table 1. 1997 and 1998 xeric tallgrass prairie species richness summary

Family	Scientific Name	Speccode	Native	1998	1997
AGAVACEAE	Yucca glauca Nutt.	YUGL1	Y	X	X
ANACARDIACEAE	Rhus aromatica Ait. var. trilobata (Nutt.) A. Gray	RHAR1	Y	X	X
ANACARDIACEAE	Toxicodendron rydbergii (Small) Greene	TORY1	Y	X	
APIACEAE	Daucus carota L.	DACA2	N		X
APIACEAE	Harbouria trachypleura (Gray) C. & R.	HATR1	Y	X	X
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	Y	X	X
APIACEAE	Musineon divaricatum (Pursh.) Nutt. var. hookeri T. & G.	MUDI1	Y	X	X
APOCYNACEAE	Apocynum cannabinum L.	APCA1	Y	X	X
ASCLEPIADACEAE	Asclepias pumila (Gray) Vail	ASPU1	Y	X	X
ASCLEPIADACEAE	Asclepias speciosa Torr.	ASSP1	Y	X	X
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	ASST1	Y	X	X
ASCLEPIADACEAE	Asclepias viridiflora Raf.	ASVI1	Y	X	X
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	Y	X	X
ASTERACEAE	Antennaria microphylla Rydb.	ANMI1	Y	X	X
ASTERACEAE	Antennaria parvifolia Nutt.	ANPA1	Y	X	X
ASTERACEAE	Arnica fulgens Pursh.	ARFU1	Y	X	X
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	Y	X	X
ASTERACEAE	Artemisia dracunculus L.	ARDR1	Y	X	X
ASTERACEAE	Artemisia frigida Willd.	ARFR1	Y	X	X
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	Y	X	X
ASTERACEAE	Aster falcatus Lindl.	ASFA1	Y	X	X
ASTERACEAE	Aster fendleri A. Gray	ASFE1	Y		X
ASTERACEAE	Aster porteri Gray	ASPO1	Y	X	X
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	N	X	X
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	N	X	X
ASTERACEAE	Chrysopsis fulcrata Greene	CHFU1	Y	X	X
ASTERACEAE	Chrysopsis villosa Pursh.	CHVI1	Y	X	X
ASTERACEAE	Chrysothamnus nauseosus (Pall.) Britt. ssp. graveolens (Nutt.) Piper	CHNA1	Y	X	X
ASTERACEAE	Chrysothamnus nauseosus (Pall.) Britt. ssp. nauseosus	CHNA2	Y	X	
ASTERACEAE	Cichorium intybus L.	CIIN1	N	X	X
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	N	X	X
ASTERACEAE	Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y	X	X
ASTERACEAE	Cirsium vulgare (Savi) Ten.	CIVU1	N	X	
ASTERACEAE	Conyza canadensis (L.) Cronq.	COCA1	Y	X	X
ASTERACEAE	Dyssodia papposa (Vent) Hitchc.	DYPA1	N	X	X
ASTERACEAE	Erigeron canus A. Gray	ERCA1	Y	X	X
ASTERACEAE	Erigeron compositus Pursh var. dicoideus A. Gray	ERCO1	Y	X	X
ASTERACEAE	Erigeron divergens T. & G.	ERDI1	Y	X	X
ASTERACEAE	Erigeron flagellaris A. Gray	ERFL1	Y	X	X
ASTERACEAE	Erigeron vetensis Rydb.	ERVE1	Y	X	X
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	Y	X	X
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y	X	X
ASTERACEAE	Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y	X	X
ASTERACEAE	Happlopappus spinulosus (Pursh) DC.	HASP1	Y		X
ASTERACEAE	Helianthus annuus L.	HEAN1	Y	X	X
ASTERACEAE	Helianthus petiolaris Nutt.	HEPE1	Y	X	X
ASTERACEAE	Helianthus pumilus Nutt.	HEPU1	Y	X	X
ASTERACEAE	Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	Y	X	X
ASTERACEAE	Hymenopappus filifolius Hook. var. cinereus (Rydb.) I. M. Johnst.	HYFI1	Y	X	X
ASTERACEAE	Kuhnia chlorolepis Woot. & Standl.	KUCH1	Y	X	
ASTERACEAE	Kuhnia eupatorioides L.	KUEU1	Y	X	X
ASTERACEAE	Lactuca oblongifolia Nutt.	LAOB1	Y	X	
ASTERACEAE	Lactuca serriola L.	LASE1	N	X	X
ASTERACEAE	Leucelene ericoides (Torr.) Greene	LEER1	Y	X	X
ASTERACEAE	Liatris punctata Hook.	LIPU1	Y	X	X
ASTERACEAE	Machaeranthera canescens (Pursh) A. Gray	MACA1	Y	X	X
ASTERACEAE	Microseris cuspidata (Pursh.) Sch. Bip.	MICU1	Y	X	X
ASTERACEAE	Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y	X	X

Table 1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
ASTERACEAE	Scorzonera laciniata L.	SCLA1	N	X	X
ASTERACEAE	Senecio fendleri Gray	SEFE1	Y	X	X
ASTERACEAE	Senecio integerrimus Nutt.	SEIN1	Y	X	X
ASTERACEAE	Senecio plattensis Nutt.	SEPL1	Y	X	X
ASTERACEAE	Senecio spartioides T. & G.	SESP1	Y	X	X
ASTERACEAE	Senecio tridenticulatus Rydb.	SETR1	Y	X	
ASTERACEAE	Solidago missouriensis Nutt.	SOMI1	Y	X	X
ASTERACEAE	Solidago mollis Bart.	SOMO1	Y	X	X
ASTERACEAE	Solidago rigida L.	SORI1	Y	X	X
ASTERACEAE	Sonchus asper (L.) Hill	SOAS1	N	X	
ASTERACEAE	Taraxacum officinale Weber	TAOF1	N	X	X
ASTERACEAE	Thelesperma megapotanicum (Spreng.) O. Ktze.	THME1	Y	X	X
ASTERACEAE	Townsendia grandiflora (Nutt.)	TOGR1	Y	X	
ASTERACEAE	Townsendia hookeri Beaman	TOHO1	Y	X	X
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N	X	X
BERBERIDACEAE	Berberis repens Lindl.	BERE1	Y	X	
BORAGINACEAE	Cryptantha virgata (Porter) Payson	CRVI1	Y	X	X
BORAGINACEAE	Cynoglossum officinale L.	CYOF1	N	X	
BORAGINACEAE	Lappula redowskii (Hornem.) Greene	LARE1	Y	X	X
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	Y	X	X
BORAGINACEAE	Mertensia lanceolata (Pursh.) A. DC.	MELA1	Y	X	X
BORAGINACEAE	Onosmodium molle Michx. var. occidentale (Mack.) Johnst.	ONMO1	Y	X	X
BORAGINACEAE	Plagiobothrys scouleri (H. & A.) I. M. Johnst.	PLSC1	Y	X	
BRASSICACEAE	Alyssum alyssoides (L.) L.	ALAL1	N	X	X
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	N	X	X
BRASSICACEAE	Arabis fendleri (S. Wats.) Greene var. fendleri	ARFE3	Y	X	X
BRASSICACEAE	Arabis glabra (L.) Bernh.	ARGL1	N	X	
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y	X	X
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	N	X	X
BRASSICACEAE	Camelina microcarpa Andrz. ex DC.	CAMI1	N	X	X
BRASSICACEAE	Descurainia pinnata (Walt.) Britt.	DEPI1	Y	X	X
BRASSICACEAE	Descurainia richardsonii (Sweet) Schultz	DERI1	Y		X
BRASSICACEAE	Descurainia sophia (L.) Webb ex Prantl.	DESO1	N	X	
BRASSICACEAE	Draba nemorosa L.	DRNE1	Y	X	X
BRASSICACEAE	Draba reptans (Lam.) Fern.	DRRE1	Y	X	X
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	ERCA2	Y	X	X
BRASSICACEAE	Lepidium campestre (L.) R. Br.	LECA1	N	X	X
BRASSICACEAE	Lepidium densiflorum Schrad.	LEDE1	Y	X	X
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	Y	X	X
BRASSICACEAE	Sisymbrium altissimum L.	SIAL1	N	X	X
CACTACEAE	Coryphantha missouriensis (Sweet) Britt. & Rose	COMI1	Y	X	X
CACTACEAE	Echinocereus viridiflorus Engelm.	ECVI1	Y	X	X
CACTACEAE	Opuntia fragilis (Nutt.) Haw.	OPFR1	Y	X	X
CACTACEAE	Opuntia macrorhiza Engelm.	OPMA1	Y	X	X
CACTACEAE	Pediocactus simpsonii (Engelm.) Britt. & Rose	PESI1	Y	X	X
CAMPANULACEAE	Campanula rotundifolia L.	CARO1	Y	X	X
CAPRIFOLIACEAE	Symphoricarpos occidentalis Hook.	SYOC1	Y	X	X
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y	X	X
CARYOPHYLLACEAE	Cerastium arvense L.	CEAR1	Y	X	X
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	Y	X	X
CARYOPHYLLACEAE	Silene antirrhina L.	SIAN1	Y	X	X
CARYOPHYLLACEAE	Silene drummondii Hook.	SIDR1	Y	X	X
CARYOPHYLLACEAE	Spergularia rubra (L.) K. Presl.	SPRU1	N	X	X
CARYOPHYLLACEAE	Vaccaria pyramidata Medic.	VAPY1	N	X	
CHENOPODIACEAE	Chenopodium album L.	CHAL1	N	X	
CHENOPODIACEAE	Chenopodium atrovirens Nutt.	CHAT1	Y	X	
CHENOPODIACEAE	Chenopodium leptophyllum Nutt. ex Moq.	CHLE2	Y	X	X
CHENOPODIACEAE	Salsola iberica Senn. & Pau.	SAIB1	N		X
CLUSIACEAE	Hypericum perforatum L.	HYPE1	N	X	X

Table 1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
COMMELINACEAE	Tradescantia occidentalis (Britt.) Smyth	TROC1	Y	X	X
CONVOLVULACEAE	Convolvulus arvensis L.	COAR1	N	X	X
CONVOLVULACEAE	Evolvulus nuttallianus R. & S.	EVNU1	Y	X	X
CRASSULACEAE	Sedum lanceolatum Torr.	SELA1	Y	X	X
CUPRESSACEAE	Juniperus communis L.	JUCO1	Y	X	X
CUPRESSACEAE	Juniperus scopulorum Sarg.	JUSC1	T	X	X
CYPERACEAE	Carex brevior (Dew.) Mack. ex Lunell.	CABR1	Y	X	
CYPERACEAE	Carex eleocharis Bailey	CAEL1	Y	X	X
CYPERACEAE	Carex filifolia Nutt.	CAFI1	Y		X
CYPERACEAE	Carex heliophila Mack.	CAHE1	Y	X	X
CYPERACEAE	Carex interior Bailey	CAIN1	Y		X
CYPERACEAE	Carex oreocharis Holm.	CAOR1	Y	X	X
CYPERACEAE	Carex praegracilis W. Boott.	CAPR1	Y		X
CYPERACEAE	Eleocharis compressa Sulliv.	ELCO1	Y	X	X
CYPERACEAE	Eleocharis macrostachya Britt.	ELMA1	Y	X	X
EUPHORBIACEAE	Euphorbia fendleri T. & G.	EUFE1	Y	X	X
EUPHORBIACEAE	Euphorbia robusta (Engelm.) Small	EURO1	Y	X	X
EUPHORBIACEAE	Euphorbia serpyllifolia Pers.	EUSE1	Y	X	
EUPHORBIACEAE	Euphorbia spathulata Lam.	EUSP1	Y	X	X
EUPHORBIACEAE	Tragia ramosa Nutt.	TRRA1	Y	X	X
FABACEAE	Amorpha fruticosa L.	AMFR1	Y	X	X
FABACEAE	Astragalus adsurgens Pall. var. robustior Hook.	ASAD1	Y	X	X
FABACEAE	Astragalus agrestis Dougl. ex G. Don	ASAG1	Y	X	X
FABACEAE	Astragalus crassicarpus Nutt.	ASCR1	Y	X	
FABACEAE	Astragalus drummondii Dougl. ex Hook.	ASDR1	Y	X	X
FABACEAE	Astragalus flexuosus (Hook.) G. Don	ASFL1	Y	X	X
FABACEAE	Astragalus shortianus Nutt. ex T.&G.	ASSH1	Y	X	X
FABACEAE	Astragalus spathulatus Sheld.	ASSP2	Y	X	
FABACEAE	Astragalus tridactylicus Gray	ASTR1	Y	X	X
FABACEAE	Dalea candida Michx. ex Willd. var. oligophylla (Torr.) Shinners.	DACA1	Y	X	X
FABACEAE	Dalea purpurea Vent	DAPU1	Y	X	X
FABACEAE	Glycyrrhiza lepidota Pursh.	GLLE1	Y	X	X
FABACEAE	Lupinus argenteus Pursh var. argenteus	LUAR1	Y	X	X
FABACEAE	Medicago sativa L. ssp. sativa	MESA1	N	X	X
FABACEAE	Melilotus alba Medic.	MEAL1	N	X	
FABACEAE	Melilotus officinalis (L.) Pall.	MEOF1	N	X	X
FABACEAE	Oxytropis lambertii Pursh.	OXLA1	Y	X	X
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	Y	X	X
FABACEAE	Robinia pseudo-acacia L.	ROPS1	N	X	X
FABACEAE	Thermopsis rhombifolia var. divaricarpa (Nels.) Isely	THRH1	Y	X	X
FABACEAE	Trifolium pratense L.	TRPR1	N	X	
FABACEAE	Vicia americana Muhl. ex Willd.	VIAM1	Y	X	
GENTIANACEAE	Gentiana affinis Griseb.	GEAF1	Y	X	X
GENTIANACEAE	Swertia radiata (Kell.) O. Ktze.	SWRA1	Y	X	X
GERANIACEAE	Erodium cicutarium (L.) L'Her.	ERCI1	N	X	X
GERANIACEAE	Geranium caespitosum James ssp. caespitosum	GECA1	Y	X	X
GROSSULARIACEAE	Ribes aureum Pursh	RIAU1	Y	X	X
GROSSULARIACEAE	Ribes cereum Dougl.	RICE1	Y		X
HYDROPHYLLACEAE	Hydrophyllum fendleri (Gray) Heller	HYFE1	Y	X	
HYDROPHYLLACEAE	Phacelia heterophylla Pursh.	PHHE1	Y	X	X
IRIDACEAE	Iris missouriensis Nutt.	IRMI1	Y	X	X
IRIDACEAE	Sisyrinchium montanum Greene	SIMO1	Y	X	X
JUNCACEAE	Juncus balticus Willd.	JUBA1	Y	X	X
JUNCACEAE	Juncus dudleyi Wieg.	JUDU1	Y		X
JUNCACEAE	Juncus interior Wieg.	JUIN1	Y	X	X
JUNCACEAE	Juncus longistylis Torr.	JULO1	Y		X
LAMIACEAE	Hedeoma hispidum Pursh.	HEHI1	Y		X
LAMIACEAE	Marrubium vulgare L.	MAVU1	N	X	X
LAMIACEAE	Monarda fistulosa L. var. menthifolia (Grah.) Fern.	MOFI1	Y	X	X

Table 1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
LAMIACEAE	Nepeta cataria L.	NECA1	N	X	
LAMIACEAE	Prunella vulgaris L.	PRVU1	Y	X	
LAMIACEAE	Scutellaria brittonii Porter	SCBR1	Y	X	X
LILIACEAE	Allium cernuum Roth	ALCE1	Y	X	X
LILIACEAE	Allium geyeri S. Wats.	ALGE1	Y	X	X
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	Y	X	X
LILIACEAE	Calochortus gunnisonii S. Wats.	CAGU1	Y	X	X
LILIACEAE	Leucocrinum montanum Nutt.	LEMO2	Y	X	X
LILIACEAE	Zigadenus venenosus Wats. var. gramineus (Rydb.) Walsh ex Peck	ZIVE1	Y		X
LINACEAE	Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y	X	X
MALVACEAE	Malva neglecta Wallr.	MANE1	N		X
MALVACEAE	Sphaeralcea coccinea (Pursh.) Rydb.	SPCO1	Y	X	X
NYCTAGINACEAE	Mirabilis hirsuta (Pursh.) MacM.	MIHI1	Y	X	X
NYCTAGINACEAE	Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	X	X
ONAGRACEAE	Calylophus serrulatus (Nutt.) Raven	CASE2	Y	X	X
ONAGRACEAE	Epilobium paniculatum Nutt.	EPPA1	Y	X	
ONAGRACEAE	Gaura coccinea Pursh.	GACO1	Y	X	X
ONAGRACEAE	Oenothera howardii (A. Nels.) W. L. Wagner	OEHO1	Y	X	X
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	Y	X	X
OROBANCHACEAE	Orobanche fasciculata Nutt.	ORFA1	Y	X	X
OXALIDACEAE	Oxalis dillenii Jacq.	OXDI1	N	X	X
PAPAVERACEAE	Argemone polyanthemos (Fedde) G. Ownbey	ARPO1	Y	X	X
PINACEAE	Pinus ponderosa Laws	PIPO1	Y	X	X
PINACEAE	Pseudotsuga menziesii (Mirb.) Franco	PSME1	Y	X	X
PLANTAGINACE	Plantago lanceolata L.	PLLA1	N	X	X
PLANTAGINACE	Plantago patagonica Jacq.	PLPA1	Y	X	X
POACEAE	Aegilops cylindrica Host	AECY1	N	X	
POACEAE	Agropyron caninum (L.) Beauv. ssp. majus (Vasey) C. L. Hitchc.	AGCA1	Y	X	X
POACEAE	Agropyron cristatum (L.) Gaertn.	AGCR1	N	X	X
POACEAE	Agropyron desertorum (Fisch.) Schult.	AGDE1	N	X	X
POACEAE	Agropyron elongatum (Host) Beauv.	AGEL1	N	X	
POACEAE	Agropyron griffithsii Scribn. & Smith	AGGR1	Y	X	X
POACEAE	Agropyron intermedium (Host) Beauv.	AGIN1	N	X	X
POACEAE	Agropyron smithii Rydb.	AGSM1	Y	X	X
POACEAE	Agrostis scabra Willd.	AGSC1	Y		X
POACEAE	Alopecurus geniculatus L.	ALGE2	Y		X
POACEAE	Andropogon gerardii Vitman	ANGE1	Y	X	X
POACEAE	Andropogon scoparius Michx.	ANSC1	Y	X	X
POACEAE	Aristida basiramea Engelm. ex Vasey var. basiramea	ARBA1	Y	X	X
POACEAE	Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y	X	X
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	Y	X	X
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	X	X
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	X	X
POACEAE	Bouteloua hirsuta Lag	BOHI1	Y	X	X
POACEAE	Bromus inermis Leyss. ssp. inermis	BRIN1	N	X	X
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X
POACEAE	Bromus tectorum L.	BRTE1	N	X	X
POACEAE	Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y	X	X
POACEAE	Dactylis glomerata L.	DAGL1	N	X	X
POACEAE	Danthonia spicata (L.) Beauv. ex R. & S.	DASP1	Y	X	X
POACEAE	Dichanthelium oligosanthes (Schultz) Gould var. scribnerianum (Nash) G	DIOL1	Y	X	X
POACEAE	Echinochloa crusgallii (L.) Beauv.	ECCR1	N	X	
POACEAE	Elymus canadensis L.	ELCA1	Y		X
POACEAE	Elymus juncea Fisch.	ELJU1	N		X
POACEAE	Festuca ovina L. var. rydbergii St. Yves	FEOV1	Y	X	X
POACEAE	Hordeum jubatum L.	HOJU1	Y	X	
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	X	X
POACEAE	Lolium perenne L.	LOPE1	N		X
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	X	X

