

Botany Appendix

Appendix A – Lists of Species Recorded 2008-2012

Appendix B – Field Data Forms

Appendix C – Vegetation Characterization Report

Appendix A – Lists of Species Recorded 2008-2012

List of herbs recorded during 2009-2012 monitoring, including their common names. Shrubs and tree seedlings are also included. Species listed by habit and native status.

Species	Common name	Acronym
Native perennials		
<i>Achillea millefolium</i>	common yarrow	ACMI
<i>Ambrosia psilostachya</i>	Cuman ragweed	AMPS
<i>Artemisia carruthii</i>	Carruth sagewort	ARCA
<i>Aristida purpurea</i>	three-awn	ARPU
<i>Artemisia carruthii</i>	Carruth wormwood	ARTCAR
<i>Aristida divaricata</i>	poverty three-awn	ARDI
<i>Aster lanceolatum</i>		
(<i>Symphyotrichum lanceolatum</i> var. <i>hesperium</i> (A. Gray) G.L. Nesom)		
<i>Bouteloua curtipendula</i>	side-oats grama	BOCU
<i>Bouteloua gracilis</i>	blue grama	BOGR
<i>Brickellia floribunda</i>	showy brickellia	BRFL
<i>Coryphantha vivipara</i>	spiny star	COVI
<i>Cucurbita foetidissima</i>	buffalo-gourd	CUFO
<i>Cyperus esculentus</i>	Yellow nutsedge	CYSE
<i>Datura wrightii</i>	Wright jimsonweed	DAWR
<i>Elymus canadensis</i>	Canadian wildrye	ELCAN
<i>Elymus glaucus</i>	blue wildrye	ELGL
<i>Eleocharis parishii</i>	Parish spikerush	ELPAR
<i>Eragrostis intermedia</i>	plains lovegrass	ERIN
<i>Fallugia paradoxa</i>	Apache plume	FAPA
<i>Hordeum jubatum</i>	foxtail barley	HOJU
<i>Juncus nevadensis</i>	Sierra rush	JUNE
<i>Leptochloa dubia</i>	green sprangletop	LEDU
<i>Macharanthera canescens</i>	hoary-daisy	MACA
<i>Melampodium leucanthum</i>	plains blackfoot	MELE
<i>Mentzelia multiflora</i>	blazing-star	MEMU
<i>Muhlenbergia asperifolia</i>	stratchgrass	MUAS
<i>Muhlenbergia rigens</i>	deergrass	MURI
<i>Oenothera cespitosa</i>	tufted evening primrose	OECE
<i>Oenothera elata</i>	Hooker evening primrose	OEEL
<i>Pascopyrum smithii</i>	Western wheatgrass	PASM
<i>Sphaeralcea parviflora</i>	Arizona globemallow	SPPA
<i>Sporobolus contractus</i>	spike dropseed	SPCO
<i>Sporobolus cryptandrus</i>	sand dropseed	SPCR
<i>Sphaeralcea fendleri</i>	Fendler globe-mallow	SPFE
<i>Symphyotrichum lanceolatum</i> ssp. <i>herperium</i>	white panicle aster	SYLA
<i>Thymophylla pentachaeta</i>	five-needle pricklyleaf	THPE

List of herbs recorded during 2009-2012 monitoring, including their common names.
Shrubs and tree seedlings are also included. Species listed by habit and native status.

Species	Common name	Acronym
Non-native perennials		
<i>Cirsium vulgare</i>	bullthistle	CIVU
<i>Convolvulus arvensis</i>	bindweed	COAR
<i>Cynodon dactylon</i>	Bermunda grass	CYDA
<i>Dipsacus fullonum</i>	Fuller teasel	DIFU
<i>Festuca arundinacea</i>	meadow fescue	FEAR
<i>Grindelia nuda</i>	gumweed	GRNU
<i>Lepidium latifolium</i>	broadleaved pepperweed	LEDA
<i>Linaria dalmatica</i>	Yugoslavian toadflax	LIDA
<i>Melilotus officinalis</i>	sweet-clove	MEOF
<i>Polypogon viridis</i>	beardless rabbitsfoot grass	POVI
<i>Rumex crispus</i>	curly dock	RUCR
<i>Verbascum thapsus</i>	mullein	VETH
Native annuals and biennials		
<i>Ambrosia acanthicarpa</i>	annual burweed	AMAC
<i>Amaranthus fimbriatus</i>	fringed amaranth	AMFI
<i>Amaranthus palmeri</i>	Palmer pigweed	AMTO
<i>Aristida adscensionis</i>	sixweeks threeawn	ARAD
<i>Bahia dissecta</i>	yellow ragweed	BADI
<i>Bouteloua aristidoides</i>	needle grama	BOAR
<i>Chenopodium neomexicanum</i>	New Mexico goose-foot	CHNE
<i>Conyza canadensis</i>	Canadian horseweed	COCA
<i>Erigeron divergens</i>	spreading fleabane	ERDI
<i>Eriogonum polycladon</i>	sorrel buckwheat	ERPO
<i>Eragrostis mexicana</i>	Mexican lovegrass	ERME
<i>Euphorbia dentata</i>	toothed spurge	EUDA
<i>Gaura parviflora</i>	velvet-leaf gaura	GAPA
<i>Helianthus annuus</i>	sunflower	HEAN
<i>Heliomeris longifolia</i>	annual golden-eye	HELO
<i>Heterotheca psammophila</i>	camphor-weed	HEPS
<i>Hymenothrix loomisii</i>	Loomis ghost-daisy	HYLO
<i>Ipomoea coccinea</i>	scarlet morning-glory	IPCO
<i>Kallstroemia parviflora</i>	small-flowered caltrop,	KAPA
<i>Leptochloa fusca</i>	bearded sprangeltop	LEFU
<i>Leptochloa panicea*</i>	mucronate sprangeltop	LEPA
<i>Lupinus sparsiflorus</i>	Coulter lupine	LUSP
<i>Machaeranthera gracilis</i>	little yellow-aster	MAGR
<i>Machaeranthera tanacetifolia</i>	tansyleaf tansyaster	MATA
<i>Nama dichotomym</i>	shy nama	NADI
<i>Onopordum acanthium</i>	Scotch cottonthistle	ONAC
<i>Panicum capillare</i>	witchgrass	PACA
<i>Physalis pubescens</i>	hairy groundcherry	PHPU
<i>Polygonum lapathifolium</i>	curlytop knotweed	POLA

List of herbs recorded during 2009-2012 monitoring, including their common names. Shrubs and tree seedlings are also included. Species listed by habit and native status.

Species	Common name	Acronym
<i>Polanisia dodecandra</i>	western clammy-weed	POLDOD
<i>Salvia reflexa</i>	lanceleaf sage	SARE
<i>Veronica anagallis-aquatica</i> *	water speedwell	VEAN
<i>Veronica peregrina</i>	neckweed	VEPE
<i>Verbesina encelioides</i>		VERENC
Non-native annuals and biennials		
<i>Amaranthus blitoides</i>	mat amaranth	AMBL
<i>Brassica campestris</i>	field mustard	BRCA
<i>Bromus diandrus</i>	ripgut grass	BRDI
<i>Bromus japonicus</i>	Japanese brome	BRJA
<i>Centaurea stoebe</i>	spotted knapweed	CEST
<i>Chloris virgata</i> **	windmill grass	CHVI
<i>Cyperus esculentus</i>	yellow nutsedge	CYES
<i>Echinochloa crus-galli</i>	barnyard grass	ECCR
<i>Eragrostis cilianensis</i>	stinking lovegrass	ERCIL
<i>Kochia scoparia</i>	summer-cypress, kochia	KOSC
<i>Lactuca serriola</i>	prickly lettuce	LASE
<i>Polygonum aviculare</i>	prostrate knotweed	POAV
<i>Polypogon monspeliensis</i>	rabbitfoot grass	POMO
<i>Portulacca oleracea</i>	purslane	POOL
<i>Salsola tragus</i>	Russian-thistle	SATR
<i>Solanum rostratum</i>	buffalo-bur	SORO
<i>Sonchus oleraceus</i>	common sowthistle	SOOL
<i>Tribulus terrestris</i>	goat-heads, puncture-vine	TRTE
* perennial in some habitats, ** Native to the US according to the USDA but apparently introduced to waste places in our area (Kearny and Peebles)		

Vascular plants collected at Watson Woods Riparian Preserve in 2008-2012. All collections made by Marc Baker. Species new to the preserve are in bold.				
Species	Family	Collector's number	Date	Cocollector (s)
<i>Linum lewisii</i>	Linaceae	16923	19 May 2009	Michael Byrd
<i>Penstemon palmeri</i>	Scrophulariaceae	16924	19 May 2009	Michael Byrd
<i>Gaillardia pinnatifida</i>	Asteraceae	16732	6 October 2008	Iyla Baker
<i>Populus angustifolia</i>	Salicaceae	17121	10 June 2010	None
<i>Robinia pseudoacacia</i>	Fabaceae	17122	10 June 2010	None
<i>Arrenatherum elatius</i> ssp. <i>elatius</i>	Poaceae	17123	10 June 2010	None
<i>Hybanthus verticillatus</i>	Violaceae	17124	10 June 2010	None
<i>Chamaesyce albomarginata</i>	Euphorbiaceae	17125	10 June 2010	None
<i>Stephanomeria thurberi</i>	Asteraceae	17126	10 June 2010	None
<i>Hordeum pusillum</i>	Poaceae	17127	10 June 2010	None
<i>Prosopis velutina</i>	Fabaceae	17128	10 June 2010	None
<i>Apocynum cannabinum</i>	Apocynaceae	17129	10 June 2010	None
<i>Cryptantha cinerea</i>	Boraginaceae	17130	10 June 2010	None
<i>Vicia americana</i>	Fabaceae	17131	10 June 2010	None
<i>Calochortus ambiguus</i>	Liliaceae	17132	10 June 2010	None
<i>Lepidium latifolium</i>	Brassicaceae	17454	9 September 2011	Gregg Fell
<i>Chamaesyce serpyllifolia</i>	Euphorbiaceae	17455	9 September 2011	Gregg Fell
<i>Pectis prostrata</i>	Asteraceae	17614	20 September 2012	Kanin Routson
<i>Cyperus esculentus</i>	Cyperaceae	17615	20 September 2012	Kanin Routson
<i>Elymus canadensis</i>	Poaceae	17616	20 September 2012	Kanin Routson
<i>Amaranthus palmeri</i>	Amaranthaceae	17617	20 September 2012	Kanin Routson
<i>Symphyotrichum lanceolatum</i>	Asteraceae	17632	8 October 2012	None
<i>Sporobolus airoides</i>	Poaceae	17633	8 October 2012	Danielle, Finnley, and Iyla Baker
<i>Leptochloa dubia</i>	Poaceae	17634	8 October 2012	Danielle, Finnley, and Iyla Baker

beginning _____ mE _____ mN, ending _____ mE _____ Mn _____ NAD83 _____ Transect length _____ cm

Intercept data in **cm**. Gaps less than **10 centimeters** are ignored. Record layers for each species along the tape. Maximum height is measured directly over the tape; size classes: 1 = ≤ 0.5 m, 2 = ≤ 1.0 m, 3 = ≤ 2.0 m, 4 = ≤ 5.0 m, 5 = ≤ 10.0 m, 6 = >10.0 m. Pale gray columns for survivorship 2m wide belt transects. T = Total inds. for sp. L = No. live inds.

Date: 2009

Technicians: Marc Baker, Michael Byrd

[illegible]

	Sp	H	In	Ot	Sp	H	In	Ot	Sp	H	In	Ot	Sp	H	In	Ot	Sp	H	In	Ot	Sp	H	In	Ot	Sp	T	L	L
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Notes: S=SALAS, X=SAEX, E=SALAE, F=POFR, H=POHI

Field data form for the Watson Woods Restoration Project: Riparian line intercept transects, herbaceous layer
 DATE:

_____ beginning _____ mE _____ mN, ending _____ mE
 _____ mN

Herbaceous Species																							
Perennial Cover												Annual Cover											
T	Sp. 1	Cvr. 1	Sp. 2	Cvr. 2	Sp. 3	Cvr. 3	Sp. 4	Cvr. 4	Sp. 5	Cvr. 5		Sp. 1	Cvr. 1	Sp. 2	Cvr. 2	Sp. 3	Cvr. 3	Sp. 4	Cvr. 4	Sp. 5	Cvr. 5	Sp. 6	Cvr. 6
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Appendix C - Vegetation Characterization Report

Vegetation characterization of the Watson Woods Riparian Preserve, Prescott, Arizona



Part 3: A comparison of changes in estimates of foliar-height density and in species diversity since 1997 and 2005 and changes values of parameters from point-center-quarter sampling since 2005.

Marc Baker

**Final Report
Draft 1**

1 November 2012

Abstract

In fall 2012, vegetation within the Watson Woods Riparian Preserve, Prescott Arizona, was characterized by estimating foliar height distribution (FHD), cover of perennial and annual herbs, and density of trees and shrubs. In addition, vegetation associations were digitally mapped and a checklist of vascular plant taxa was made. The primary goal of the study was to compare estimates with those made in 1997 and 2005. Mean FHD among transects, as measured in meters, remained constant ($2.34 \text{ m}^3/\text{m}^2$) between fall 2005 and fall 2012. Although mean FHD, as measured in decimeters increased slightly in 2012 ($1.34 \text{ m}^3/\text{m}^2$ from $1.28 \text{ m}^3/\text{m}^2$), the increase was not statistically significant. Between 1997 and 2012, FHD increased markedly for six species:

- *Festuca arundinacea*, is an exotic perennial grass;
- *Salix exigua*, and *S. lasiolepis*, are desirable native shrubs;
- *Populus angustifolia*, *P. ×hinckleyana*, are desirable native trees; and *Ulmus pumila*, is an undesirable exotic and highly invasive tree.

There was slight but statistically insignificant increase in mean maximum height among all transects between 1997 (5.92m) and 2005 (7.59m) and between 2005 and 2012. Total absolute density of woody perennials more than doubled for riparian species between 2005 (204 individuals per ha) and 2012 (416.5 individuals per ha), and nearly doubled for non-riparian perennials (59.2 vs 92.2 individuals per ha). Estimates for average canopy cover increased between fall 2005 and fall 2012, with riparian species increasing from 25.4% in 2005 to 31.9% in 2012. Similarly, average canopy cover for non-riparian species jumped from 8.4% in 2005 to 20.4% in 2012. Specimens were made of approximately 15 previously undocumented taxa. Riparian woodland was the dominate vegetation type in 2012, representing a nearly 10% increase over fall 2005. There were notable increases in both ds of *Fallugia paradoxa* and *Chrysothamnus nauseosus* scrub. Areas of disturbed perennial and grassland both fell between 2005 and 2012. There were no significant areas of emergents or *Dipsacus fullonum* in 2012.

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Introduction

The Watson Woods Riparian Preserve is located toward the northeastern edge of Prescott, Arizona, just east of State Highway 89 (Fig 1). Its boundaries roughly parallel and include a section of Granite Creek between Watson Lake, to the north, and what was once the Whipple Military Reservation, to the south (now owned by the Yavapai Nation and the Department of Veterans Affairs Medical Center). The 125 acre preserve is comprised of a flood plain dissected by anastomosing channels of the intermittent Granite Creek. The alluvium of the flood plain is composed mainly of granitic and basaltic silts, sands, and gravels. Some sandstone has been imported as fill for the now abandoned railroad. Although much of the substrate retains evidence of disturbance from historical mining of sand and gravel, some has remained stable long enough to allow young wooded and perennial grassland areas to form as a sparse mosaic throughout the flood plain. There is a small pond at the north end of the Preserve that often dries up during the late spring-early summer. A small portion of the Preserve along the floodplain consists of dry slopes supporting disclimax grassland, chaparral, and juniper-piñon pine woodland. In June of 1997, a large fire occurred within the largest portion of woodland and many of the larger trunks were killed. Another fire in 2005 burned approximately three acres of the same area.

In 1997/1998, the vegetation within the Preserve was characterized by estimating foliar height density (FHD, also referred to as foliar height distribution and foliar height diversity) for perennial species, estimating percent cover for annual species, mapping plant associations, and cataloguing vascular plant taxa. It was the intent of the present study to repeat the 1997/1998 sampling in order to record changes in vegetation and introduce sampling by Point-Center-Quarter (PCQ) in order to estimate additional parameters, such as tree and shrub density, and to compare the advantages and disadvantages of PCQ with those of FHD.

Methods

Vegetation sampling

The primary objectives of the 2012 vegetation sampling were to estimate changes since 2005 for foliar-height density (FHD) of perennial vegetation and cover of annuals along the FHD transects. Because the Point Center Quarter Method (PCQ) was introduced in 2005, objectives of this study also included estimates in changes since that time in values of parameters associated with PCQ samples, which included densities of shrubs and trees; percent canopy cover; and cover of annuals and perennial herbs.

Transect method

Vegetation sampling using transects was conducted within one month of the period of the highest average rainfall for central Arizona (Bulk 1985). In September of 1997 twenty-six 40m transects were established, including one along the creek channel near the northwestern corner of the preserve (Table 1). In September 2005 the sampling was repeated with the exception of one transect that had been buried by construction of the Prescott Lakes Parkway Bridge and another that had been inundated by the swelling of the pond at the north end to the Preserve. The latter was relocated as a straight transect to the east-southeast of the pond. Foliar height density was estimated as the total number hits, by taxon, at each of 20 points along each transect. This parameter is very similar to vegetation volume. The method is a modified version of the vertical-line intercept of MacArthur & Horn (1969) and vegetation volume of Mills et al. (1991). FHD estimation was chosen over the line intercept method because the latter estimates vegetation cover only and does not account for vegetation height or structure within the canopy. Both Total FHD and total vegetation volume (the sum total of cubic decimeters within the site boundaries that contain vegetation) correlate closely with breeding bird densities (Mills et al. 1991), which is a primary management concern for the preserve. For the purposes of this report, FHD is treated synonymously with VV and the FHD data are presented as m^3/m^2 . For example, if a ground cover was sampled at every point along a transect within the first meter of the vertical pole, then it would constitute $1 \text{ m}^3/\text{m}^2$ (20 hits/ 20 points). If a tree was sampled at every point along a transect from meter one to meter three of the vertical pole, then it would constitute $3 \text{ m}^3/\text{m}^2$ (60 hits/ 20 points). Data measured by decimeters are simply more accurate and are nearly always less than those measured to the nearest meter. For example, if the ground cover from the first example reached only .5m tall on the average, then its FHD or VV as measured in dm would be only $0.5 \text{ m}^3/\text{m}^2$ (100 hits/10 hits per m/ 20 points).

Transects were relocated using the seven reference points established in 1997; four at well sites and three at fence posts. All reference points were photographed in both 1997 and in 2005 (Appendix 2). In 1997, starting points for all transects were fixed by measuring their distance and direction from a specified reference point (Table 1). In 2005, Universal Transverse Mercator (UTM) coordinates using the zone 12, NAD27 grid (datum of the most recent USGS 7.5'

topographic quadrangle) were recorded to the nearest 5m for all of the reference points and transect starting points. In 2012, FHD transect start, middle, and end points were recorded to within 1m using decimal degrees, WGS84 (Appendix 6), which obsoleted the reference points. Most transects continued in the same direction along the determined heading (from reference point) for 20m and then proceed perpendicular for another 20m to the right. Each starting, pivot, and ending point was marked in 1997 with rebar. Rebar was not placed in water-saturated soil or within stream bottoms. Two transects continued without the 90° bend for 40m along the eastern edge (toe zone) of the bank of Granite Creek.

Five reference reach transects were non-randomly located and sampled during spring 2006 within the portions of the Preserve that possessed, based on 1997 data, the apparent oldest, highest density, and diversity of native species; lowest density and diversity of exotic species; and most apparent stability in terms of geomorphic characters (Moody 2006). Two transects were located along toe zone of Granite Creek, which affectively sampled vegetation within the canopy from the toe and bank zones. A single transect was located within the low to high overbank zone (suitable habitat was lacking for a second transect in this zone) and two transects were located within the transition zone (upland habitat).

Foliar height-density

Measurements were taken every two meters along the transect beginning with meter two, where a nine meter graduated collapsible pole was set vertically and living perennial vegetation within 1dm of the pole was recorded, by species, in height increments of 1m (see field data form 1, Appendix 1). Thus for each 40m transect, FHD was sampled within twenty cylinders with a radius of 1dm. FHD was calculated for each transect, by taxon, as the number of hits of each taxon divided by the number of transect points (20). Total FHD for each taxon was simply the sum of FHD hits for each taxon of all transects. Total FHD for all taxa, by transect, was the sum of all hits along each transect, and estimated average total FHD for the Preserve was the average of Total FHD, by transect.

Table 1. Locations of transects with respect to nearest reference point . Decimal degree WGS84 and UTM (Zone 12, UTM, NAD83) coordinates data provided in Appendix X.

Transect Number	Reference Point	Bearing (east of magnetic north)	Distance from Reference Point
1	1	230°	146m
2	1	295°	38m
3	2	190°	46m
4	2	190°	46m
5	3	070°	120m
6	3	315°	106m
7	3	290°	79m
8	3	225°	130m
9	4	030°	90m
10	4	275°	48m
11	4	195°	138m
12	4	130°	50m
13	5	120°	22m
14	5	280°	109m
15	5	030°	219m
16	5	210°	63m
17	5	350°	123m
18	6	110°	72m
19	6	185°	153m
20	6	170°	231m
21	3	020°	135m
22	3	050°	146m
23	3	170°	122m
24	7	080°	128m
25	7	010°	183m
26	7	320°	47m

Percent cover of annuals

At each 2m point along each transect a 20cm by 50cm (0.1m²) Daubenmire Grid was laid on top of the herbaceous layer and the cover of annuals was estimated by counting the number of squares (cm²) occupied (field data form 1, Appendix 1). The cover was recorded as cover classes one through six 1= trace-5%, 2= 6-25%, 3= 26-50%, 4= 51-75%, 5= 76-95%, 6= 96-100%).

Point Center Quarter Method

The Point Center Quarter Method, as described by Krebs (1998) was conducted both in the spring and fall 2005 to estimate density of woody individuals, by species; and modified to estimate annual plant cover, perennial plant cover, height of woody individuals, and percent canopy cover (field data form 2, Appendix 1). Two subplots were sampled, one representing vegetation along the perennial water channel and the other representing the non-channel vegetation. Fifty non-permanent points were selected randomly within each of the two subplots by acquiring X:Y coordinates from a table of random numbers (Elzinga et al. 1998). The ranges of coordinates were determined from a UTM grid overlay of the study area. Points within 50m of any other previously chosen point were re-constructed. Coordinates of the sampling sites were then downloaded into a GPS unit and points were visited parsimoniously using the "nearest waypoint" function. Tree and shrub density was estimated by measuring the distance from the point to the nearest individual in each quarter. Total absolute density of individuals (the density of all woody species) was calculated using the following equation: $(\text{individuals/ha}) = (10,000\text{m}^2/\text{ha}) / (\text{mean})^2$, where the mean is the sum of all distances divided by the total number of quadrates (4 times the number of points). Relative density, by species, was calculated by dividing the number of hits for a particular species counted by the total number of quadrates. The absolute density for any one species was calculated by multiplying its relative density times total absolute density. Cover of perennial and annual plants was estimated with the Daubenmire Grid at the base of each point. Percent canopy cover was estimated using a clear Plexiglass® square marked with randomly distributed black dots. Percent cover was simply calculated as the number of dots covered by canopy per 100 counts.

Vegetation mapping

Vegetation was mapped May-September 1997 using the relative cover occurrence of the dominant plant species (see Munz & Keck 1949-1950, Whittaker 1962). The method follows traditional approaches to vegetation mapping in Arizona (Brown et al. 1979, Warren et al. 1982). Procedure generally followed that of Kuchler's comprehensive method (Kuchler 1967) and Braun-Blanquet's table method (see Ellenberg 1956). Mapping resolution was ca. 5m. The approach used in 2005 made use of GIS technology that was unavailable to the author in 1998. WWRP was visited on three separate occasions and over 300 waypoints were entered into a Garmin® GPS unit. For each waypoint, a tree or shrub species, or a floristic cover designation was recorded, such as annual disturbed, perennial disturbed, or grassland. GPS data were then downloaded using IGage® software and used to create an ArcGIS® shapefile. Field data were added to the shapefile by importing the database portion of the shapefile into Excel®. The spreadsheet was then pasted into the annotation editor of ALL TOPO V7®, converted from NAD27 to State Plane, and exported back into an Arcview® shapefile. The new shapefile was then overlaid onto the winter and summer WWRP ortho-rectified digital aerial photographs to aid in the creation of a shapefile composed of polygons.

Floristics

The study site was visited in early spring, late spring/early summer before monsoon rains, and late summer/early fall after monsoon rains. If possible, at least two collections were made from reproductive individuals of all new or previously uncollected plant taxa encountered. Specimens were processed on site using a 12" X 18" field press and later rearranged and repressed using a standard herbarium press. Presses were placed within a well-ventilated plant press dryer. Field notes for included elevation, locality data (including both latitude/longitude [decimal degrees WGS84] and the NAD83, Zone 12, Universal Transverse Mercator [UTM] grid system), name of USGS 7.5' quadrangle, distances from major landmarks, date, collection number, substrate type, community type, frequency of individuals, and plant associates. In addition, a record was made of characteristics of the plant that would not be apparent after the specimen was pressed and dried. Photographs were taken for most collections, including views of habitat and close-ups of flowers and/or fruits. Duplicate specimens were deposited variously in the following public herbaria: Northern Arizona University (ASC), Arizona State University (ASU), Yavapai College (YCH), and institution of the taxonomic specialist. For each collection, at least one duplicate was mounted for the Prescott Creeks herbarium with MO type glue on U/C type 11.5 × 16.5in herbarium mounting paper. Fragment packets and labels were made of 100% cotton, acid-free paper and affixed with acid-free adhesive.

Results

Vegetation sampling

Foliar height density (FHD)

Overall mean FHD among transects remained constant between 2005 and 2012 at 2.34 m³/m² (Tables 2 and 3). As measured in dm, there was a slight increase from 1.28 m³/m² in 2005 to 1.34 m³/m² in 2012. Analysis of variance (ANOVA) indicated the difference was not significant ($p = .85$). The difference between the means of transects within disturbed areas between 2005 and 2012 was obviously insignificant (see transects 1, 7, 9, 12, 14, 16, 17, 18, 21, and 25 in Appendix 4). Only transects 9 and 18 showed marked signs of an increase in woody species. Among all transects, two showed positive changes from highly disturbed or dominated by exotic invasives to dominated by natives, Transect 1 and 18, while two showed negative changes, Transect 7 and 13 (Table 5). Five transects had a change of dominant woody species. FHD values by year, by transect, are presented in figure 1.

In 2005 mean FHD among transects increased from 1.49 m³/m² in 1997 to 2.34 m³/m² in 2005, an overall increase of 57% (Tables 2 and 3, fig. 1). In general, the areas that were most disturbed in 1997 had the highest percent change in FHD (Table 4). Analysis of variance (ANOVA) indicated a significant difference between the means of the two trials ($p = 0.062$). The difference between the means of

transects within disturbed areas (transects 7, 9, 14, 15, 16, 17, 18, 21, 23. and 25) for the two trials was significant ($p = 0.010$), while the difference between means for transects within relatively undisturbed areas was not significant ($p = 0.273$). Mean FHD for the five transects along the reference reaches (2006) was 8.51 (Table 6).

Mean maximum height among transects increased slightly between 2005 (7.59 m) and 2012 (8.96 m) ($p = 1.0$). Although mean maximum height among transects increased more dramatically between 1997 (5.92 m) and 2005, ANOVA indicated that there was no significant difference between the means of the two trials ($p = 0.248$). Similarly, mean average height among transects increased from 2.17m per transect point in 1997 to 2.61m in 2005 but the difference was not significant ($p = 0.334$). For transects located within disturbed areas, however, the means were significant between 1997 and 2005 ($p = 0.015$).

The exotic perennial grass, *Festuca arundinacea*, had a noticeable gain in estimated FHD between 2005 and 2012, and to a lesser extent, there were gains in the estimate FHDs for *Populus angustifolia*, *P. ×hinckleyana*, *Salix exigua*, and *S. lasiolepis*, while that for *Ulmus pumila* had a decrease (Figures 2a and 2b).

Table 2. Maximum height, average height and average foliage-height density (FHD), by transect, for 1997 and 2005 sampling. 2005 data given for hits as decimeters and as meters. ND = no data available. Shaded transects represent those of highly disturbed areas that were lacking or nearly lacking in FHD of shrubs or trees in 1997.

	September 1997 (measured by meters)			September 2005 (measured by meters)			September 2005 (measured by decimeters)		
Transect number	Max. Ht. (m)	Ave. Ht* (m)	Ave. FHD	Max. Ht. (m)	Ave. Ht* (m)	Ave. FHD	Max. Ht. (m)	Ave. Ht* (m)	Ave. FHD
1	7	0.65	0.40	14.0	4.1	2.85	13.5	3.64	1.66
2	9	2.20	1.60	11.0	4.7	2.30	10.6	4.22	1.13
3	14	8.35	4.65	18.0	11.85	6.45	18.0	11.66	5.57
4	7	1.85	1.75	9.0	2.85	3.45	8.8	2.40	1.66
5	1	0.50	0.60	ND	ND	ND	ND	ND	ND
6	15	10.95	6.90	17.0	10.6	5.50	17.0	10.42	3.95
7	4	0.65	0.65	9.0	1.3	1.25	8.9	0.95	0.46
8	9	3.90	2.85	7.0	4.5	3.35	7.0	4.10	2.05
9	1	0.15	0.15	2.0	0.6	0.70	2.0	0.33	0.24
10	5	1.25	1.65	6.0	1.4	1.85	5.8	0.71	0.60
11	5	1.30	1.30	6.0	2.2	2.30	5.6	1.78	0.94
12	1	0.20	0.20	8.0	1.2	1.85	7.5	0.64	0.79
13	7	2.70	1.55	8.0	2.5	1.95	8.0	2.05	0.84
14	1	0.65	0.80	18.0	3.3	3.40	18.0	2.95	2.05
15	11	2.25	1.45	4.0	1.1	1.70	3.5	0.63	0.55
16	2	0.80	1.10	5.0	1.35	1.50	5.0	0.85	0.66
17	1	0.50	0.55	8.0	1.3	1.55	7.4	0.84	0.76
18	1	0.80	1.15	1.0	0.85	1.10	0.8	0.40	0.47
19	16	7.25	2.50	12.0	4.9	2.45	11.5	4.35	1.37
20	2	1.10	1.40	8.0	3.45	3.25	7.1	2.98	1.56
21	1	0.05	0.05	2.0	0.5	0.70	1.1	0.29	0.30
22	4	1.15	1.30	7.0	1.9	2.40	6.4	1.23	1.17
23	0	0.00	0.00	1.0	0.35	0.45	1.0	0.20	0.29
24	17	1.75	0.35	2.0	1.1	1.60	1.5	0.36	0.27
25	1	0.45	0.50	1.0	0.85	1.15	0.8	0.31	0.39
26	12	5.05	3.45	13.0	7.3	3.50	13.0	6.92	2.22
Mean among transects	5.92	2.17	1.49	7.88	3.04	2.34	7.59	2.61	1.28

*Average height is the sum of the maximum heights for all transect points divided by the number of points (20)

Table 3. Maximum height, average height and average foliage-height density (FHD), by transect, for 2012 sampling. Data presented in hits as both decimeters and meters. ND = no data available. p = .988 m, .846 dm

	September 2012 (measured by meters)			September 2012 (measured by decimeters)		
Transect number	Max. Ht. (m)	Ave. Ht* (m)	Ave. FHD	Max. Ht. (m)	Ave. Ht* (m)	Ave. FHD
1	13	3.4	1.95	12.8	3.21	1.18
2	15	8.9	4.5	14.8	8.3	2.31
3	20	13.6	5.35	19.5	13.1	4.22
4	15	2.95	3.7	14.2	2.5	2.41
6	20	10.85	5	19.2	10.34	3.15
7	9	0.8	0.45	8.3	0.49	0.26
8	9	2.7	2.05	2.23	9	1.08
9	3	0.95	1.05	3	0.625	0.47
10	3	1.45	1.55	2.8	0.98	0.77
11	6	2.25	1.8	5.6	1.74	0.89
12	12	2.5	3	11.6	2.145	1.17
13	7	2.55	1.85	6.2	2.105	0.81
14	11	5.2	3.3	10.4	4.76	1.92
15	5	1.45	1.2	4.6	0.98	0.43
16	7	1.8	1.95	6.6	1.445	1.31
17	11	1.95	2.1	10.7	1.715	1.15
18	2	0.8	1.1	1.1	0.345	0.46
19	14	5.2	3.05	13.5	4.685	1.81
20	9	4.3	2.1	8.5	3.945	1.55
21	1	0.7	0.8	0.7	0.365	0.40
22	8	2.05	1.8	7.1	1.76	1.09
23	1	0.45	0.45	0.8	0.235	0.21
24	10	3.85	3.6	9.4	3.255	1.84
25	1	0.85	1.25	0.7	0.24	0.31
26	12	4.45	3.45	11.8	4.055	2.35
Mean among transects	8.96	3.44	2.34	8.25	3.29	1.34

Table 4. Changes in vegetation association and average total FHD for each transect between 1997 and 2005 sampling.