Table 1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
POACEAE	Muhlenbergia wrightii Vasey	MUWR1	Y	X	
POACEAE	Oryzopsis hymenoides (R. & S.) Ricker	ORHY1	Y	X	X
POACEAE	Panicum capillare L.	PACA1	Y	X	
POACEAE	Panicum virgatum L.	PAVI1	Y	X	X
POACEAE	Phleum pratense L.	PHPR1	N	X	X
POACEAE	Poa bulbosa L.	POBU1	N	X	
POACEAE	Poa canbyi (Scribn.) Piper	POCA1	Y	X	X
POACEAE	Poa compressa L.	POCO1	N	X	X
POACEAE	Poa fendleriana (Steud.) Vasey	POFE1	Y	X	X
POACEAE	Poa pratensis L.	POPR1	N	X	X
POACEAE	Schedonnardus paniculatus (Nutt.) Trel.	SCPA2	N	X	
POACEAE	Secale cereale L.	SECE1	N	X	X
POACEAE	Setaria viridis (L.) Beauv.	SEVI1	N	X	X
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	X	X
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y	X	X
POACEAE	Sporobolus asper (Michx.) Kunth	SPAS1	Y	X	X
POACEAE	Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	Y	X	X
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y	X	X
POACEAE	Stipa comata Trin. & Rupr.	STCO1	Y	X	X
POACEAE	Stipa neomexicana (Thur.) Scribn.	STNE1	Y	X	
POACEAE	Stipa spartea Trinius	STSP1	Y	X	X
POACEAE	Stipa viridula Trin.	STVI1	Y	X	X
POACEAE	Triticum aestivum L.	TRAE1	N	X	
POLEMONIACEAE	Gilia opthalmoides Brand. ssp. clokeyi (Mason) A. & V. Grant	GIOP1	Y	X	
POLEMONIACEAE	Ipomopsis spicata (Nutt.) V. Grant ssp. spicata	IPSP1	Y	X	X
POLEMONIACEAE	Navarretia minima Nutt.	NAMI1	N	X	X
POLYGONACEAE	Eriogonum alatum Torr.	ERAL1	Y	X	X
POLYGONACEAE	Eriogonum effusum Nutt.	EREF1	Y	X	X
POLYGONACEAE	Eriogonum umbellatum Torr.	ERUM1	Y	X	X
POLYGONACEAE	Polygonum arenastrum Jord. ex Bor.	POAR1	N	X	
POLYGONACEAE	Polygonum convolvulus L.	POCO2	N	X	X
POLYGONACEAE	Polygonum douglasii Greene	PODO1	Y	X	
POLYGONACEAE	Polygonum ramosissimum Michx.	PORA1	Y		X
POLYGONACEAE	Polygonum sawatchense Small	POSA1	Y	X	
POLYGONACEAE	Rumex acetosella L.	RUAC1	N	X	X
POLYGONACEAE	Rumex crispus L.	RUCR1	N	X	X
POLYGONACEAE	Rumex salicifolius Weinm. ssp. triangulivalvis Danser	RUSA1	Y	X	X
PORTULACACEAE	Claytonia rosea Rydb.	CLRO1	Y	X	
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y	X	X
PRIMULACEAE	Androsace occidentalis Pursh.	ANOC1	Y	X	X
RANUNCULACEAE	Anemone patens L.	ANPA2	Y	X	X
RANUNCULACEAE	Clematis ligusticifolia Nutt.	CLLI1	Y		X
RANUNCULACEAE	Delphinium nuttalianum Pritz. ex Walpers	DENU1	Y	X	X
RANUNCULACEAE	Delphinium virescens Nutt. ssp. penardii (Huth) Ewan	DEVI1	Y	X	X
RANUNCULACEAE	Myosurus minimus L.	MYMI1	Y	X	X
ROSACEAE	Amelanchier alnifolia Nutt.	AMAL1	Y	X	X
ROSACEAE	Crataegus erythropoda Ashe	CRER1	Y	X	X
ROSACEAE	Geum macrophyllum Willd.	GEMA1	Y		X
ROSACEAE	Potentilla fissa Nutt.	POFI1	Y	X	X
ROSACEAE	Potentilla gracilis Dougl. ex Hook. var. glabrata (Lehm.) C. L. Hitchc.	POGR1	Y	X	X
ROSACEAE	Potentilla hippiana Lehm.	POHI1	Y	X	X
ROSACEAE	Potentilla pensylvanica L.	POPE4	Y	X	X
ROSACEAE	Prunus pumila L. var. besseyi (Bailey) Gl.	PRPU1	Y	X	X
ROSACEAE	Prunus virginiana L. var. melanocarpa (A. Nels.) Sarg.	PRVI1	Y	X	X
ROSACEAE	Rosa acicularis Lindl.	ROAC1	Y	X	
ROSACEAE	Rosa arkansana Porter	ROAR1	Y	X	X
ROSACEAE	Rosa woodsii Lindl.	ROWO1	Y	X	
RUBIACEAE	Galium aparine L.	GAAP1	Y	X	X
RUBIACEAE	Galium septentrionale Roemer & Schultes	GASE1	Y	X	

Table 1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
SALICACEAE	Populus deltoides Marsh. ssp. monilifera (Ait.) Eckenw.	PODE1	Y	X	X
SANTALACEAE	Comandra umbellata (L.) Nutt.	COUM1	Y	X	X
SAXIFRAGACEAE	Heuchera parvifolia Nutt. ex T.& G.	HEPA1	Y	X	X
SAXIFRAGACEAE	Saxifraga rhomoidea Greene	SARH1	Y	X	X
SCROPHULARIACEAE	Castilleja integra A. Gray	CAIN2	Y	X	X
SCROPHULARIACEAE	Castilleja sessiliflora Pursh.	CASE3	Y	X	X
SCROPHULARIACEAE	Collinsia parviflora Doug. ex Lindl.	COPA1	Y	X	X
SCROPHULARIACEAE	Linaria dalmatica (L.) Mill.	LIDA1	N	X	X
SCROPHULARIACEAE	Linaria vulgaris Hill	LIVU1	N		X
SCROPHULARIACEAE	Penstemon secundiflorus Benth.	PESE1	Y	X	X
SCROPHULARIACEAE	Penstemon strictus Bentham in De Candolle	PEST1	Y		X
SCROPHULARIACEAE	Penstemon virens Penn.	PEVI1	Y	X	X
SCROPHULARIACEAE	Penstemon virgatus Gray ssp. asa-grayi Crosswhite	PEVI2	Y		X
SCROPHULARIACEAE	Scrophularia lanceolata Pursh.	SCLA2	Y	X	
SCROPHULARIACEAE	Verbascum blattaria L.	VEBL1	N	X	X
SCROPHULARIACEAE	Verbascum thapsus L.	VETH1	N	X	X
SCROPHULARIACEAE	Veronica peregrina L. var. xalapensis (H. B. K.) St. John & Warren	VEPE1	Y	X	X
SELAGINELLACEAE	Selaginella densa Rydb.	SEDE1	Y	X	X
SOLANACEAE	Physalis heterophylla Nees	PHHE2	Y	X	X
SOLANACEAE	Physalis virginiana P. Mill.	PHVI2	Y	X	X
SOLANACEAE	Solanum rostratum Dun.	SORO1	Y	X	
SOLANACEAE	Solanum triflorum Nutt.	SOTR1	Y		X
ULMACEAE	Ulmus pumila L.	ULPU1	N	X	X
VERBENACEAE	Lippia cuneifolia (Torr.) Steud.	LICU1	Y	X	X
VERBENACEAE	Verbena bracteata Lag. & Rodr.	VEBR1	Y	X	X
VIOLACEAE	Viola nuttallii Pursh.	VINU1	Y	X	X
	Total number of species			295	274
	Percent native species			79	81

Table 2. 1998 xeric mixed grassland foliar cover summary

				TR01			TR06			TR12		
Family	Scientific Name	Speccode	Native	Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	Y							20	0.20	0.24
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	Y	20	0.20	0.25	20	1.00	1.17	40	0.40	0.48
ASTERACEAE	Antennaria parvifolia Nutt.	ANPA1	Y	20	0.20	0.25						
ASTERACEAE	Artemisia frigida Willd.	ARFR1	Y	20	0.20	0.25	20	0.20	0.23			
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	Y							40	0.80	0.97
ASTERACEAE	Aster porteri Gray	ASPO1	Y	100	11.80	14.53				80	1.20	1.45
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	N				20	0.20	0.23			
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	N	20	0.20	0.25						
ASTERACEAE	Chrysopsis villosa Pursh.	CHVI1	Y	40	0.40	0.49						
ASTERACEAE	Helianthus pumilus Nutt.	HEPU1	Y				20	0.20	0.23			
ASTERACEAE	Lactuca serriola L.	LASE1	N							20	0.20	0.24
ASTERACEAE	Liatris punctata Hook.	LIPU1	Y	80	2.40	2.96				80	2.20	2.66
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N				20	0.20	0.23			
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	Y							20	0.20	0.24
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	N	20	0.20	0.25	40	1.40	1.64	60	0.80	0.97
BRASSICACEAE	Descurainia pinnata (Walt.) Britt.	DEPI1	Y							20	0.20	0.24
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	Y	20	0.20	0.25						
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y	100	4.00	4.93				80	1.00	1.21
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	Y	40	0.40	0.49						
CYPERACEAE	Carex filifolia Nutt.	CAFI1	Y				20	0.20	0.23			
CYPERACEAE	Carex heliophila Mack.	CAHE1	Y	80	5.80	7.14	60	1.60	1.87	100	4.00	4.83
EUPHORBIACEAE	Euphorbia robusta (Engelm.) Small	EURO1	Y							40	0.40	0.48
FABACEAE	Dalea purpurea Vent	DAPU1	Y	20	0.20	0.25						
FABACEAE	Oxytropis lambertii Pursh.	OXLA1	Y							20	0.20	0.24
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	Y	80	1.40	1.72				20	0.20	0.24
LINACEAE	Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y				40	0.40	0.47			
ONAGRACEAE	Calylophus serrulatus (Nutt.) Raven	CASE2	Y	20	0.20	0.25						
POACEAE	Andropogon gerardii Vitman	ANGE1	Y	100	9.60	11.82	40	0.80	0.94	100	12.20	14.73
POACEAE	Andropogon scoparius Michx.	ANSC1	Y	80	1.40	1.72	40	0.40	0.47			
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	Y	20	0.20	0.25	60	0.60	0.70			
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	100	3.00	3.69	80	1.60	1.87	100	3.60	4.35
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	80	1.60	1.97	80	1.60	1.87	100	3.00	3.62
POACEAE	Bouteloua hirsuta Lag	BOHI1	Y	60	1.00	1.23				40	0.40	0.48
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	40	0.40	0.49	100	7.40	8.67	80	1.80	2.17
POACEAE	Bromus tectorum L.	BRTE1	N	20	0.40	0.49				20	0.80	0.97
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	80	1.60	1.97				80	1.20	1.45
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	80	14.80	18.23				100	2.20	2.66
POACEAE	Poa compressa L.	POCO1	N	80	6.60	8.13	60	4.20	4.92	100	6.20	7.49
POACEAE	Poa pratensis L.	POPR1	N	20	5.00	6.16	80	6.80	7.96	60	1.40	1.69
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	40	0.80	0.99	40	0.40	0.47	20	0.20	0.24

Table 2. (cont.)

Family	Scientific Name	Speccode	Native	TR01			TR06			TR12		
				Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y	80	1.20	1.48				40	1.60	1.93
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y	60	0.80	0.99						
POACEAE	Stipa comata Trin. & Rupr.	STCO1	Y	100	4.00	4.93	100	43.40	50.82	100	36.20	43.72
POACEAE	Stipa neomexicana (Thur.) Scribn.	STNE1	Y				20	3.60	4.22			
POLYGONACEAE	Eriogonum alatum Torr.	ERAL1	Y	40	0.40	0.49						
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y	20	0.20	0.25						
SANTALACEAE	Comandra umbellata (L.) Nutt.	COUM1	Y	40	0.40	0.49						
SCROPHULARIACEAE	Linaria dalmatica (L.) Mill.	LIDA1	N				100	9.20	10.77			
	Total foliar cover				81.20	100.00		85.40	100.00		82.80	100.00
	Total native foliar cover				68.40	84.24		56.00	65.57		71.60	86.47

Note: Absolute cover = Absolute foliar cover is the percentage of the number of hits on a species out of the total number of hits possible at a site (500).
Relative cover = Relative foliar cover is the number of hits on a species relative to the total number of all vegetative hits recorded per site (i.e., the percent of vegetative cover the species represented).
All cover values presented are means (n = 5).

Table 3. 1998 wetlands species richness

Family	Scientific Name	Speccode	Native	Site		
				W1	W2	W3
ALISMATACEAE	Sagittaria latifolia Willd.	SALA1	Y			X
APIACEAE	Cicuta maculata L. var. angustifolia Hook.	CIMA1	Y	X		
ASCLEPIADACEAE	Asclepias incarnata L.	ASIN1	Y		X	X
ASCLEPIADACEAE	Asclepias speciosa Torr.	ASSP1	Y	X	X	X
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X	X
ASTERACEAE	Arnica fulgens Pursh.	ARFU1	Y	X		
ASTERACEAE	Arctium minus Bernh.	ARMI1	Y	X		
ASTERACEAE	Aster falcatus Lindl.	ASFA1	Y	X	X	
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	N	X	X	X
ASTERACEAE	Cirsium vulgare (Savi) Ten.	CIVU1	N	X	X	X
ASTERACEAE	Lactuca serriola L.	LASE1	N	X	X	X
ASTERACEAE	Sonchus asper (L.) Hill	SOAS1	N		X	
ASTERACEAE	Solidago missouriensis Nutt.	SOMI1	Y	X		
ASTERACEAE	Taraxacum officinale Weber	TAOF1	N	X	X	
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N	X	X	X
BORAGINACEAE	Cynoglossum officinale L.	CYOF1	N		X	X
BORAGINACEAE	Onosmodium molle Michx. var. occidentale (Mack.) Johnst.	ONMO1	Y	X		
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	N	X		X
BRASSICACEAE	Nasturtium officinale R. Br.	NAOF1	N	X		X
BRASSICACEAE	Thlaspi arvense L.	THAR1	N	X	X	X
CANNABACEAE	Humulus lupulus L. var. lupuloides E. Small	HULU1	Y	X		
CAPRIFOLIACEAE	Symphoricarpos occidentalis Hook.	SYOC1	Y	X	X	X
CERATOPHYLLACEAE	Ceratophyllum demersum L.	CEDE1	Y			X
CLUSIACEAE	Hypericum perforatum L.	HYPE1	N	X	X	X
CYPERACEAE	Carex hystericina Muhl. ex Willd.	CAHY1	Y			X
CYPERACEAE	Carex interior Bailey	CAIN1	Y		X	X
CYPERACEAE	Carex lanuginosa Michx.	CALA1	Y	X	X	X
CYPERACEAE	Carex nebrascensis Dew.	CANE1	Y	X	X	X
CYPERACEAE	Carex praegracilis W. Boott.	CAPR1	Y		X	
CYPERACEAE	Carex scoparia Schkuhr. ex Willd.	CASC1	Y	X		
CYPERACEAE	Eleocharis macrostachya Britt.	ELMA1	Y	X	X	X
CYPERACEAE	Scirpus pallidus (Britt.) Fern	SCPA1	Y		X	
EQUISETACEAE	Equisetum laevigatum A. Br.	EQLA1	Y	X	X	
EUPHORBIACEAE	Euphorbia robusta (Engelm.) Small	EURO1	Y			X
FABACEAE	Amorpha fruticosa L.	AMFR1	Y	X		
FABACEAE	Dalea purpurea Vent	DAPU1	Y	X		
FABACEAE	Glycyrrhiza lepidota Pursh.	GLLE1	Y	X		
FABACEAE	Thermopsis rhombifolia var. divaricarpa (Nels.) Isely	THRH1	Y	X		
FABACEAE	Trifolium sp.	TRI1				X
IRIDACEAE	Iris missouriensis Nutt.	IRMI1	Y		X	
JUNCACEAE	Juncus balticus Willd.	JUBA1	Y	X	X	X
JUNCACEAE	Juncus dudleyi Wieg.	JUDU1	Y	X	X	X
JUNCACEAE	Juncus ensifolius Wikst. var. montanus (Englm.) C. L. Hitchc.	JUEN1	Y		X	X
JUNCACEAE	Juncus longistylis Torr.	JULO1	Y	X	X	X
JUNCACEAE	Juncus nodosus L.	JUNO1	Y		X	X
JUNCACEAE	Juncus torreyi Cov.	JUTO1	Y		X	
LAMIACEAE	Lycopus americanus Muhl. ex Barton	LYAM1	Y	X	X	X
LAMIACEAE	Mentha arvensis L.	MEAR1	Y	X	X	X
LAMIACEAE	Monarda fistulosa L. var. menthifolia (Grah.) Fern.	MOFI1	Y			X
LAMIACEAE	Nepeta cataria L.	NECA1	N	X		X
LAMIACEAE	Prunella vulgaris L.	PRVU1	Y	X	X	X
LEMNACEAE	Lemna minor L.	LEMI1	Y	X	X	X
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	Y	X		
LILIACEAE	Smilacina stellata (L.) Desf.	SMST1	Y	X		
LYTHRACEAE	Lythrum alatum Pursh.	LYAL1	Y		X	

Table 3. (cont.)

Family	Scientific Name	Speccode	Native	Site W1	Site W2	Site W3
ONAGRACEAE	Epilobium ciliatum Raf. ssp. glandulosum (Lehm.) Hock & Raven	EPCI1	Y	X	X	X
ONAGRACEAE	Epilobium paniculatum Nutt.	EPPA1	Y	X	X	X
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	Y	X	X	X
OXALIDACEAE	Oxalis dillenii Jacq.	OXDI1	N	X		X
POACEAE	Agropyron repens (L.) Beauv.	AGRE1	N	X	X	X
POACEAE	Agrostis scabra Willd.	AGSC1	Y	X	X	X
POACEAE	Agrostis stolonifera L.	AGST1	N	X	X	X
POACEAE	Bromus inermis Leyss. ssp. inermis	BRIN1	N	X		
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X	X
POACEAE	Calamagrostis stricta (Timm.) Koel	CAST2	Y		X	
POACEAE	Glyceria striata (Lam.) Hitchc.	GLST1	Y	X	X	X
POACEAE	Hordeum jubatum L.	HOJU1	Y	X		X
POACEAE	Poa compressa L.	POCO1	N		X	
POACEAE	Poa palustris L.	POPA1	N	X	X	X
POACEAE	Poa pratensis L.	POPR1	N	X	X	X
POACEAE	Sphenopholis obtusata (Michx.) Scribn.	SPOB1	Y		X	X
POACEAE	Spartina pectinata Link	SPPE1	Y	X	X	X
POLYGONACEAE	Polygonum convolvulus L.	POCO2	N	X		X
POLYGONACEAE	Polygonum ramosissimum Michx.	PORA1	Y	X		X
POLYGONACEAE	Rumex crispus L.	RUCR1	N	X	X	X
POLYGONACEAE	Rumex obtusifolius L.	RUOB1	N	X		
PRIMULACEAE	Lysimachia ciliata L.	LYCI1	Y	X		
RANUNCULACEAE	Ranunculus macounii Britt.	RAMA1	Y	X		X
ROSACEAE	Geum aleppicum Jacq.	GEAL1	Y	X	X	X
ROSACEAE	Geum macrophyllum Willd.	GEMA1	Y	X	X	X
ROSACEAE	Potentilla gracilis Dougl. ex Hook. var. glabrata (Lehm.) C. L. Hitchc.	POGR1	Y	X	X	
ROSACEAE	Potentilla norvegica L.	PONO1	Y	X		X
ROSACEAE	Rosa arkansana Porter	ROAR1	Y	X		X
RUBIACEAE	Galium aparine L.	GAAP1	Y	X		X
RUBIACEAE	Galium septentrionale Roemer & Schultes	GASE1	Y	X		
SCROPHULARIACEAE	Mimulus glabratus H. B. K. var. fremontii (Benth.) A. L. Grant	MIGL1	Y			X
SCROPHULARIACEAE	Scrophularia lanceolata Pursh.	SCLA2	Y	X		
SCROPHULARIACEAE	Veronica anagallis-aquatica L.	VEAN1	N	X		X
SCROPHULARIACEAE	Verbascum blattaria L.	VEBL1	N		X	
SCROPHULARIACEAE	Verbascum thapsus L.	VETH1	N	X		X
TYPHACEAE	Typha latifolia L.	TYLA1	Y	X	X	X
UNKNOWN	Unidentifiable species	UNKN		X		
URTICACEAE	Urtica dioica L. ssp. gracilis (Ait.) Seland.	URDI1	Y	X		X
VERBENACEAE	Verbena hastata L.	VEHA1	Y	X	X	X
VIOLACEAE	Viola sororia Willd.	VISO1	Y			X
			Total # species:	72	54	63
			Percent native species:	69	69	68

Wetland Indicator Species					
Facultative species	FAC		14	6	9
Facultative upland species	FACU		15	9	1
Facultative upland species - less frequently found in wetlands	FACU-		0	0	1
Facultative wetland species	FACW		12	12	10
Non-indicator species	NI		9	8	8
Obligate wetland species	OBL		14	15	19
Upland species	UPL		1	2	1
		Total # species:	65	52	49

Table 4. 1998 wetland foliar cover data summary

Family	Scientific Name	Speccode	W1			W2			W3		
			Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover
ASCLEPIADACEAE	Asclepias incarnata L.	ASIN1							80	3.60	3.83
ASCLEPIADACEAE	Asclepias speciosa Torr.	ASSP1	40	1.40	1.48	20	0.20	0.23			
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	20	0.20	0.21						
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	80	5.40	5.71	40	3.40	3.86	100	5.20	5.53
ASTERACEAE	Lactuca serriola L.	LASE1							20	0.20	0.21
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	80	7.40	7.82				100	4.60	4.89
BRASSICACEAE	Nasturtium officinale R. Br.	NAOF1	20	0.80	0.85				20	3.20	3.40
CLUSIACEAE	Hypericum perforatum L.	HYPE1	20	1.40	1.48	20	0.20	0.23			
CYPERACEAE	Carex hystericina Muhl. ex Willd.	CAHY1							20	0.20	0.21
CYPERACEAE	Carex interior Bailey	CAIN1							40	0.40	0.43
CYPERACEAE	Carex lanuginosa Michx.	CALA1	60	7.60	8.03	80	6.00	6.82	20	0.40	0.43
CYPERACEAE	Carex nebrascensis Dew.	CANE1	80	3.00	3.17	80	5.00	5.68	100	6.00	6.38
CYPERACEAE	Carex praegracilis W. Boott.	CAPR1				60	1.60	1.82			
CYPERACEAE	Eleocharis macrostachya Britt.	ELMA1	20	0.80	0.85	20	0.80	0.91	80	2.80	2.98
FABACEAE	Thermopsis rhombifolia var. divaricarpa (Nels.) Isely	THRH1	40	1.20	1.27						
JUNCACEAE	Juncus balticus Willd.	JUBA1	100	37.80	39.96	100	45.20	51.36	100	37.40	39.79
JUNCACEAE	Juncus ensifolius Wikst. var. montanus (Englm.) C. L. Hitchc.	JUEN1				20	0.20	0.23	20	0.20	0.21
JUNCACEAE	Juncus longistylis Torr.	JULO1	40	2.20	2.33	40	3.80	4.32	60	1.60	1.70
JUNCACEAE	Juncus nodosus L.	JUNO1				20	0.40	0.45			
LAMIACEAE	Mentha arvensis L.	MEAR1	80	3.40	3.59				40	1.80	1.91
LAMIACEAE	Monarda fistulosa L. var. menthifolia (Grah.) Fern.	MOFI1							20	0.20	0.21
LAMIACEAE	Nepeta cataria L.	NECA1							20	0.20	0.21
LAMIACEAE	Prunella vulgaris L.	PRVU1				20	0.20	0.23			
LEMNACEAE	Lemna minor L.	LEMI1				20	0.20	0.23	40	0.40	0.43
LILIACEAE	Smilacina stellata (L.) Desf.	SMST1	20	0.20	0.21						
LYTHRACEAE	Lythrum alatum Pursh.	LYAL1				20	0.40	0.45			
ONAGRACEAE	Epilobium ciliatum Raf. ssp. glandulosum (Lehm.) Hock & Raven	EPCI1	60	1.20	1.27	20	0.20	0.23	40	0.40	0.43
ONAGRACEAE	Epilobium paniculatum Nutt.	EPPA1	40	0.60	0.63	20	0.40	0.45	80	1.40	1.49
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	20	0.20	0.21				40	0.80	0.85
POACEAE	Agropyron repens (L.) Beauv.	AGRE1	40	0.40	0.42	20	0.40	0.45			
POACEAE	Agrostis scabra Willd.	AGSC1	20	0.40	0.42				80	4.60	4.89
POACEAE	Agrostis stolonifera L.	AGST1	40	0.60	0.63				60	1.60	1.70
POACEAE	Calamagrostis stricta (Timm.) Koel	CAST2				20	1.60	1.82			
POACEAE	Glyceria striata (Lam.) Hitchc.	GLST1							20	1.20	1.28
POACEAE	Hordeum jubatum L.	HOJU1	20	0.20	0.21				20	0.20	0.21
POACEAE	Poa pratensis L.	POPR1	60	2.40	2.54	40	4.40	5.00	80	3.20	3.40
POACEAE	Spartina pectinata Link	SPPE1	20	1.80	1.90	40	5.00	5.68	40	1.40	1.49
POACEAE	Sphenopholis obtusata (Michx.) Scribn.	SPOB1							20	0.20	0.21

Table 4. (cont.)

Family	Scientific Name	Speccode	W1			W2			W3		
			Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover	Frequency	Absolute Cover	Relative Cover
POLYGONACEAE	Polygonum convolvulus L.	POCO2	20	0.40	0.42				20	0.40	0.43
POLYGONACEAE	Rumex crispus L.	RUCR1				20	0.20	0.23			
ROSACEAE	Geum aleppicum Jacq.	GEAL1	20	0.20	0.21	60	1.40	1.59	40	0.40	0.43
ROSACEAE	Geum macrophyllum Willd.	GEMA1	80	2.60	2.75	80	1.00	1.14	60	1.60	1.70
RUBIACEAE	Galium aparine L.	GAAP1	20	0.40	0.42				20	0.20	0.21
RUBIACEAE	Galium septentrionale Roemer & Schultes	GASE1	20	0.40	0.42						
SCROPHULARIACEAE	Scrophularia lanceolata Pursh.	SCLA2	20	0.20	0.21						
SCROPHULARIACEAE	Verbascum thapsus L.	VETH1	20	0.20	0.21						
SCROPHULARIACEAE	Veronica anagallis-aquatica L.	VEAN1							20	0.20	0.21
TYPHACEAE	Typha latifolia L.	TYLA1	60	8.80	9.30	40	5.80	6.59	40	7.20	7.66
URTICACEAE	Urtica dioica L. ssp. gracilis (Ait.) Seland.	URDI1							20	0.20	0.21
VERBENACEAE	Verbena hastata L.	VEHA1	20	0.60	0.63				20	0.20	0.21
VIOLACEAE	Viola sororia Willd.	VISO1							20	0.20	0.21
UNKNOWN	Unknown species	UNKN	20	0.20	0.21						
	Total cover			94.60	100.00		88.00	100.00		94.00	100.00
	Shannon-Weiner diversity index			1.03			0.84			1.07	

Note: Absolute cover = Absolute foliar cover is the percentage of the number of hits on a species out of the total number of hits possible at a wetland (500).
Relative cover = Relative foliar cover is the number of hits on a species relative to the total number of all vegetative hits recorded per wetland (i.e., the percent of vegetative cover the species represented).
All cover values presented are means (n = 5).

Table 5. 1998 estimated weed infestation acreage summary

	1998 Acreage (Estimated)				
		Density Level			
Common Name	Site Total	High	Medium	Low	Scattered
Diffuse knapweed	2,913	761	778	987	388
Russian knapweed	1	NA	NA	NA	NA
Dalmatian toadflax	1,934	313	273	989	359
Musk thistle	1,685	32	515	1,035	102
Mullein	867	168	225	460	13
Jointed goatgrass	35	NA	NA	NA	NA
Annual rye	26	NA	NA	NA	NA
Scotch thistle	9	NA	NA	NA	NA

Note: NA - data not collected by density level

Table 6. Comparison of 1997 and 1998 weed infestation extents

			Density Level			
Weed Species	Year	Site Total	High	Medium	Low	Scattered
Diffuse knapweed	1997	2,678	696	893	658	431
	1998	2,913	761	778	987	388
Dalmatian toadflax	1997	422	135	205	82	0
	1998	1,934	313	273	989	359
Musk thistle	1997	474	2	270	202	0
	1998	1,685	32	515	1,035	102
Mullein	1997	575	117	238	203	17
	1998	867	168	225	460	13

Note: All values are estimated acreages.
See text for density level descriptions.

Appendix A

Technical Reports

Report 1	1998 High-Value Plant Community Survey
Report 2	Monitoring Summary for Diffuse Knapweed Control Study
Report 3	Effects of a Late-Summer Grassland Fire on Diffuse Knapweed Density
Report 4	1998 Wetland Monitoring Summary
Report 5	1998 Xeric Mixed Grassland Monitoring Summary

Report 1

1998 High-Value Plant Community Survey

1. 1998 High-Value Plant Community Survey

1.1 Introduction

The goal of the high-value vegetation monitoring is to qualitatively assess the status and quality of the high-value plant communities (xeric tallgrass prairie, tall upland shrubland, selected wetlands, and Great Plains riparian woodland) at the Rocky Flats Environmental Technology Site (Site) and to document any changes. The high-value plant communities at the Site are those identified by Site ecologists and the Colorado Natural Heritage Program (CNHP) as containing significant or rare ecological resources at both the local and regional scale (K-H 1997a; CNHP 1994, 1995).

Objectives of the high-value vegetation monitoring are to qualitatively:

- assess species richness of the plant communities
- identify any rare plant populations
- document the locations and continued presence of any rare plant populations
- identify and document any infestations of noxious weeds
- document the effectiveness of weed control applications
- assess the impacts of disturbance on the plant communities
- provide a general assessment of the overall status and quality of the plant communities.

1.2 Methods

1.2.1 Species Richness Inventory

As part of the rotating schedule for monitoring high-value vegetation communities on the Site, the xeric tallgrass prairie was monitored in 1998. Species richness was inventoried in each of the 12 xeric tallgrass prairie management units (Figure 1-1). Inventories were conducted by traversing each management unit twice during the growing season (spring and late summer) and recording all vascular plant species observed. Attempts were made to visit, as completely as possible, all areas and microhabitats occurring within each management unit.

1.2.2 Weed Mapping

Sitewide weed mapping continued for selected species as a means of identifying high-priority treatment areas, monitoring the distribution of specific noxious weed species on the Site, and tracking the effectiveness of weed control at the Site. Weed mapping was conducted on foot during the high-value vegetation surveys in the xeric tallgrass prairie, and from a vehicle using binoculars for the remainder of the Site. Species were mapped during their respective flowering periods, when they were most visible. The species mapped included diffuse knapweed (*Centaurea diffusa*), musk thistle (*Carduus nutans*), dalmatian toadflax (*Linaria dalmatica*), and common mullein (*Verbascum thapsus*). These species were also mapped in 1997. An additional four species, Russian knapweed (*Centaurea repens*), annual rye (*Secale cereale*), Scotch thistle (*Onopordum acanthium*), and jointed goatgrass (*Aegilops cylindrica*), were also mapped in 1998 due their increasing infestation levels and the aggressiveness of these species. Canada thistle (*Cirsium arvense*) was not mapped, because it is common throughout most of the wetlands on the Site, and therefore, the wetlands map would provide a good indication of the infested areas.

Infestation areas were classified into general density categories of high, medium, low, and scattered, based on a subjective interpretation of the extent, visual density, need for control, and aggressive nature of the species. In general, a high-density category indicated an area that was dominated by a nearly solid infestation and/or very high cover of the species. A medium-density category was used where the infestation provided less cover and was less homogeneous in the distribution of the species. The low-density category was used where the species were present in fewer numbers and were not visually dominating the landscape, but were beginning to establish a foothold in the community and in need of control. The scattered-density category was used only in a few cases and indicated a sporadic occurrence of the species. The rare plant and noxious weed populations and distributions were drawn in the field on 44×34-inch sitewide base maps. With regard to the resulting maps, it should be noted that the boundaries shown on the maps are only approximate and are based on professional judgement. They should not be interpreted as a precise outline of the distribution of these species, because no surveying or global positioning system (GPS) equipment was used to locate boundary edges, nor do the maps necessarily represent every location of the species on the Site.

1.2.3 Photographic Documentation

No photographs were taken at the permanent photo points during the summer of 1998 because of the switch to an alternate year schedule. Summer photographs will be taken again in the summer of 1999. Winter photographic documentation will be conducted in winter 1999, when the areas of woody vegetation will be photographed from the permanent photo points established in 1997 (K-H 1998). These photos will be used to document the condition of the Great Plains riparian woodland and tall upland shrubland areas when the leaves are off the plants. Photographs will be taken in the same compass directions from these photo points.