Transect	Dominant woody species 1997	Dominant woody species 2006	Change in average FHD	Percent change average FHD
1	<i>Ulmus pumila</i>	<i>Ulmus pumila</i>	2.45	613
2*	<i>Salix laevigata</i>	<i>Salix laevigata</i>	0.70	44
3	<i>Populus fremontii</i>	<i>Populus fremontii</i>	1.80	39
4	<i>Salix laevigata</i>	<i>Salix laevigata</i>	1.70	97
5**	Herbaceous only	N/A	N/A	N/A
6	<i>Populus fremontii</i>	<i>Populus fremontii</i>	-1.40	-20
7	<i>Salix laevigata</i>	<i>Salix laevigata</i>	0.60	92
8	<i>Salix laevigata</i>	<i>Salix laevigata</i>	0.50	18
9	Herbaceous only	<i>Salix exigua</i>	0.55	367
10	<i>Juglans major</i>	<i>Juglans major</i>	0.20	12
11	<i>Populus angustifolia</i>	<i>Populus angustifolia</i>	1.00	77
12	Herbaceous only	<i>Populus fremontii</i>	1.65	825
13	<i>Populus fremontii</i>	<i>Populus fremontii</i>	0.40	26
14	Herbaceous only	<i>Populus angustifolia</i>	2.60	325
15	<i>Populus fremontii</i>	<i>Salix laevigata</i>	0.25	17
16	<i>Salix exigua</i>	<i>Juglans major</i>	0.40	36
17	Herbaceous only	<i>Populus ×hinckleyana</i>	1.00	182
18	<i>Salix exigua</i>	Herbaceous only	-0.05	-4
19	<i>Populus fremontii</i>	<i>Populus fremontii</i>	-0.05	-2
20	<i>Salix laevigata</i>	<i>Tamarix ramosissima</i>	1.85	132
21	Herbaceous only	Herbaceous only	0.65	1300
22	<i>Salix lasiolepis</i>	<i>Acer negundo</i>	1.10	85
23	Herbaceous only	Herbaceous only	0.45	N/A
24	<i>Populus fremontii</i>	<i>Salix lasiolepis</i>	1.25	357
25	Herbaceous only	Herbaceous only	0.65	130
26	<i>Salix laevigata</i>	<i>Salix laevigata</i>	0.05	1
		Overall average	0.85	***57

*Transect 2 was redirected because the 1997 legs were under water in 2005.

Transect 5 was destroyed during bridge construction prior to 2005. *calculated as the percent change of average FHD and not as the average percent change in FHD, which would be much higher, 162.9.

Table 5. Changes in vegetation association and average total FHD (by meter) for each transect between 2005 and 2012 sampling.

Transect	Dominant woody species 2005	Dominant woody species 2012	Change in average FHD	Percent change in average FHD
1	<i>Ulmus pumila</i>	<i>Populus fremontii</i>	-0.90	-32
2	<i>Salix laevigata</i>	<i>Populus fremontii</i>	2.20	96
3	<i>Populus fremontii</i>	<i>Populus fremontii</i>	-1.10	-17
4	<i>Salix laevigata</i>	<i>Populus fremontii</i>	0.25	7
6	<i>Populus fremontii</i>	<i>Populus fremontii</i>	-0.50	-9
7	<i>Salix laevigata</i>	Herbaceous only	-0.80	-64
8	<i>Salix laevigata</i>	<i>Salix laevigata</i>	-1.30	-39
9	<i>Salix exigua</i>	<i>Salix exigua</i>	0.35	50
10	<i>Juglans major</i>	<i>Juglans major</i>	-0.30	-16
11	<i>Populus angustifolia</i>	<i>Populus angustifolia</i>	-0.50	-22
12	<i>Populus fremontii</i>	<i>Populus ×hinckleyana</i>	1.15	62
13	<i>Populus fremontii</i>	<i>Ulmus pumila</i>	-0.10	-5
14	<i>Populus angustifolia</i>	<i>Populus fremontii</i>	-0.10	-3
15	<i>Salix laevigata</i>	<i>Salix laevigata</i>	-0.50	-29
16	<i>Juglans major</i>	<i>Juglans major</i>	0.45	30
17	<i>Populus ×hinckleyana</i>	<i>×hinckleyana</i>	0.55	35
18	Herbaceous only	<i>Salix exigua</i>	0.00	0
19	<i>Populus fremontii</i>	<i>Populus fremontii</i>	0.60	24
20	<i>Tamarix ramosissima</i>	<i>Tamarix ramosissima</i>	-1.15	-35
21	Herbaceous only	Herbaceous only	0.10	14
22	<i>Acer negundo</i>	<i>Acer negundo</i>	-0.60	-25
23	Herbaceous only	Herbaceous only	0.00	0
24	<i>Salix lasiolepis</i>	<i>Populus fremontii</i>	2.00	125
25	Herbaceous only	Herbaceous only	0.10	9
26	<i>Salix laevigata</i>	<i>Salix laevigata</i>	-0.05	-1
		Overall average	0.00	0

*calculated as the percent change of average FHD and not as the average percent change in FHD, which would be much higher, 162.9.

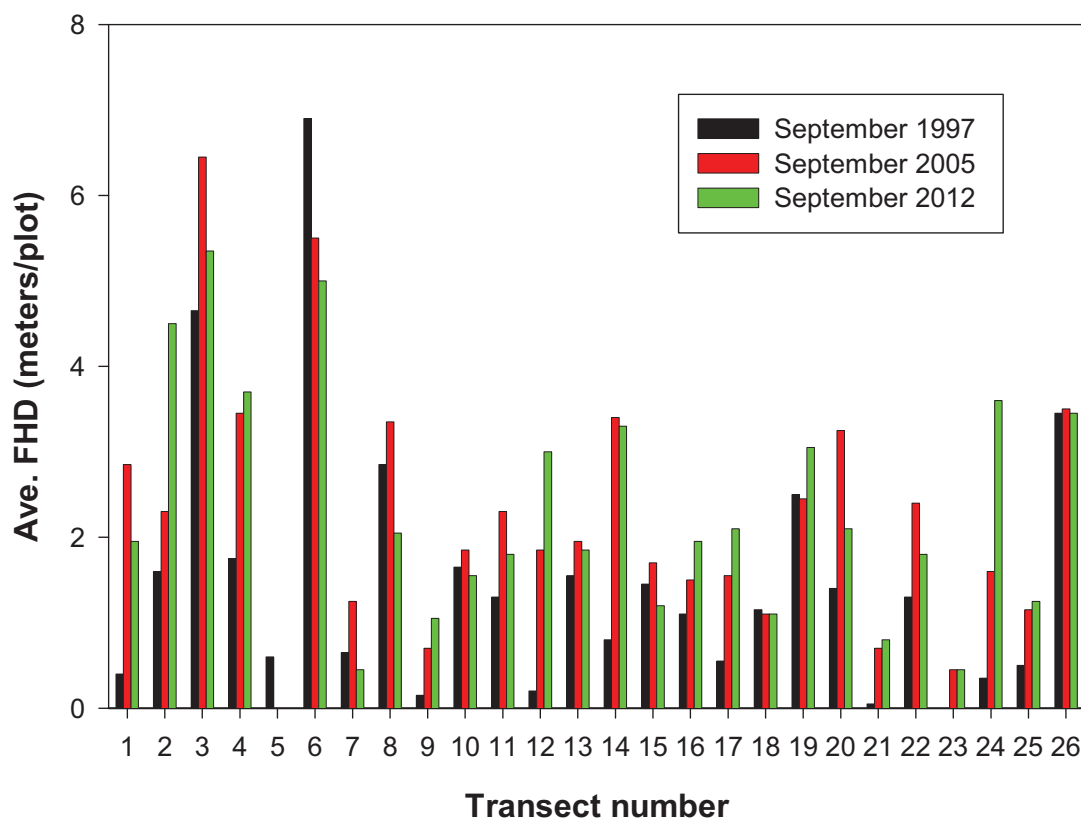


Figure 1. Comparison of average FHD (as measured by meters), by transect, for September 1997, September 2005, and September 2012.

Table 6. Maximum height, average height, average foliage-height density (FHD), and total FHD, by reference reach transect, 2005. Data given for hits as decimeters and as meters.

Number	Type	Hits measured by meters			Hits measured by decimeters		
		Max. Ht. (m)	Mean Ht* (m)	Total/ Mean FHD	Max. Ht. (m)	Ave. Ht* (m)	Total/ Mean FHD
1	Toe and Bank	11	6.2	71/11.8	10.7	5.75	37.9/6.3
2	Toe and Bank	9	2.6	55.0/6.1	8.3	2.09	27/3.00
3	Low & High Overbank	22.0	11.9	90.0/15.0	22.0	11.6	68.6/11.4
4	Transition (upland)	3	1.35	43/3.9	2.7	0.79	14.9/1.35
5	Transition (upland)	4	1.55	43/5.73	3.5	1.03	12.3/0.88
Overall average		9.8	4.72	60.4/8.51	9.44	4.252	32.1/4.59

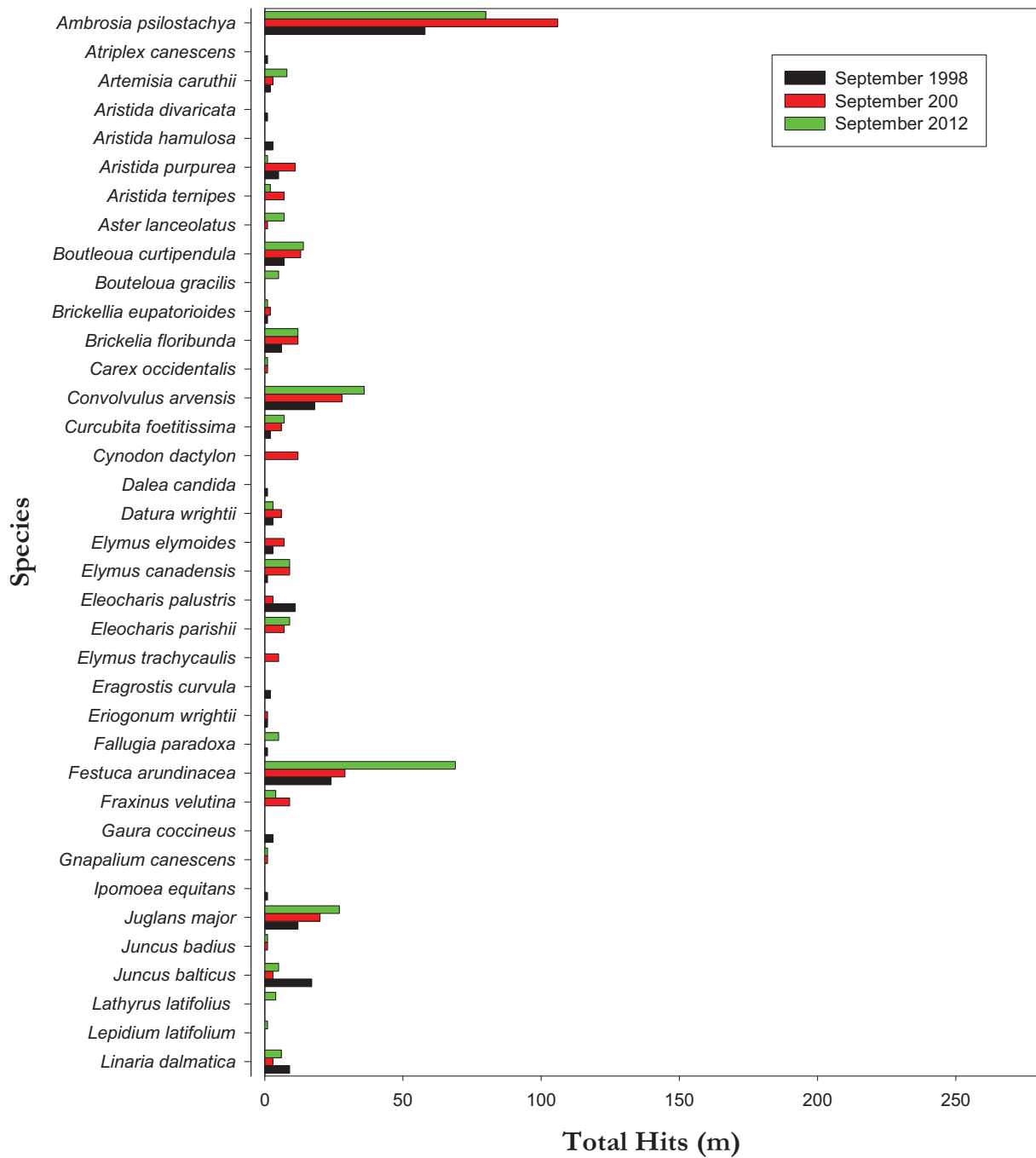


Figure 2a. Total hits FHD (by meters) of perennials for all transects, by species A-L.

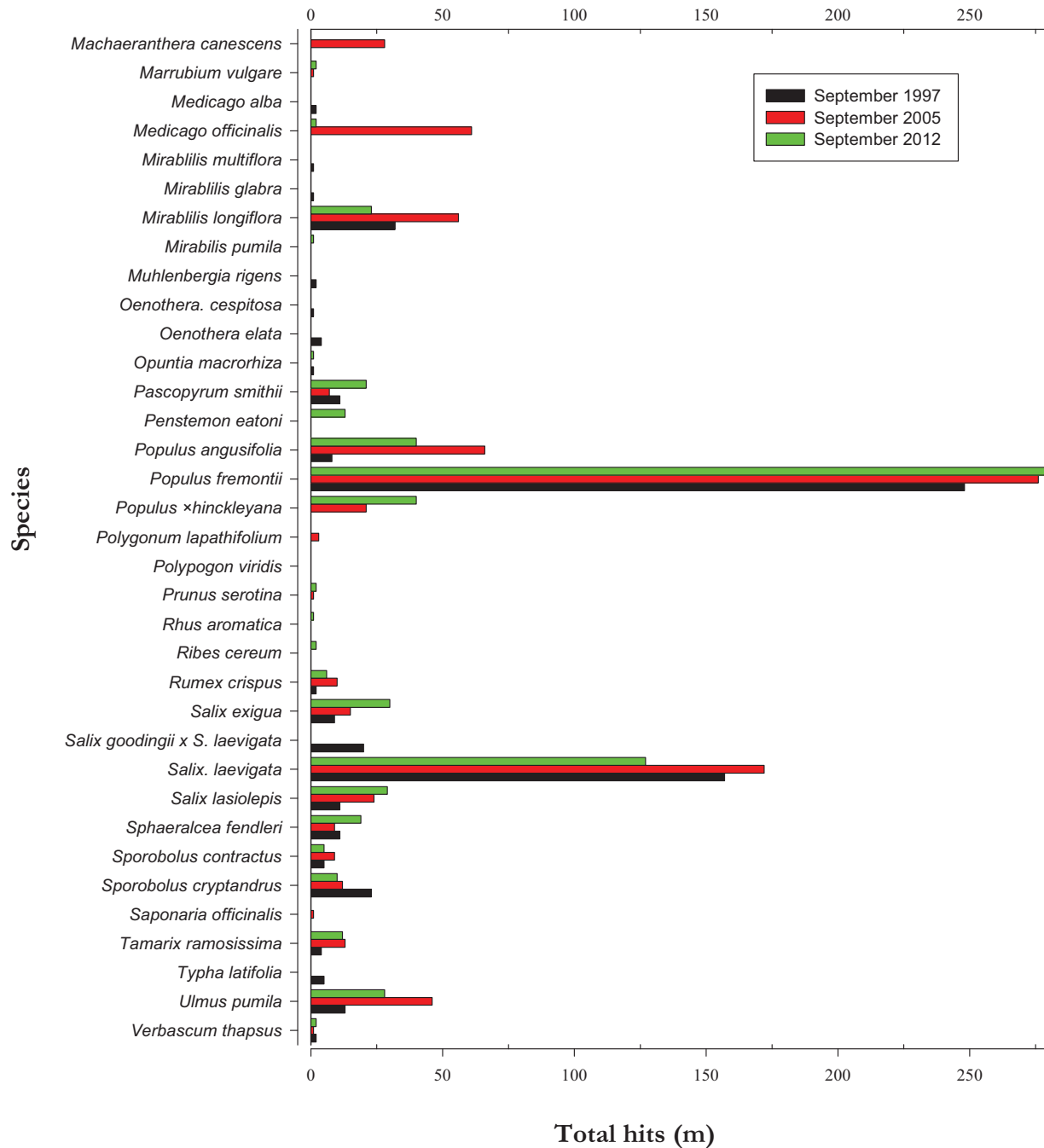


Figure 2b. Total hits FHD (meters) of perennials for all transects, by species M-Z.

Percent cover of annuals

Total percent cover of annuals within transects increased 37% between 1997 and 2005 and decreased 13% between 2005 and 2012 with average cover along some transects considerably lower and others considerably higher (Table 7). Graphs depicting annual cover, by species is presented in Appendix 5.

Table 7. Average percent cover of annuals, by transect, for 1997, 2005, and 2012 sampling. ND = no data available.

Transect number	Percent cover		
	1997	2005	2012
1	42.8	50.2	40.25
2	40.1	18.9	1.25
3	42.1	55.1	11.15
4	9.8	4.6	43.95
5	8.3	ND	ND
6	9.8	39.4	3.5
7	35.3	27.4	32.4
8	11.6	17.4	35.4
9	16.0	8.9	13.6
10	3.3	16.5	30.95
11	6.0	11.5	10
12	39.4	29.8	22.15
13	4.4	17.6	7.8
14	2.7	8.6	20.75
15	1.4	43.5	13.65
16	4.9	14.8	32.9
17	34.4	23.5	23.6
18	6.9	9.5	22.7
19	13.1	33.1	11
20	4.3	38.5	21.75
21	36.7	43.1	38.05
22	31.9	13.4	22.35
23	38.8	67.3	46.45
24	0	4.5	3.05
25	16.4	16.8	14.3
26	13.8	9.5	18.7
Mean among transects	18.2	24.9	21.7

Point center quarter method

Total density of woody perennials more than doubled for riparian species between 2005 (204 individuals per ha) and 2012 (416.5 individuals per ha), and nearly doubled for non-riparian perennials (59.2 vs 92.2 individuals per ha)(Tables 8–11). However, because density increases as the square of the distances, these data are not as dramatic as they first appear and neither are significant at the $p = 0.01$ level ($p = 0.002$ for riparian and $p = .158$ for non-riparian). Estimates for average canopy cover increased between fall 2005 and fall 2012, with riparian species increasing from 25.4% in 2005 to 31.9% in 2012. Similarly, average canopy cover for non-riparian species increased from 8.4% in 2005 to 20.4% in 2012.

Table 8. Summary of Riparian Woody Perennial PCQ data for the September 2005 sampling in the Watson Woods Preserve.
Average canopy cover was 25.4%.

Species	Average width	Average height	Relative density	Absolute density (individuals per ha)
<i>Acer negundo</i>	3.0	3.0	0.010	2.04
<i>Amorpha fruticosa</i>	0.9	0.9	0.005	1.02
<i>Fraxinus velutina</i>	7.5	7.8	0.010	2.04
<i>Gleditzia triacantha</i>	9.0	10.0	0.005	1.02
<i>Juglans major</i>	1.5	2.0	0.005	1.02
<i>Populus angustifolia</i>	3.5	6.0	0.005	1.02
<i>Populus fremontii</i>	4.9	7.3	0.110	22.44
<i>Populus</i> <i>×hinckleyana</i>	3.4	6.5	0.055	11.22
<i>Robinia</i> <i>pseudoacacia</i>	1.3	2.9	0.005	1.02
<i>Salix exigua</i>	1.2	2.1	0.065	13.26
<i>Salix laevigata</i>	6.4	7.3	0.235	47.94
<i>Salix lasiolepis</i>	4.1	3.7	0.345	70.38
<i>Tamarix</i> <i>ramosissima</i>	0.8	2.2	0.005	1.02
<i>Ulmus pumila</i>	4.2	5.9	0.140	28.56
Overall Average	4.5	5.3	Total density 204.00	

Table 9. Summary of Riparian Woody Perennial PCQ data for the September 2012 sampling in the Watson Woods Preserve.
 Average canopy cover was 31.9%.

Species	Average width	Average height	Relative density	Absolute density (individuals per ha)
<i>Acer negundo</i>	6.4	5.6	0.005	2.1
<i>Fraxinus velutina</i>	2.0	1.3	0.005	2.1
<i>Populus angustifolia</i>	0.8	1.7	0.025	10.4
<i>Populus fremontii</i>	4.2	8.5	0.170	70.8
<i>Populus</i>				
× <i>hinckleyana</i>	2.9	5.3	0.040	16.7
<i>Ribes cereum</i>	1.2	1.5	0.005	2.1
<i>Salix exigua</i>	0.7	1.8	0.245	102.0
<i>Salix laevigata</i>	5.6	9.4	0.075	31.2
<i>Salix lasiolepis</i>	2.9	3.6	0.310	129.1
<i>Tamarix</i>				
<i>ramosissima</i>	1.8	2.2	0.015	6.2
<i>Ulmus pumila</i>	2.2	3.2	0.105	43.7
Overall Average	2.8	4.0	Total density: 416.5	

Table 10. Summary of non-riparian woody perennial PCQ data for the September 2005 sampling in the Watson Woods Preserve. Average canopy cover was 8.4%.

Species	Average width	Average height	Relative density	Abs density (individuals per ha)
<i>Acer negundo</i>	5.00	8.17	0.015	0.89
<i>Cercocarpus montanus</i>	2.30	1.00	0.005	0.30
<i>Eriogonum wrightii</i>	1.30	0.55	0.010	0.59
<i>Fallugia paradoxa</i>	1.56	1.32	0.025	1.48
<i>Fraxinus velutina</i>	4.18	6.63	0.020	1.18
<i>Gleditzia triacanthos</i>	3.50	0.80	0.005	0.30
<i>Juglans major</i>	7.06	6.55	0.050	2.96
<i>Pinus ponderosa</i>	3.00	7.80	0.005	0.30
<i>Populus angustifolia</i>	6.30	7.40	0.050	2.96
<i>Populus fremontii</i>	11.36	12.11	0.135	7.99
<i>Populus ×hinckleyana</i>	6.06	7.01	0.065	3.85
<i>Purshia stansburiana</i>	3.00	4.50	0.005	0.30
<i>Robinia neomexicana</i>	1.27	1.67	0.015	0.89
<i>Salix exigua</i>	2.16	2.24	0.035	2.07
<i>Salix gooddingii</i>	2.50	2.20	0.005	0.30
<i>Salix laevigata</i>	6.62	7.14	0.155	9.17
<i>Salix lasiolepis</i>	5.74	4.84	0.090	5.33
<i>Tamarix ramosissima</i>	5.60	3.74	0.060	3.55
<i>Ulmus pumila</i>	4.61	5.51	0.250	14.79
Overall average	6.00	6.41	Total density: 59.17	

Table 11. Summary of non-riparian woody perennial PCQ data for the September 2012 sampling in the Watson Woods Preserve. Average canopy cover was 20.4%.

Species	Average width	Average height	Relative density	Abs density (individuals per ha)
<i>Acer negundo</i>	7.4	11.4	0.010	0.9
<i>Amorpha fruticosa</i>	7.6	1.9	0.005	0.5
<i>Baccharis pteronioides</i>	0.8	0.8	0.010	0.9
<i>Celtis reticulata</i>	2.4	3.1	0.010	0.9
<i>Chrysothamnus nauseosus</i>	1.0	0.7	0.020	1.8
<i>Elaeagnus angustifolia</i>	1.3	1.5	0.005	0.5
<i>Eriogonum wrightii</i>	0.4	0.2	0.020	1.8
<i>Fallugia paradoxa</i>	1.8	1.3	0.015	1.4
<i>Fraxinus velutina</i>	5.8	7.3	0.035	3.2
<i>Gutierrezia sarothrae</i>	0.7	0.4	0.005	0.5
<i>Juniperus deppeana</i>	1.0	4.3	0.005	0.5
<i>Juglans major</i>	6.3	6.9	0.035	3.2
<i>Lycium pallidum</i>	0.5	0.7	0.020	1.8
<i>Populus angustifolia</i>	2.4	4.2	0.050	4.6
<i>Populus fremontii</i>	8.3	12.5	0.105	9.7
<i>Populus ×hinckleyana</i>	4.5	6.7	0.100	9.2
<i>Rhus aromatica</i>	1.5	2.2	0.015	1.4
<i>Ribes cereum</i>	1.5	1.3	0.010	0.9
<i>Robinia pseudoacacia</i>	2.8	9.1	0.010	0.9
<i>Salix exigua</i>	1.7	2.9	0.125	11.5
<i>Salix laevigata</i>	7.4	11.2	0.120	11.1
<i>Salix lasiolepis</i>	3.2	3.8	0.115	10.6
<i>Tamarix ramosissima</i>	4.7	6.2	0.020	1.8
<i>Ulmus pumila</i>	4.5	11.4	0.135	12.5
Overall average	3.3	4.7	Total density: 92.2	

Relative densities by species are shown in Figures 3 and 4. Comparison of densities, by species between the two samples indicates a modest degree of reliability for the PCQ method. Absolute densities for riparian species increased from 2005 to 2012, with the exception of *Salix laevigata*. Non-riparian absolute densities also increased, except for *Fallugia paradoxa*, which dipped slightly. Interestingly, the absolute densities for exotics *Tamarix ramosissima* and *Ulmus pumila* decreased markedly between samplings.

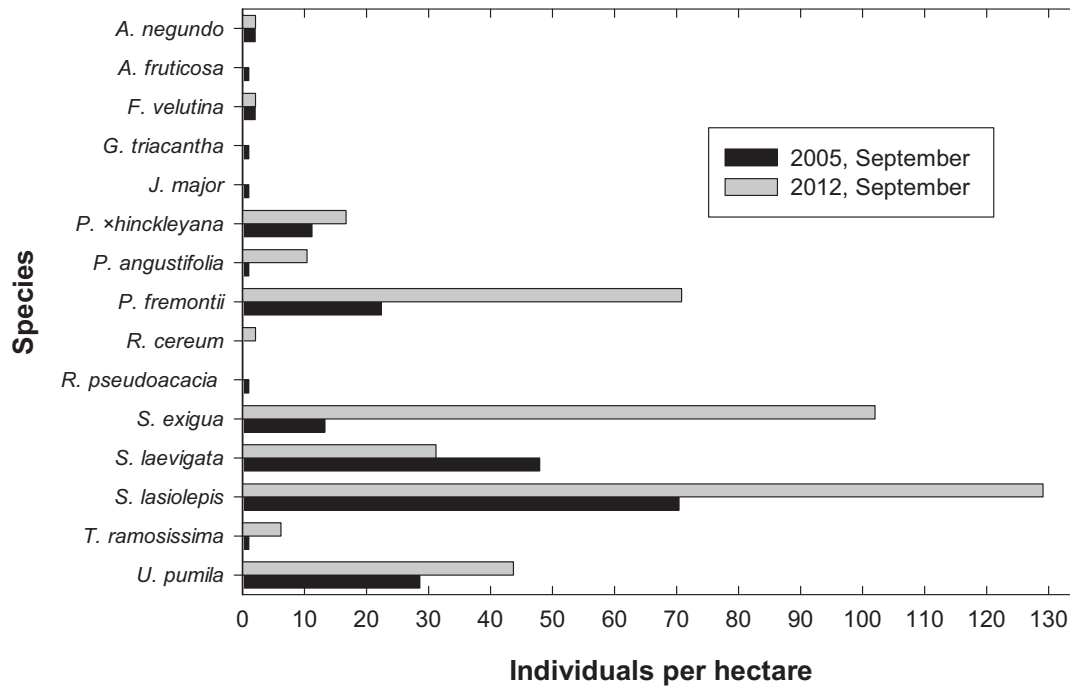


Figure 3. Comparison of the absolute densities of riparian woody perennials between September 2005 and September 2012.