1.2.4 Qualitative Habitat Assessments

Qualitative habitat assessments were made in each of the high-value vegetation community management units on the Site during 1998. Assessment objectives dealt primarily with habitat loss, threats to the plant community, weed issues, rare plant species, dominant plant species health in the community, and general community quality. Attempts were also made to revisit each of the locations where CNHP–listed plant species of special concern are known to occur. These species include the mountain-loving sedge (*Carex oreocharis*), forktip three-awn (*Aristida basiramea*), dwarf wild indigo (*Amorpha nana*), and carrionflower greenbriar (*Smilax herbacea* var. *lasioneuron*). Population locations were mapped during the 1997 field season. Locations were revisited to confirm the continued presence of these species on the Site and to evaluate any concerns about them. Further details on the methods used are found in the document *High-Value Vegetation Survey Plan for the Rocky Flats Environmental Technology Site* (K-H 1997b) and *The Environmental Management Department Operating Procedures Manual* (DOE 1994).

1.3 Results and Discussion

1.3.1 Site Flora

As a result of the 1998 fieldwork, a total of seven new records of vascular plant species are reported for the Site. Plant nomenclature follows that of GPFA (1986), Weber (1976), and Weber (1990), in that order of determination. The new plant species reported for the Site flora are:

Calamagrostis stricta (Timm.) Koel	Northern reedgrass
Sorbus scopulina Greene	Mountain ash
Centaurea repens L.	Russian knapweed[1]
Astragalus spathulatus Sheld.	Draba milk-vetch
Agropyron elongatum (Host) Beauv.	Tall wheatgrass
Chenopodium atrovirens Rydb.	Dark goosefoot
Solidago nana Nutt.	Low goldenrod

Of these species, none are rare or imperiled; however, the discovery of Russian knapweed on the Site is cause for concern. It is listed as a noxious weed by the state of Colorado and property owners are required by law to control it. During 1998, the single population of Russian knapweed on the Site was treated with the herbicide Telar to control its spread.

[1] Listed as a noxious weed by the State of Colorado.

1.3.2 Xeric Tallgrass Prairie

A total of 295 plant species were recorded in the xeric tallgrass prairie at the Site during 1998 (Table 1-1). Of these, 79 percent were native species. This was an increase of 21 species, compared to the 1997 Site inventory, which found 274 species in the xeric tallgrass prairie. Four of these species were new to the Site species list (the last four in the list above). A Sorensen similarity index (Brower and Zar 1977) using presence/absence data from the two years yielded a value of 0.87, indicating a high floristic similarity between years, as would be expected. Examination of the species lists from both years (Table 1-1) shows no significant difference in the inventory results. The different species observed during the two years are mostly a result of the slight differences in routes used to traverse the management units, and of the natural variability in abundance of individual species.

Examination of the qualitative habitat assessment forms completed for the xeric tallgrass prairie management units revealed concerns similar to those reported last year (K-H 1998). The biggest management issue in the xeric tallgrass prairie, as well as the biggest threat, is weeds, especially diffuse knapweed. This species is found across much of the xeric tallgrass prairie and continues to spread. At many locations, other weed species—such as musk thistle, dalmatian toadflax, annual rye, common mullein, and numerous other less aggressive species—are also problems. The issue of weed control is discussed in greater detail later in this report.

Other management concerns for the xeric tallgrass prairie are related to plant litter buildup and human disturbance. At many locations, the bunch grasses are choked with dead plant material. In addition, the high accumulation of plant litter found on the prairie poses a wildfire concern. Prescribed burns would provide the best solution for this problem by removing the dead plant material (fuel) and recycling the nutrients to the grasses and forbs. This action would reduce the chance of catastrophic wildfire, and improve the health and vigor of the native plant species.

Continued human disturbance of the xeric tallgrass prairie is also a problem that is further degrading the quality of the prairie. Field surveys in 1998 identified two problems that disturbed the soil surface at certain locations in the xeric tallgrass prairie and will potentially open these locations to further noxious weed invasion, especially by diffuse knapweed. One of these problems is road maintenance in the Buffer Zone. Blading of the main roads in the Buffer Zone is conducted annually to maintain the firebreak roads and provide mechanical weed control through constant disturbance. In 1996, however, the width of most Buffer Zone roads that were bladed was reduced. The lack of constant disturbance along these road margins created the perfect habitat for many of the large weed infestations now present. The presence and abundance of these species, combined with a lack of disturbance and/or herbicide treatment, has allowed more of these species to invade the prairie margins along the roads. It is apparent that herbicide applications are also necessary to control the weeds that are not being controlled by blading along the road margins. Revegetation, in conjunction with herbicide treatments, would help to improve the condition of these areas and reduce the weed infestations along the road margins.

The second problem was discovered on the far western edge of the Site, near the gravel-mining operations, where additional test pits had been dug on previously undisturbed portions of xeric tallgrass prairie. Although permissible under current mine permits, these disturbances create increasing weed control problems for the Site. It is crucial to prevent small areas of disturbance such as these from becoming islands of weed infestation, which if left uncontrolled, can cause the spread of noxious weeds to previously weed-free areas. Much of the area on the western edge of the Site, where test pits were dug several years ago, is now covered with diffuse knapweed that established on the test pits and then spread across the once weed-free xeric tallgrass prairie.

1.3.3 Rare Plant Monitoring

Mapped locations of the plant species of concern, as listed by the CNHP, were revisited during the 1998 surveys. The known populations of mountain-loving sedge, forktip three-awn, and dwarf wild indigo were all found again, and the plants were evaluated. All three species were observed in vegetative, flowering, and fruiting condition, and seemed to be doing well. Carrionflower greenbriar was the only species where plants were not observed at some of the previously known population locations during 1998. However, it is often a difficult species to locate, and it is not known whether it comes up every year. Therefore, an attempt will be made to observe plants at these population locations again in 1999. At those locations where carrionflower greenbriar was observed, it was in vegetative, flowering, and fruiting condition, and appeared to be doing well.

1.3.4 Weeds

The 1998 weed distribution maps for diffuse knapweed, musk thistle, dalmatian toadflax, and mullein are shown in Figures 1-2 through 1-5, respectively. Four additional species—annual rye, Russian knapweed, Scotch thistle, and jointed goatgrass—were mapped in 1998 because of their aggressive nature and their recent appearance at various locations on the Site. The distributions of these species are shown in Figures 1-6 and 1-7. After being entered into the Site Geographic Information System (GIS), the overall extent of these species across the Site was estimated by species and by infestation level using the GIS coverages. Table 1-2 contains the estimated total acreage and acreage-by-density category for each of the species, based on these maps. The species with the greatest extent on the Site was diffuse knapweed, covering nearly 2,913 acres, followed by dalmatian toadflax (1,934 acres), musk thistle (1,685 acres), and mullein (867 acres). The total acreage of the Site is approximately 6,485 acres (K-H 1997c). It should be noted that this acreage is only approximate and should not be interpreted as exact areas. These values are also representative of known locations for these species. It is possible that unmapped infestations are present as well.

Table 1-3 shows the change in infested acreage between the 1997 and 1998 mapped areas. The large increases in infestation acreages for dalmatian toadflax, musk thistle, and mullein are due in large part to the time of year in which mapping was conducted. During 1997, all weed mapping was conducted in late August to early September, when

most of these species were no longer flowering. To better estimate the extent of these species in 1998, mapping was conducted for each species when it was in flower. Therefore, the increase in acreage shown for these species is an artifact of sampling. However, the more accurate mapping completed in 1998 reveals the substantial foothold that these weed species already have on the Site. If the distributions of all the different weed species are combined, it is apparent that most of the Site is infested and weed control is needed for one or more species. However, diffuse knapweed is by far the most aggressive species needing continued control on the Site.

During the 1997 calendar year, approximately 520 acres of diffuse knapweed were treated with Tordon 22K. Figure 1-8 shows the location of the areas treated and the pre-treatment density levels of diffuse knapweed at these locations. Figure 1-9 shows the same locations in 1998 during the growing season after the herbicide was applied. Many of the areas were totally clean (i.e., no diffuse knapweed present) during the growing season after treatment. In other areas, the infestation density was reduced by one or two density levels.

Several factors may contribute to making the herbicide treatment more effective in some locations rather than in others. First, some areas may have been missed during treatment. Second, application methods vary in the evenness with which the herbicide is spread. At most of the large clean locations shown on Figure 1-9, the herbicide treatments were applied using a truck-mounted boom that had a computer-regulated application rate tied to the speed of the vehicle. This method was also used at the western-most location (mostly scattered-density level; Figure 1-9), but this area is dotted with old fence posts and irrigation ditches that had to be avoided. As a result, maneuvering around obstacles left some areas untreated, allowing patches of diffuse knapweed to remain in the treated area. At the locations northeast of the Industrial Area, the herbicide was applied with hose or backpack equipment. As a result, the herbicide application was much less even, and more spots were missed. This would account for higher remaining density levels, even after application. Third, as previously mentioned, some error may be due to mapping inconsistencies.

Overall, the herbicide applications were generally effective on the diffuse knapweed, irregardless of whether the application was made in the spring or fall. However, qualitative observations made at the different treatment locations during 1998 showed that the herbicide affected the native species differently depending on the time of application. At locations treated in November to December 1997, the native spring ephemeral forb species were hardest hit. Little to no flowering of the native spring wildflowers was observed during spring 1998 at any of the locations treated in late fall. However, at those locations where the herbicide application was made in June 1997, only a slight depression of the spring wildflower display was noticed in 1998, compared to adjacent untreated areas. Thus, the timing of the herbicide application may have a major impact on the native forb community. Based on 1998 observations on the Site, a late fall application has a more significant impact on the spring-flowering native forbs than an early summer treatment. Observation of these areas will continue during 1999 to

determine how long this effect lasts and to help determine when the most appropriate application timeframe is for killing the weeds and protecting the native species.

On the positive side, not only was diffuse knapweed controlled (albeit to varying extents) at all treatment locations, but many other weedy forbs also were controlled or had reduced infestation levels. Qualitative observations showed that non-native species such as musk thistle, salsify (*Tragopogon dubius*), western ragweed (*Ambrosia psilostachya*), wild lettuce (*Scorzonera laciniata*), and alyssum (*Alyssum minus*) were all effectively controlled. Even common mullein was controlled at some locations. In addition, qualitative observations showed that the graminoid species responded positively at all treatment locations, in both early summer and late fall. The reduced competition from both the native and weedy forbs allowed the graminoids to take advantage of the situation, as their growth appeared more robust and more flowering was observed as opposed to adjacent untreated areas. Additionally, at one treatment location where a wildfire had crossed the pediment in March 1994, the warm-season graminiod species big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), blue grama (*Bouteloua gracilis*), and side-oats grama (*Bouteloua curtipendula*) flowered profusely and were much taller than elsewhere on the Site. This suggests that combining prescribed burning with herbicide efforts could greatly improve the quality of the prairie community at the Site.

Currently the City of Boulder Mountain Parks is conducting trials using prescribed burning in conjunction with herbicide applications for control of diffuse knapweed (Armstrong 1998, pers. comm.). Results are promising thus far and the technique may be applicable to Site conditions. By burning diffuse knapweed infested areas, the surface litter is removed and knapweed seeds are allowed to germinate. Once the knapweed plants reach the rosette stage they are then treated with herbicide. Because the overtopping litter has been removed, herbicide application is much more effective and the knapweed plants are killed. The herbicide then continues to work for several years without reapplication, and the recycled nutrients released by the fire allow the native species to improve in vigor and health. The native species thus gain a competitive edge by improving the plant community's resistance to reinfestation by the weeds.

The effectiveness of the herbicide Transline was also qualitatively evaluated in 1998 at locations where it was applied during the fall of 1997 (Figure 5-6 in K-H 1998). Transline was applied in the Rock Creek drainage where diffuse knapweed was growing in proximity to wetlands and tall upland shrublands. Observations showed good control of diffuse knapweed in 1998. In most cases, the areas were completely clean, and at locations where total effectiveness was not achieved, the infestation levels dropped by one or two density levels. At all the Transline application areas, there was little observed impact to the native forb and graminoid components of the plant communities.

Although the impacts to the native forb community were fewer with the Transline herbicide, from an economic and pragmatic viewpoint, its use is less desirable because these areas will have to be retreated every one or two years, and it is considerably more expensive than Tordon 22K. With Tordon 22K, one of the benefits is the longer-term

residual effect: retreatment is needed only every 3–5 years. One of the goals of this monitoring effort is to determine more definitively what retreatment frequency will be required for effective longer-term control of diffuse knapweed under the conditions in the Buffer Zone.

Although diffuse knapweed infestations have been controlled at several treatment locations, significant hurdles must be overcome to achieve similar success across the entire Buffer Zone. Part of the problem is that the extent of the diffuse knapweed infestation is expanding at a faster rate than the current level of control effort. The 1997 and 1998 diffuse knapweed mapping data show that, even though approximately 520 acres of prairie were treated with herbicide during calendar year 1997, the extent of knapweed infestation on the Site still increased by nearly 380 acres in 1998. Even if the diffuse knapweed had been completely controlled on all 520 treated acres, there still would have been a net increase of nearly 150 acres of knapweed between 1997 and 1998, based on the maps.

Some of this discrepancy is attributable to the application methods. At some treatment locations, it is not possible to achieve complete control, so these areas retain some level of infestation and need further control. This is most apparent on the steeper hillside and obstacle-strewn areas where continuous, even application of the herbicide by conventional ground equipment is not possible. Thus, for example, in areas where the boom truck must be maneuvered around objects, or where hose or backpack application is necessary over large areas, spots are missed. At many of these locations, aerial spraying would provide a much more even distribution of the herbicide across the landscape, regardless of steep terrain or small surface irregularities such as rough ground or fence posts that may exist.

As improvements are made in the weed control program to address these concerns, monitoring will continue to evaluate the effectiveness of management actions and the overall condition of the high-value plant communities on Site.

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Table 1-1. 1997 and 1998 xeric tallgrass prairie species richness summary

Family	Scientific Name	Speccode	Native	1998	1997
AGAVACEAE	Yucca glauca Nutt.	YUGL1	Y	X	X
ANACARDIACEAE	Rhus aromatica Ait. var. trilobata (Nutt.) A. Gray	RHAR1	Y	X	X
ANACARDIACEAE	Toxicodendron rydbergii (Small) Greene	TORY1	Y	X	
APIACEAE	Daucus carota L.	DACA2	N		X
APIACEAE	Harbouria trachypleura (Gray) C. & R.	HATR1	Y	X	X
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	Y	X	X
APIACEAE	Musineon divaricatum (Pursh.) Nutt. var. hookeri T. & G.	MUDI1	Y	X	X
APOCYNACEAE	Apocynum cannabinum L.	APCA1	Y	X	X
ASCLEPIADACEAE	Asclepias pumila (Gray) Vail	ASPU1	Y	X	X
ASCLEPIADACEAE	Asclepias speciosa Torr.	ASSP1	Y	X	X
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	ASST1	Y	X	X
ASCLEPIADACEAE	Asclepias viridiflora Raf.	ASVI1	Y	X	X
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	Y	X	X
ASTERACEAE	Antennaria microphylla Rydb.	ANMI1	Y	X	X
ASTERACEAE	Antennaria parvifolia Nutt.	ANPA1	Y	X	X
ASTERACEAE	Arnica fulgens Pursh.	ARFU1	Y	X	X
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	Y	X	X
ASTERACEAE	Artemisia dracunculus L.	ARDR1	Y	X	X
ASTERACEAE	Artemisia frigida Willd.	ARFR1	Y	X	X
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	Y	X	X
ASTERACEAE	Aster falcatus Lindl.	ASFA1	Y	X	X
ASTERACEAE	Aster fendleri A. Gray	ASFE1	Y		X
ASTERACEAE	Aster porteri Gray	ASPO1	Y	X	X
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	N	X	X
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	N	X	X
ASTERACEAE	Chrysopsis fulcrata Greene	CHFU1	Y	X	X
ASTERACEAE	Chrysopsis villosa Pursh.	CHVI1	Y	X	X
ASTERACEAE	Chrysothamnus nauseosus (Pall.) Britt. ssp. graveolens (Nutt.) Piper	CHNA1	Y	X	X
ASTERACEAE	Chrysothamnus nauseosus (Pall.) Britt. ssp. nauseosus	CHNA2	Y	X	
ASTERACEAE	Cichorium intybus L.	CIIN1	N	X	X
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	N	X	X
ASTERACEAE	Cirsium undulatum (Nutt.) Spreng.	CIUN1	Y	X	X
ASTERACEAE	Cirsium vulgare (Savi) Ten.	CIVU1	N	X	
ASTERACEAE	Conyza canadensis (L.) Cronq.	COCA1	Y	X	X
ASTERACEAE	Dyssodia papposa (Vent) Hitchc.	DYPA1	N	X	X
ASTERACEAE	Erigeron canus A. Gray	ERCA1	Y	X	X
ASTERACEAE	Erigeron compositus Pursh var. dicoideus A. Gray	ERCO1	Y	X	X
ASTERACEAE	Erigeron divergens T. & G.	ERDI1	Y	X	X
ASTERACEAE	Erigeron flagellaris A. Gray	ERFL1	Y	X	X
ASTERACEAE	Erigeron vetensis Rydb.	ERVE1	Y	X	X
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	Y	X	X
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y	X	X
ASTERACEAE	Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	Y	X	X
ASTERACEAE	Happlopappus spinulosus (Pursh) DC.	HASP1	Y		X
ASTERACEAE	Helianthus annuus L.	HEAN1	Y	X	X
ASTERACEAE	Helianthus petiolaris Nutt.	HEPE1	Y	X	X
ASTERACEAE	Helianthus pumilus Nutt.	HEPU1	Y	X	X
ASTERACEAE	Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	Y	X	X
ASTERACEAE	Hymenopappus filifolius Hook. var. cinereus (Rydb.) I. M. Johnst.	HYFI1	Y	X	X
ASTERACEAE	Kuhnia chlorolepis Woot. & Standl.	KUCH1	Y	X	
ASTERACEAE	Kuhnia eupatorioides L.	KUEU1	Y	X	X
ASTERACEAE	Lactuca oblongifolia Nutt.	LAOB1	Y	X	
ASTERACEAE	Lactuca serriola L.	LASE1	N	X	X
ASTERACEAE	Leucelene ericoides (Torr.) Greene	LEER1	Y	X	X
ASTERACEAE	Liatris punctata Hook.	LIPU1	Y	X	X
ASTERACEAE	Machaeranthera canescens (Pursh) A. Gray	MACA1	Y	X	X
ASTERACEAE	Microseris cuspidata (Pursh.) Sch. Bip.	MICU1	Y	X	X
ASTERACEAE	Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	Y	X	X

Table 1-1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
ASTERACEAE	Scorzonera laciniata L.	SCLA1	N	X	X
ASTERACEAE	Senecio fendleri Gray	SEFE1	Y	X	X
ASTERACEAE	Senecio integerrimus Nutt.	SEIN1	Y	X	X
ASTERACEAE	Senecio plattensis Nutt.	SEPL1	Y	X	X
ASTERACEAE	Senecio spartioides T. & G.	SESP1	Y	X	X
ASTERACEAE	Senecio tridenticulatus Rydb.	SETR1	Y	X	
ASTERACEAE	Solidago missouriensis Nutt.	SOMI1	Y	X	X
ASTERACEAE	Solidago mollis Bart.	SOMO1	Y	X	X
ASTERACEAE	Solidago rigida L.	SORI1	Y	X	X
ASTERACEAE	Sonchus asper (L.) Hill	SOAS1	N	X	
ASTERACEAE	Taraxacum officinale Weber	TAOF1	N	X	X
ASTERACEAE	Thelesperma megapotanicum (Spreng.) O. Ktze.	THME1	Y	X	X
ASTERACEAE	Townsendia grandiflora (Nutt.)	TOGR1	Y	X	
ASTERACEAE	Townsendia hookeri Beaman	TOHO1	Y	X	X
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N	X	X
BERBERIDACEAE	Berberis repens Lindl.	BERE1	Y	X	
BORAGINACEAE	Cryptantha virgata (Porter) Payson	CRVI1	Y	X	X
BORAGINACEAE	Cynoglossum officinale L.	CYOF1	N	X	
BORAGINACEAE	Lappula redowskii (Hornem.) Greene	LARE1	Y	X	X
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	Y	X	X
BORAGINACEAE	Mertensia lanceolata (Pursh.) A. DC.	MELA1	Y	X	X
BORAGINACEAE	Onosmodium molle Michx. var. occidentale (Mack.) Johnst.	ONMO1	Y	X	X
BORAGINACEAE	Plagiobothrys scouleri (H. & A.) I. M. Johnst.	PLSC1	Y	X	
BRASSICACEAE	Alyssum alyssoides (L.) L.	ALAL1	N	X	X
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	N	X	X
BRASSICACEAE	Arabis fendleri (S. Wats.) Greene var. fendleri	ARFE3	Y	X	X
BRASSICACEAE	Arabis glabra (L.) Bernh.	ARGL1	N	X	
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y	X	X
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	N	X	X
BRASSICACEAE	Camelina microcarpa Andrz. ex DC.	CAMI1	N	X	X
BRASSICACEAE	Descurainia pinnata (Walt.) Britt.	DEPI1	Y	X	X
BRASSICACEAE	Descurainia richardsonii (Sweet) Schultz	DERI1	Y		X
BRASSICACEAE	Descurainia sophia (L.) Webb ex Prantl.	DESO1	N	X	
BRASSICACEAE	Draba nemorosa L.	DRNE1	Y	X	X
BRASSICACEAE	Draba reptans (Lam.) Fern.	DRRE1	Y	X	X
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	ERCA2	Y	X	X
BRASSICACEAE	Lepidium campestre (L.) R. Br.	LECA1	N	X	X
BRASSICACEAE	Lepidium densiflorum Schrad.	LEDE1	Y	X	X
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	Y	X	X
BRASSICACEAE	Sisymbrium altissimum L.	SIAL1	N	X	X
CACTACEAE	Coryphantha missouriensis (Sweet) Britt. & Rose	COMI1	Y	X	X
CACTACEAE	Echinocereus viridiflorus Engelm.	ECVI1	Y	X	X
CACTACEAE	Opuntia fragilis (Nutt.) Haw.	OPFR1	Y	X	X
CACTACEAE	Opuntia macrorhiza Engelm.	OPMA1	Y	X	X
CACTACEAE	Pediocactus simpsonii (Engelm.) Britt. & Rose	PESI1	Y	X	X
CAMPANULACEAE	Campanula rotundifolia L.	CARO1	Y	X	X
CAPRIFOLIACEAE	Symphoricarpos occidentalis Hook.	SYOC1	Y	X	X
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y	X	X
CARYOPHYLLACEAE	Cerastium arvense L.	CEAR1	Y	X	X
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	Y	X	X
CARYOPHYLLACEAE	Silene antirrhina L.	SIAN1	Y	X	X
CARYOPHYLLACEAE	Silene drummondii Hook.	SIDR1	Y	X	X
CARYOPHYLLACEAE	Spergularia rubra (L.) K. Presl.	SPRU1	N	X	X
CARYOPHYLLACEAE	Vaccaria pyramidata Medic.	VAPY1	N	X	
CHENOPODIACEAE	Chenopodium album L.	CHAL1	N	X	
CHENOPODIACEAE	Chenopodium atrovirens Nutt.	CHAT1	Y	X	
CHENOPODIACEAE	Chenopodium leptophyllum Nutt. ex Moq.	CHLE2	Y	X	X
CHENOPODIACEAE	Salsola iberica Senn. & Pau.	SAIB1	N		X
CLUSIACEAE	Hypericum perforatum L.	HYPE1	N	X	X

Table 1-1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
COMMELINACEAE	Tradescantia occidentalis (Britt.) Smyth	TROC1	Y	X	X
CONVOLVULACEAE	Convolvulus arvensis L.	COAR1	N	X	X
CONVOLVULACEAE	Evolvulus nuttallianus R. & S.	EVNU1	Y	X	X
CRASSULACEAE	Sedum lanceolatum Torr.	SELA1	Y	X	X
CUPRESSACEAE	Juniperus communis L.	JUCO1	Y	X	X
CUPRESSACEAE	Juniperus scopulorum Sarg.	JUSC1	T	X	X
CYPERACEAE	Carex brevior (Dew.) Mack. ex Lunell.	CABR1	Y	X	
CYPERACEAE	Carex eleocharis Bailey	CAEL1	Y	X	X
CYPERACEAE	Carex filifolia Nutt.	CAFI1	Y		X
CYPERACEAE	Carex heliophila Mack.	CAHE1	Y	X	X
CYPERACEAE	Carex interior Bailey	CAIN1	Y		X
CYPERACEAE	Carex oreocharis Holm.	CAOR1	Y	X	X
CYPERACEAE	Carex praegracilis W. Boott.	CAPR1	Y		X
CYPERACEAE	Eleocharis compressa Sulliv.	ELCO1	Y	X	X
CYPERACEAE	Eleocharis macrostachya Britt.	ELMA1	Y	X	X
EUPHORBIACEAE	Euphorbia fendleri T. & G.	EUFE1	Y	X	X
EUPHORBIACEAE	Euphorbia robusta (Engelm.) Small	EURO1	Y	X	X
EUPHORBIACEAE	Euphorbia serpyllifolia Pers.	EUSE1	Y	X	
EUPHORBIACEAE	Euphorbia spathulata Lam.	EUSP1	Y	X	X
EUPHORBIACEAE	Tragia ramosa Nutt.	TRRA1	Y	X	X
FABACEAE	Amorpha fruticosa L.	AMFR1	Y	X	X
FABACEAE	Astragalus adsurgens Pall. var. robustior Hook.	ASAD1	Y	X	X
FABACEAE	Astragalus agrestis Dougl. ex G. Don	ASAG1	Y	X	X
FABACEAE	Astragalus crassicarpus Nutt.	ASCR1	Y	X	
FABACEAE	Astragalus drummondii Dougl. ex Hook.	ASDR1	Y	X	X
FABACEAE	Astragalus flexuosus (Hook.) G. Don	ASFL1	Y	X	X
FABACEAE	Astragalus shortianus Nutt. ex T.&G.	ASSH1	Y	X	X
FABACEAE	Astragalus spathulatus Sheld.	ASSP2	Y	X	
FABACEAE	Astragalus tridactylicus Gray	ASTR1	Y	X	X
FABACEAE	Dalea candida Michx. ex Willd. var. oligophylla (Torr.) Shinners.	DACA1	Y	X	X
FABACEAE	Dalea purpurea Vent	DAPU1	Y	X	X
FABACEAE	Glycyrrhiza lepidota Pursh.	GLLE1	Y	X	X
FABACEAE	Lupinus argenteus Pursh var. argenteus	LUAR1	Y	X	X
FABACEAE	Medicago sativa L. ssp. sativa	MESA1	N	X	X
FABACEAE	Melilotus alba Medic.	MEAL1	N	X	
FABACEAE	Melilotus officinalis (L.) Pall.	MEOF1	N	X	X
FABACEAE	Oxytropis lambertii Pursh.	OXLA1	Y	X	X
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	Y	X	X
FABACEAE	Robinia pseudo-acacia L.	ROPS1	N	X	X
FABACEAE	Thermopsis rhombifolia var. divaricarpa (Nels.) Isely	THRH1	Y	X	X
FABACEAE	Trifolium pratense L.	TRPR1	N	X	
FABACEAE	Vicia americana Muhl. ex Willd.	VIAM1	Y	X	
GENTIANACEAE	Gentiana affinis Griseb.	GEAF1	Y	X	X
GENTIANACEAE	Swertia radiata (Kell.) O. Ktze.	SWRA1	Y	X	X
GERANIACEAE	Erodium cicutarium (L.) L'Her.	ERCI1	N	X	X
GERANIACEAE	Geranium caespitosum James ssp. caespitosum	GECA1	Y	X	X
GROSSULARIACEAE	Ribes aureum Pursh	RIAU1	Y	X	X
GROSSULARIACEAE	Ribes cereum Dougl.	RICE1	Y		X
HYDROPHYLLACEAE	Hydrophyllum fendleri (Gray) Heller	HYFE1	Y	X	
HYDROPHYLLACEAE	Phacelia heterophylla Pursh.	PHHE1	Y	X	X
IRIDACEAE	Iris missouriensis Nutt.	IRMI1	Y	X	X
IRIDACEAE	Sisyrinchium montanum Greene	SIMO1	Y	X	X
JUNCACEAE	Juncus balticus Willd.	JUBA1	Y	X	X
JUNCACEAE	Juncus dudleyi Wieg.	JUDU1	Y		X
JUNCACEAE	Juncus interior Wieg.	JUIN1	Y	X	X
JUNCACEAE	Juncus longistylis Torr.	JULO1	Y		X
LAMIACEAE	Hedeoma hispidum Pursh.	HEHI1	Y		X
LAMIACEAE	Marrubium vulgare L.	MAVU1	N	X	X
LAMIACEAE	Monarda fistulosa L. var. menthifolia (Grah.) Fern.	MOFI1	Y	X	X

Table 1-1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
LAMIACEAE	Nepeta cataria L.	NECA1	N	X	
LAMIACEAE	Prunella vulgaris L.	PRVU1	Y	X	
LAMIACEAE	Scutellaria brittonii Porter	SCBR1	Y	X	X
LILIACEAE	Allium cernuum Roth	ALCE1	Y	X	X
LILIACEAE	Allium geyeri S. Wats.	ALGE1	Y	X	X
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	Y	X	X
LILIACEAE	Calochortus gunnisonii S. Wats.	CAGU1	Y	X	X
LILIACEAE	Leucocrinum montanum Nutt.	LEMO2	Y	X	X
LILIACEAE	Zigadenus venenosus Wats. var. gramineus (Rydb.) Walsh ex Peck	ZIVE1	Y		X
LINACEAE	Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	Y	X	X
MALVACEAE	Malva neglecta Wallr.	MANE1	N		X
MALVACEAE	Sphaeralcea coccinea (Pursh.) Rydb.	SPCO1	Y	X	X
NYCTAGINACEAE	Mirabilis hirsuta (Pursh.) MacM.	MIHI1	Y	X	X
NYCTAGINACEAE	Mirabilis linearis (Pursh.) Heimerl	MILI1	Y	X	X
ONAGRACEAE	Calylophus serrulatus (Nutt.) Raven	CASE2	Y	X	X
ONAGRACEAE	Epilobium paniculatum Nutt.	EPPA1	Y	X	
ONAGRACEAE	Gaura coccinea Pursh.	GACO1	Y	X	X
ONAGRACEAE	Oenothera howardii (A. Nels.) W. L. Wagner	OEHO1	Y	X	X
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	Y	X	X
OROBANCHACEAE	Orobanche fasciculata Nutt.	ORFA1	Y	X	X
OXALIDACEAE	Oxalis dillenii Jacq.	OXDI1	N	X	X
PAPAVERACEAE	Argemone polyanthemos (Fedde) G. Ownbey	ARPO1	Y	X	X
PINACEAE	Pinus ponderosa Laws	PIPO1	Y	X	X
PINACEAE	Pseudotsuga menziesii (Mirb.) Franco	PSME1	Y	X	X
PLANTAGINACE	Plantago lanceolata L.	PLLA1	N	X	X
PLANTAGINACE	Plantago patagonica Jacq.	PLPA1	Y	X	X
POACEAE	Aegilops cylindrica Host	AECY1	N	X	
POACEAE	Agropyron caninum (L.) Beauv. ssp. majus (Vasey) C. L. Hitchc.	AGCA1	Y	X	X
POACEAE	Agropyron cristatum (L.) Gaertn.	AGCR1	N	X	X
POACEAE	Agropyron desertorum (Fisch.) Schult.	AGDE1	N	X	X
POACEAE	Agropyron elongatum (Host) Beauv.	AGEL1	N	X	
POACEAE	Agropyron griffithsii Scribn. & Smith	AGGR1	Y	X	X
POACEAE	Agropyron intermedium (Host) Beauv.	AGIN1	N	X	X
POACEAE	Agropyron smithii Rydb.	AGSM1	Y	X	X
POACEAE	Agrostis scabra Willd.	AGSC1	Y		X
POACEAE	Alopecurus geniculatus L.	ALGE2	Y		X
POACEAE	Andropogon gerardii Vitman	ANGE1	Y	X	X
POACEAE	Andropogon scoparius Michx.	ANSC1	Y	X	X
POACEAE	Aristida basiramea Engelm. ex Vasey var. basiramea	ARBA1	Y	X	X
POACEAE	Aristida purpurea Nutt. var. longiseta (Steud.) Vasey	ARFE1	Y	X	X
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	Y	X	X
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	X	X
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	X	X
POACEAE	Bouteloua hirsuta Lag	BOHI1	Y	X	X
POACEAE	Bromus inermis Leyss. ssp. inermis	BRIN1	N	X	X
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X
POACEAE	Bromus tectorum L.	BRTE1	N	X	X
POACEAE	Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y	X	X
POACEAE	Dactylis glomerata L.	DAGL1	N	X	X
POACEAE	Danthonia spicata (L.) Beauv. ex R. & S.	DASP1	Y	X	X
POACEAE	Dichanthelium oligosanthes (Schultz) Gould var. scribnerianum (Nash) G	DIOL1	Y	X	X
POACEAE	Echinochloa crusgallii (L.) Beauv.	ECCR1	N	X	
POACEAE	Elymus canadensis L.	ELCA1	Y		X
POACEAE	Elymus juncea Fisch.	ELJU1	N		X
POACEAE	Festuca ovina L. var. rydbergii St. Yves	FEOV1	Y	X	X
POACEAE	Hordeum jubatum L.	HOJU1	Y	X	
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	X	X
POACEAE	Lolium perenne L.	LOPE1	N		X
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	X	X