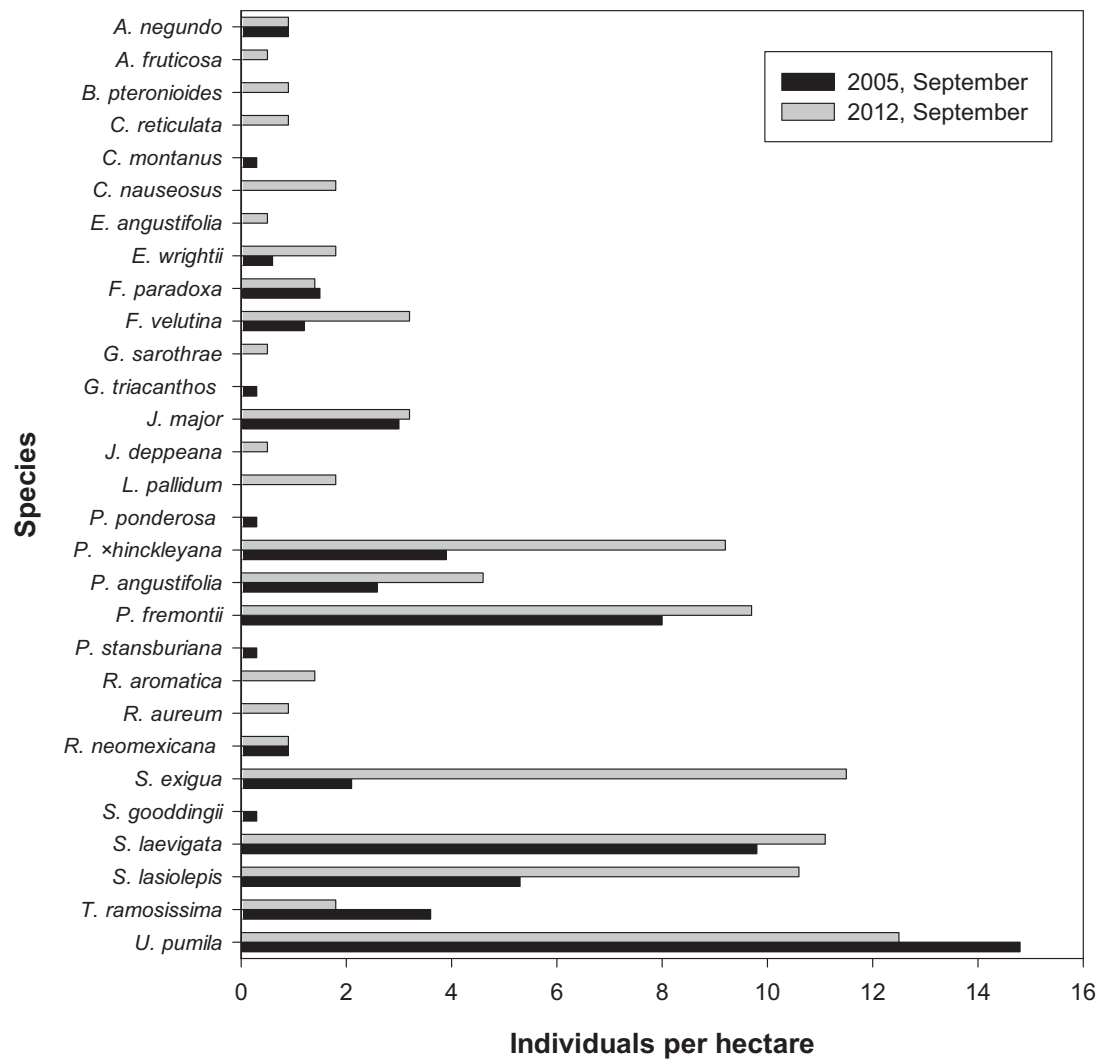


Figure 4. Comparison of the absolute densities of upland woody perennials between September 2005 and September 2012.

In 2005, percent cover of perennial herbs was much higher for riparian PCQ plots (61.4%) than for non-riparian PCQ plots (31.8%) and much higher for both riparian and non-riparian plots in the fall than in the spring (Tables 12-13). Results from a T-test indicated that neither riparian ($p = .007$) or non-riparian ($p = .478$) perennial samples from September 2012 are significantly different than those of September 2005. For fall 2012, the difference between riparian and non-riparian perennial herb percent cover was not as dramatic with the riparian decreasing to 43.62% and the non-riparian increasing to 36.5%. In the fall of 2005, *Festuca arundinacea*, an invasive exotic grass, and *Melilotus officinalis*, an invasive perennial herb, both had a percent covers three times as high as that of *Ambrosia psilostachya*, the native perennial with the highest cover. However, percent cover estimates for *M. officinalis* decreased dramatically in the 2012 sampling. *Cynodon dactylon*, another invasive exotic grass, also had high percent cover in 2005 but decreased in 2012. In fall 2005, the native perennial herb, *Mirabilis longiflora*, was much more abundant in comparison to fall 2005. Unfortunately, the invasive exotic *Lepidium latifolium* occurred within PCQ plots for the first time in 2012 (Figure 5).

In contrast to perennial herbs, annuals and biennials had a much higher cover in non-riparian plots in comparison to that on riparian plots in both fall 2005 and fall 2012 (Table 14, Figures 6a and 6b). Results from a T-test indicated that neither riparian ($p = .026$) or non-riparian ($p = .017$) annual samples from September 2012 are significantly different than those of September 2005. In spring 2005, two invasive exotic grasses, *Bromus japonicum* and *B. tectorum*, dominated the spring flora, and a third *B. diandrus*, was dominant only in the non-riparian plots. The three species were also prevalent in the fall 2005 flora. Two additional fall 2005 annuals were abundant, *Helianthus annuus*, a native, and *Kochia scoparia*, a non-native. Probably the most important change in the 2012 herb flora was the widespread occurrence of *Centaurea stoebe*, an very invasive exotic biennial. Other noteworthy changes were a large increase in percent covers for two exotic annuals, *Chloris virgata* and *Portulaca oleracea* and a large decrease in percent cover for the native annual *Machaeranthera tanacetifolia*.

A summary of percent cover of perennials from PCQ points, by plot is provided in Table 15 and a summary of percent cover of annuals and biennials, by plot, is provided in Table 16.

Table 12. Summary of average distance from PCQ point for woody species, by plot. $p = .002$ for both riparian and non-riparian.

Plot	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
1	4.73	3.90	3.875	6.28
2	4.48	5.00	6.5	7.78
3	7.78	14.38	5.2	12.60
4	6.13	12.65	5.525	9.55
5	4.00	7.93	5.775	9.73
6	2.00	23.08	2.725	3.53
7	3.28	28.98	4.25	3.95
8	6.18	45.75	3.45	8.05
9	2.68	1.38	3.475	9.30
10	4.83	10.93	2.125	9.40
11	11.80	21.58	1.7	2.15
12	12.10	21.58	10.85	10.48
13	19.40	8.23	5.875	6.93
14	5.50	47.63	6.225	5.00
15	5.40	5.10	3.875	33.93
16	2.55	36.00	1.875	25.85
17	5.13	9.10	2.65	2.33
18	4.15	3.68	8.15	4.20
19	5.40	6.88	5.45	5.18
20	1.60	41.95	6.325	19.58
21	2.25	14.95	1.925	5.20
22	6.28	12.03	9	2.20
23	4.93	8.13	8.65	10.08
24	24.78	10.13	2.525	7.63
25	6.28	15.65	3.2	9.65
26	8.20	7.25	1.825	17.88
27	11.98	12.53	5.325	5.00
28	20.40	8.30	3.2	12.15
29	13.18	20.25	6.5	8.40
30	9.70	5.78	9.85	11.73
31	12.60	15.15	4.45	5.60
32	10.28	21.23	7.95	14.60
33	14.50	17.75	20.175	5.30
34	4.35	8.03	1.5	9.03
35	5.95	6.38	5.95	3.83
36	7.55	5.68	1.3	25.55
37	7.88	4.50	1.075	10.40
38	9.03	5.45	0.475	14.55
39	4.55	2.20	0.85	15.50

Table 12. Summary of average distance from PCQ point for woody species, by plot. $p = .002$ for both riparian and non-riparian.

Plot	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
40	8.35	3.10	1.525	24.70
41	9.48	2.08	5.325	16.73
42	2.95	6.28	3.85	16.48
43	2.50	7.18	12.725	5.48
44	4.85	8.50	8.9	15.03
45	13.35	12.88	1.675	16.80
46	8.43	9.38	0.775	6.78
47	13.60	4.93	0.675	4.28
48	3.83	11.88	2.325	2.85
49	3.10	3.95	6.7	14.68
50	10.88	24.50	9.35	6.85

Table 13. Summary of average percent cover for riparian and non-riparian perennial herbs.

Species	Riparian sampling			Non-riparian sampling		
	2005 Spring	2005 Fall	2012 Fall	2005 Spring	2005 Fall	2012 Fall
<i>Achillea millefolium</i>					0.2	2.1
<i>Ambrosia psilostachya</i>	0.9	5.68	9.54	0.2	6.3	5.74
<i>Aristida orcuttiana</i>					0.3	
<i>Aristida purpurea</i>					0.2	
<i>Aristida ternipes</i>				0.6	0.2	
<i>Artemisia caruthii</i>	0.6			0.2		1.1
<i>Artemisia dracunculus</i>	0.5		1.8			
<i>Aster lanceolatus</i>		0.70	0.2			
<i>Bouteloua curtipendula</i>				1.3	2.0	1.9
<i>Bouteloua gracilis</i>				0.1		0.12
<i>Brickellia eupatorioides</i>	0.2	0.20			0.1	
<i>Brickellia floribunda</i>			0.1		2.1	2.1
<i>Bromus marginatus</i>	5.5			1.4		
<i>Carex occidentalis</i>			0.4			
<i>Convolvulus arvensis</i>	0.0	0.24	0.7		0.2	1.4
<i>Cucurbita foetidissima</i>					0.6	0.3
<i>Cynodon dactylon</i>		4.40	1.6			
<i>Datura wrightii</i>					1.6	1.2
<i>Eleocharis montevidensis</i>	0.9					
<i>Eleocharis palustris</i>		0.04				
<i>Eleocharis parishii</i>	1.0	1.54	0.4	0.3		
<i>Elymus canadensis</i>		2.40	1.1		0.1	2
<i>Elymus repens</i>						1.1
<i>Festuca arundinacea</i>	11.2	19.20	16.2	0.7	2.5	4.1
<i>Grindelia aphanactis</i>				0.1		
<i>Hymenothrix wrightii</i>						0.4
<i>Juncus balticus</i>	0.8		1.9			1.2
<i>Juncus nevadensis</i>	1.3		0.8			
<i>Juncus tenuis</i>			0.2			
<i>Juncus torreyi</i>			0.1			
<i>Lathyrus latifolius</i>	0.8		0.5			
<i>Lepidium latifolium</i>						0.8
<i>Linanthus dalmatica</i>					0.1	0.06
<i>Machaeranthera canescens</i>						0.9
<i>Marrubium vulgare</i>	0.9					0.04
<i>Melilotus officinalis</i>	0.4	19.10	1.3		4.3	0.1
<i>Mirabilis longiflorus</i>		0.80			8.4	3.6

Table 13. Summary of average percent cover for riparian and non-riparian perennial herbs.

Species	Riparian sampling			Non-riparian sampling		
	2005 Spring	2005 Fall	2012 Fall	2005 Spring	2005 Fall	2012 Fall
<i>Muhlenbergia rigens</i>	3.8	3.50				
<i>Oenothera caespitosum</i>					0.4	
<i>Panicum obtusum</i>						0.04
<i>Pascopyrum smithii</i>			2.1	0.9	0.4	1
<i>Paspalum dilitatum</i>	1.0					
<i>Polygonum lapathifolium</i>		0.50				
<i>Polypogon viridis</i> (Ag)		1.50	4.28			0.6
<i>Rumex crispus</i>	1.1	1.00	0.5	0.6	0.2	0.14
<i>Scirpus acutus</i>			0.1			
<i>Sporobolus airoides</i>						0.7
<i>Sporobolus contractus</i>				0.3	1.1	1.8
<i>Sporobolus cryptandrus</i>						0.2
<i>Sphaeralcea fendleri</i>			0.4	0.5		1.72
<i>Typha angustifolia</i>	0.0	0.04			0.7	
<i>Typha latifolia</i>		0.20				
Total	30.9	61.04	43.62	7.2	31.8	36.5

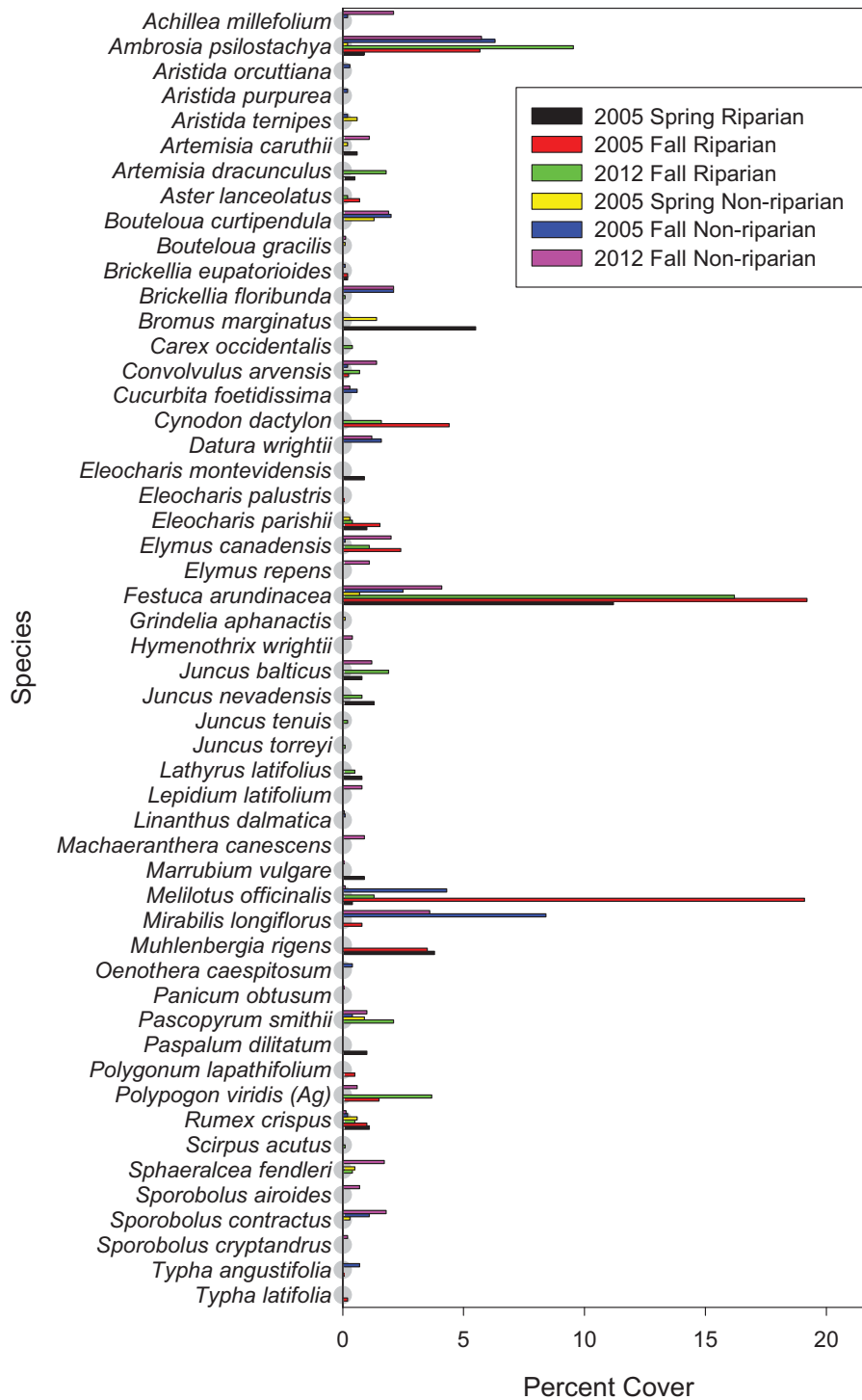


Figure 5. Average percent cover for perennial herbs as estimated with PCQ method for riparian and non-riparian samplings made in the spring and fall of 2005 and the fall of 2012.

Table 14. Summary of percent cover for riparian and non-riparian biennials and annuals.

Species	Riparian			Non-riparian		
	2005, Spring	2005, Fall	2012 Fall	2005 Spring	2005 Fall	2012 Fall
<i>Ambrosia acanthicarpa</i>					1.3	0.04
<i>Amaranthus retroflexus</i>					0.1	
<i>Amaranthus palmeri</i>		0.1	0		0.8	1.04
<i>Bahia dissecta</i>			0.2		0.2	0.1
<i>Bidens tenuisecta</i>		0.1			0.2	0.24
<i>Bromus diandrus</i>		0.8	4.5	4.1	7.6	2
<i>Bromus japonicus</i>	1.1	0.6		2.0		
<i>Bromus tectorum</i>	1.6	0.4	1.4	9.7	5.1	0.3
<i>Centaurea stoebe</i>			3.6			0.5
<i>Chamaesyce serpyllifolia</i>						0.54
<i>Chenopodium</i>		0.7		0.4	1.0	
<i>neomexicanum</i>						1.1
<i>Chloris virgata</i>		0.1			0.4	2.64
<i>Conyza canadensis</i>		0.8	0.4		2.0	
<i>Conium maculatum</i>	0.1			0.7	0.5	
<i>Cyperus esculentum</i>			0.1			0.2
<i>Dipsacus fullonum</i>				0.4	1.4	1.3
<i>Echinochloa crus-galli</i>		0.4	1.9			0.24
<i>Eragrostis lutescens</i>		0.1	1.7		0.2	
<i>Eragrostis mexicana</i>			0.4		0.1	0.4
<i>Erigeron divergens</i>		0.2	0.2	0.1	0.1	
<i>Eriogonum polycladon</i>				0.1	2.0	0.44
<i>Erodium cicutarium</i>						0.7
<i>Erysimum repandrum</i>				0.4		0.02
<i>Gaura parviflora</i>					0.0	0.34
<i>Grindelia aphanactis</i>				0.1	0.5	1.2
<i>Helianthus annuus</i>		1.0	0.1	0.1	2.5	0.1
<i>Heterotheca psammophila</i>		0.1			2.7	3
<i>Hymenoxys loomsii</i>		0.7	0.6		0.4	0.84
<i>Ipomoea coccinea</i>		0.1	0.08		0.2	0.14
<i>Ipomoea purpurea</i>			0.2		0.3	
<i>Kallstroemia parviflora</i>						0.02
<i>Kochia scoparia</i>				0.1	3.8	1.4
<i>Lamium amplexicaule</i>				0.3		
<i>Lepidium densiflorum</i>						0.1
<i>Lolium perenne</i>		0.3				
<i>Machaeranthera gracilis</i>					0.5	0.2
<i>Machaeranthera</i>				1.0	3.7	
<i>tanacetifolia</i>						1.3

Table 14. Summary of percent cover for riparian and non-riparian biennials and annuals.

Species	Riparian			Non-riparian		
	2005, Spring	2005, Fall	2012 Fall	2005 Spring	2005 Fall	2012 Fall
<i>Malva parviflora</i>			0.2			
<i>Medicago lupulina</i>			0.2			
<i>Mimulus guttatus</i>		0.4				
<i>Oenothera elata</i>		0.3				0.02
<i>Oenothera cespitosum</i>			0.04			
<i>Onopordum acanthium</i>					0.3	
<i>Panicum capillare</i>		0.4	0.04		0.2	0.3
<i>Plantago wrightiana</i>				1.4		
<i>Polanisia dodecandra</i>						0.2
<i>Polygonum aviculare</i>		0.6			0.0	
<i>Polypogon monspeliensis</i>		0.1			0.5	
<i>Portulaca oleracea</i>		0.1				3.84
<i>Salsola kali</i>						0.2
<i>Salvia reflexa</i>						0.4
<i>Sanvitalia abertii</i>					0.0	0.08
<i>Sonchus oleraceus</i>			0.3			0.2
<i>Taraxacum officinale</i>				0.1		
<i>Verbascum thapsus</i>			0.3		0.5	
<i>Xanthium strumarium</i>		1.6	0.3		0.1	
Total	2.7	9.7	16.76	22.6	39.9	25.68

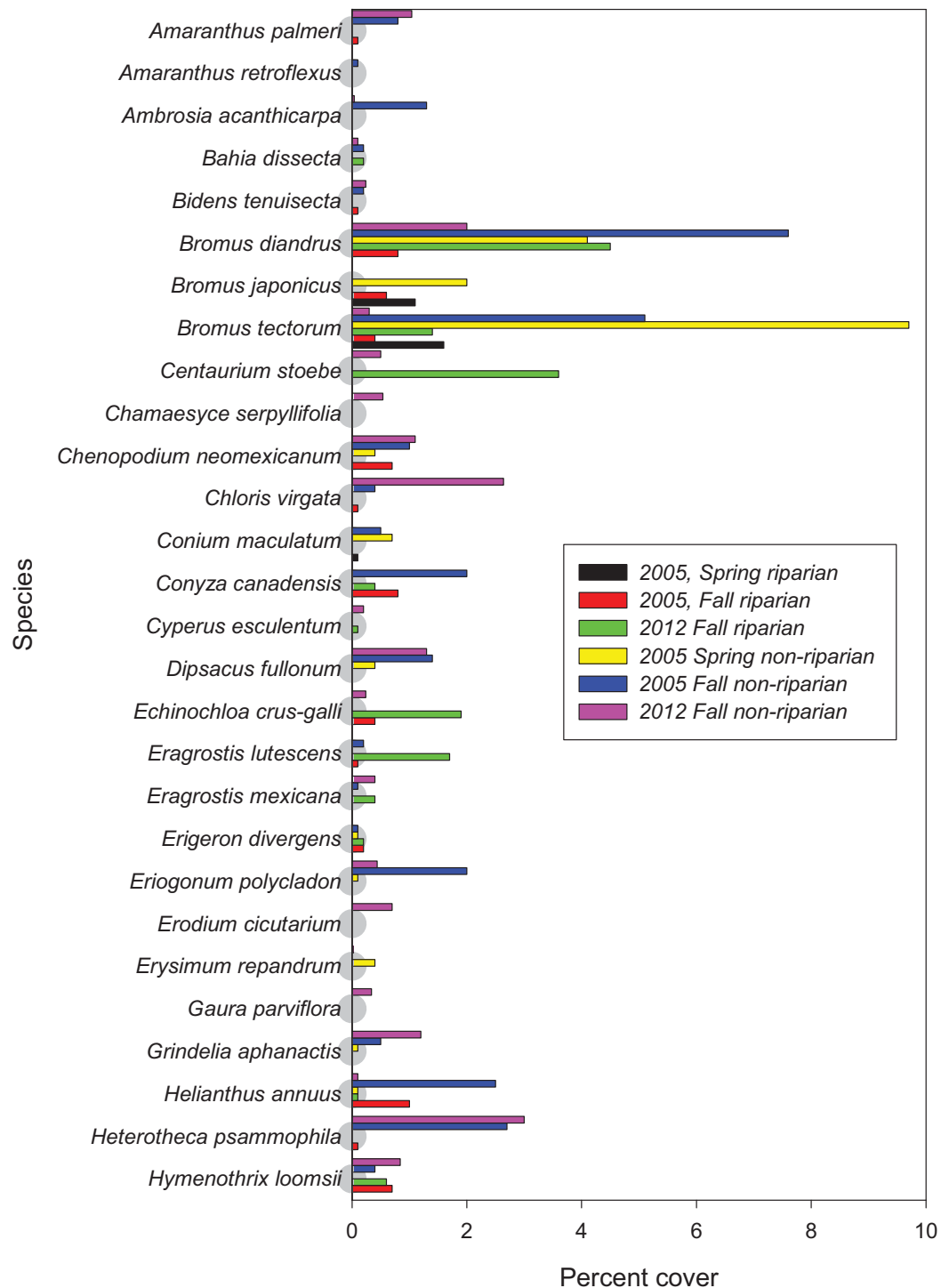


Figure 6a. Average percent cover for annual and biennial herbs (A-K) as estimated with PCQ method for riparian and non-riparian samplings made in the spring and fall of 2005 and the fall of 2012.

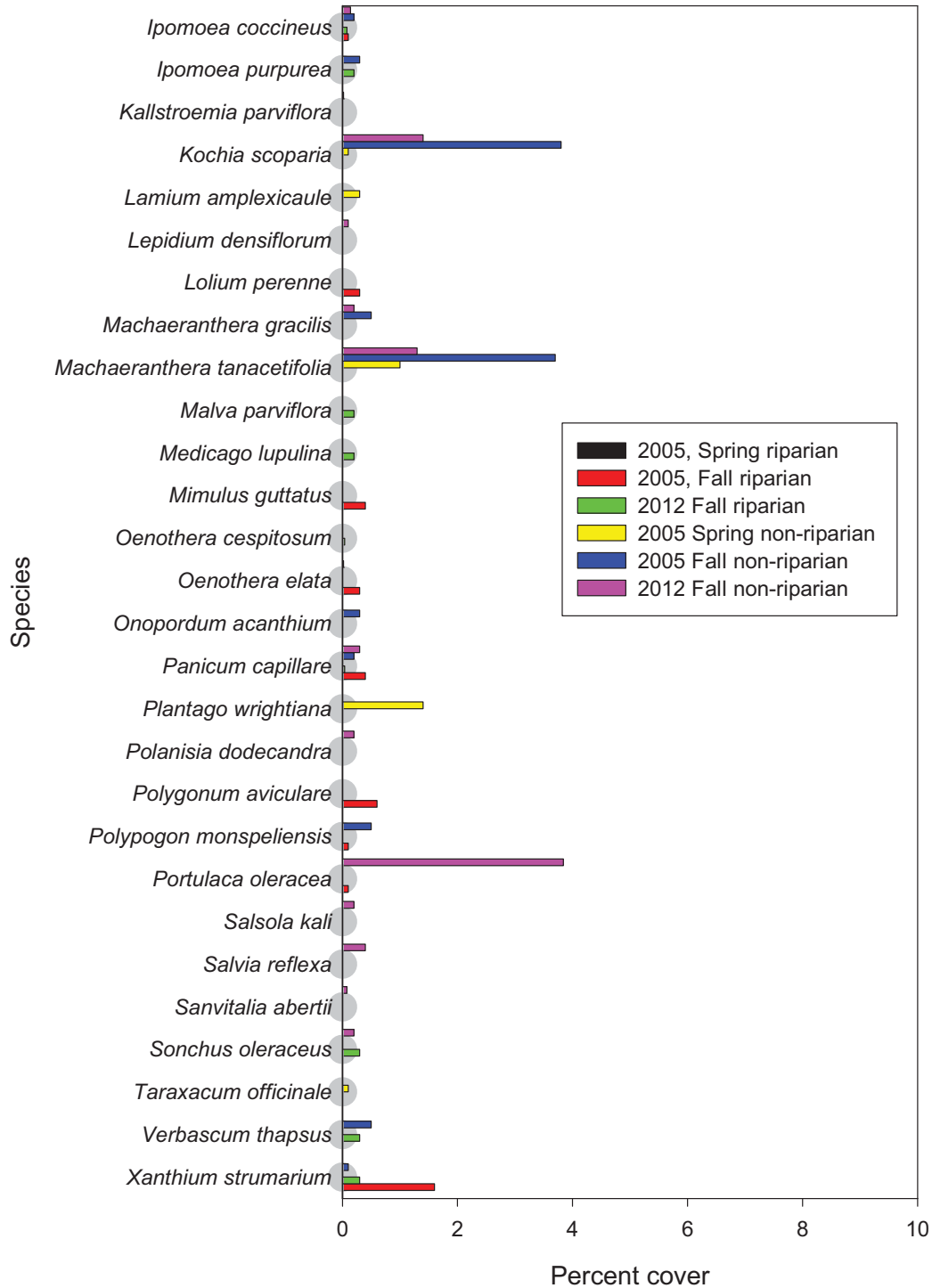


Figure 6b. Average percent cover for annual and biennial herbs (L-Z) as estimated with PCQ method for riparian and non-riparian samplings made in the spring and fall of 2005 and the fall of 2012.

Table 15. Summary of percent cover of perennials from PCQ points, by plot.				
Transect	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
1	105	35	10	30
2	72	35	30	10
3	70	95	20	75
4	90	30	75	85
5	100	0	30	40
6	12	30	0	55
7	90	0	65	75
8	30	25	45	50
9	100	10	89	2
10	60	25	0	5
11	80	5	90	70
12	65	7	100	30
13	82	40	0	2
14	65	0	45	49
15	95	55	40	0
16	60	0	55	10
17	35	5	20	40
18	100	45	0	90
19	90	50	75	65
20	70	0	80	55
21	0	40	35	35
22	102	0	70	2
23	60	35	75	70
24	90	15	70	0
25	25	5	5	10
26	95	65	60	64
27	10	10	70	80
28	10	85	100	40
29	80	75	25	50
30	25	30	20	35
31	90	35	80	60
32	15	35	100	5
33	30	55	10	0
34	85	20	65	0
35	0	30	25	30
36	0	0	50	0
37	55	45	10	23
38	40	25	35	40
39	80	85	40	35
40	100	65	85	0
41	60	0	0	45

Table 15. Summary of percent cover of perennials from PCQ points, by plot.

Transect	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
42	55	100	2	61
43	95	40	40	25
44	100	0	0	0
45	72	65	40	0
46	100	35	20	55
47	70	45	0	50
48	42	5	90	45
49	0	85	55	35
50	20	0	25	90

Table 16. Summary of percent cover of annuals and biennials from PCQ points, by plot.

Transect	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
1	0	15	31	45
2	20	20	45	25
3	0	0	40	0
4	0	45	2	0
5	0	80	45	0
6	0	60	0	0
7	0	65	15	80
8	4	65	10	40
9	0	5	0	75
10	35	15	0	23
11	0	70	0	20
12	57	55	0	51
13	0	5	0	32
14	0	100	25	30
15	0	10	7	0
16	0	65	0	80
17	20	65	32	10
18	0	40	42	0
19	10	80	0	0
20	0	100	0	15
21	0	10	0	7
22	0	65	0	40
23	2	25	0	15
24	10	6	5	47
25	37	92	2	23

Table 16. Summary of percent cover of annuals and biennials from PCQ points, by plot.

Transect	September 2005		September 2012	
	Riparian	Non-riparian	Riparian	Non-riparian
26	1	75	0	35
27	19	19	2	20
28	24	0	0	34
29	35	0	65	0
30	0	0	55	35
31	20	65	10	0
32	10	20	0	45
33	0	31	55	32
34	5	50	10	20
35	0	60	0	0
36	0	0	20	37
37	42	10	25	7
38	7	30	20	25
39	35	7	35	35
40	0	80	0	80
41	20	40	20	15
42	2	0	0	2
43	0	24	25	25
44	0	0	100	92
45	7	90	50	65
46	0	10	50	0
47	20	50	0	0
48	25	80	0	0
49	0	0	30	0
50	20	95	45	22

Floristics

Specimens were made of 15 previously undocumented taxa (Table 17). *Lepidium latifolium* is an aggressive exotic invasive and is spreading quickly throughout the preserve. The individual of *Prosopis velutina* with Watson Woods at an unusually high elevation and perhaps could be a good seed source for attempts at growing the species as an ornamental in the Prescott area.