Table 1-1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
POACEAE	Muhlenbergia wrightii Vasey	MUWR1	Y	X	
POACEAE	Oryzopsis hymenoides (R. & S.) Ricker	ORHY1	Y	X	X
POACEAE	Panicum capillare L.	PACA1	Y	X	
POACEAE	Panicum virgatum L.	PAVI1	Y	X	X
POACEAE	Phleum pratense L.	PHPR1	N	X	X
POACEAE	Poa bulbosa L.	POBU1	N	X	
POACEAE	Poa canbyi (Scribn.) Piper	POCA1	Y	X	X
POACEAE	Poa compressa L.	POCO1	N	X	X
POACEAE	Poa fendleriana (Steud.) Vasey	POFE1	Y	X	X
POACEAE	Poa pratensis L.	POPR1	N	X	X
POACEAE	Schedonnardus paniculatus (Nutt.) Trel.	SCPA2	N	X	
POACEAE	Secale cereale L.	SECE1	N	X	X
POACEAE	Setaria viridis (L.) Beauv.	SEVI1	N	X	X
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	X	X
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y	X	X
POACEAE	Sporobolus asper (Michx.) Kunth	SPAS1	Y	X	X
POACEAE	Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	Y	X	X
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y	X	X
POACEAE	Stipa comata Trin. & Rupr.	STCO1	Y	X	X
POACEAE	Stipa neomexicana (Thur.) Scribn.	STNE1	Y	X	
POACEAE	Stipa spartea Trinius	STSP1	Y	X	X
POACEAE	Stipa viridula Trin.	STVI1	Y	X	X
POACEAE	Triticum aestivum L.	TRAE1	N	X	
POLEMONIACEAE	Gilia opthalmoides Brand. ssp. clokeyi (Mason) A. & V. Grant	GIOP1	Y	X	
POLEMONIACEAE	Ipomopsis spicata (Nutt.) V. Grant ssp. spicata	IPSP1	Y	X	X
POLEMONIACEAE	Navarretia minima Nutt.	NAMI1	N	X	X
POLYGONACEAE	Eriogonum alatum Torr.	ERAL1	Y	X	X
POLYGONACEAE	Eriogonum effusum Nutt.	EREF1	Y	X	X
POLYGONACEAE	Eriogonum umbellatum Torr.	ERUM1	Y	X	X
POLYGONACEAE	Polygonum arenastrum Jord. ex Bor.	POAR1	N	X	
POLYGONACEAE	Polygonum convolvulus L.	POCO2	N	X	X
POLYGONACEAE	Polygonum douglasii Greene	PODO1	Y	X	
POLYGONACEAE	Polygonum ramosissimum Michx.	PORA1	Y		X
POLYGONACEAE	Polygonum sawatchense Small	POSA1	Y	X	
POLYGONACEAE	Rumex acetosella L.	RUAC1	N	X	X
POLYGONACEAE	Rumex crispus L.	RUCR1	N	X	X
POLYGONACEAE	Rumex salicifolius Weinm. ssp. triangulivalvis Danser	RUSA1	Y	X	X
PORTULACACEAE	Claytonia rosea Rydb.	CLRO1	Y	X	
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y	X	X
PRIMULACEAE	Androsace occidentalis Pursh.	ANOC1	Y	X	X
RANUNCULACEAE	Anemone patens L.	ANPA2	Y	X	X
RANUNCULACEAE	Clematis ligusticifolia Nutt.	CLLI1	Y		X
RANUNCULACEAE	Delphinium nuttalianum Pritz. ex Walpers	DENU1	Y	X	X
RANUNCULACEAE	Delphinium virescens Nutt. ssp. penardii (Huth) Ewan	DEVI1	Y	X	X
RANUNCULACEAE	Myosurus minimus L.	MYMI1	Y	X	X
ROSACEAE	Amelanchier alnifolia Nutt.	AMAL1	Y	X	X
ROSACEAE	Crataegus erythropoda Ashe	CRER1	Y	X	X
ROSACEAE	Geum macrophyllum Willd.	GEMA1	Y		X
ROSACEAE	Potentilla fissa Nutt.	POFI1	Y	X	X
ROSACEAE	Potentilla gracilis Dougl. ex Hook. var. glabrata (Lehm.) C. L. Hitchc.	POGR1	Y	X	X
ROSACEAE	Potentilla hippiana Lehm.	POHI1	Y	X	X
ROSACEAE	Potentilla pensylvanica L.	POPE4	Y	X	X
ROSACEAE	Prunus pumila L. var. besseyi (Bailey) Gl.	PRPU1	Y	X	X
ROSACEAE	Prunus virginiana L. var. melanocarpa (A. Nels.) Sarg.	PRVI1	Y	X	X
ROSACEAE	Rosa acicularis Lindl.	ROAC1	Y	X	
ROSACEAE	Rosa arkansana Porter	ROAR1	Y	X	X
ROSACEAE	Rosa woodsii Lindl.	ROWO1	Y	X	
RUBIACEAE	Galium aparine L.	GAAP1	Y	X	X
RUBIACEAE	Galium septentrionale Roemer & Schultes	GASE1	Y	X	

Table 1-1. (cont.)

Family	Scientific Name	Speccode	Native	1998	1997
SALICACEAE	Populus deltoides Marsh. ssp. monilifera (Ait.) Eckenw.	PODE1	Y	X	X
SANTALACEAE	Comandra umbellata (L.) Nutt.	COUM1	Y	X	X
SAXIFRAGACEAE	Heuchera parvifolia Nutt. ex T.& G.	HEPA1	Y	X	X
SAXIFRAGACEAE	Saxifraga rhomoidea Greene	SARH1	Y	X	X
SCROPHULARIACEAE	Castilleja integra A. Gray	CAIN2	Y	X	X
SCROPHULARIACEAE	Castilleja sessiliflora Pursh.	CASE3	Y	X	X
SCROPHULARIACEAE	Collinsia parviflora Doug. ex Lindl.	COPA1	Y	X	X
SCROPHULARIACEAE	Linaria dalmatica (L.) Mill.	LIDA1	N	X	X
SCROPHULARIACEAE	Linaria vulgaris Hill	LIVU1	N		X
SCROPHULARIACEAE	Penstemon secundiflorus Benth.	PESE1	Y	X	X
SCROPHULARIACEAE	Penstemon strictus Bentham in De Candolle	PEST1	Y		X
SCROPHULARIACEAE	Penstemon virens Penn.	PEVI1	Y	X	X
SCROPHULARIACEAE	Penstemon virgatus Gray ssp. asa-grayi Crosswhite	PEVI2	Y		X
SCROPHULARIACEAE	Scrophularia lanceolata Pursh.	SCLA2	Y	X	
SCROPHULARIACEAE	Verbascum blattaria L.	VEBL1	N	X	X
SCROPHULARIACEAE	Verbascum thapsus L.	VETH1	N	X	X
SCROPHULARIACEAE	Veronica peregrina L. var. xalapensis (H. B. K.) St. John & Warren	VEPE1	Y	X	X
SELAGINELLACEAE	Selaginella densa Rydb.	SEDE1	Y	X	X
SOLANACEAE	Physalis heterophylla Nees	PHHE2	Y	X	X
SOLANACEAE	Physalis virginiana P. Mill.	PHVI2	Y	X	X
SOLANACEAE	Solanum rostratum Dun.	SORO1	Y	X	
SOLANACEAE	Solanum triflorum Nutt.	SOTR1	Y		X
ULMACEAE	Ulmus pumila L.	ULPU1	N	X	X
VERBENACEAE	Lippia cuneifolia (Torr.) Steud.	LICU1	Y	X	X
VERBENACEAE	Verbena bracteata Lag. & Rodr.	VEBR1	Y	X	X
VIOLACEAE	Viola nuttallii Pursh.	VINU1	Y	X	X
	Total number of species			295	274
	Percent native species			79	81

Table 1-2. 1998 estimated weed infestation acreage summary

	1998 Acreage (Estimated)				
		Density Level			
Common Name	Site Total	High	Medium	Low	Scattered
Diffuse knapweed	2,913	761	778	987	388
Russian knapweed	1	NA	NA	NA	NA
Dalmatian toadflax	1,934	313	273	989	359
Musk thistle	1,685	32	515	1,035	102
Mullein	867	168	225	460	13
Jointed goatgrass	35	NA	NA	NA	NA
Annual rye	26	NA	NA	NA	NA
Scotch thistle	9	NA	NA	NA	NA

Note: NA - data not collected by density level

Table 1-3. Comparison of 1997 and 1998 weed infestation extents

Weed Species	Year	Site Total	Density Level			
			High	Medium	Low	Scattered
Diffuse knapweed	1997	2,678	696	893	658	431
	1998	2,913	761	778	987	388
Dalmatian toadflax	1997	422	135	205	82	0
	1998	1,934	313	273	989	359
Musk thistle	1997	474	2	270	202	0
	1998	1,685	32	515	1,035	102
Mullein	1997	575	117	238	203	17
	1998	867	168	225	460	13

Note: All values are acreages.
See text for density level descriptions.

Report 2

Monitoring Summary for Diffuse Knapweed Control Study

2. Monitoring Summary for Diffuse Knapweed Control Study

2.1 Introduction

Diffuse knapweed (*Centaurea diffusa*) is a noxious weed that has become increasingly widespread across the Front Range of Colorado. Over the past several years, the spread of this species has become a serious threat with regard to managing the natural resources in the Buffer Zone at the Rocky Flats Environmental Technology Site (Site). Under the Colorado Noxious Weed Act, diffuse knapweed is listed as a noxious weed that must be controlled by property owners, and it is listed as one of the top ten prioritized species for control in the state (CRS 1996).

Diffuse knapweed is a very aggressive competitor in dry conditions such as those found at the Site. Studies elsewhere have shown that it rapidly invades overgrazed range lands, disturbed sites, and even undisturbed plant communities, often becoming a dominant species and altering the species composition of the plant community (Powell 1990; FEIS 1996; Sheley et al. 1998). Studies have also shown that diffuse knapweed–infested lands exhibit increased soil erosion, degraded water quality, lower wildlife value, reduced grazing capacity, and less aesthetic and recreational value (Sheley et al. 1997, 1998).

Observations at the Site have shown that over the past seven years, the spread of diffuse knapweed has become epidemic. Weed mapping done in late summer 1997 showed that approximately 41 percent of the Site had some level of diffuse knapweed infestation (K-H 1998), and 1998 mapping revealed that the area in need of control was approximately 45 percent, even after weed control measures had been implemented over several hundred acres (see Section 1).

In 1997, a study was begun to evaluate the effectiveness of Tordon 22K (trademark of DowElanco; effective chemical compound is picloram) in controlling diffuse knapweed on the Site. Tordon 22K has been proven to be one of the more effective chemicals used to treat diffuse knapweed infestations, because it provides a multi-year residual effect that can prevent the species from germinating for several years after its application (Beck 1994). It has been used on the Site for the past several years, generally along roads and in localized areas of the Buffer Zone.

One of the areas currently affected at an increasing rate by diffuse knapweed is the Site's relict xeric tallgrass prairie. The Site contains a significant portion of what has been identified as the largest remaining stand of this plant community known to occur in Colorado, and potentially in all of North America (CNHP 1995). Because of the importance of this plant community, a management concern has arisen as to what effect the spraying of Tordon 22K might have on the native species in the xeric tallgrass prairie. Thus, the purposes of this study were to assess the effectiveness of Tordon 22K in controlling diffuse knapweed and to identify any potential effects on desirable species in the xeric tallgrass prairie.

2.2 Study Site Location and Characteristics

The area selected for the study is north of the T130 trailer complex, west of the Industrial Area (Figure 2-1). The xeric tallgrass prairie at the Site is located primarily on the pediment, which is underlain by Rocky Flats Alluvium (SCS 1980). The soils are classified as Flatirons very cobbly sandy loams (SCS 1980). The study site is essentially flat, with only a 1° slope to the northeast. The study site is large enough for placement of both control and treatment plots (each 60 × 65 m), and a large amount of diffuse knapweed was present where the two plots would be located.

2.3 Methods

Within the control and treatment plots, five parallel, randomly located, 50-m transects were established from a baseline using X and Y coordinates generated by a computerized random number generator (Figure 2-2). Transects were permanently marked, assigned numbers, and labeled. Although it would have been preferable to collect a full year's worth of data prior to herbicide application, logistics and the required time frame only allowed for a single spring sampling prior to herbicide application. The first summer's data set would still be comparable to the second summer, however, because very little time would have passed since the herbicide application, and no major change would be observed until the following summer.

Sampling during 1997 was conducted June 16–19 and again from September 2–4. In 1998, sampling was conducted on June 17–19 and August 24–27. The treatment plot was sprayed with Tordon 22K, applied at a rate of 1 pint/acre, June 23–24, using a truck-mounted spray unit with a 16.75-m (55-ft) boom. The boom was held approximately 0.6–1.0 m (2–3 ft) above the vegetation. A uniform application rate was obtained across the area using a computerized spray system that regulated the application pressure rate according to the speed of the truck. Some diffuse knapweed plants had already bolted and were in the bud stage at the time the spraying occurred, but many rosettes were still present.

Species richness was determined in a 2-m-wide belt centered along the length of each 50-m transect. Every plant species rooted within the 100-m^2 area was recorded. In addition, the densities of the woody plant stems and cactus species were counted for the 100-m^2 area and recorded. Basal cover and foliar cover estimates were made using a point-intercept method along each of the 50-m transects. A 2-m-long rod, with a 6-mm diameter, was dropped vertically at 50-cm increments along the transect to record a total of 100 intercept points. Two types of hits were recorded.

- Basal cover hits indicated what material the rod contacted at the ground surface. Hits could be vegetation (live plants), litter (fallen dead material), rock (pebbles and cobbles that were greater than the rod diameter), bare ground, or water, in that order of priority based on the protection from erosion each type of cover provided. A basal

vegetation hit was recorded only if the rod was touching the stem or crown of the plant where the plant entered the ground.

- Foliar vegetation hits (defined as a portion of a plant touching the rod) were recorded in three categories as defined by height and growth form. The topmost hit of each growth form was recorded. The growth forms measured were herbaceous, woody <2 m in height, and woody >2 m in height.

Frequency information by species was gathered by randomly locating 25 1-m^2 quadrats (5 per transect) in each of the control and treatment plots and recording all species present in each plot. Density stem counts for diffuse knapweed, St. John's-wort (*Hypericum perforatum*), and curly-top gumweed (*Grindelia squarrosa*) were also made using these same quadrats. No distinctions were made during counts for seedlings, rosettes, or adult plants. More detailed summaries of these specific methods are found in the *Environmental Monitoring Department Operating Procedures Manual* (DOE 1991) and the *High Value Vegetation Survey Plan for the Rocky Flats Environmental Technology Site* (K-H 1997).

Species richness data were summarized by generating a species list for the control plot and treatment plot for each sampling period. In addition, other species richness variables were calculated from the species lists. Basal cover data were reported as total percent cover of vegetation, litter, rock, and bare ground. Foliar cover data were reported as frequency, absolute cover, and relative cover for each species encountered. Frequency from the cover data was defined as the percent of point-intercept transects in which a species occurred, out of the total five possible sampled per plot. Absolute foliar cover was the percentage of the number of hits on a species out of the total number of hits possible at a plot (500). This value is the actual cover of a species. Relative foliar cover was the number of hits on a species relative to the total number of vegetative hits recorded per plot (i.e., the percent of total vegetative cover [100 percent] represented by the species).

Both absolute and relative foliar cover values are means averaged over the five transects. Frequency based on quadrats (n=25) was defined as the number of quadrats in which a species was recorded, divided by 25 (the total number of quadrats possible), multiplied by 100. Density count data were summarized as the mean number of stems per square meter.

Statistical analysis on the results was conducted only when mean values were different enough to suggest a meaningful interpretation. Nonparametric tests were used for all analyses, because normality and variance requirements were not met. Comparisons between independent samples (i.e., the control and treatment plots) were done using Mann-Whitney U tests (Fowler and Cohen 1990). Dependent sample comparisons (i.e., within treatment over time) were done using Wilcoxon's test for matched pairs and Friedmans 2-way analysis of variance (ANOVA; Fowler and Cohen 1990; Sheskin 1997). Frequency analyses were done using a McNemar test (Sheskin 1997). The

difference between two regression lines was used to evaluate the differences in Shannon-Weaver diversity indices between the control and treatment plots over time (Fowler and Cohen 1990). For most results, descriptive comparisons were made between the control and treatment plots from the two years of data to examine potential changes over time—pre-treatment to post-treatment.

2.4 Results from 1997 and 1998

Compared to 1997, diffuse knapweed density declined significantly in 1998, in both the control and treatment plots, with the larger decrease occurring in the treatment plot (Wilcoxon's test for matched pairs; T = 9.5 and T = 0, respectively, $P < 0.05$; Table 2-1). Initial diffuse knapweed frequency in the control and treatment plots was 76 and 80 percent, respectively (Table 2-2, Figure 2-3). After herbicide application, diffuse knapweed frequency decreased by 60 percent in the treatment plot (McNemar test; $X^2 = 13.1$; Table 2-2, Figure 2-3) while remaining stable in the control plot.

A total of 98 species was recorded at the study plots during 1997 and 1998. Table 2-3 lists the species richness from each plot for each sampling session. The total number of species recorded in the control and treatment plots during each sampling period showed a seasonality effect (Table 2-4). Overall richness and the mean number of species per quadrat were higher in the spring and then showed a slight decline by late summer. However, after the herbicide application, the treatment plot had an overall richness loss of 12 species during the first summer, compared with only 3 lost in the control plot (Table 2-4). By the following year (spring and summer), however, the treatment plot had regained some of the lost species richness. The percent of native species increased slightly in both the control and treatment plots over the two-year period (Table 2-4). Species diversity (Shannon-Weaver Index) declined significantly in the treatment plot, while in the control plot, diversity remained stable (difference between two regression lines, $t = 2.776$, $df = 4$; Figure 2-4).

Basal vegetation cover and rock cover remained stable during both years in the control and treatment plots, while bare ground cover decreased by similar amounts in both plots (Table 2-4). The loss of bare ground cover was offset largely by similar increases in plant litter cover in both the control and treatment plots (Table 2-4). Cactus densities remained stable in the control plot during both years; however, in the treatment plot, the twistspine prickly pear density (*Opuntia macorhiza*) was especially hard hit by the herbicide treatment (Table 2-4). Twistspine prickly pear density declines were statistically significant, dropping from 1.09 plants/m^2 in summer 1997 to only 0.26 plants/m^2 in summer 1998 (Friedman 2-Way ANOVA by Ranks, $X^2 = 5$, $df = 1$; Table 2-4). Numerically, declines in the density of the hedgehog cactus (*Echinocereus viridiflora*) were also observed in the treatment plot, however they were not found to be statistically significant (Friedman 2-Way ANOVA by Ranks, $X^2 = 3.2$, $df = 1$; Table 2-4).

Foliar cover results, by species, for the control and treatment plots for each sampling session are presented in Table 2-5. Total foliar cover increased by similar amounts in

both the control and treatment plots over the two years, 17.4 and 15.2 percent, respectively (Table 2-5). Absolute native and non-native cover also showed parallel increases in both the control and treatment plots (Table 2-5). However, non-native cover increased by much larger amounts than native cover; most of this difference resulted from increases in the cover of the non-native graminoid, Canada bluegrass (*Poa compressa*; Table 2-5). Absolute forb cover was approximately the same in the control and treatment plots at the beginning of the study, 10.6 and 12.2 percent, respectively. Absolute forb cover remained stable in the control plot during the two years of monitoring (Table 2-5). In the treatment plot, however, absolute forb cover steadily declined after the herbicide treatment, decreasing from 12.2 to 3.8 percent (Table 2-5). Absolute graminoid cover increased in both the control and treatment plots over the same period, to 18 and 23.6 percent, respectively (Table 2-5). Cool-season graminoid species accounted for most of this increase, increasing by 15.2 and 18 percent in the control and treatment plots, respectively (Table 2-5). Warm-season grasses increased by only 2.8 and 5.6 percent in the control and treatment plots, respectively (Table 2-5). Examination of the data also showed seasonal shifts in cover amounts for many of these groupings. Often, the results from spring sampling would increase by late summer, then decrease the following spring and increase again by summer.

Change in species composition was evaluated by examining changes in the proportions of cover values for different species or groups of species. Relative forb and graminoid cover remained stable in the control plot over the two years, showing only a slight shift at the end of the second summer (Table 2-5). In the treatment plot, however, the proportions of forb to graminoid cover changed, indicating a shift in community structure (Table 2-5). Relative cover of forbs in the treatment plot declined steadily after the herbicide treatment (from 18.4 to 4.7 percent; Table 5), while graminoids increased (from 81.6 to 95.3 percent; Table 2-5). Evaluation of forb frequencies revealed no significant change in overall forb frequencies, nor in native or non-native forb frequencies. However, on a per species basis, diffuse knapweed, Fendler sandwort (*Arenaria fendleri*), and twistspine prickly pear, showed statistically significant declines in frequency (Table 2-2).

2.5 Discussion

This study examined the effect of Tordon 22K on diffuse knapweed and other species found in the xeric tallgrass prairie on the Site. The herbicide Tordon 22K was effective at controlling diffuse knapweed one year after spraying. Diffuse knapweed frequency was reduced significantly by treatment. Variability in the knapweed density data precluded attributing the loss of density in the treatment plot to the herbicide treatment alone. However, visual observations of the treatment plot revealed no adult knapweed plants present one year after treatment. In the control plot, adult knapweed plants were visually abundant, and knapweed frequency was not significantly changed. Continued monitoring of these plots will help determine how long the herbicide application controls the knapweed under site-specific conditions.

While the observed effect on diffuse knapweed was desired, there was some impact to other species in the plant community. Four specific effects were observed:

- First, forbs other than diffuse knapweed were affected. Overall forb cover decreased as a result of the herbicide treatment. Non-native forb cover was completely eliminated from the treatment plot, but a large decline in native forb cover also occurred. Although forb cover decreased, no significant loss of forb frequency occurred. This indicated that although there was a loss of forb cover, these species were not eliminated from the grassland. Associated with the loss of absolute and relative forb cover in the treatment plot was an increase in the amount of relative graminoid cover. The increase in relative graminoid cover in the treatment plot was attributable to the loss of relative forb cover. However, no actual increase in the amount of absolute graminoid cover (attributable to the herbicide application) was observed, because similar absolute graminoid cover increases were observed in both the control and treatment plots.

- Second, the herbicide treatment caused a loss of cactus density. The twistspine prickly pear cactus density was reduced by nearly 75 percent in the treatment plot.

- Third, species diversity declined significantly in the treatment plot, while remaining stable in the control plot.

- And fourth, overall plot species richness declined initially in the treatment plot. However, by the end of the second year, most of the initial decline had been recovered.

The long-term implications of these impacts to the plant community, and the time required for natural recovery at the Site, are uncertain.

Data from the Site are consistent with the data from other studies that have shown a decline of species diversity and a loss of forb and weed cover after spraying with Tordon 22K. The Site data does not show the corresponding large increase in graminoid cover that was observed at other locations, however. Rice and Toney (1996) reported decreases in forb cover due to herbicide treatments on native prairie in Montana. They reported that these responses were transitory, however, and that forb values returned to pre-treatment levels after about three years. Rice et al. (1997) found that species diversity also declined after spraying with Tordon 22K, but recovered after 2–3 years. Both of these studies also indicated that, as a result of lost weed and forb cover (i.e., reduced competition), the graminoid component of the community responded vigorously. In the Lolo National Forest in Montana, Henry (1998) reported that two years after spraying with Tordon 22K, a mountain grassland community had a 95 percent reduction in weed biomass and an 86 percent decrease in forb biomass. Associated with this was a 714 percent increase in grass biomass.

At the Site, although increases in overall graminoid cover (absolute graminoid cover) did occur in the treatment plot, they were not attributable to the herbicide treatments, because similar increases occurred in the control plot as well. The increases in relative graminoid cover are explained by the loss of relative forb cover: because this measure must add up to 100 percent, a change in one directly affects the other. Why increases in absolute graminoid cover were not shown in the Site treatment plot data is unknown. Perhaps biomass sampling would have been a more sensitive measure to use for evaluation. This method was used in some of the studies mentioned above, but time and personnel constraints prohibited its use in this study. General qualitative observations of the impact of the herbicide treatments at the study plots and other locations on the Site would suggest, however, that the graminoid species did respond positively to the herbicide treatment. At many locations, the vigor, robustness, and flowering of the graminoid species in sprayed areas was visually obvious and in stark contrast to adjacent unsprayed areas. So although the quantitative data do not indicate a measurable change in graminoid response, qualitative observations do suggest that the graminoid species responded favorably to the reduced competition from weeds and other forbs. (See Section 1 for more discussion of the qualitative effects of herbicide treatments on grasslands on the Site).

The general conclusions from this study thus far are that diffuse knapweed was controlled in the treatment plot, and that only minimal impact to the native plant community was observed. Based on these results, the use of Tordon 22K should be continued for control of diffuse knapweed and resource management on the Site. Although some minor negative impacts were manifested initially, if the longer-term responses at the Site are similar to responses documented elsewhere, the prudent use of Tordon 22K can provide a valuable tool for assisting in the control of diffuse knapweed and management of the grasslands at the Site.

2.6 References

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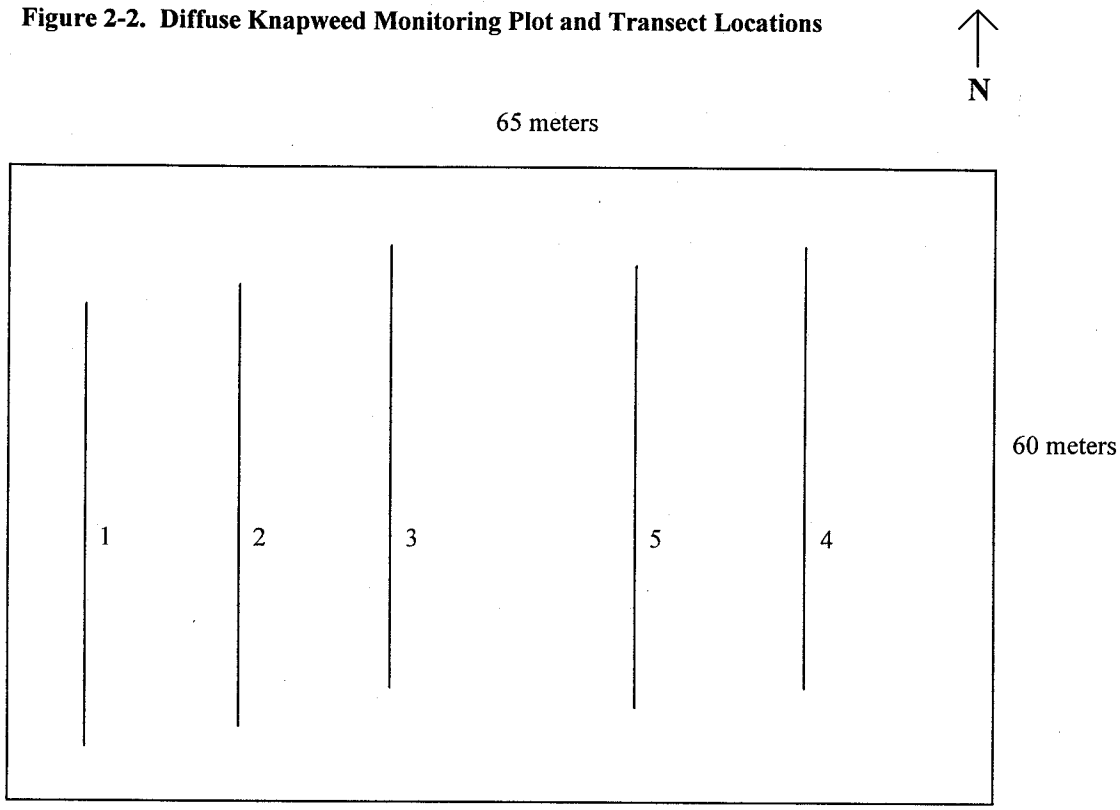
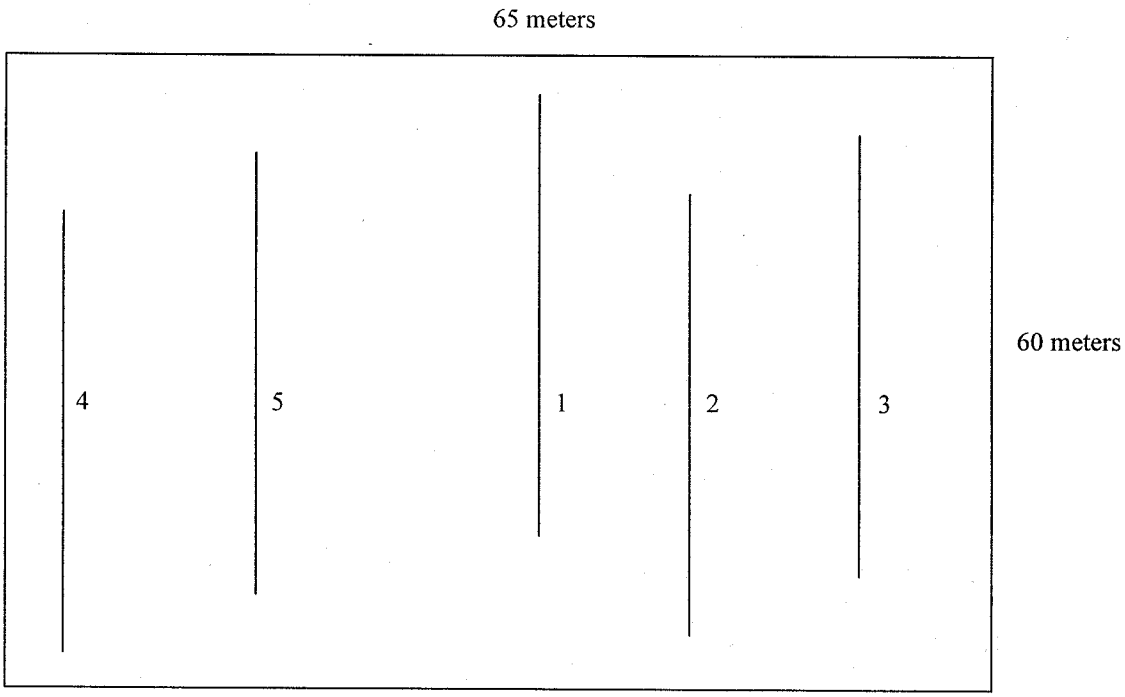
Figure 2-2. Diffuse Knapweed Monitoring Plot and Transect Locations



Control Plot - DKC



Treatment Plot - DKT

Table 2-1. 1997 and 1998 diffuse knapweed herbicide monitoring plot densities

	Control	Treatment
Spring 1997	5.56 [a]	22.96 [a]
Summer 1997	3.64	6.12
Spring 1998	14.52	2.24
Summer 1998	1.72 [b]	1.12 [c]

Note: Values are densities (# plants/m^2)
Different letters represent significant differences (P = 0.05).

Table 2-2. 1997–1998 diffuse knapweed herbicide monitoring plot plant frequency summary

Family	Scientific Name	Speccode	Form	Native	Cool/ Warm Season	Site DKC - Control				Site DKT - Treatment			
						Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	F	Y		92		92	48	80	8	92	72
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	ASST1	F	Y		8	4						
ASCLEPIADACEAE	Asclepias viridiflora Raf.	ASVI1	F	Y		8	12	8	8				
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	F	Y		8	8	8	4				
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	F	Y		72	68	64	68	32	32	12	16
ASTERACEAE	Arnica fulgens Pursh.	ARFU1	F	Y		36	16	40	28	16	12	16	12
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	F	Y						4	4	4	
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	F	Y		68	68	68	64	36	36	32	16
ASTERACEAE	Aster porteri Gray	ASPO1	F	Y		76	76	84	76	80	84	80	72
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	F	N		76	76	76	60	80	60	52	20
ASTERACEAE	Chrysopsis fulcrata Greene	CHFU1	F	Y		8	8	8	4				
ASTERACEAE	Erigeron divergens T. & G.	ERDI1	F	Y						4			
ASTERACEAE	Erigeron flagellaris A. Gray	ERFL1	F	Y		4	4	4	4		4		
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	F	Y		12	4	8	4	8	4		4
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	GRSQ1	F	Y		56	48	68	40	20	16	12	
ASTERACEAE	Lactuca serriola L.	LASE1	F	N		12	12	28	8	20	8		
ASTERACEAE	Liatris punctata Hook.	LIPU1	F	Y		16	20	20	28	20	20	28	20
ASTERACEAE	Microseris cuspidata (Pursh.) Sch. Bip.	MICU1	F	Y		4		8		4		4	
ASTERACEAE	Scorzonera laciniata L.	SCLA1	F	N						4	4		
ASTERACEAE	Senecio plattensis Nutt.	SEPL1	F	Y		8	4	4		24	12	20	4
ASTERACEAE	Solidago mollis Bart.	SOMO1	F	Y		24	24	28	28				
ASTERACEAE	Taraxacum officinale Weber	TAOF1	F	N						4			
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	F	N		8	16	44	32	12	8		4
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	F	Y		4	4						
BORAGINACEAE	Mertensia lanceolata (Pursh.) A. DC.	MELA1	F	Y				4		4			
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N		28	20	12	16	4	4	16	4
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	F	Y						4			
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	F	N						4			
BRASSICACEAE	Camelina microcarpa Andrz. ex DC.	CAMI1	F	N		8							
BRASSICACEAE	Draba reptans (Lam.) Fern.	DRRE1	F	Y		16	4	4					4
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	ERCA2	F	Y		8	4	8		4			
BRASSICACEAE	Lepidium campestre (L.) R. Br.	LECA1	F	N			4	4	4	16	8	16	12
BRASSICACEAE	Lepidium densiflorum Schrad.	LEDE1	F	Y		4	4			12	8		
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	F	Y		8	8	12	16	12	16	12	12
CACTACEAE	Echinocereus viridiflorus Engelm.	ECVI1	C	Y		16	16	20	8	40	36	28	32
CACTACEAE	Opuntia macrorhiza Engelm.	OPMA1	C	Y		40	40	40	40	64	76	20	32
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	F	Y		32	44	20	44	52	40	28	28
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	F	Y						12	12	4	4
CARYOPHYLLACEAE	Silene antirrhina L.	SIAN1	F	Y		8	8	4		4		28	
CLUSIACEAE	Hypericum perforatum L.	HYPE1	F	N		52	64	44	16	16	8	72	12
COMMELINACEAE	Tradescantia occidentalis (Britt.) Smyth	TROC1	F	Y						4		4	
CYPERACEAE	Carex heliophila Mack.	CAHE1	G	Y	C	64	72	72	68	32	40	52	40
FABACEAE	Dalea purpurea Vent	DAPU1	F	Y		8	4	8	8	12	12	8	12
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	F	Y		32	40	44	36	20	8	16	16
JUNCACEAE	Juncus interior Wieg.	JUIN1	G	Y			4		4				4
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	F	Y		20	4	8		36	12	24	12

Table 2-2. (cont.)

Family	Scientific Name	Speccode	Form	Native	Cool/ Warm Season	Site DKC - Control				Site DKT - Treatment			
						Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	F	Y				4					
OROBANCHACEAE	Orobanche fasciculata Nutt.	ORFA1	F	Y							4	4	4
POACEAE	Andropogon gerardii Vitman	ANGE1	G	Y	W	88	88	88	84	68	64	64	64
POACEAE	Andropogon scoparius Michx.	ANSC1	G	Y	W	28	28	20	24	20	40	20	20
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W	36	40	28	28	8	32	28	12
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W		16	8	8	16	28	16	24
POACEAE	Bouteloua hirsuta Lag	BOHI1	G	Y	W	16	16	16	28	16			4
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	G	N	C			4	4	36	32	32	36
POACEAE	Bromus tectorum L.	BRTE1	G	N	C					8	4	12	8
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C	40	32	28	20	36	20	28	20
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W	100	100	96	100	96	96	92	92
POACEAE	Poa compressa L.	POCO1	G	N	C	92	100	100	100	96	96	100	100
POACEAE	Poa pratensis L.	POPR1	G	N	C	8	8	8	8			4	4
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	G	Y	C	8	12						
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	G	Y	W		4	4	4				4
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	G	Y	W	20	20	20	24				
POACEAE	Stipa comata Trin. & Rupr.	STCO1	G	Y	C				4				
POLEMONIACEAE	Collomia linearis Nutt.	COLI1	F	Y						4		4	4
POLYGONACEAE	Polygonum ramosissimum Michx.	PORA1	F	Y					8			4	8
POLYGONACEAE	Rumex crispus L.	RUCR1	F	N						4			
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	F	Y			4	4					
SCROPHULARIACEAE	Penstemon virens Penn.	PEVI1	F	Y		4		4	4	16		28	12
SCROPHULARIACEAE	Veronica peregrina L. var. xalapensis (H. B. K.) St. John & Warren	VEPE1	F	Y				4				72	32

Note: Frequency values are percentages (n = 25).