Table 17. Vascular plants collected at Watson Woods Riparian Preserve in 2008-2012. All collections made by Marc Baker. Species new to the preserve are in bold.			
Species	Family	Collector's number	Date
<i>Linum lewisii</i>	Linaceae	16923	19 May 2009
<i>Penstemon palmeri</i>	Scrophulariaceae	16924	19 May 2009
<i>Gaillardia pinnatifida</i>	Asteraceae	16732	6 October 2008
<i>Populus angustifolia</i>	Salicaceae	17121	10 June 2010
<i>Robinia pseudoacacia</i>	Fabaceae	17122	10 June 2010
<i>Arrhenatherum elatius</i>	Poaceae	17123	10 June 2010
<i>Hybanthus verticillatus</i>	Violaceae	17124	10 June 2010
<i>Chamaesyce albomarginata</i>	Euphorbiaceae	17125	10 June 2010
<i>Stephanomeria thurberi</i>	Asteraceae	17126	10 June 2010
<i>Hordeum pusillum</i>	Poaceae	17127	10 June 2010
<i>Prosopis velutina</i>	Fabaceae	17128	10 June 2010
<i>Apocynum cannabinum</i>	Apocynaceae	17129	10 June 2010
<i>Cryptantha cinerea</i>	Boraginaceae	17130	10 June 2010
<i>Vicia americana</i>	Fabaceae	17131	10 June 2010
<i>Calochortus ambiguus</i>	Liliaceae	17132	10 June 2010
<i>Lepidium latifolium</i>	Brassicaceae	17454	9 September 2011
<i>Chamaesyce serpyllifolia</i>	Euphorbiaceae	17455	9 September 2011
<i>Pectis prostrata</i>	Asteraceae	17614	20 September 2012
<i>Cyperus esculentus</i>	Cyperaceae	17615	20 September 2012
<i>Elymus canadensis</i>	Poaceae	17616	20 September 2012
<i>Amaranthus palmeri</i>	Amaranthaceae	17617	20 September 2012
<i>Symphotrichum lanceolatum</i>	Asteraceae	17632	8 October 2012
<i>Sporobolus airoides</i>	Poaceae	17633	8 October 2012
<i>Leptochloa dubia</i>	Poaceae	17634	8 October 2012

Vegetation mapping

Descriptions of vegetation types recorded during 2005 and 2102 are presented in Table 18. Vegetation polygons are mapped and presented in Figure 7. Riparian woodland was the dominate vegetation type of the Watson Woods Riparian Preserve in fall 2012, and represented a nearly 10% increase over fall 2005 Table 19). Stands of *Fallugia paradoxa* nearly doubled in size between the two samples and *Chrysothamnus nauseosus* scrub went from one or two individuals in 2005 to an area of .2 hectares in 2012. Areas of disturbed perennial and grassland both fell between 2005 and 2012. There were no significant areas of emergents or *Dipsacus fullonum* in 2012.

Table 18. Descriptions of vegetation types recorded during 2005 and 2102.	
Vegetation classification	Description
<i>Chrysothamnus nauseosus</i>	Scrub dominated by shrubs of <i>Chrysothamnus nauseosus</i> .
Disturbed annual	Areas of past disturbance that remain dominated by exotic or native annuals or biennials.
<i>Dipsacus fullonum</i>	Seasonally wet areas dominated by the biennial <i>Dipsacus fullonum</i> .
Disturbed perennial	Areas of past disturbance that remain dominated by mostly exotic perennial herbs.
Emergent	Seasonally wet areas dominated by sedges (<i>Carex</i> , <i>Cyperus</i>) and rushes (<i>Scirpus</i> , <i>Juncus</i> , <i>Eleocharis</i>).
<i>Fallugia paradoxa</i>	Scrub dominated by shrubs (often rhizomatous clones) of <i>Fallugia paradoxa</i> .
Grassland	Areas dominated by perennial native grasses.
Mixed sclerophyll	Scrub dominated by upland shrubs.
Native perennial	Areas dominated by perennial native herbs.
Riparian woodland	Open to dense woodland dominated by riparian shrub and trees, primarily <i>Acer</i> , <i>Populus</i> and <i>Salix</i> .
<i>Tamarix ramosissima</i>	Woodland dominated by <i>Tamarix ramosissima</i> .
<i>Ulmus pumila</i>	Woodland dominated by <i>Ulmus pumila</i> .

Table 19. Total estimated areas for vegetation types within the Watson Woods Riparian Preserve, 2005 and 2012.

Vegetation classification	2005		2012	
	Hectares	Acres	Hectares	Acres
<i>Chrysothamnus nauseosus</i>	0	0	0.2	0.5
Disturbed annual	14.7	36.4	14.3	35.4
<i>Dipsacus fullonum</i>	0.2	0.4	0	0
Disturbed perennial	6.9	17.0	5.7	14.2
Emergent	0.1	0.2	0	0
<i>Fallugia paradoxa</i>	0.3	0.6	0.5	1.2
Grassland	8.1	20.0	6.9	17.1
Mixed sclerophyll	0.8	2.0	0.9	2.3
Native perennial	0	0	0.2	0.4
Riparian woodland	17.0	41.9	18.6	45.9
<i>Tamarix ramosissima</i>	0.0	0.1	0.0	0.0
<i>Ulnus pumila</i>	0.7	1.7	1.0	2.5

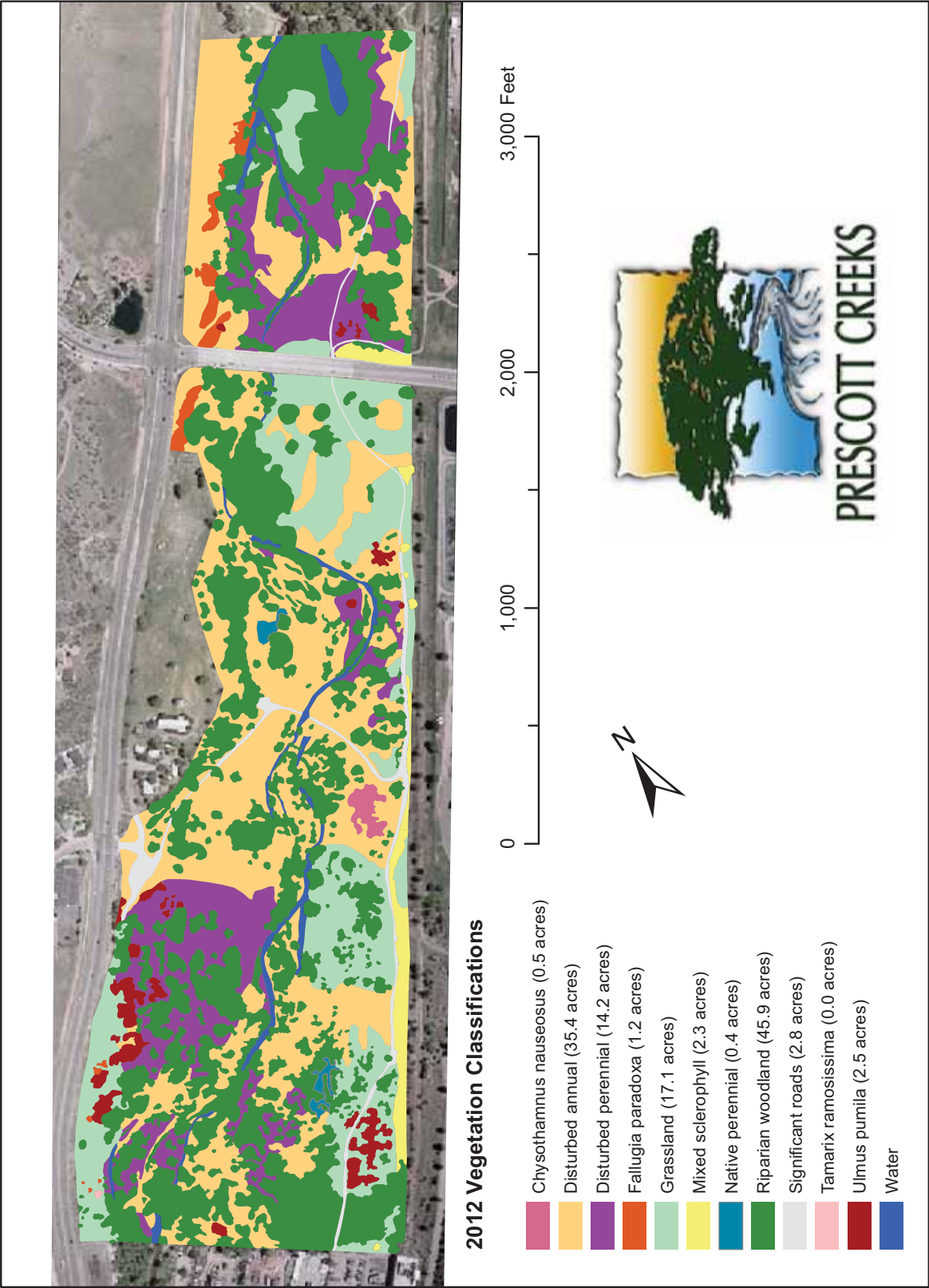


Figure 7. 2012 vegetation map of Watson Woods Riparian Preserve.

Discussion and conclusions

Mean FHD for perennials remained constant as measured in meters ($2.34 \text{ m}^3/\text{m}^2$) and nearly constant as measured in decimeters ($1.34 \text{ m}^3/\text{m}^2$ from $1.28 \text{ m}^3/\text{m}^2$) between fall 2005 and fall 2012. Of the six species that had a noticeable gain in estimated FHD between 1997 and 2012, *Festuca arundinacea* is the most disturbing, since it is an exotic perennial grass that occurs primarily on moist channel banks. In a more positive note, the FHD for *Ulmus pumila*, which is an undesirable exotic and highly invasive tree, decreased between 2005 and 2012. The remaining four, *Populus angustifolia*, *P. ×hinckleyana*, *Salix exigua*, *S. lasiolepis*, which are desirable native shrubs are good indicators of habitat within the Preserve converting to a more native-species rich woodland. Only one of these, *Populus angustifolia*, had a decrease in estimated FHD between 2005 and 2012, while the others had an increase. The estimated FHD for three perennial herbs, *Machaeranthera canescens*, *Medicago officinalis*, and *Mirabilis longiflora* decreased dramatically between 2005 and 2012. The slight increase in mean maximum height among all transects between 1997 (5.92 m) and 2005 (7.59 m) and between 2005 and 2012 (8.96 m) could be explained by the increase in FHD, at least as measured in decimeters, since, the two are inexorably linked. Also, at least some of the FHD accounted for by low-growing herbs in 2005, such as *M. canescens*, *M. officinalis*, and *M. longiflora*, was not present in 2012 and the aforementioned tree and shrub species had higher estimated FHD values in 2012.

Estimated percent cover of annuals along the FHD transects fluctuated among 1997, 2005, and 2012 indicating a lack of general trend and there were no obvious trends among the three samples in terms of specific herbs (see Appendix 5).

Although estimated total absolute density of woody perennials more than doubled for riparian species between 2005 (204 individuals per ha) and 2012 (416.5 individuals per ha), and nearly doubled for non-riparian perennials (59.2 vs 92.2 individuals per ha), the results were not statistically significant at the $p = 0.01$ level. For riparian sample, however, the difference was significant at the $p = 0.01$ level. Estimates for average canopy cover increased between fall 2005 and fall 2012, with riparian species increasing from 25.4% in 2005 to 31.9% in 2012. Similarly, average canopy cover for non-riparian species jumped from 8.4% in 2005 to 20.4% in 2012. Specimens were made of approximately 15 previously undocumented taxa.

Data from PCQ sampling has much better resolution than that of FHD methodology as judged by probability values. This combined with the fact that the FHD method is much more labor intensive, suggests that the FHD method is much less efficient than the PCQ method. The FHD method, however, has an advantage of presenting a more pictorial graphing of transects. Because of the rather large discrepancy in estimates between FHD measured in meters vs those measured in decimeters, and the personal observation that measuring in decimeters does not entail much added effort, measurements in decimeters is probably better.

Two exotic invasive species are of management concern, *Centaurea stoebe* and *Lepidium latifolium*. Individuals of these species have only recently been recorded within the Preserve and are spreading rapidly.

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Appendix 1. Forms

Form 1. Transect field form for Foliar height-density, cover of annuals, and DBD of woody perennials.

Technicians: _____ Date: _____
 Transect no. _____ m from reference point no. _____ @ _____ E of magnetic north

Perennial foliar height distribution for Watson Woods Riparian Preserve,
 Reference Reach

Ht (dm)														
2														
4														
6														
8														
10														
12														
14														
16														
18														
20														
22														
24														
26														
28														
30														
32														
34														
36														
38														
40														

Annual Cover

2		12		22		32	
4		14		24		34	
6		16		26		36	
8		18		28		38	
10		20		30		40	

DBH within 1m of transect:

Form 2. Point-quarter method field form.

Technician(s):		Baker		Sub Plot:		Upland		Date:		Watson Wood Riparian Preserve - Vegetation Sampling - Point Center Quarter															
Point #	Woody Species									Herbaceous Species															
	90°			180°			270°			360°			Perennial Cover					Annual Cover							
	Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Sp. 1	Cvr. 1	Sp. 2	Cvr. 2	Sp. 3	Cvr. 3	Sp. 4	Cvr. 4	Sp. 5	Cvr. 5
1																									
2																									
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Notes:																									

Form PCQ Data Form (2) xls updated 01/18/20051 of 2

Watson Wood Riparian Preserve - Vegetation Sampling - Point Center Quarter

Technician(s):	Baker	Woody Species												Herbaceous Species										Date:				
		90°				180°				270°				360°				Perennial Cover					Annual Cover					
		Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Ht.	Taxon	Dist.	W	Ht.	Sp. 1	Cvr. 1	Sp. 2	Cvr. 2	Sp. 3	Cvr. 3		Sp. 4	Cvr. 4	Sp. 5	Cvr. 5
Point #																												
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Notes:																												

Appendix 2. Reference point photos.



Reference point 1, 1997



Reference point 1, 2006



Reference point 2, 1997



Reference point 2, 2006



Reference point 3, 1997



Reference point 3, 2006



Reference point 4, 1997



Reference point 4, 2006



Reference point 5, 1997



Reference point 5, 2006



Reference point 6, 1997



Reference point 6, 2006



Reference point 7, 1997



Reference point 7, 2006

Appendix 3. Transect photos for 1997, 2005, and 2012.



FHD transect 1, 00m, 1997.



FHD transect 1, 00m, 2005.



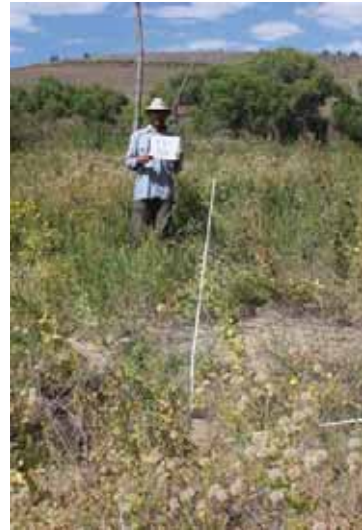
FHD transect 1, 00m, 2012.



FHD transect 1, 20m, 1997.



FHD transect 1, 20m, 2005.



FHD transect 1, 20m, 2012.



FHD transect 2, 00m, 1997.



FHD transect 2, 00m, 2005.



FHD transect 2, 00m, 2012.



FHD transect 2, 20m, 1997.



FHD transect 2, 20m, 2005.



FHD transect 2, 20m, 2012.



FHD transect 3, 00m, 1997.



FHD transect 3, 00m, 2005.



FHD transect 3, 00m, 2012.



FHD transect 3, 20m, 1997.



FHD transect 3, 20m, 2005.



FHD transect 3, 20m, 2012.



FHD transect 4, 00m, 1997.



FHD transect 4, 00m, 2005.



FHD transect 4, 00m, 2012.



FHD transect 4, 20m, 1997.



FHD transect 4, 20m, 2005.



FHD transect 4, 20m.



FHD transect 5, 00m, 1997.



FHD transect 5, 20m, 1997.



FHD transect 6, 00m, 1997.



FHD transect 6, 00m, 2005.



FHD transect 6, 00m, 2012.



FHD transect 6, 20m, 1997.



FHD transect 6, 20m, 2005.



FHD transect 6, 20m, 2012.



FHD transect 7, 00m, 1997.



FHD transect 7, 00m, 2005.



FHD transect 7, 00m, 2012.



FHD transect 7, 20m, 1997.



FHD transect 7, 20m, 2005.



FHD transect 7, 20m, 2012.



FHD transect 8, 00m, 1997.



FHD transect 8, 00m, 2005.



FHD transect 8, 00m, 2012.



FHD transect 8, 20m, 1997.



FHD transect 8, 20m, 2005.



FHD transect 8, 20m, 2012.



FHD transect 9, 00m, 1997.



FHD transect 9, 00m, 2005.



FHD transect 9, 00m, 2012.



FHD transect 9, 20m, 1997.



FHD transect 9, 20m, 2005.



FHD transect 9, 20m, 2012.



FHD transect 10, 00m, 1997.



FHD transect 10, 00m, 2005.



FHD transect 10, 00m, 2012.



FHD transect 10, 20m, 1997.



FHD transect 10, 20m, 2005.



FHD transect 10, 20m, 2012.



FHD transect 11, 00m, 1997.



FHD transect 11, 00m, 2005.



FHD transect 11, 00m, 2012.



FHD transect 11, 20m, 1997.



FHD transect 11, 20m, 2005.



FHD transect 11, 20m, 2012.



FHD transect 12, 00m, 1997.



FHD transect 12, 00m, 2005.



FHD transect 12, 00m, 2012.



FHD transect 12, 20m, 1997.



FHD transect 12, 20m, 2005.



FHD transect 12, 20m,



FHD transect 13, 00m, 1997.



FHD transect 13, 00m, 2005.



FHD transect 13, 00m, 2012.



FHD transect 13, 20m, 1997.



FHD transect 13, 20m, 2005.



FHD transect 13, 20m, 2012.



FHD transect 14, 00m, 1997.



FHD transect 14, 00m, 2005.



FHD transect 14, 00m, 2012.



FHD transect 14, 20m, 1997.



FHD transect 14, 20m, 2005.



FHD transect 14, 20m, 2012.



FHD transect 15, 00m, 1997.



FHD transect 15, 00m, 2005.



FHD transect 15, 00m, 2012.



FHD transect 15, 20m, 1997.



FHD transect 15, 20m, 2005.



FHD transect 15, 20m, 2012.



FHD transect 16, 00m, 1997.



FHD transect 16, 00m, 2005.



FHD transect 16, 00m, 2012.



FHD transect 16, 20m, 1997.



FHD transect 16, 20m, 2005.



FHD transect 16, 20m, 2012.



FHD transect 17, 00m, 1997.



FHD transect 17, 00m, 2005.



FHD transect 17, 00m, 2012.



FHD transect 17, 20m, 1997.



FHD transect 17, 20m, 2005.



FHD transect 17, 20m, 2012.



FHD transect 18, 00m, 1997.



FHD transect 18, 00m, 2005.



FHD transect 18, 00m, 2012.



FHD transect 18, 20m, 1997.



FHD transect 18, 20m, 2005.



FHD transect 18, 20m, 2012.



FHD transect 19, 00m, 1997.



FHD transect 19, 00m, 2005.



FHD transect 19, 00m, 2012.



FHD transect 19, 20m, 1997.



FHD transect 19, 20m, 2005.



FHD transect 19, 20m, 2012.



FHD transect 20, 00m, 1997.



FHD transect 20, 00m, 2005.



FHD transect 20, 00m, 2012.



FHD transect 20, 20m, 1997.



FHD transect 20, 20m, 2005.



FHD transect 20, 20m, 2012.



FHD transect 21, 00m, 1997.



FHD transect 21, 00m, 2005.



FHD transect 21, 00m, 2012.



FHD transect 21, 20m, 1997.



FHD transect 21, 20m, 2005.



FHD transect 21, 20m, 2012.



FHD transect 22, 00m, 1997.



FHD transect 22, 00m, 2005.



FHD transect 22, 00m, 2012.



FHD transect 22, 20m, 1997.



FHD transect 22, 20m, 2005.



FHD transect 22, 20m, 2012.



FHD transect 23, 00m, 1997.



FHD transect 23, 00m, 2005.



FHD transect 23, 00m, 2012.



FHD transect 23, 20m, 1997.



FHD transect 23, 20m, 2005.



FHD transect 23, 20m, 2012.



FHD transect 24, 00m, 1997.



FHD transect 24, 00m, 2005.



FHD transect 24, 00m, 2012.



FHD transect 24, 20m, 1997.



FHD transect 24, 20m, 2005.



FHD transect 24, 20m, 2012.



FHD transect 25, 00m, 1997.



FHD transect 25, 00m, 2005.



FHD transect 25, 00m, 2012.



FHD transect 15, 20m, 1997.



FHD transect 25, 20m, 2005.



FHD transect 25, 20m, 2012.



FHD transect 26, 00m, 1997.



FHD transect 26, 00m, 2005.



FHD transect 26, 00m, 2012.



FHD transect 26, 20m, 1997.

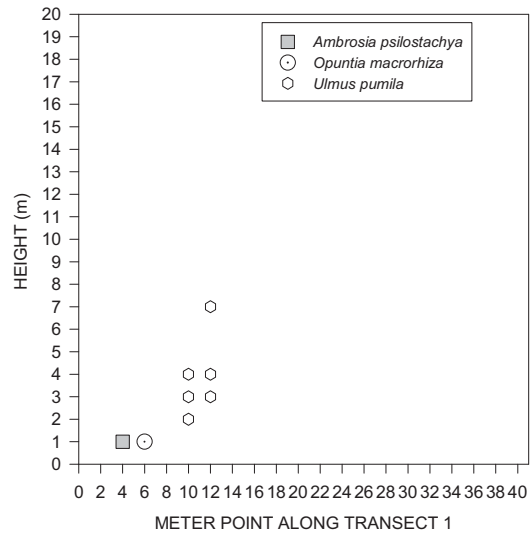


FHD transect 26, 20m, 2005.

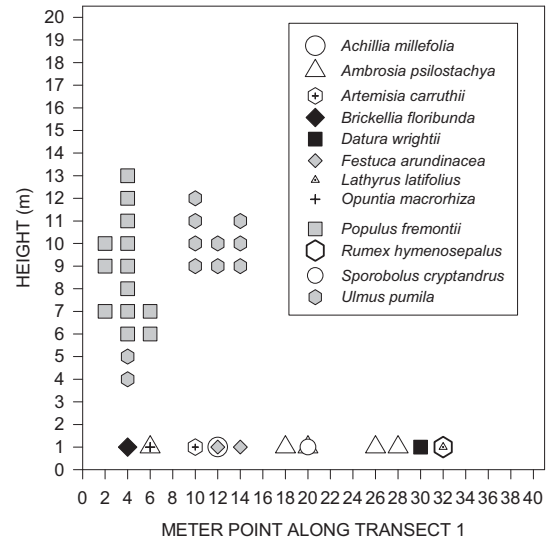


FHD transect 26, 20m, 2012.

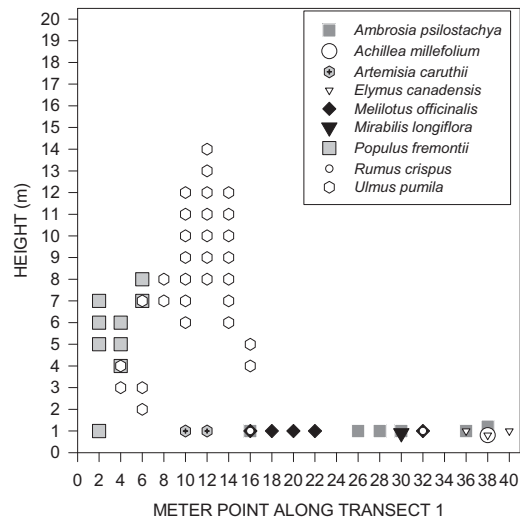
Appendix 4. FHD graphs, by transect, for 1997, 2005, and 2012.



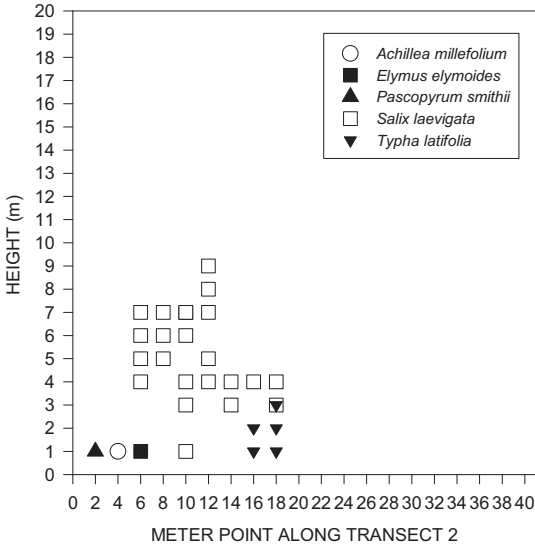
Foliar height distribution
along transect 01, 1998



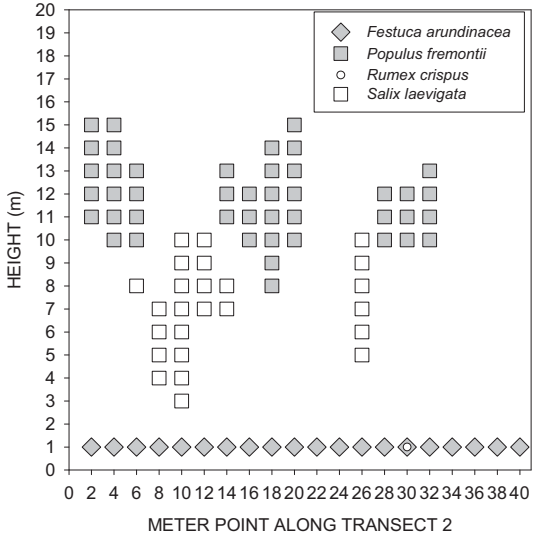
Foliar height distribution
along transect 01, 2012



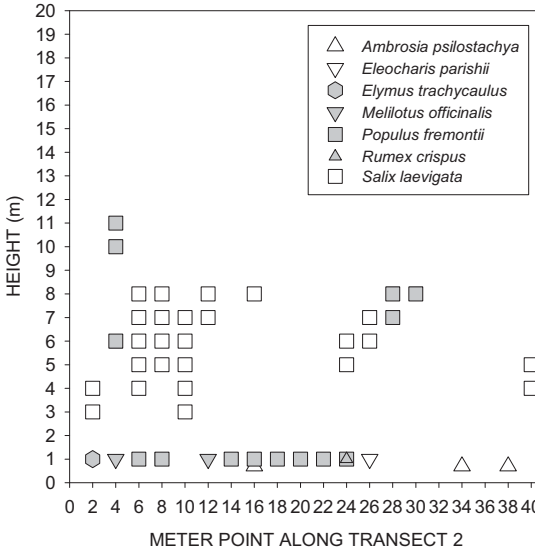
Foliar height distribution
along transect 01, 2005.



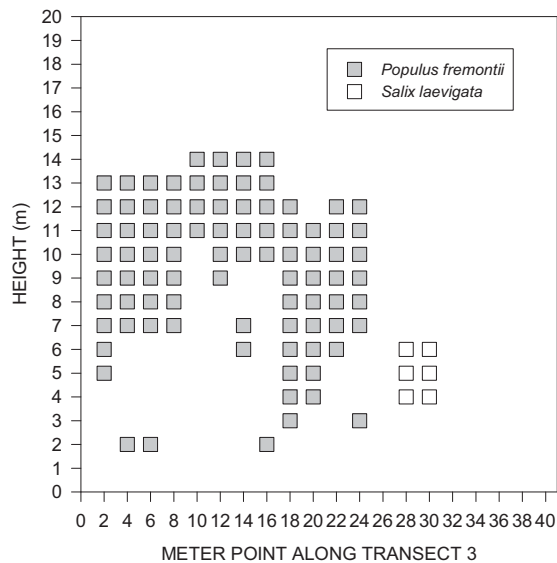
Foliar height distribution
along transect 02, 1998.



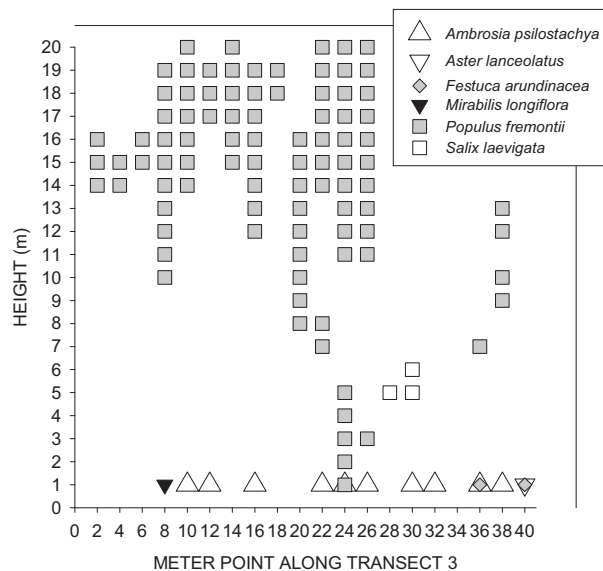
Foliar height distribution
along transect 02, 2012.



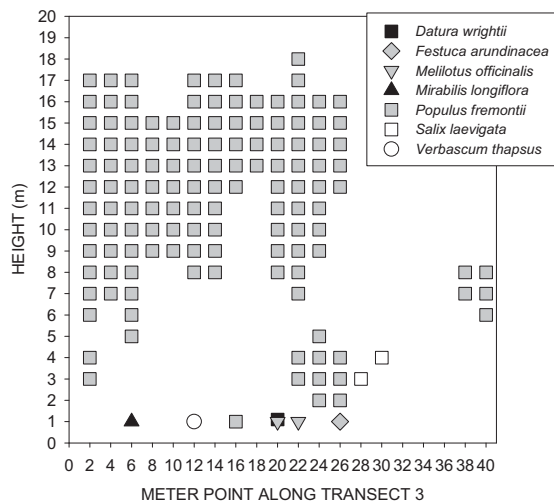
Foliar height distribution
along transect 02, 2005.



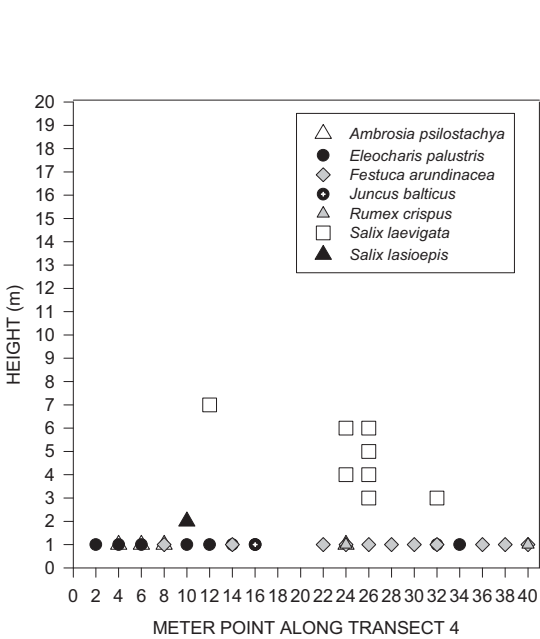
Foliar height distribution
along transect 03, 1998.



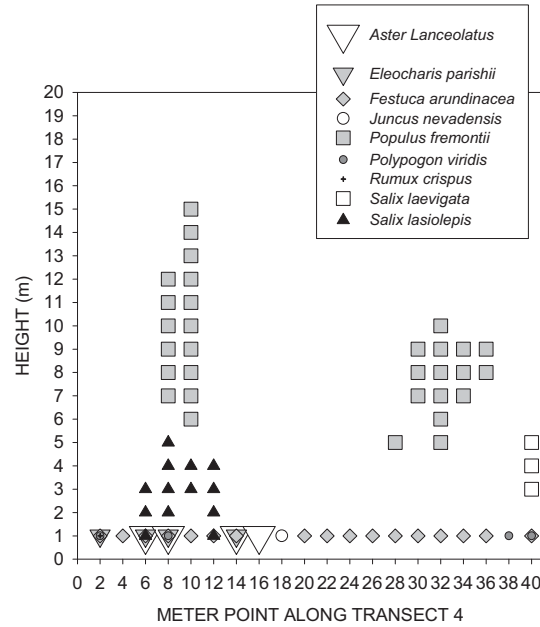
Foliar height distribution
along transect 03, 2012.



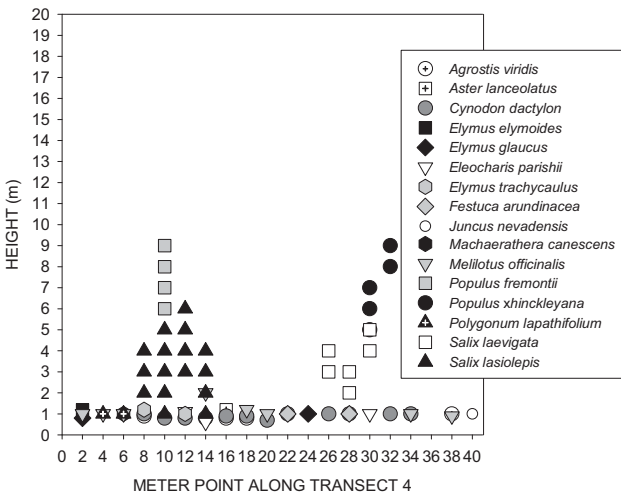
Foliar height distribution
along transect 03, 2005.



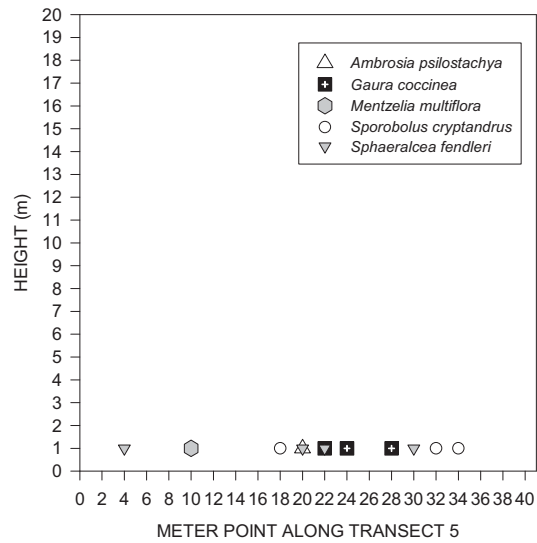
Foliar height distribution
along transect 04, 1998.



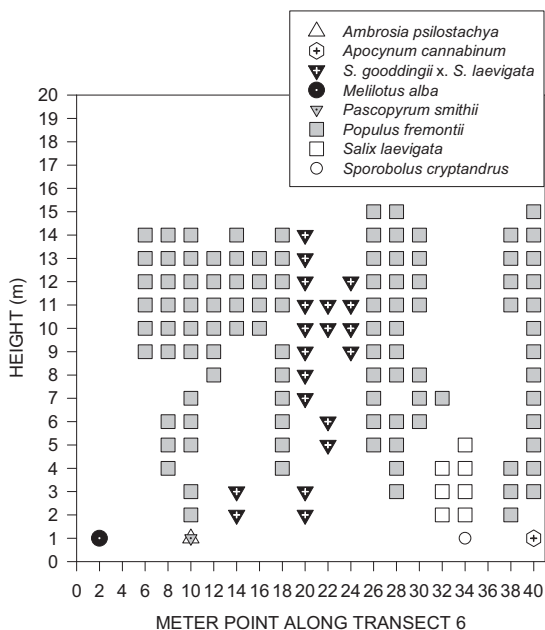
Foliar height distribution
along transect 04, 2012.



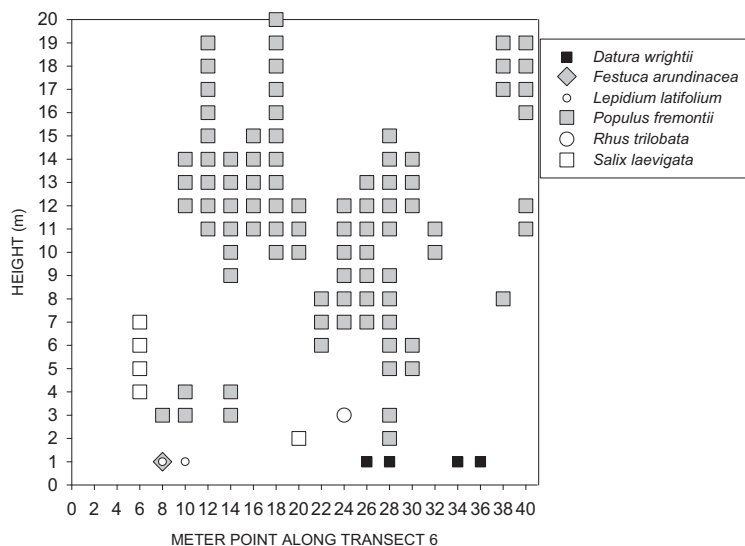
Foliar height distribution
along transect 04, 2005.



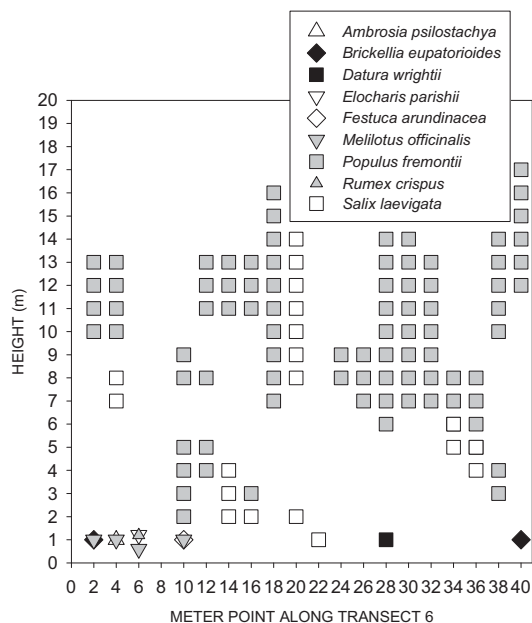
Foliar height distribution
 along transect 05, 1998.



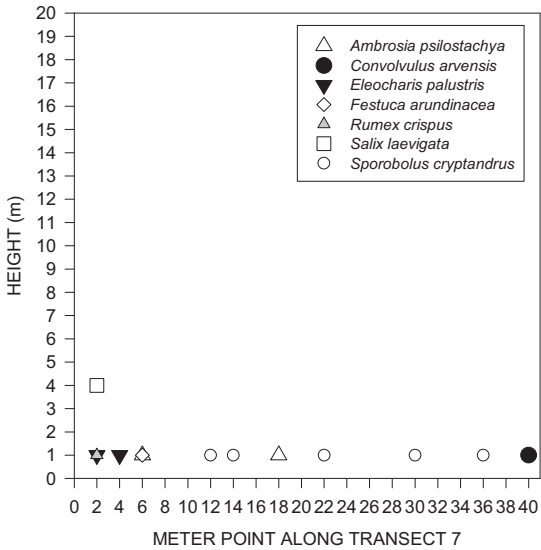
Foliar height distribution
along transect 06, 1998.



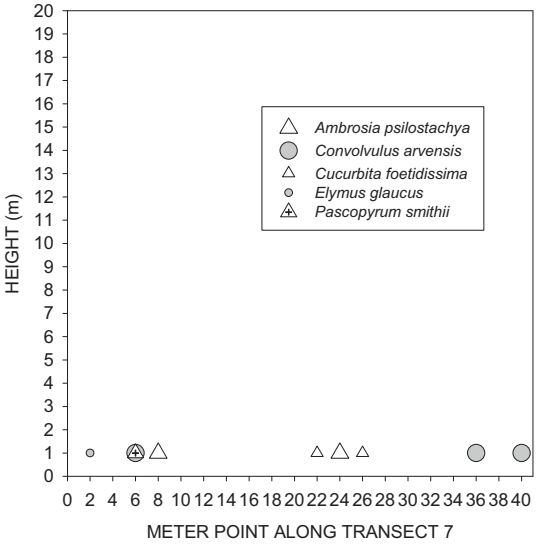
Foliar height distribution
along transect 06, 2012.



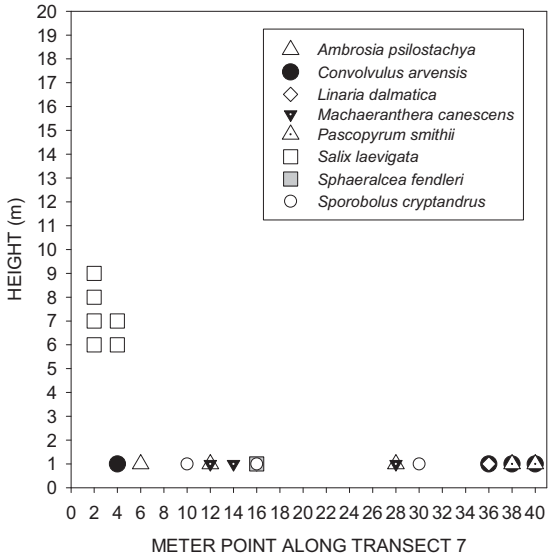
Foliar height distribution
along transect 06, 2005.



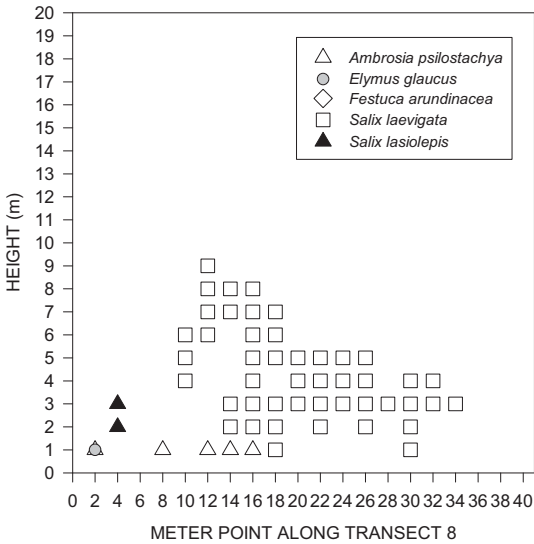
Foliar height distribution
along transect 07, 1998.



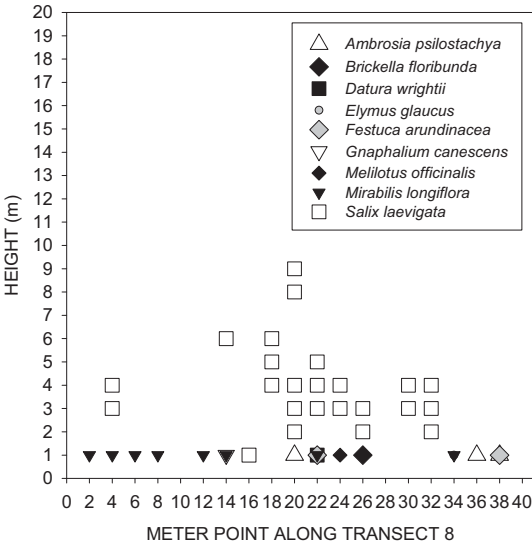
Foliar height distribution
along transect 07, 2012.



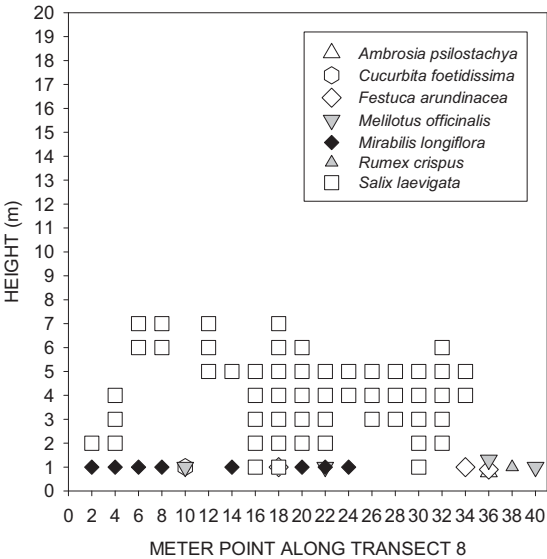
Foliar height distribution
along transect 07, 2005.



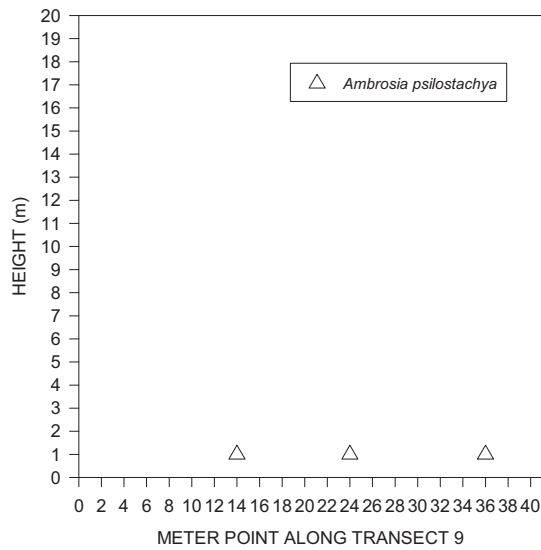
Foliar height distribution
along transect 08, 1998.



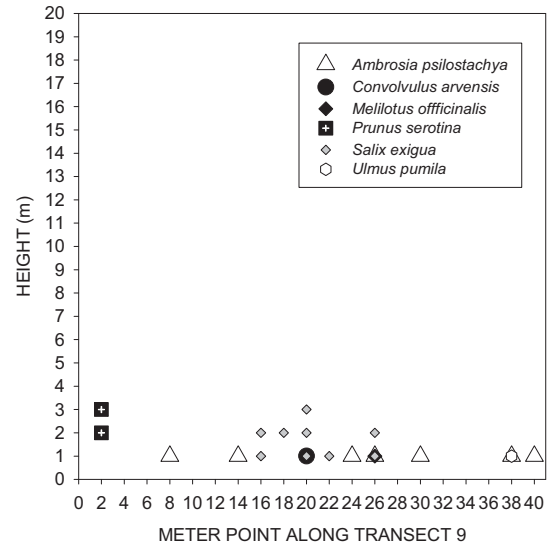
Foliar height distribution
along transect 08, 2012.



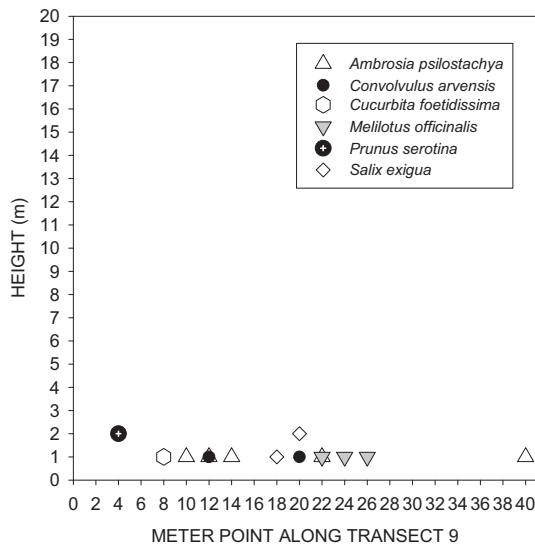
Foliar height distribution
along transect 08, 2005



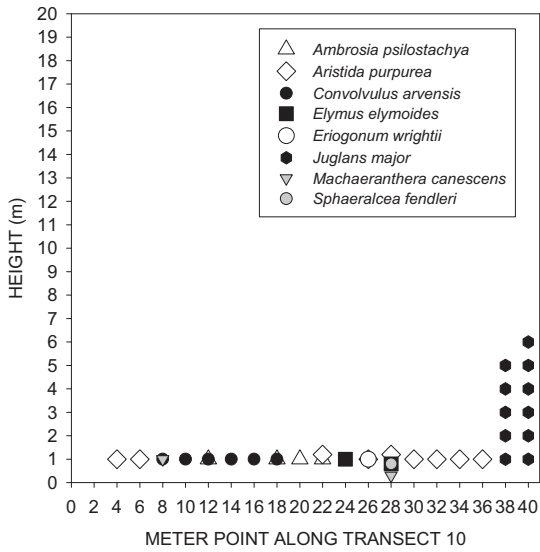
Foliar height distribution
along transect 09, 1998.



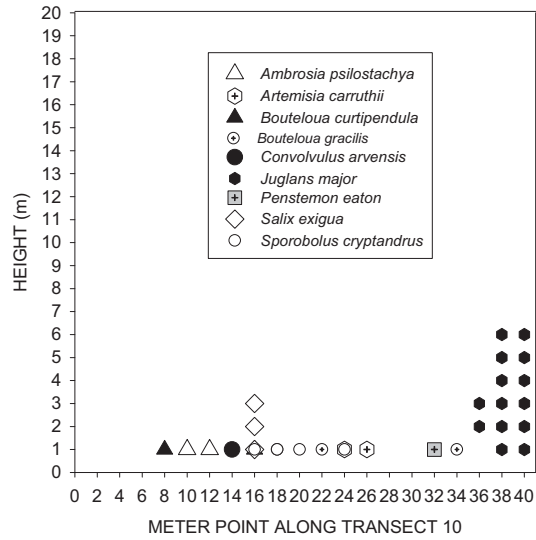
Foliar height distribution
along transect 09, 2012.



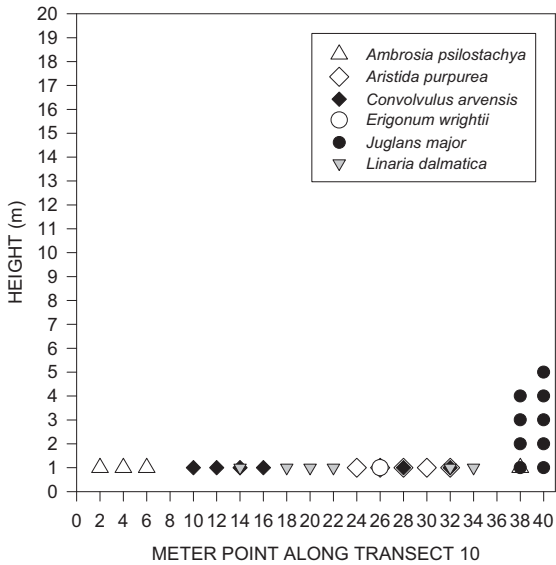
Foliar height distribution
along transect 09, 2005.



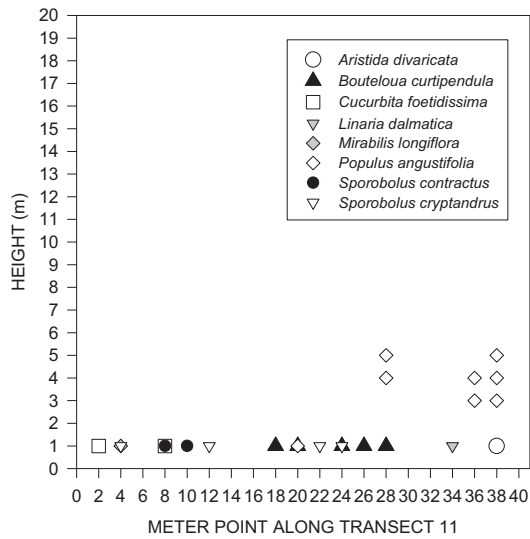
Foliar height distribution
along transect 10, 1998.



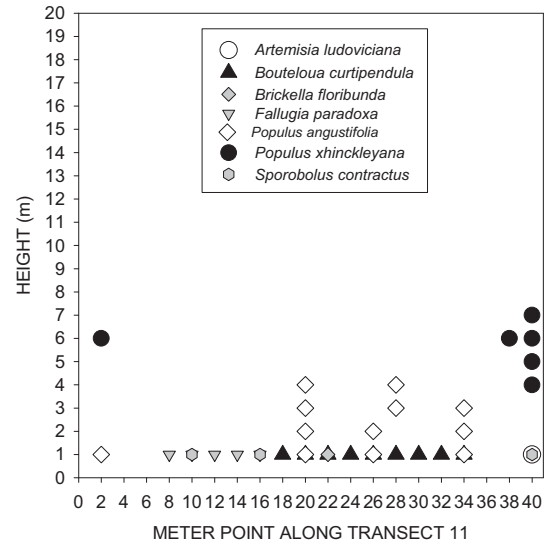
Foliar height distribution
along transect 10, 2012.



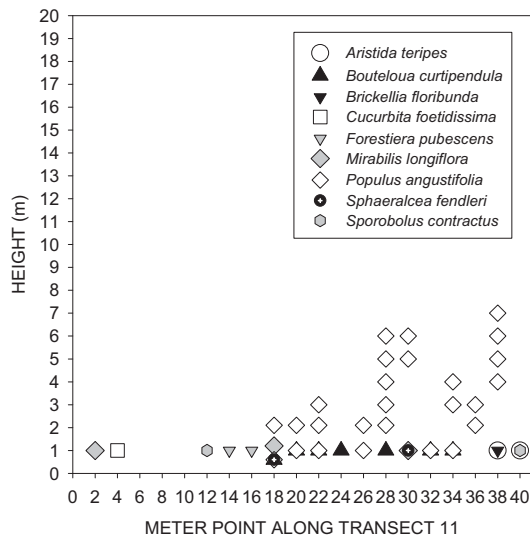
Foliar height distribution
along transect 10, 2005.



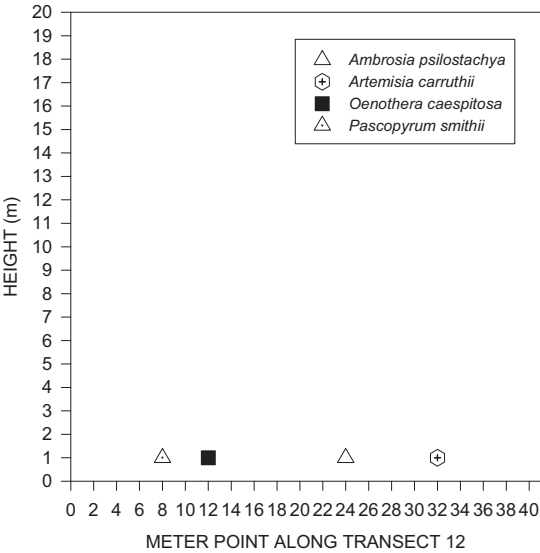
Foliar height distribution
along transect 11, 1998.



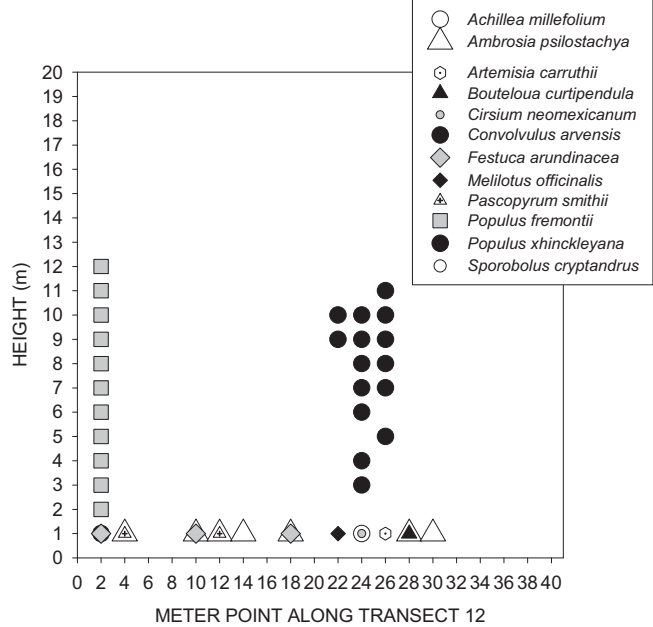
Foliar height distribution
along transect 11, 2012.



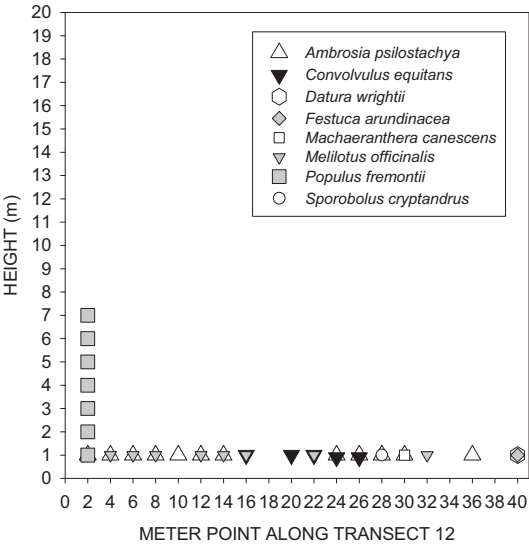
Foliar height distribution
along transect 11, 2005.



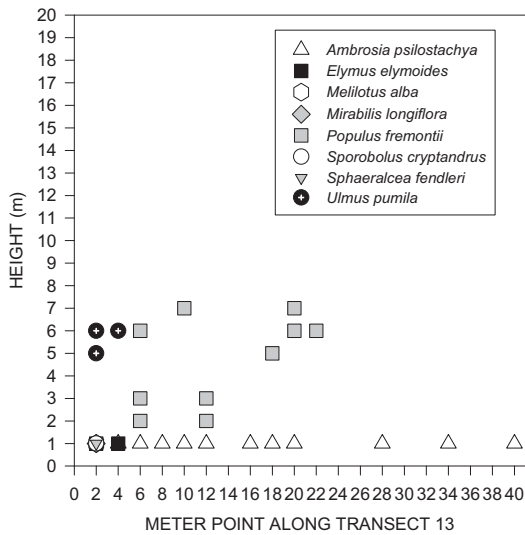
Foliar height distribution
along transect 12, 1998.



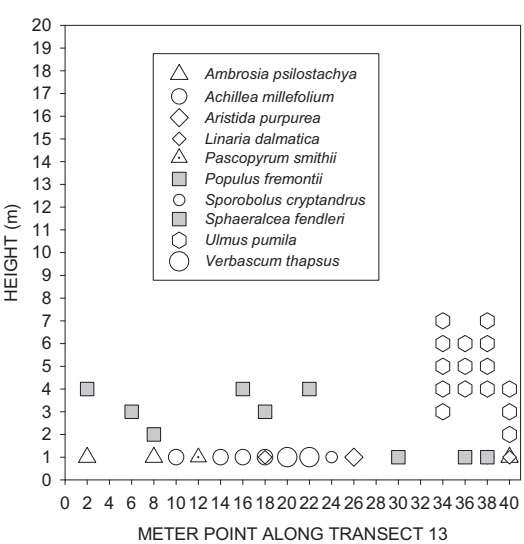
Foliar height distribution
along transect 12, 2012.



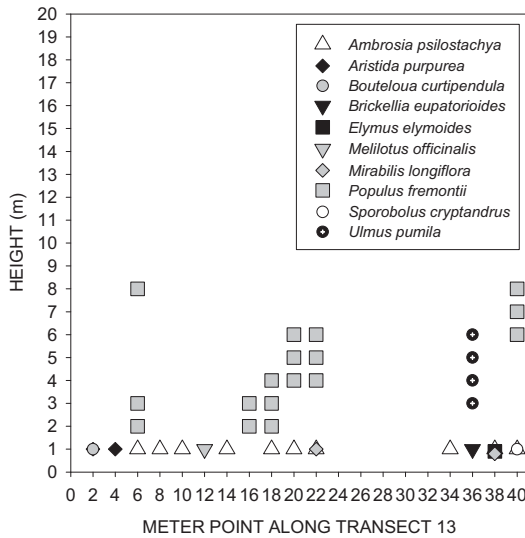
Foliar height distribution
along transect 12, 2005.



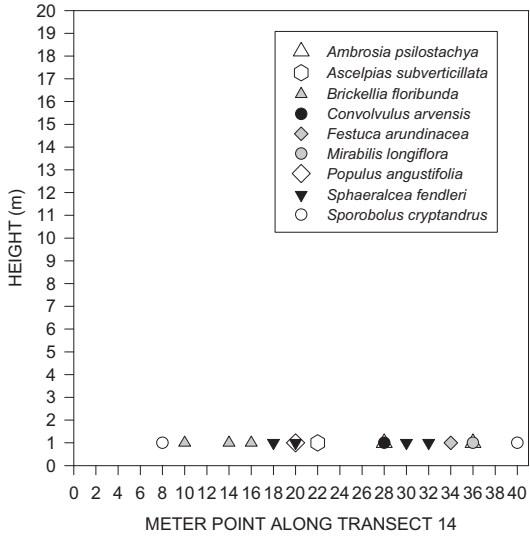
Foliar height distribution
along transect 13, 1998.



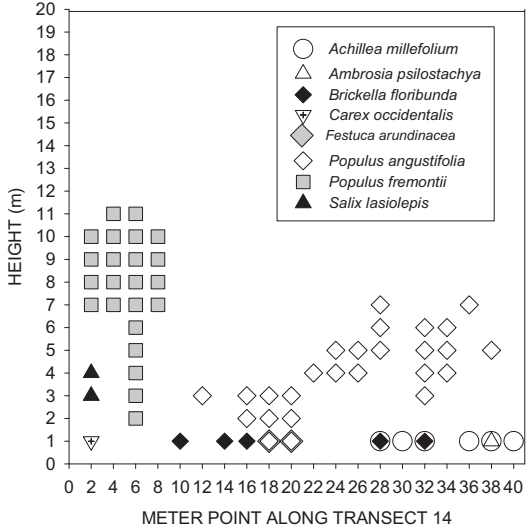
Foliar height distribution
along transect 13, 2012.



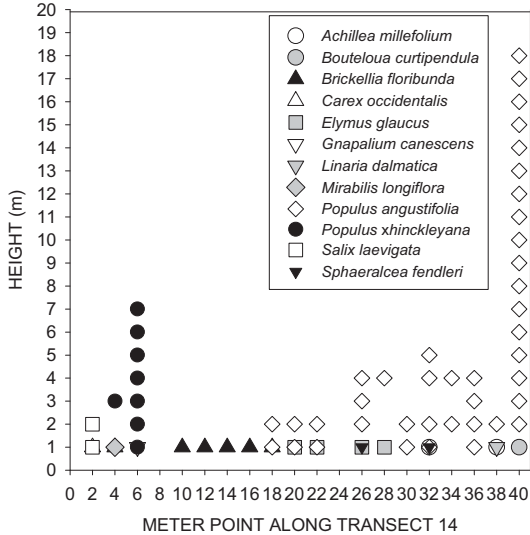
Foliar height distribution
along transect 13, 2005.