Table 2-3. 1997 and 1998 diffuse knapweed herbicide monitoring plot species richness summary

Family	Scientific Name	Speccode	Native	DKC - Control				DKT - Treatment			
				Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
APIACEAE	Lomatium orientale Coult. & Rose	LOOR1	Y	X	X	X	X	X	X	X	X
ASCLEPIADACEAE	Asclepias stenophylla A. Gray	ASST1	Y	X	X	X	X	X			X
ASCLEPIADACEAE	Asclepias viridiflora Raf.	ASVI1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Ambrosia psilostachya DC.	AMPS1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Antennaria parvifolia Nutt.	ANPA1	Y	X	X	X		X	X	X	X
ASTERACEAE	Arnica fulgens Pursh.	ARFU1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	Y	X	X		X	X	X	X	
ASTERACEAE	Artemisia frigida Willd.	ARFR1	Y					X			
ASTERACEAE	Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Aster porteri Gray	ASPO1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	N	X	X	X	X	X			
ASTERACEAE	Centaurea diffusa Lam.	CEDI1	N	X	X	X	X	X	X	X	X
ASTERACEAE	Chrysopsis fulcrata Greene	CHFU1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Chrysopsis villosa Pursh.	CHVI1	Y			X	X			X	X
ASTERACEAE	Cirsium arvense (L.) Scop.	CIAR1	N					X		X	
ASTERACEAE	Erigeron divergens T. & G.	ERDI1	Y				X	X	X		X
ASTERACEAE	Erigeron flagellaris A. Gray	ERFL1	Y	X	X	X	X	X	X	X	
ASTERACEAE	Gaillardia aristata Pursh.	GAAR1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Grindelia squarrosa (Pursh.) Dun.	GRSQ1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Lactuca serriola L.	LASE1	N	X	X	X	X	X	X		X
ASTERACEAE	Liatris punctata Hook.	LIPU1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Microseris cuspidata (Pursh.) Sch. Bip.	MICU1	Y	X		X		X		X	
ASTERACEAE	Scorzonera laciniata L.	SCLA1	N	X	X	X		X	X		
ASTERACEAE	Senecio plattensis Nutt.	SEPL1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Senecio spartioides T. & G.	SESP1	Y						X		X
ASTERACEAE	Solidago mollis Bart.	SOMO1	Y	X	X	X	X	X	X	X	X
ASTERACEAE	Solidago rigida L.	SORI1	Y		X	X	X				
ASTERACEAE	Taraxacum officinale Weber	TAOF1	N	X	X	X	X	X	X	X	X
ASTERACEAE	Tragopogon dubius Scop.	TRDU1	N	X	X	X	X	X	X	X	X
BORAGINACEAE	Lithospermum incisum Lehm.	LIIN1	Y	X	X	X					
BORAGINACEAE	Mertensia lanceolata (Pursh.) A. DC.	MELA1	Y			X		X			
BRASSICACEAE	Alyssum alyssoides (L.) L.	ALAL1	N			X		X			
BRASSICACEAE	Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	N	X	X	X	X	X	X	X	X
BRASSICACEAE	Arabis hirsuta (L.) Scop. var. pynocarpa (Hopkins) Rollins	ARHI1	Y			X	X	X	X		
BRASSICACEAE	Barbarea vulgaris R. Br.	BAVU1	N					X	X	X	
BRASSICACEAE	Camelina microcarpa Andrz. ex DC.	CAMI1	N	X	X	X	X	X		X	X
BRASSICACEAE	Draba reptans (Lam.) Fern.	DRRE1	Y	X	X	X					X
BRASSICACEAE	Erysimum capitatum (Nutt.) DC.	ERCA2	Y	X	X	X	X	X	X	X	X
BRASSICACEAE	Lepidium campestre (L.) R. Br.	LECA1	N	X	X	X	X	X	X	X	X
BRASSICACEAE	Lepidium densiflorum Schrad.	LEDE1	Y	X	X			X	X	X	X
BRASSICACEAE	Lesquerella montana (A. Gray) Wats.	LEMO1	Y	X	X	X	X	X	X	X	X
BRASSICACEAE	Sisymbrium altissimum L.	SIAL1	N	X	X					X	

Table 2-3. (Cont.)

Family	Scientific Name	Speccode	Native	DKC - Control				DKT - Treatment			
				Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
CACTACEAE	Coryphantha missouriensis (Sweet) Britt. & Rose	COMI1	Y	X				X			
CACTACEAE	Echinocereus viridiflorus Engelm.	ECVI1	Y	X	X	X	X	X	X	X	X
CACTACEAE	Opuntia macrorhiza Engelm.	OPMA1	Y	X	X	X	X	X	X	X	X
CARYOPHYLLACEAE	Arenaria fendleri A. Gray	ARFE2	Y	X	X	X	X	X	X	X	X
CARYOPHYLLACEAE	Paronychia jamesii T. & G.	PAJA1	Y	X			X	X	X	X	X
CARYOPHYLLACEAE	Silene antirrhina L.	SIAN1	Y	X	X	X		X	X	X	X
CLUSIACEAE	Hypericum perforatum L.	HYPE1	N	X	X	X	X	X	X	X	X
COMMELINACEAE	Tradescantia occidentalis (Britt.) Smyth	TROC1	Y	X				X		X	X
CRASSULACEAE	Sedum lanceolatum Torr.	SELA1	Y					X	X	X	X
CYPERACEAE	Carex heliophila Mack.	CAHE1	Y	X	X	X	X	X	X	X	X
CYPERACEAE	Eleocharis compressa Sulliv.	ELCO1	Y	X	X	X	X	X	X	X	X
FABACEAE	Dalea purpurea Vent	DAPU1	Y	X	X	X	X	X	X	X	X
FABACEAE	Medicago lupulina L.	MELU1	N					X			
FABACEAE	Oxytropis lambertii Pursh.	OXLA1	Y	X							
FABACEAE	Psoralea tenuiflora Pursh.	PSTE1	Y	X	X	X	X	X	X	X	X
HYDROPHYLLACEAE	Phacelia heterophylla Pursh.	PHHE1	Y						X	X	X
JUNCACEAE	Juncus interior Wieg.	JUIN1	Y		X	X	X			X	X
LAMIACEAE	Hedeoma hispidum Pursh.	HEHI1	Y							X	
LILIACEAE	Allium textile A. Nels. & Macbr.	ALTE1	Y	X	X	X	X	X	X	X	X
LILIACEAE	Leucocrinum montanum Nutt.	LEMO2	Y	X		X					
ONAGRACEAE	Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	Y	X	X	X	X				
OROBANCHACEAE	Orobanche fasciculata Nutt.	ORFA1	Y	X					X	X	X
PLANTAGINACE	Plantago lanceolata L.	PLLA1	N	X	X	X	X	X	X	X	X
PLANTAGINACE	Plantago patagonica Jacq.	PLPA1	Y					X			
POACEAE	Agropyron smithii Rydb.	AGSM1	Y	X						X	
POACEAE	Andropogon gerardii Vitman	ANGE1	Y	X	X	X	X	X	X	X	X
POACEAE	Andropogon scoparius Michx.	ANSC1	Y	X	X	X	X	X	X	X	X
POACEAE	Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	Y		X						
POACEAE	Bouteloua curtipendula (Michx.) Torr.	BOCU1	Y	X	X	X	X	X	X	X	X
POACEAE	Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	Y	X	X	X	X	X	X	X	X
POACEAE	Bouteloua hirsuta Lag	BOHI1	Y	X	X	X	X	X	X	X	X
POACEAE	Bromus inermis Leyss. ssp. inermis	BRIN1	N	X	X	X	X				
POACEAE	Bromus japonicus Thunb. ex Murr.	BRJA1	N	X	X	X	X	X	X	X	X
POACEAE	Bromus tectorum L.	BRTE1	N					X	X	X	X
POACEAE	Buchloe dactyloides (Nutt.) Engelm.	BUDA1	Y					X	X		X
POACEAE	Koeleria pyramidata (Lam.) Beauv.	KOPY1	Y	X	X	X	X	X	X	X	X
POACEAE	Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	Y	X	X	X	X	X	X	X	X
POACEAE	Muhlenbergia wrightii Vasey	MUWR1	Y							X	X
POACEAE	Poa compressa L.	POCO1	N	X	X	X	X	X	X	X	X
POACEAE	Poa pratensis L.	POPR1	N	X	X	X	X	X	X	X	X
POACEAE	Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	Y	X	X		X	X	X		X
POACEAE	Sorghastrum nutans (L.) Nash	SONU1	Y		X	X	X		X	X	X
POACEAE	Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	Y	X	X	X	X	X	X	X	X
POACEAE	Stipa comata Trin. & Rupr.	STCO1	Y				X			X	

Table 2-3. -(cont.)

Family	Scientific Name	Speccode	Native	DKC - Control				DKT - Treatment			
				Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
POLEMONIACEAE	Collomia linearis Nutt.	COLI1	Y					X		X	X
POLYGONACEAE	Eriogonum alatum Torr.	ERAL1	Y			X	X	X	X	X	X
POLYGONACEAE	Polygonum convolvulus L.	POCO2	N			X					
POLYGONACEAE	Polygonum ramosissimum Michx.	PORA1	Y			X	X			X	X
POLYGONACEAE	Rumex crispus L.	RUCR1	N					X		X	X
PORTULACACEAE	Talinum parviflorum Nutt.	TAPA1	Y		X	X	X	X			
ROSACEAE	Potentilla gracilis Dougl. ex Hook. var. glabrata (Lehm.) C. L. Hitchc.	POGR1	Y					X			
ROSACEAE	Prunus virginiana L. var. melanocarpa (A. Nels.) Sarg.	PRVI1	Y	X	X	X	X				
SCROPHULARIACEAE	Penstemon virens Penn.	PEVI1	Y	X	X	X	X	X	X	X	X
SCROPHULARIACEAE	Verbascum blattaria L.	VEBL1	N	X	X	X	X				
SCROPHULARIACEAE	Veronica peregrina L. var. xalapensis (H. B. K.) St. John & Warren	VEPE1	Y			X	X			X	X

Table 2-4. 1997 and 1998 diffuse knapweed herbicide monitoring plot data summary

Variables	DKC - Control				DKT - Treatment			
	Spring 97	Summer 97	Spring 98	Summer 98	Spring 97	Summer 97	Spring 98	Summer 98
Species Richness								
# plant families	18.0	18.0	19.0	18.0	20.0	17.0	21.0	20.0
# species	68.0	65.0	70.0	65.0	74.0	62.0	70.0	68.0
% natives	75.0	74.0	74.0	77.0	73.0	77.0	77.0	79.0
Mean # species/quadrat	13.8	12.8	14.0	12.1	12.2	10.1	11.9	9.1
Mean Percent Cover								
Total basal vegetation cover	10.8	8.0	11.2	9.2	10.8	10.2	10.2	8.8
Rock cover	12.8	12.0	10.2	10.8	19.8	17.4	18.2	17.2
Bare ground cover	11.6	4.0	3.0	2.2	9.0	5.4	2.6	3.0
Litter cover	64.8	76.0	75.6	77.8	60.4	67.0	69.0	71.0
Weed Densities (mean # stems/m^2)								
Diffuse knapweed	5.6	3.6	14.5	1.7	23.0	6.1	2.2	1.1
Curly-top gumweed	1.7	1.3	7.4	1.3	1.4	1.2	0.7	0.0
St. John's-wort	0.8	1.3	1.0	0.3	0.6	0.3	2.7	0.2
Weed Frequencies (%)								
Diffuse knapweed	76.0	76.0	76.0	60.0	80.0	60.0	52.0	20.0
Curly-top gumweed	56.0	48.0	68.0	40.0	20.0	16.0	12.0	0.0
St. John's-wort	52.0	64.0	44.0	16.0	16.0	8.0	72.0	12.0
Cactus Densities (mean # stems/m^2)								
Twistspine prickly pear cactus	0.62	0.65	0.54	0.65	0.79	1.09	0.24	0.26
Hedgehog cactus	0.06	0.05	0.05	0.06	0.20	0.22	0.14	0.13

Table 2-5. 1997 and 1998 diffuse knapweed herbicide monitoring plot foliar cover data summary

Scientific Name	Speccode	Form	Native	Cool/ Warm Season	Site DKC - Control											
					Frequency (%)				Absolute Foliar Cover (%)				Relative Foliar Cover (%)			
					Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
Centaurea diffusa Lam.	CEDI1	F	N		100	100	40	80	2.6	4.8	0.4	1.0	3.8	6.1	0.5	1.2
Tragopogon dubius Scop.	TRDU1	F	N		40	20	60		0.4	0.2	0.6		0.6	0.3	0.8	
Lepidium campestre (L.) R. Br.	LECA1	F	N		20	20	20	20	0.4	0.2	0.2	0.2	0.6	0.3	0.3	0.2
Plantago lanceolata L.	PLLA1	F	N													
Camelina microcarpa Andrz. ex DC.	CAMI1	F	N					20				0.2				0.2
Hypericum perforatum L.	HYPE1	F	N			20				0.2				0.3		
Aster porteri Gray	ASPO1	F	Y		100	100	100	100	2.6	2.0	5.4	4.6	3.8	2.5	7.1	5.4
Ambrosia psilostachya DC.	AMPS1	F	Y		60	60	100	80	1.2	0.6	1.2	1.4	1.8	0.8	1.6	1.6
Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	F	Y		100	20	40	40	1.0	0.2	0.6	0.4	1.5	0.3	0.8	0.5
Psoralea tenuiflora Pursh.	PSTE1	F	Y		40	80	40	80	0.8	1.4	0.8	1.6	1.2	1.8	1.1	1.9
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	F	Y		40	80		20	0.4	1.2		0.2	0.6	1.5		0.2
Arenaria fendleri A. Gray	ARFE2	F	Y		40	20		40	0.4	0.2		0.4	0.6	0.3		0.5
Silene antirrhina L.	SIAN1	F	Y		20				0.2				0.3			
Liatris punctata Hook.	LIPU1	F	Y		20				0.2				0.3			
Arnica fulgens Pursh.	ARFU1	F	Y		20		20		0.2		0.2		0.3		0.3	
Asclepias stenophylla A. Gray	ASST1	F	Y		20	20			0.2	0.2			0.3	0.3		
Lesquerella montana (A. Gray) Wats.	LEMO1	F	Y													
Solidago mollis Bart.	SOMO1	F	Y													
Senecio plattensis Nutt.	SEPL1	F	Y													
Penstemon virens Penn.	PEVI1	F	Y													
Erigeron flagellaris A. Gray	ERFL1	F	Y			20	20			0.2	0.2			0.3	0.3	
Lomatium orientale Coult. & Rose	LOOR1	F	Y				60				0.8				1.1	
Lepidium densiflorum Schrad.	LEDE1	F	Y													
Gaillardia aristata Pursh.	GAAR1	F	Y			20				0.2				0.3		
Allium textile A. Nels. & Macbr.	ALTE1	F	Y													
Dalea purpurea Vent	DAPU1	F	Y			20	20			0.2	0.2			0.3	0.3	
Poa compressa L.	POCO1	G	N	C	100	100	100	100	17.2	20.8	25.4	31.8	25.2	26.4	33.5	37.1
Poa pratensis L.	POPR1	G	N	C	20	40	40	20	0.4	0.6	0.8	0.2	0.6	0.8	1.1	0.2
Bromus japonicus Thunb. ex Murr.	BRJA1	G	N	C												
Bromus tectorum L.	BRTE1	G	N	C												
Carex heliophila Mack.	CAHE1	G	Y	C	60	100	80	80	0.6	1.6	2.0	2.0	0.9	2.0	2.6	2.3
Eleocharis compressa Sulliv.	ELCO1	G	Y	C	20		20		0.4		0.2		0.6		0.3	
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C	40	20	20	20	0.4	0.2	0.2	0.2	0.6	0.3	0.3	0.2
Sitanion hystrix (Nutt.) Sm. var. brevifolium (Sm.) Hitchc.	SIHY1	G	Y	C		20				0.2				0.3		
Muhlenbergia montana (Nutt.) Hitchc.	MUMO1	G	Y	W	100	100	100	100	23.2	24.4	23.2	22.2	34.0	31.0	30.6	25.9
Andropogon gerardii Vitman	ANGE1	G	Y	W	100	100	100	100	8.6	11.0	7.2	12.2	12.6	14.0	9.5	14.3
Sporobolus heterolepis (A. Gray) A. Gray	SPHE1	G	Y	W	100	100	100	100	5.6	6.2	4.8	6.0	8.2	7.9	6.3	7.0
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W	40	80	40	80	0.4	1.8	1.0	0.8	0.6	2.3	1.3	0.9
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W	20			20	0.4			0.2	0.6			0.2
Andropogon scoparius Michx.	ANSC1	G	Y	W	20	20	20		0.4	0.2	0.2		0.6	0.3	0.3	
Bouteloua hirsuta Lag	BOHI1	G	Y	W			20				0.2				0.3	

Table 2-5. (cont.)

Scientific Name	Speccode	Form	Native	Cool/ Warm Season	Site DKT - Treatment											
					Frequency (%)				Absolute Foliar Cover (%)				Relative Foliar Cover (%)			
					Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998	Spring 1997	Summer 1997	Spring 1998	Summer 1998
Total foliar cover									66.4	71.0	75.4	81.6	100.0	100.0	100.0	100.0
Total forb cover									12.2	8.8	5.0	3.8	18.4	12.4	6.6	4.7
Total native forb cover									7.0	3.8	5.0	3.8	10.5	5.4	6.6	4.7
Total non-native forb cover									5.2	5.0	0.0	0.0	7.8	7.0	0.0	0.0
Total graminoid cover									54.2	62.2	70.4	77.8	81.6	87.6	93.4	95.3
Total native cover									44.8	50.8	47.0	47.2	67.5	71.5	62.3	57.8
Total non-native cover									21.6	20.2	28.4	34.4	32.5	28.5	37.7	42.2
Total warm season graminoid cover									36.8	45.6	41.2	42.4	55.4	64.2	54.6	52.0
Total cool season graminoid cover									17.4	16.6	29.2	35.4	26.2	23.4	38.7	43.4

Note: Absolute cover = Absolute foliar cover is the percentage of the number of hits on a species out of the total number of hits possible at a site (500).
Relative cover = Relative foliar cover is the number of hits on a species relative to the total number of all vegetative hits recorded per site (i.e., the percent of vegetative cover the species represented).
All cover values presented are means (n = 5).