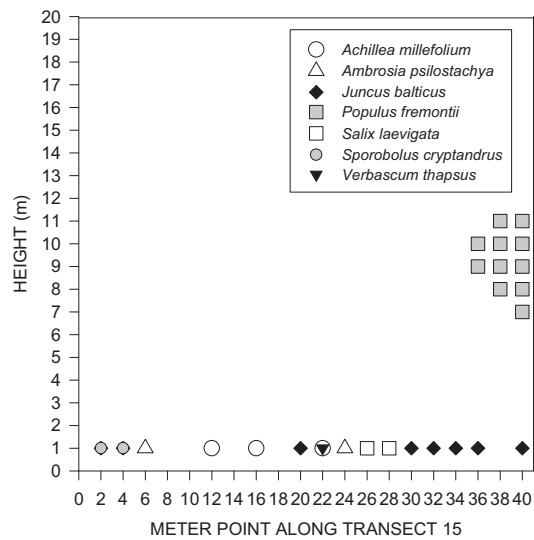
Foliar height distribution
along transect 14, 1998.



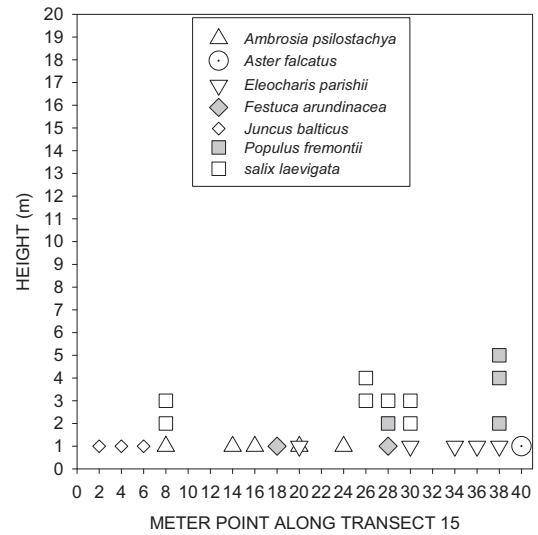
Foliar height distribution
along transect 14, 2012.



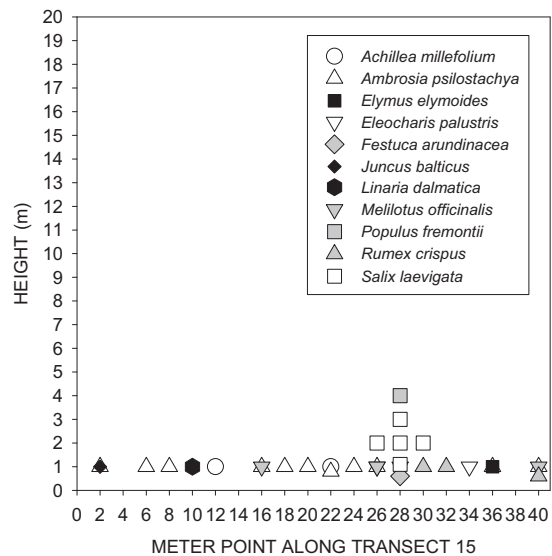
Foliar height distribution
along transect 14, 2005.



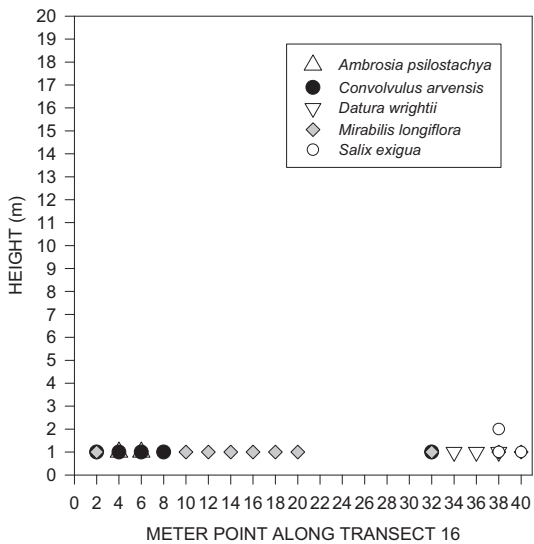
Foliar height distribution
along transect 15, 1998.



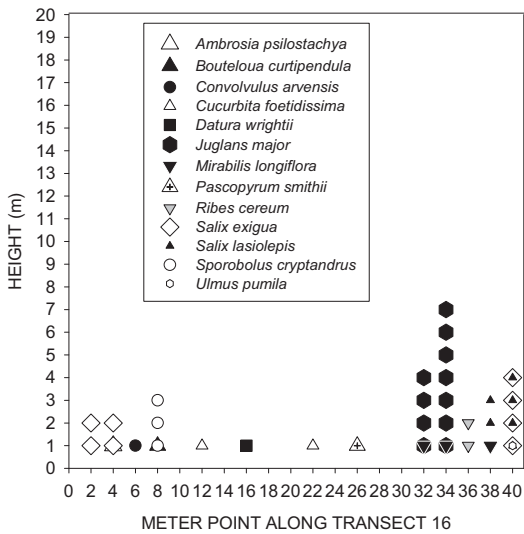
Foliar height distribution
along transect 15, 2012.



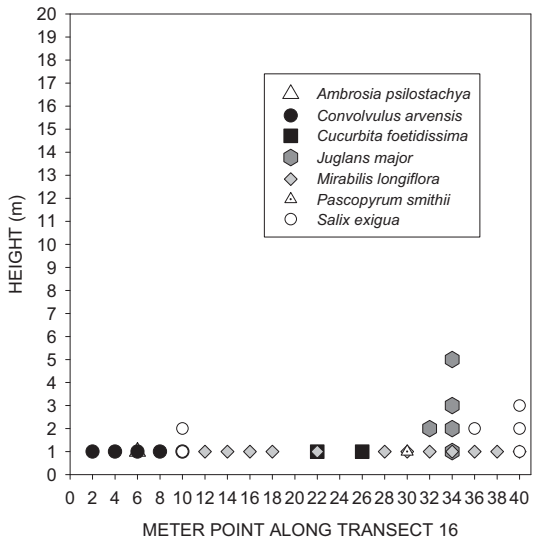
Foliar height distribution
along transect 15, 2005.



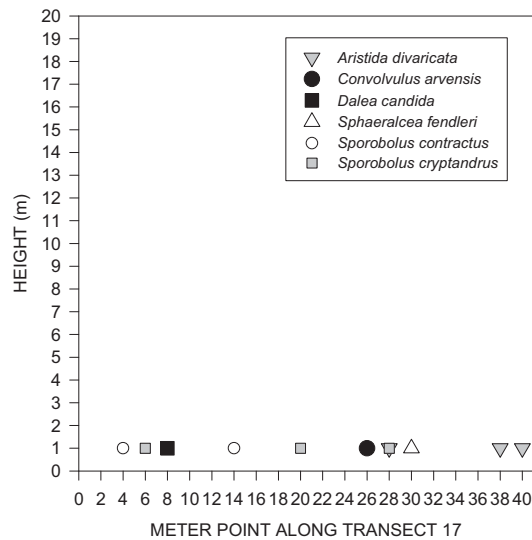
Foliar height distribution
along transect 16, 1998.



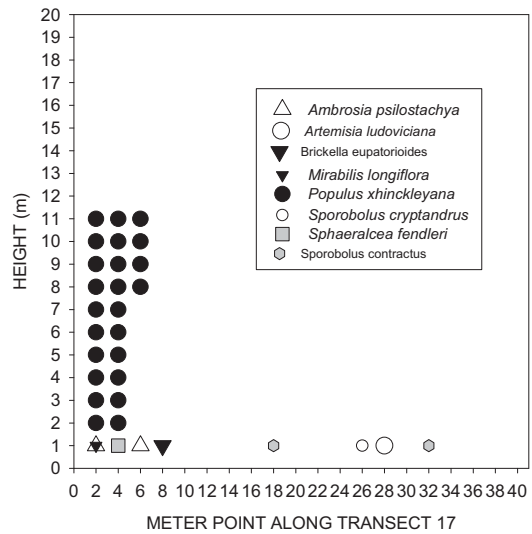
Foliar height distribution
along transect 16, 2012.



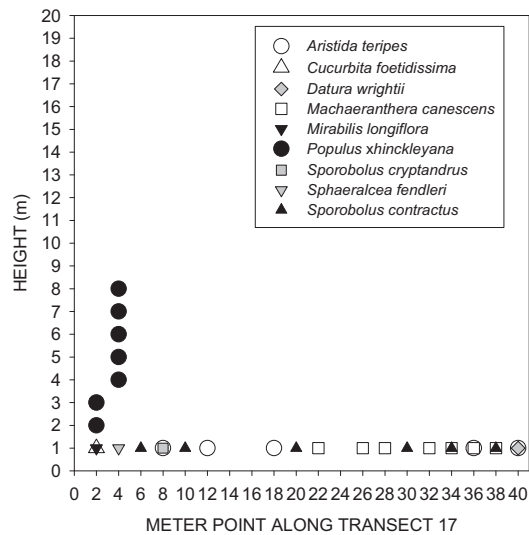
Foliar height distribution
along transect 16, 2005.



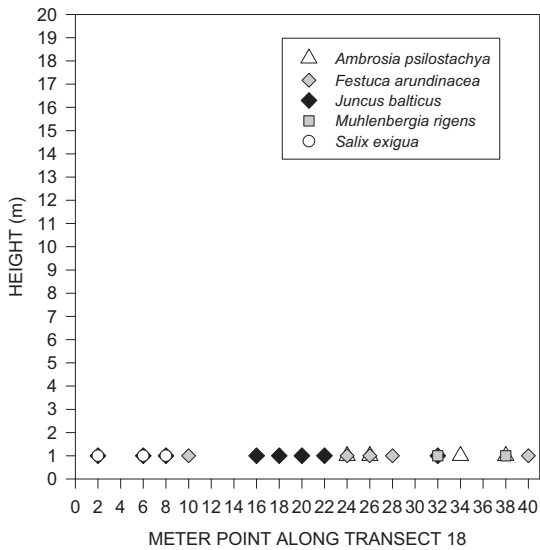
Foliar height distribution
 along transect 17, 1998.



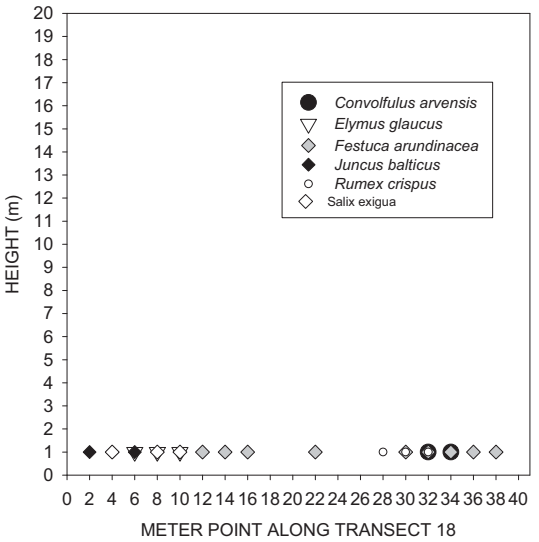
Foliar height distribution
 along transect 17, 2012.



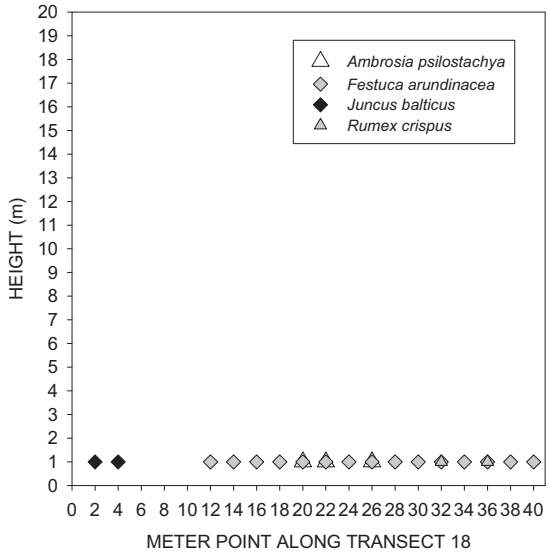
Foliar height distribution
 along transect 17, 2005.



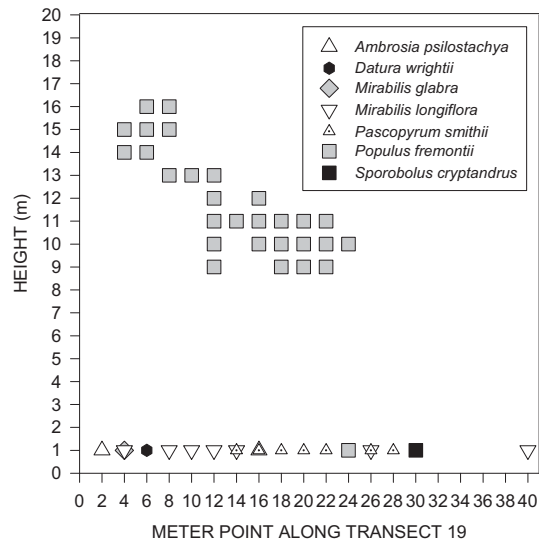
Foliar height distribution
along transect 18, 1998.



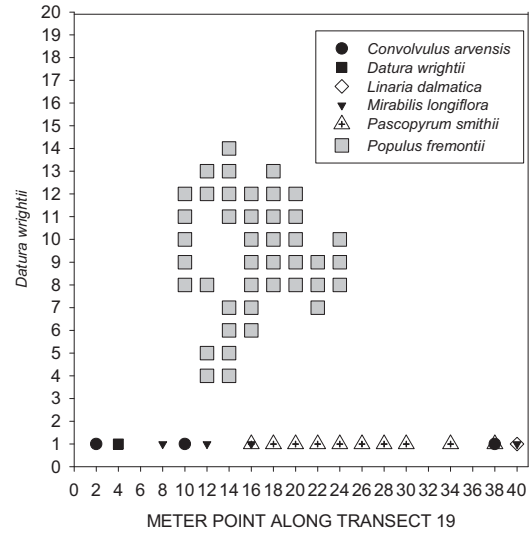
Foliar height distribution
along transect 18, 2012.



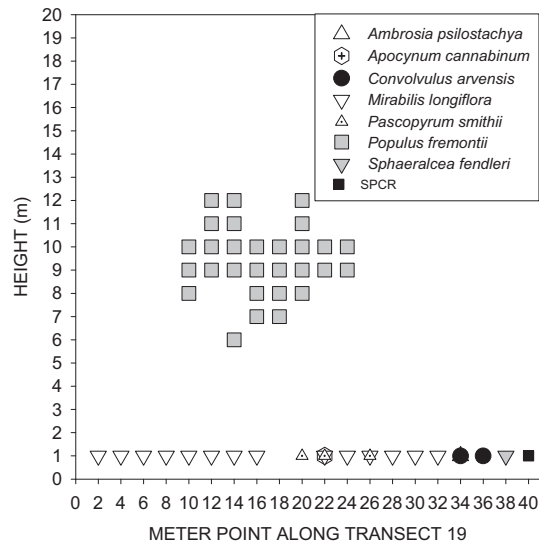
Foliar height distribution
along transect 18, 2005.



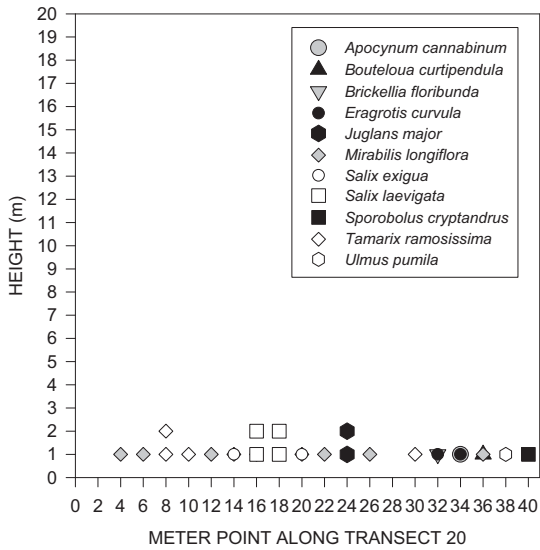
Foliar height distribution
 along transect 19, 1998.



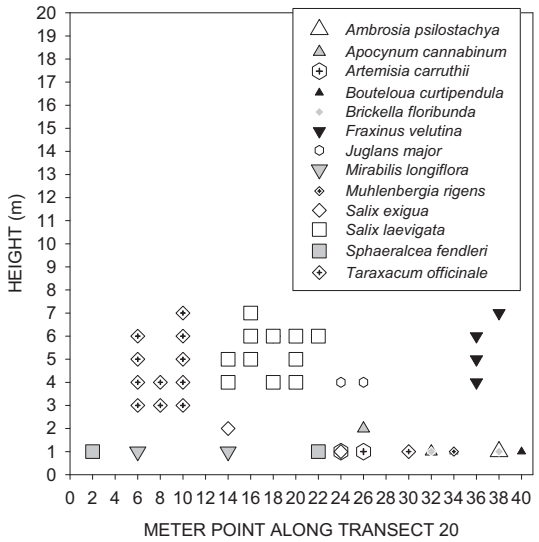
Foliar height distribution
 along transect 19, 2012.



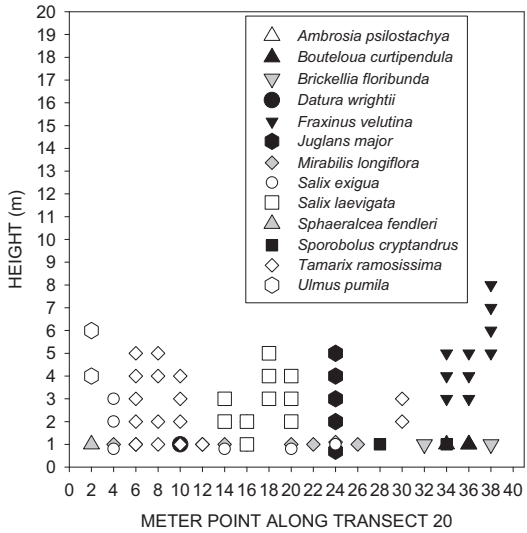
Foliar height distribution
 along transect 19, 2005.



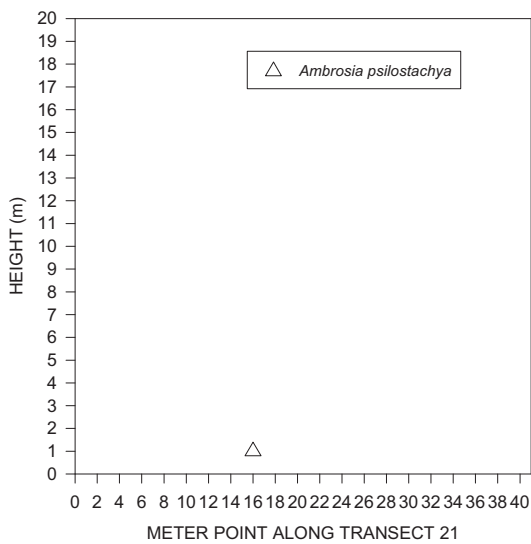
Foliar height distribution
along transect 20, 1998.



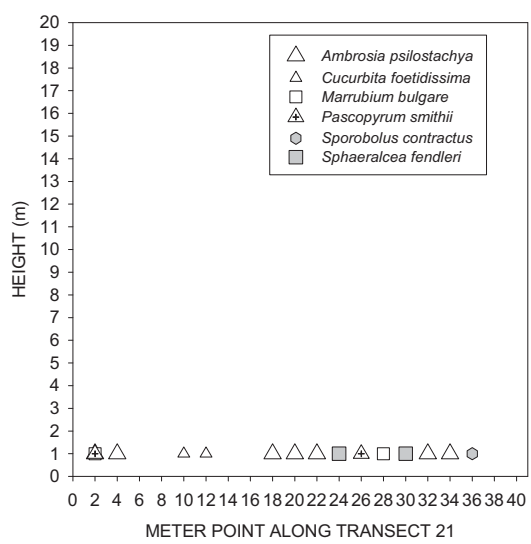
Foliar height distribution
along transect 20, 2012.



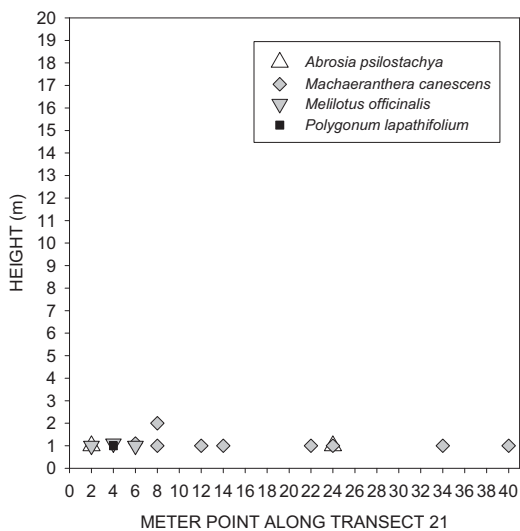
Foliar height distribution
along transect 20, 2005.



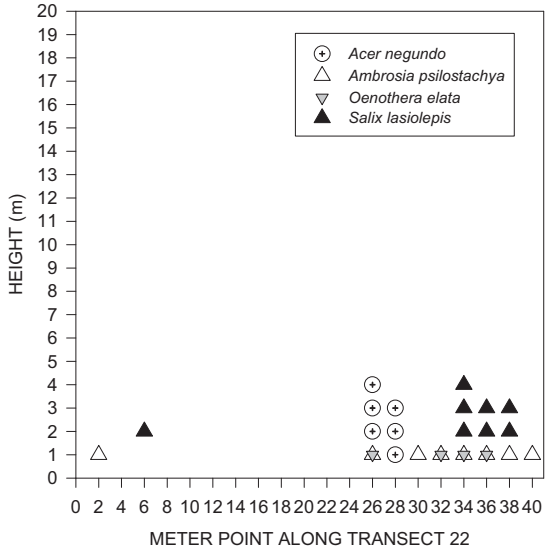
Foliar height distribution
along transect 21, 1998.



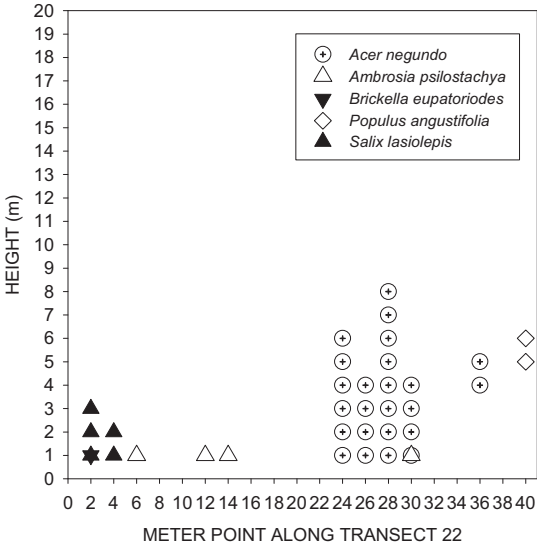
Foliar height distribution
along transect 21, 2012.



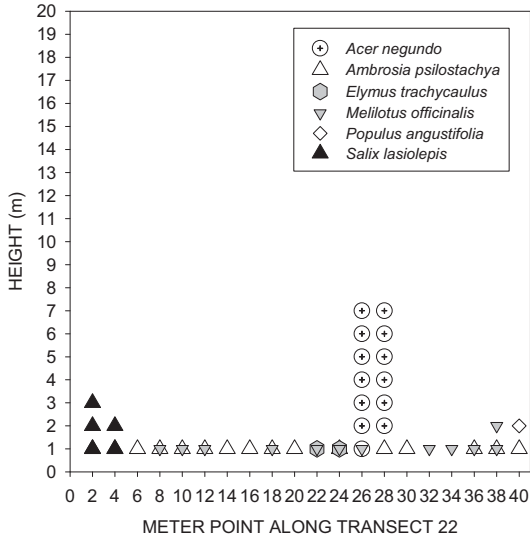
Foliar height distribution
along transect 21, 2005.



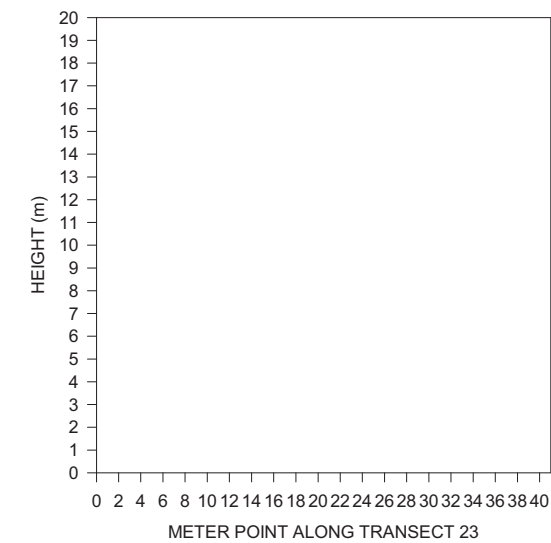
Foliar height distribution
along transect 22, 1998.



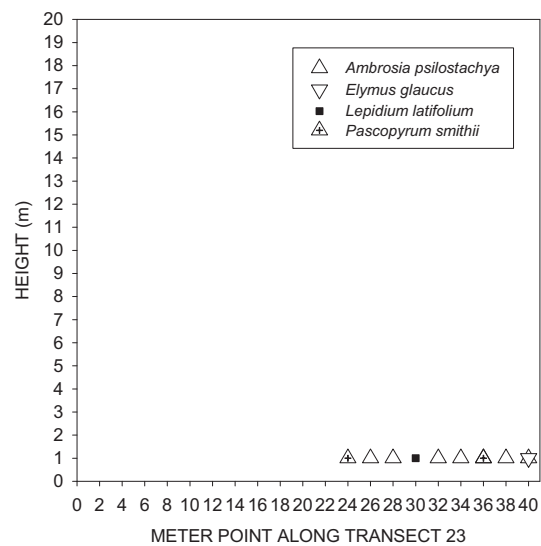
Foliar height distribution
along transect 22, 2012.



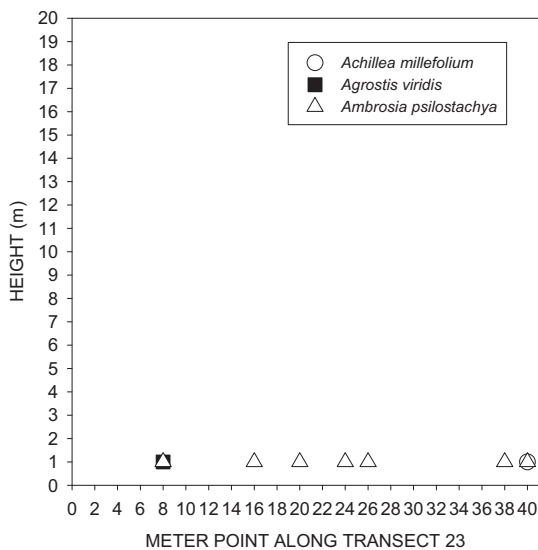
Foliar height distribution
along transect 22, 2005.



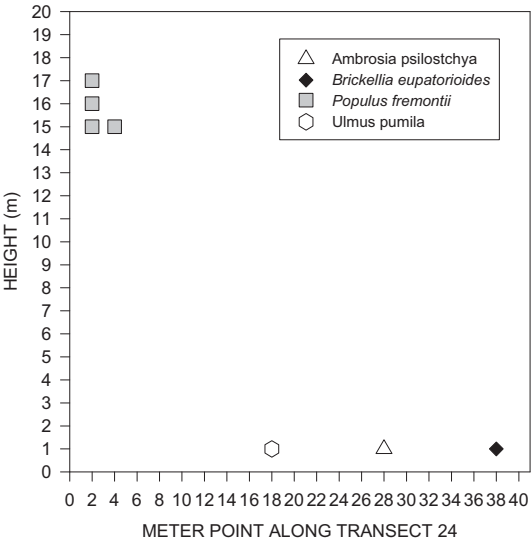
Foliar height distribution
along transect 23, 1998. No
FHD was recorded.



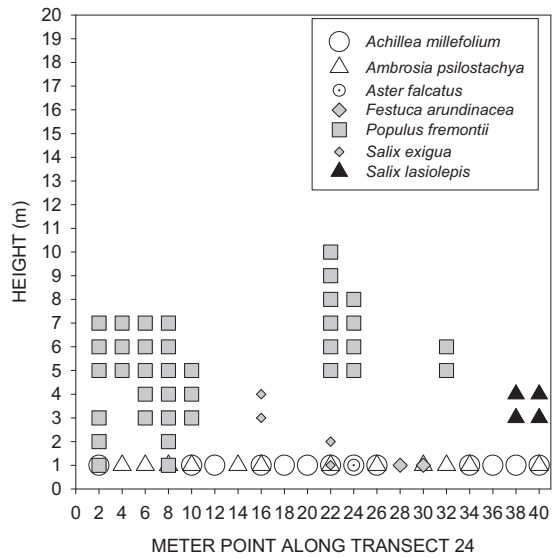
Foliar height distribution
along transect 23, 2012.



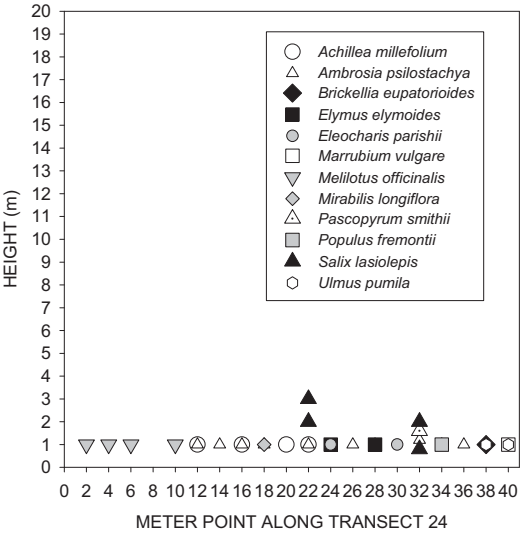
Foliar height distribution
along transect 23, 2005.



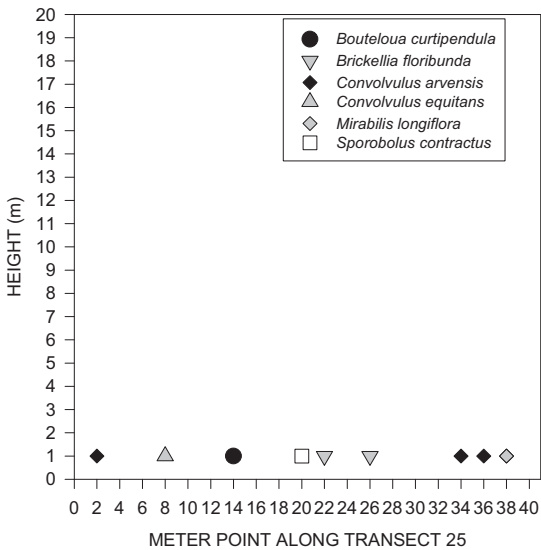
Foliar height distribution
along transect 24, 1998.



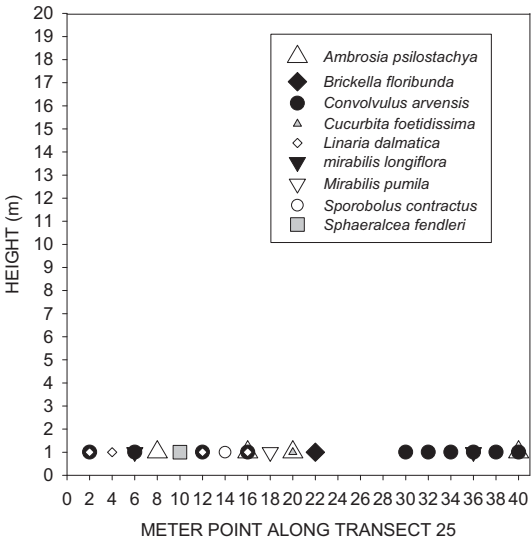
Foliar height distribution
along transect 24, 2012.



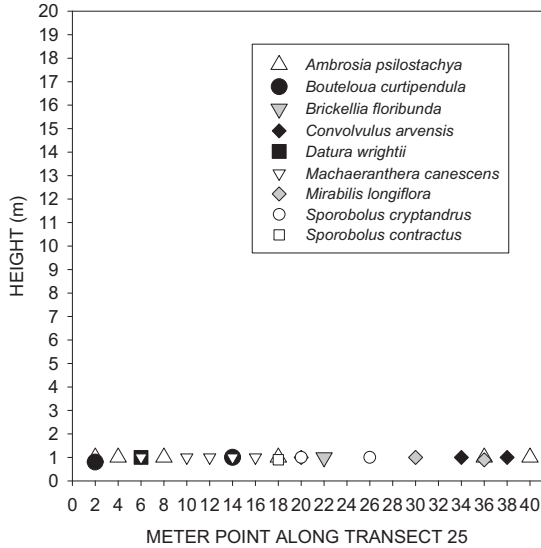
Foliar height distribution
along transect 24, 2005.



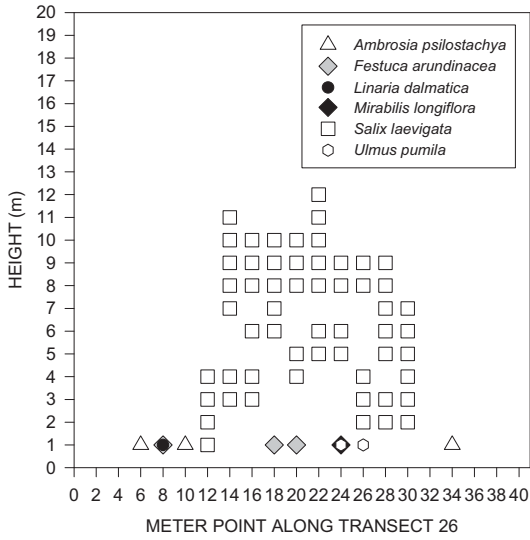
Foliar height distribution
along transect 25, 1998.



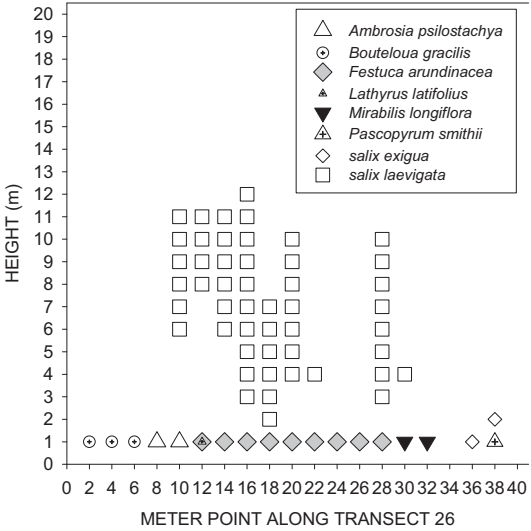
Foliar height distribution
along transect 25, 2012.



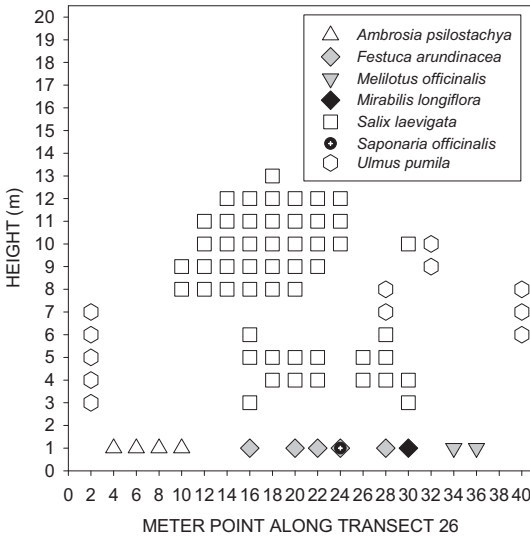
Foliar height distribution
along transect 25, 2005.



Foliar height distribution
along transect 26, 1998.

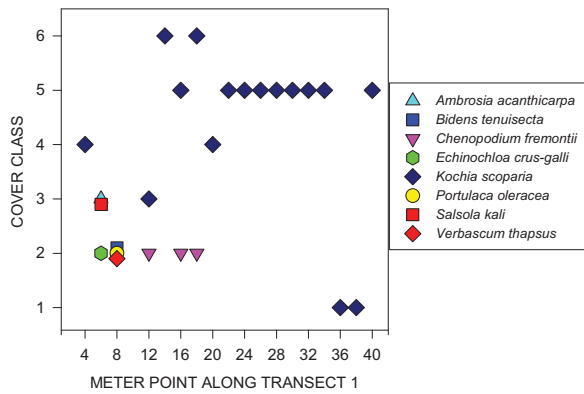


Foliar height distribution
along transect 26, 2012.

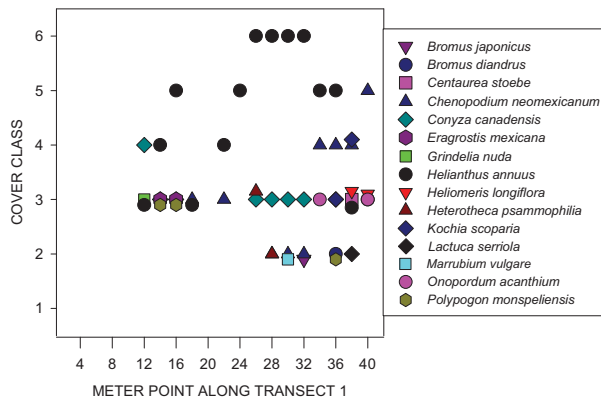


Foliar height distribution
along transect 26, 2005.

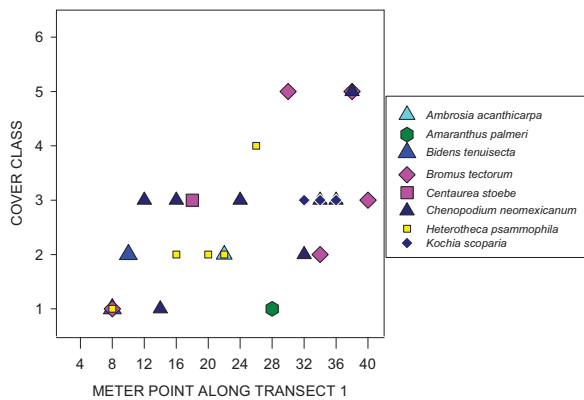
Appendix 5. Graphs of annual cover, by transect for 1997, 2005, and 2012.



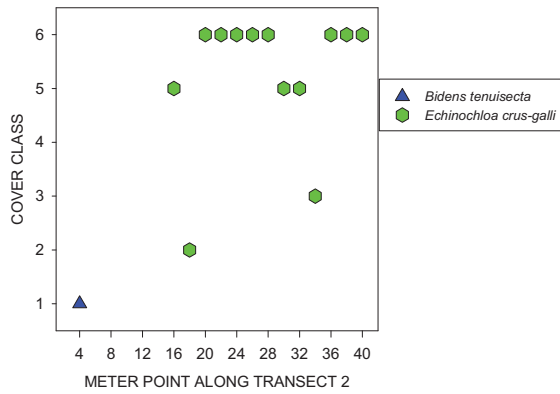
Annuals along
transect 1, 1998.



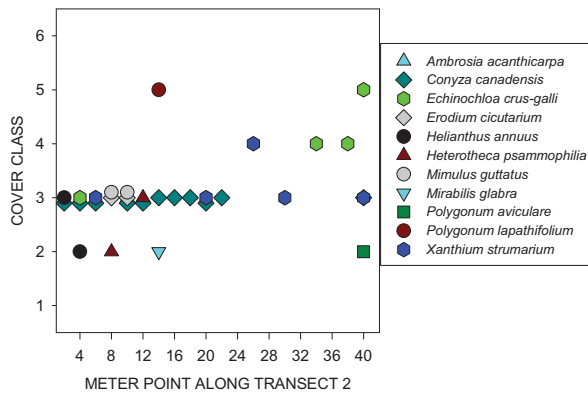
Annuals along
transect 1, 2005.



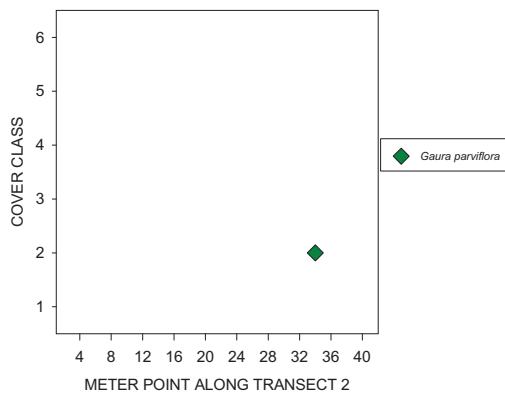
Annuals along
transect 1, 2012.



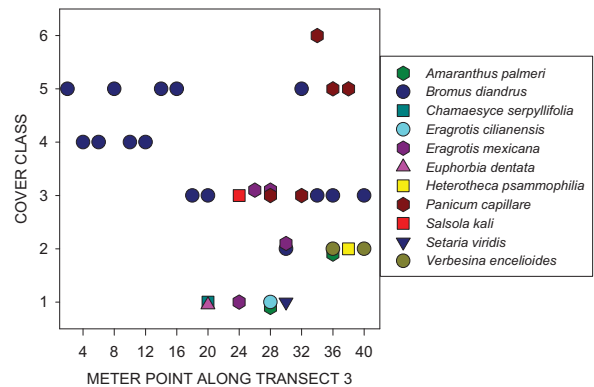
Annuals along
transect 2, 1998.



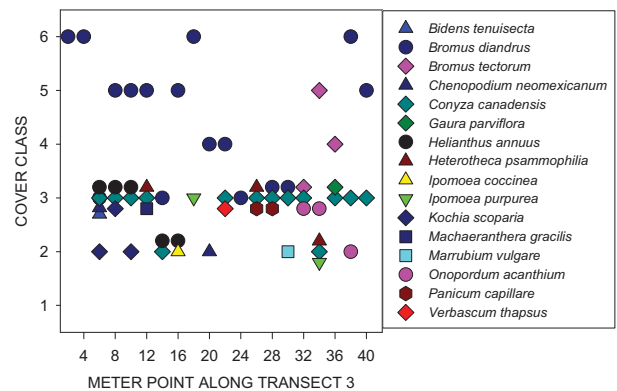
Annuals along
transect 2, 2005.



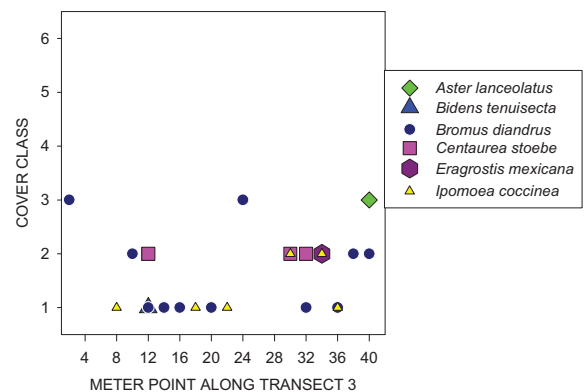
Annuals along
transect 2, 2012.



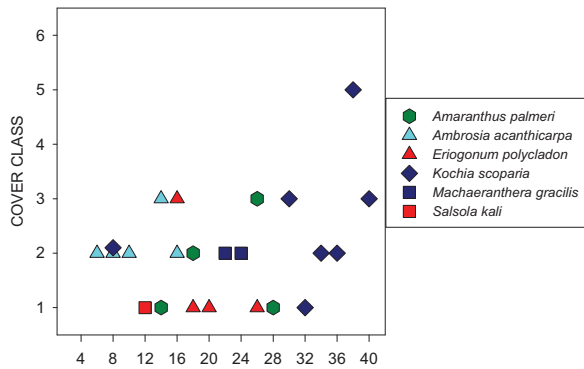
Annuals along
transect 3, 1998.



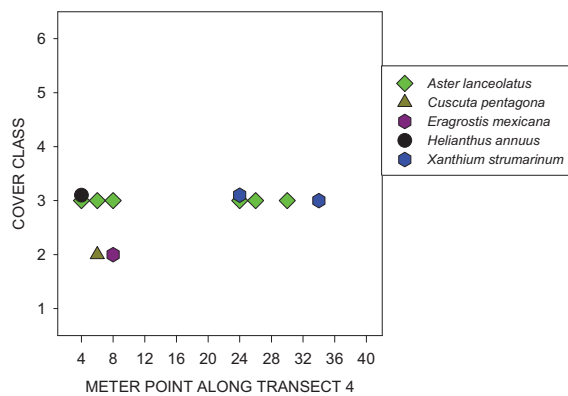
Annuals along
transect 3, 2005.



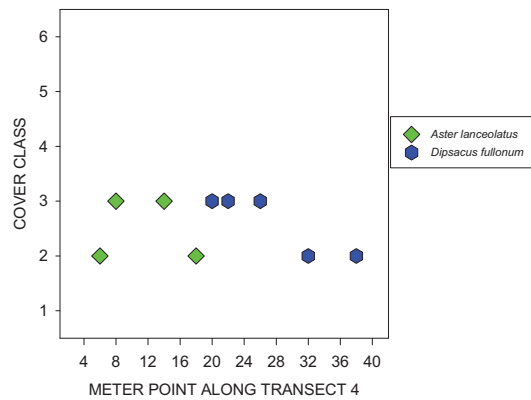
Annuals along
Transect 3, 2012.



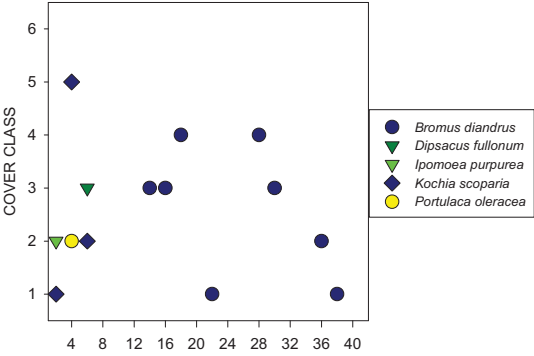
Annuals along
transect 4, 1998.



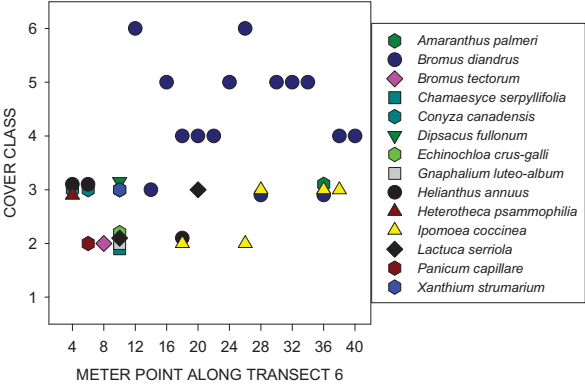
Annuals along
transect 4, 2005.



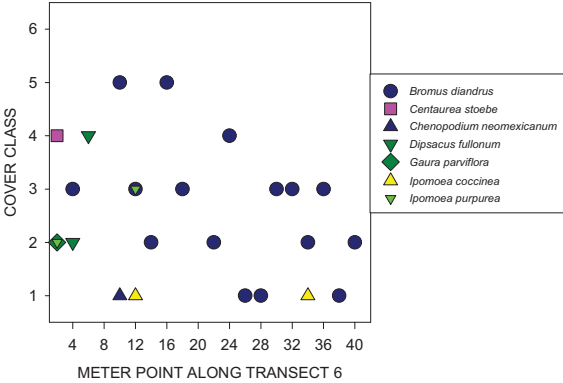
Annuals along
Transect 4, 2012.



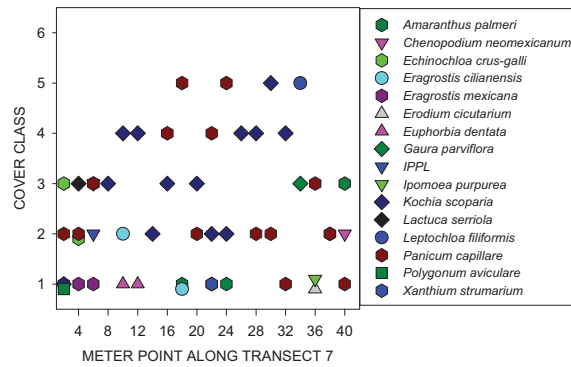
Annuals along
transect 6, 1998.



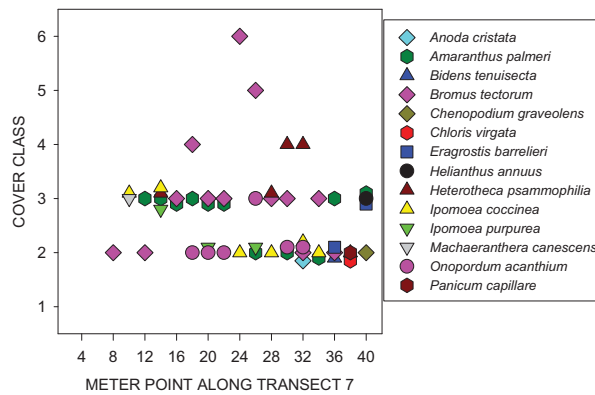
Annuals along
transect 6, 2005.



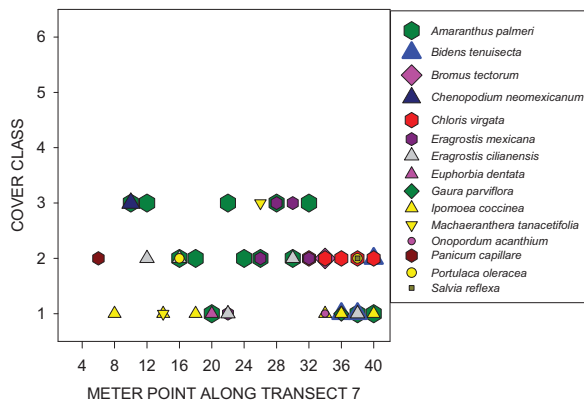
Annuals along
transect 6, 2012.



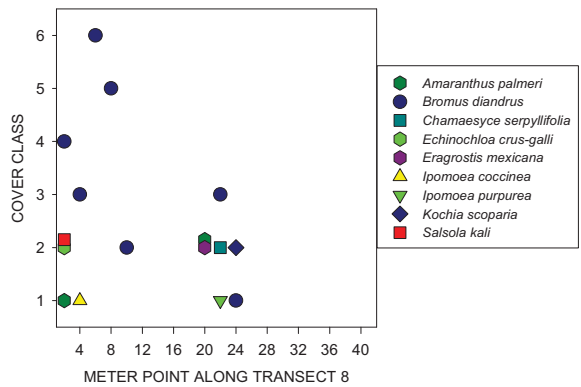
Annuals along
transect 7, 1998.



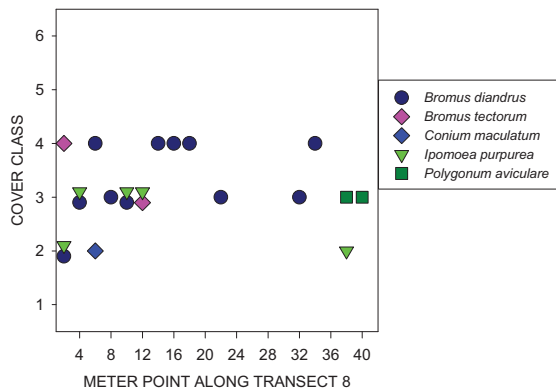
Annuals along
transect 7, 2005.



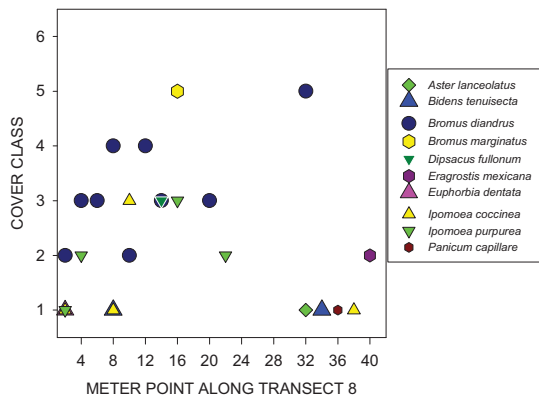
Annuals along
transect 7, 2012.



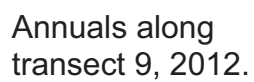
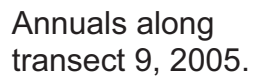
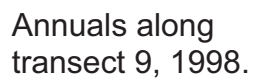
Annuals along
transect 8, 1998.

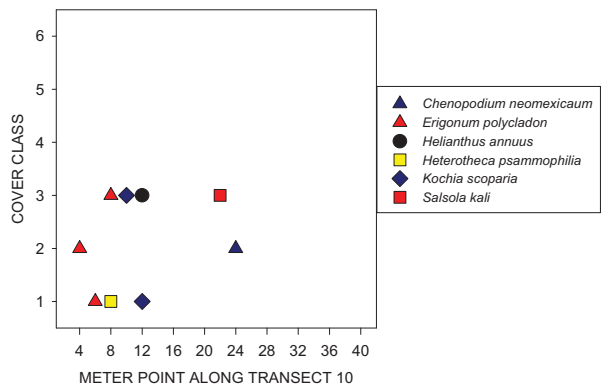


Annuals along
transect 8, 2005.

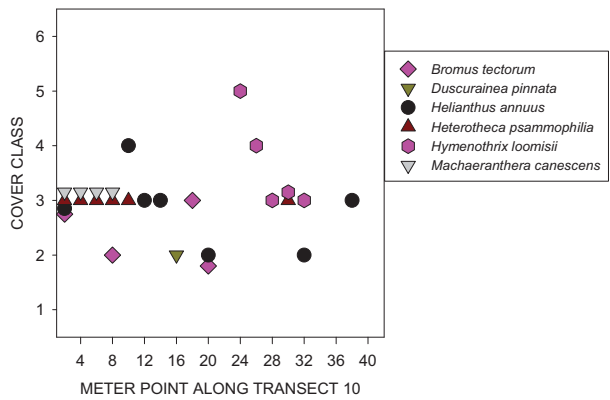


Annuals along
transect 8, 2012.

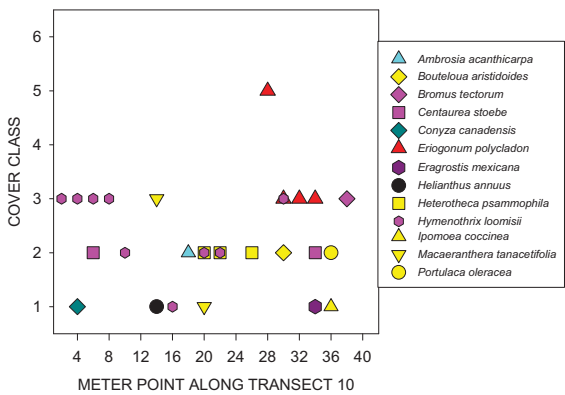




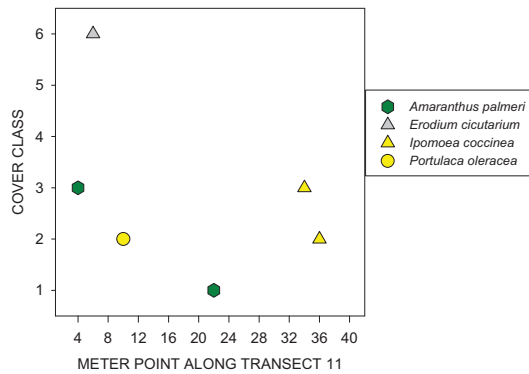
Annuals along
transect 10, 1998.



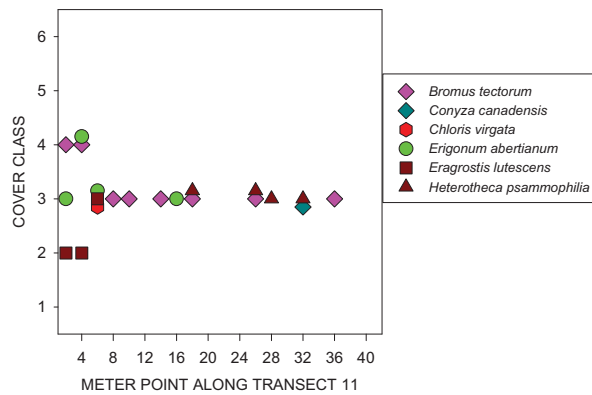
Annuals along
transect 10, 2005.



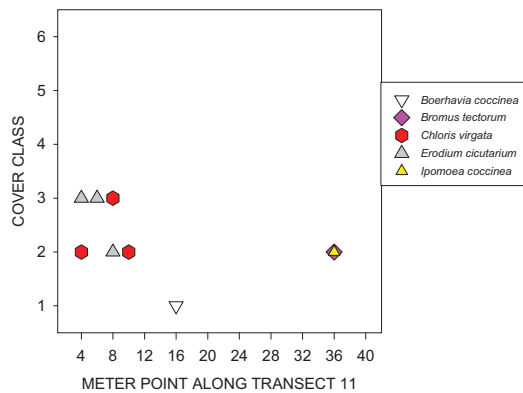
Annuals along
transect 10, 2012.



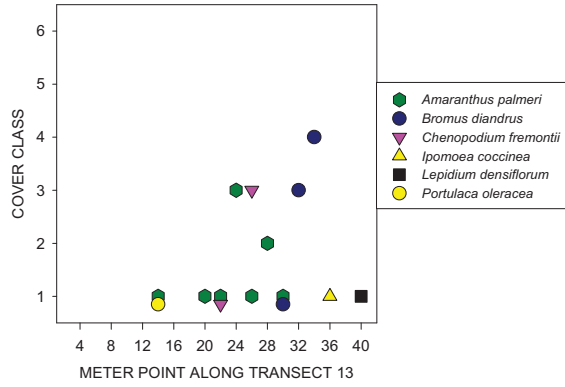
Annuals along
transect 11, 1998.



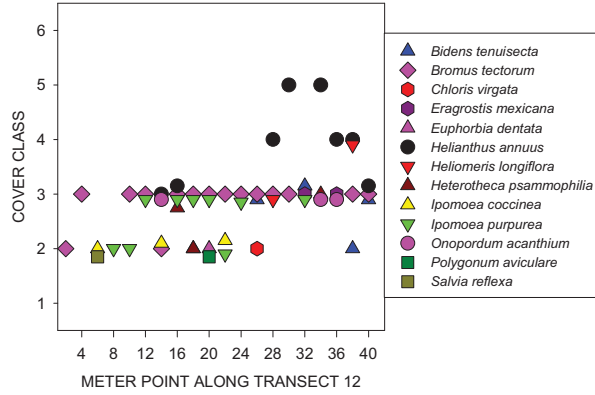
Annuals along
transect 11, 2005.



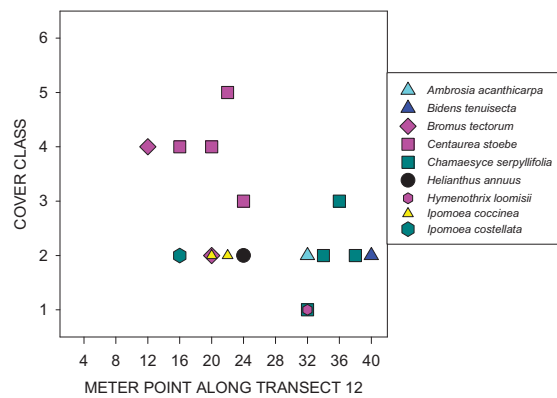
Annuals along
transect 11, 2012.



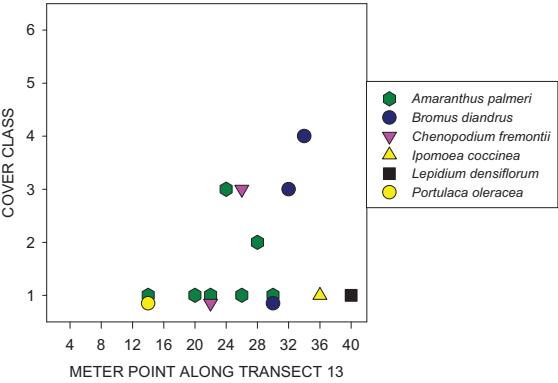
Annuals along
transect 12, 1998.



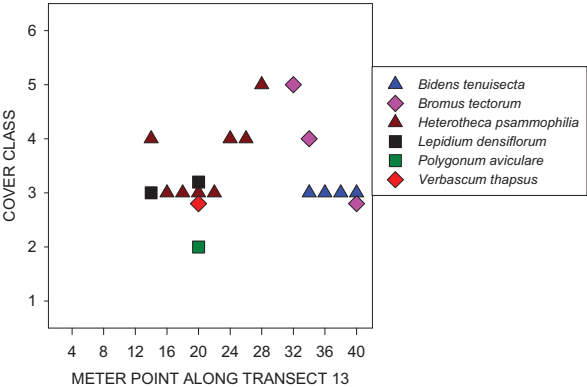
Annuals along
transect 12, 2005.



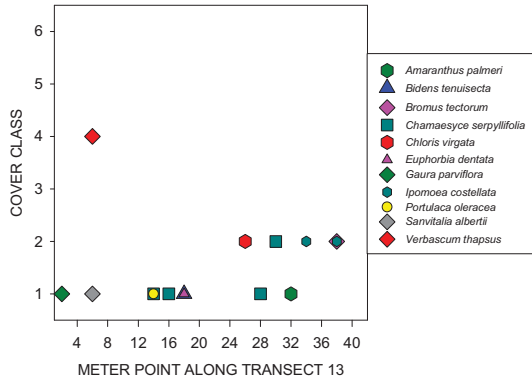
Annuals along
transect 12, 2012.



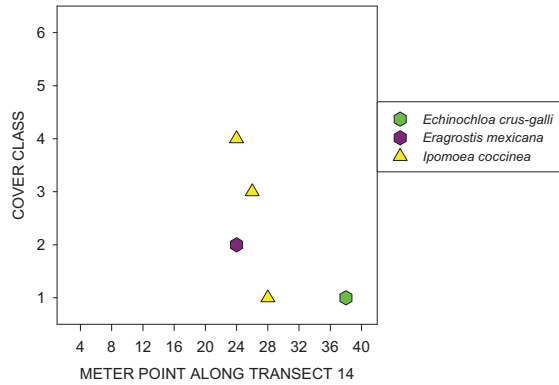
Annuals along
transect 13, 1998



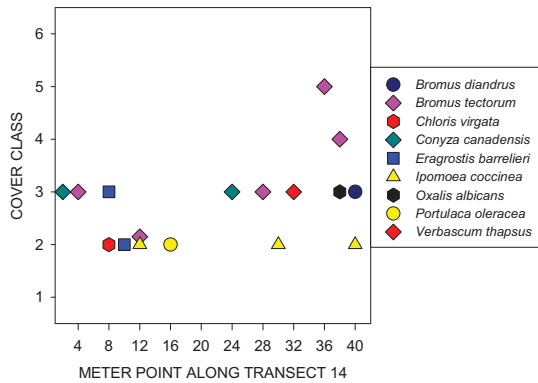
Annuals along
transect 13, 2005.



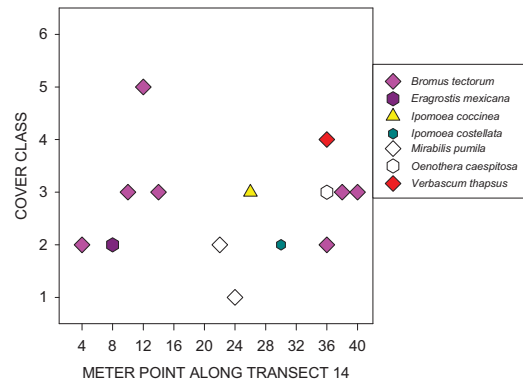
Annuals along
transect 13, 2012



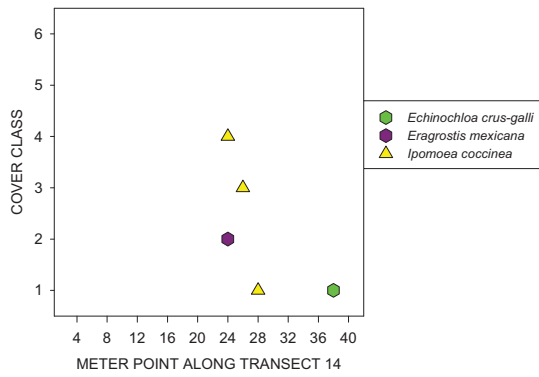
Annuals along
transect 14, 1998.



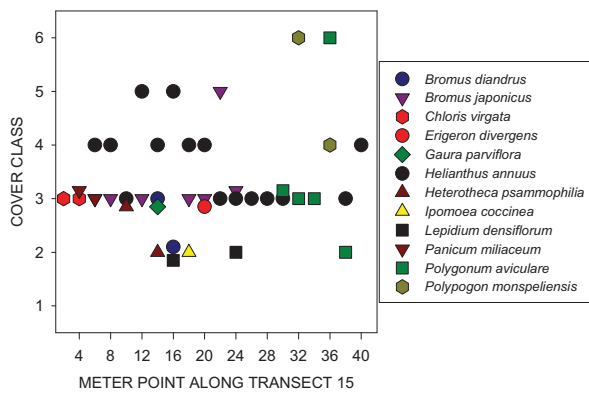
Annuals along
transect 14, 2005.



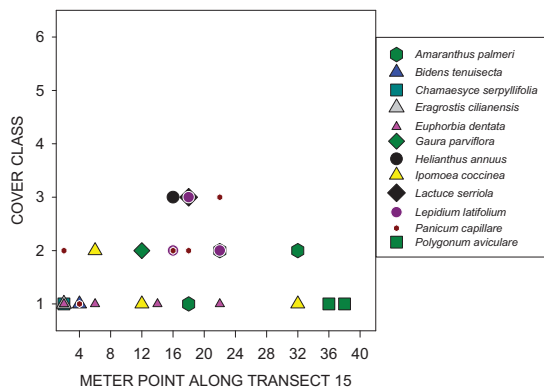
Annuals along
transect 14, 2012.



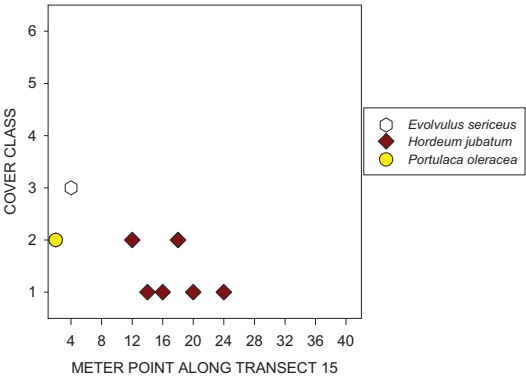
Annuals along
transect 15, 1998.



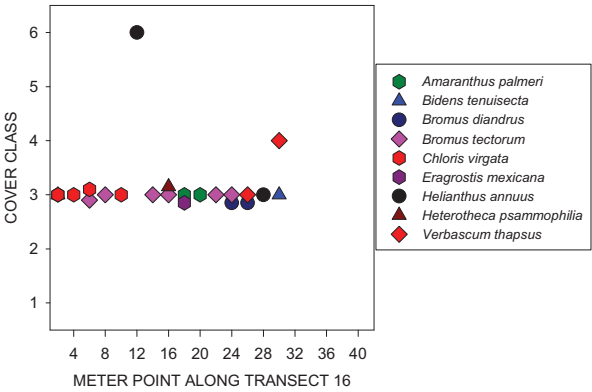
Annuals along
transect 15, 2005.



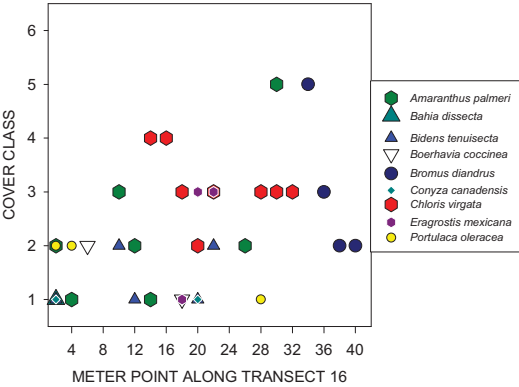
Annuals along
transect 15, 2012.



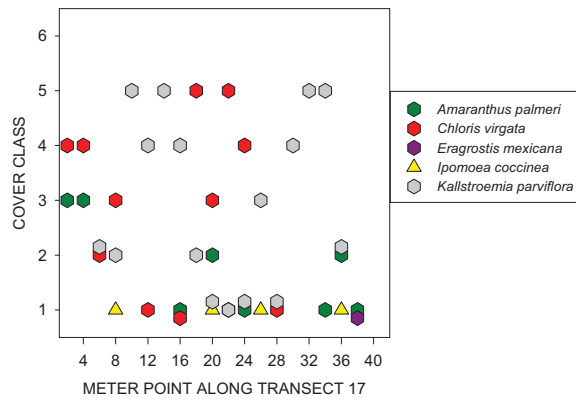
Annuals along
transect 16, 1998.



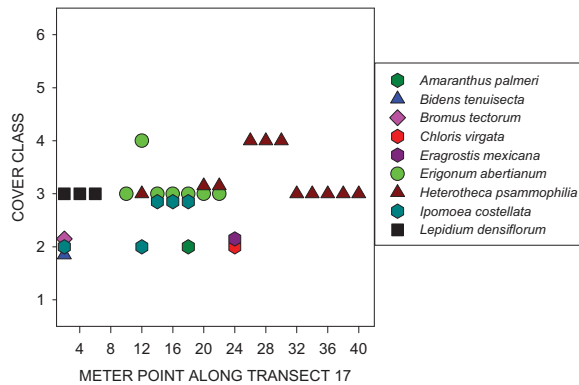
Annuals along
transect 16, 2005.



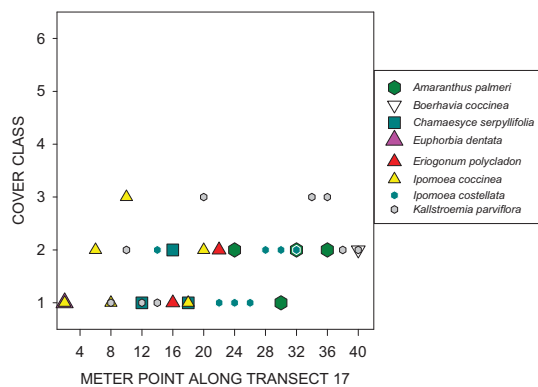
Annuals along
transect 16, 2012.



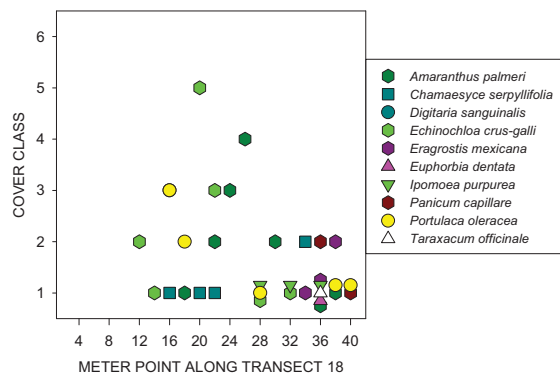
Annuals along
transect 17, 1998.



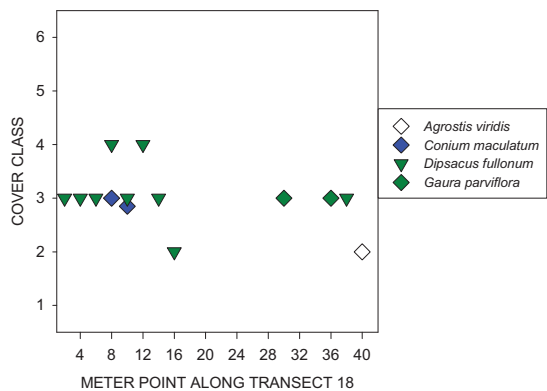
Annuals along
transect 17, 2005.



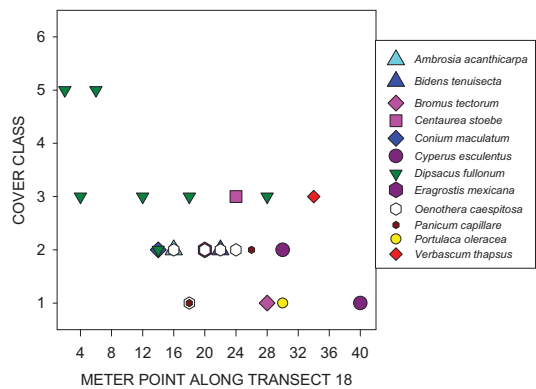
Annuals along
transect 17, 2012.



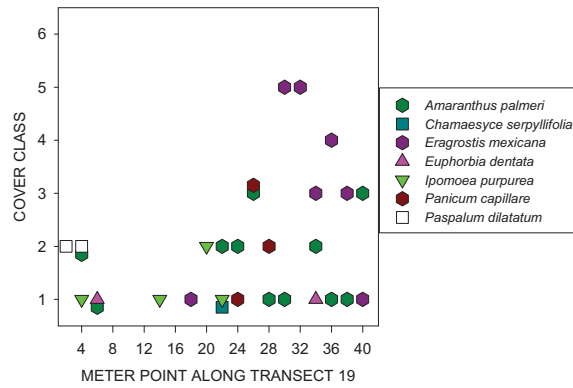
Annuals along
transect 18, 1998.



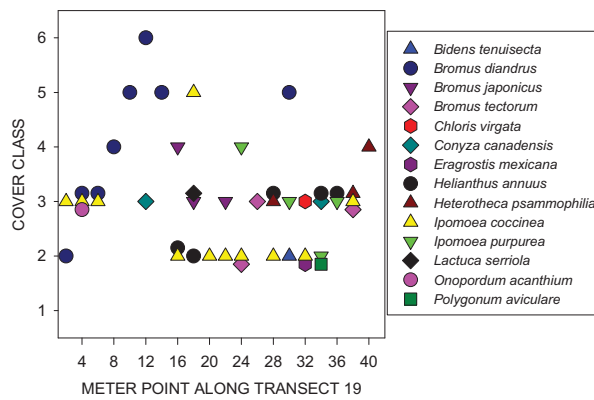
Annuals along
transect 18, 2005.



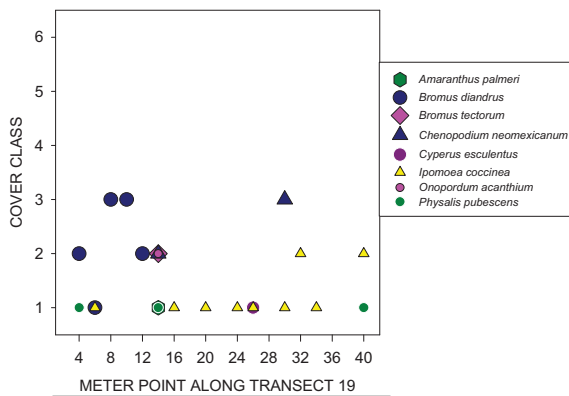
Annuals along
transect 18, 2012.



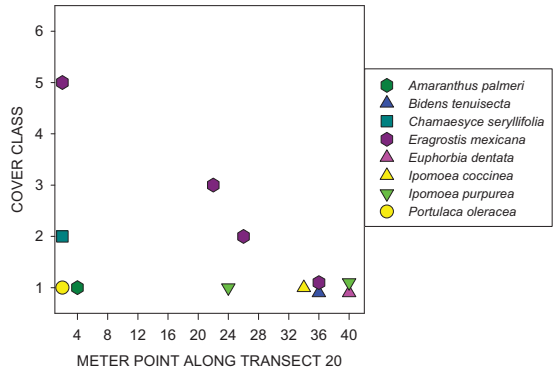
Annuals along
transect 19, 1998.



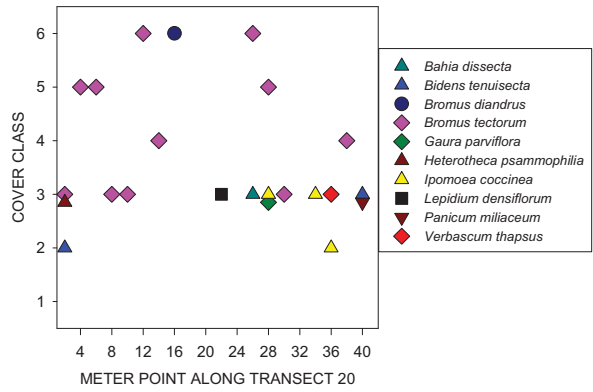
Annuals along
transect 19, 2005.



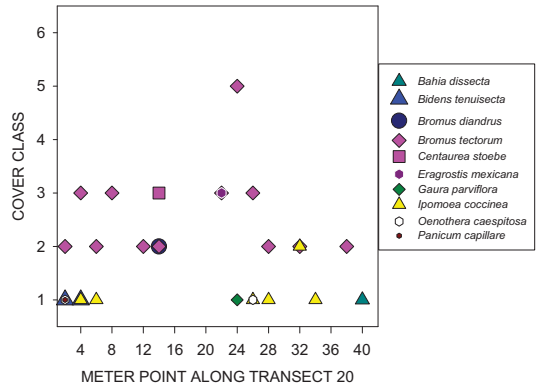
Annuals along
transect 19, 2012.



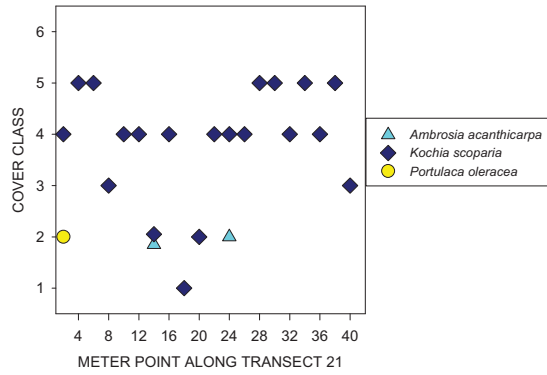
Annuals along
transect 20, 1998.



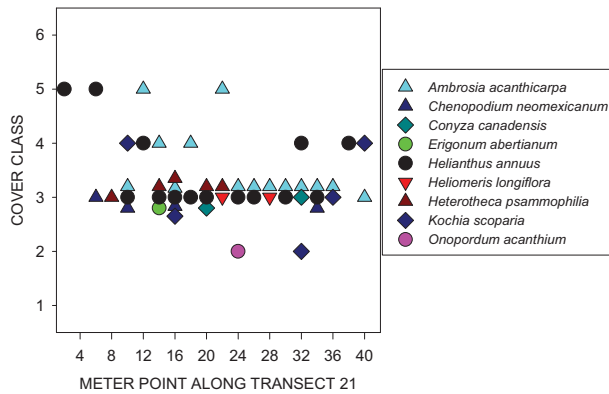
Annuals along
transect 20, 2005.



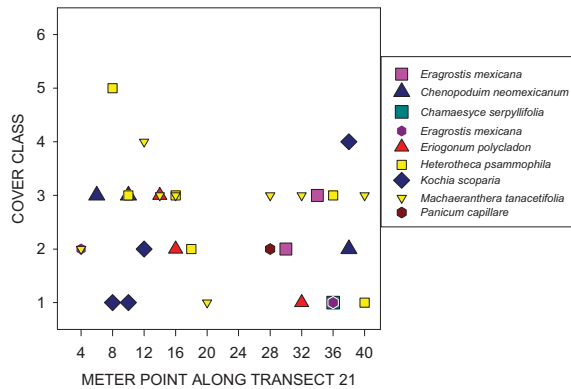
Annuals along
transect 20, 2012.



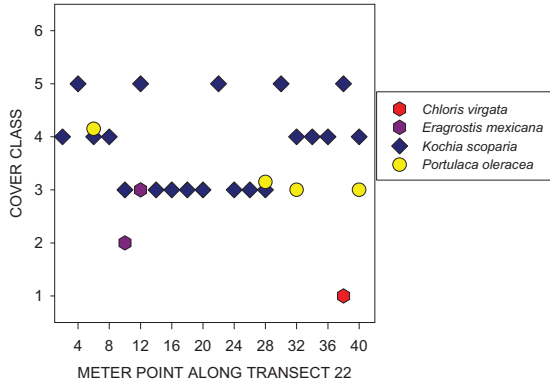
Annuals along
transect 21, 1998.



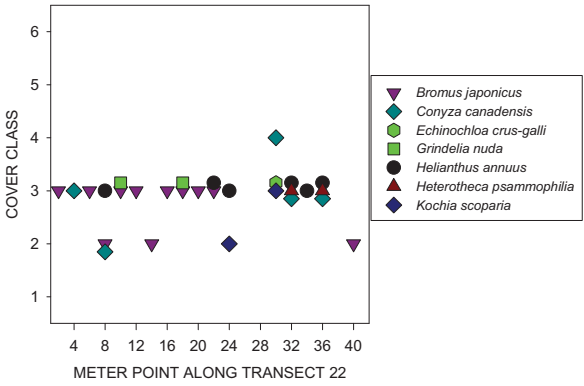
Annuals along
transect 21, 2005.



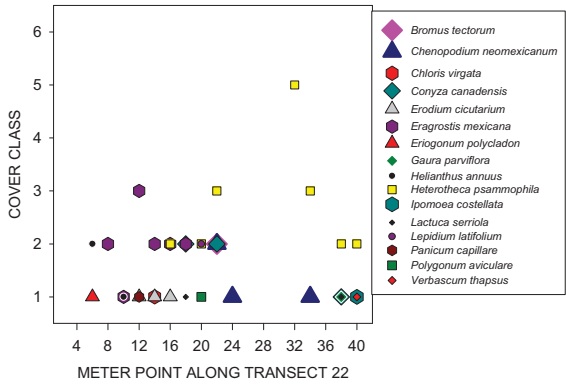
Annuals along
transect 21, 2012.



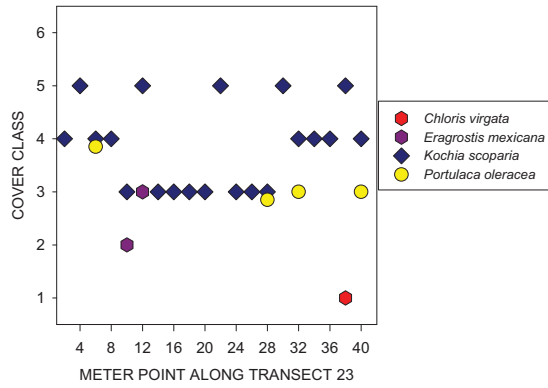
Annuals along
transect 22, 1998.



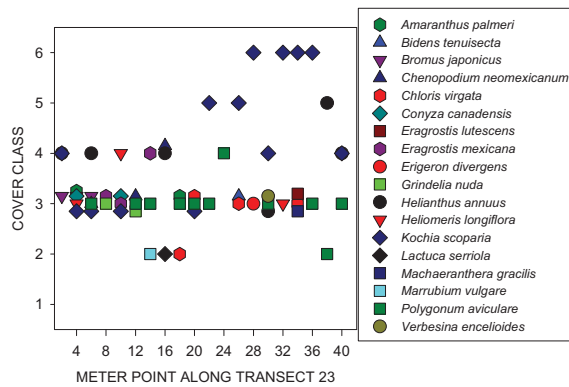
Annuals along
transect 22, 2005.



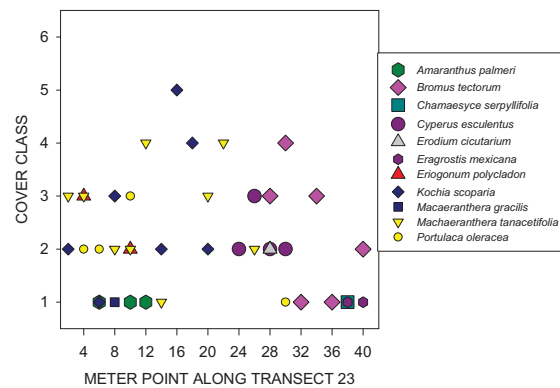
Annuals along
transect 22, 2012



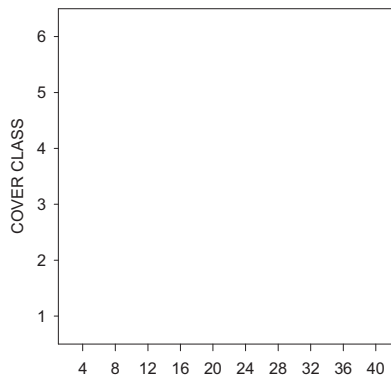
Annuals along
transect 23, 1998.



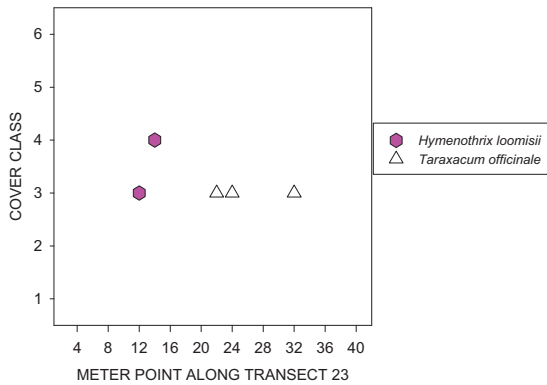
Annuals along
transect 23, 2005.



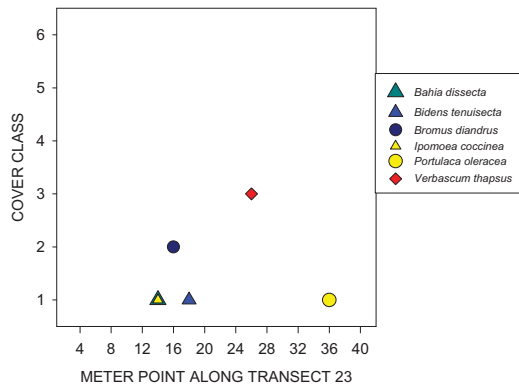
Annuals along
transect 23, 2012



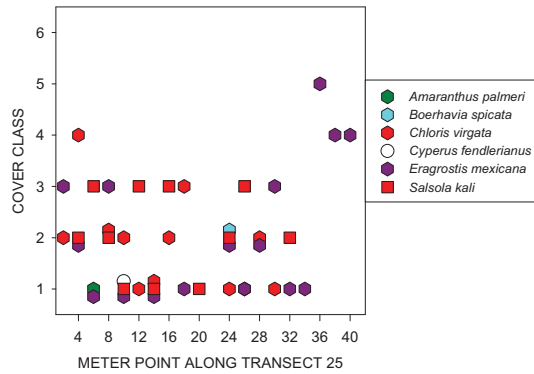
Annuals along
transect 24, 2005.



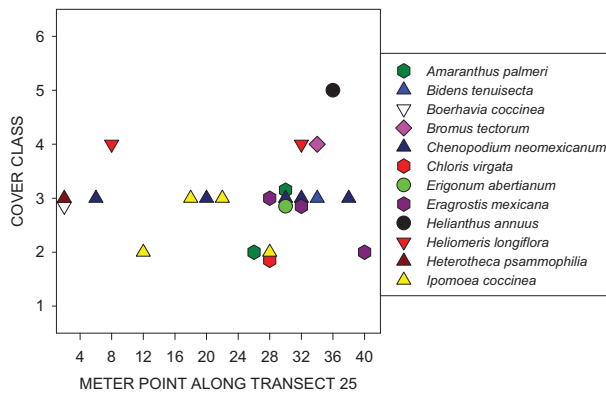
Annuals along
transect 24, 1998



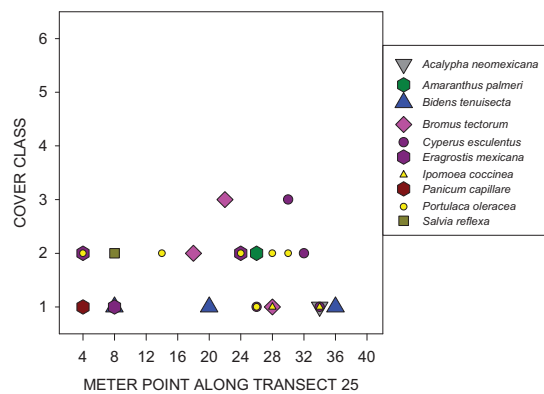
Annuals along
transect 24, 2012



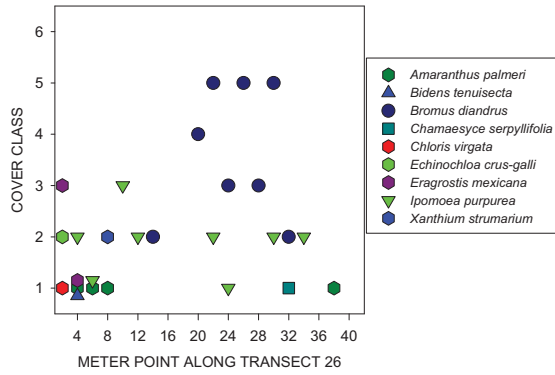
Annuals along
transect 25, 1998.



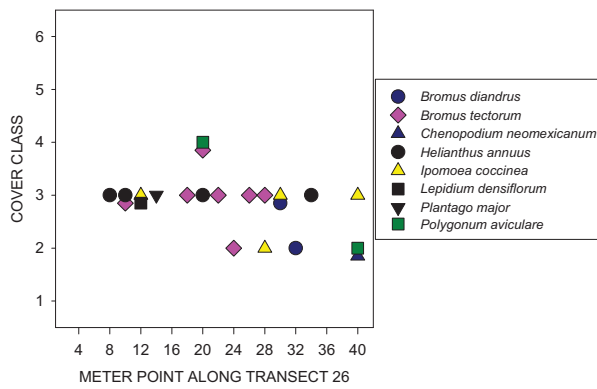
Annuals along
transect 25, 2005.



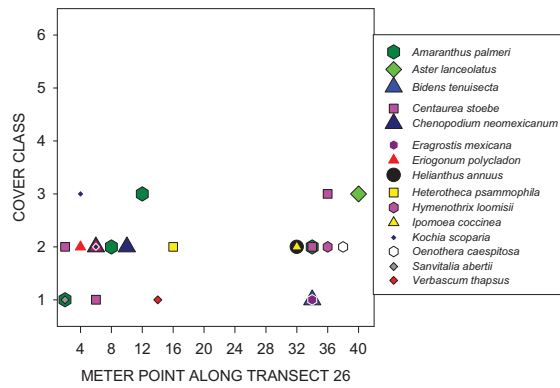
Annuals along
transect 25, 2012



Annuals along
transect 26, 1998.



Annuals along
transect 26, 2005.



Annuals along
transect 26, 2012

Appendix 6. Decimal degree WGS84 and UTM (Zone 12, UTM, NAD83) coordinates for FHD transects.

Decimal degree WGS84 and UTM (Zone 12, UTM, NAD83) coordinates for beginning (meter 00), middle (meter 02) and end (meter 40) of FHD transects.

Transec t	Meter	Latitude	Longitude	Northing	Easting
1	0	34.57726731	-112.4289462	368934	3827093
1	20	34.57718955	-112.4291437	368916	3827085
1	40	34.57733894	-112.4292690	368905	3827101
2	0	34.57805467	-112.4280359	369019	3827179
2	20	34.57821097	-112.4279068	369031	3827196
2	40	34.57837307	-112.4278102	369040	3827214
3	0	34.57891226	-112.4284747	368980	3827275
3	20	34.57874310	-112.4285164	368976	3827256
3	40	34.57880698	-112.4287424	368955	3827263
4	0	34.57792806	-112.4301781	368822	3827168
4	20	34.57779476	-112.4303190	368809	3827153
4	40	34.57766566	-112.4304682	368795	3827139
5		Not available, transect no longer exists			
6	0	34.57610923	-112.4317355	368677	3826968
6	20	34.57628879	-112.4318568	368666	3826988
6	40	34.57638227	-112.4316980	368681	3826998
7	0	34.57572427	-112.4317112	368678	3826925
7	20	34.57583308	-112.4318761	368663	3826938
7	40	34.57597157	-112.4317554	368675	3826953
8	0	34.57488822	-112.4323750	368616	3826834
8	20	34.57481122	-112.4325698	368598	3826825
8	40	34.57497008	-112.4326712	368589	3826843
9	0	34.57368343	-112.4321247	368637	3826700
9	20	34.57384816	-112.4320512	368644	3826718
9	40	34.57378978	-112.4318493	368663	3826711
10	0	34.57317598	-112.4333349	368525	3826645
10	20	34.57318984	-112.4335488	368506	3826647
10	40	34.57336277	-112.4334962	368511	3826666
11	0	34.57208757	-112.4334294	368515	3826524
11	20	34.57193761	-112.4335299	368506	3826508
11	40	34.57200971	-112.4337299	368487	3826516
12	0	34.57279932	-112.4324594	368605	3826602
12	20	34.57265453	-112.4323554	368614	3826586
12	40	34.57253772	-112.4325136	368600	3826573
13	0	34.56815879	-112.4359447	368278	3826092
13	20	34.56804801	-112.4357727	368294	3826079
13	40	34.56789998	-112.4359019	368282	3826063
14	0	34.56867452	-112.4372274	368161	3826151
14	20	34.56875871	-112.4374176	368144	3826160

Decimal degree WGS84 and UTM (Zone 12, UTM, NAD83) coordinates for beginning (meter 00), middle (meter 02) and end (meter 40) of FHD transects.

Transec t	Meter	Latitude	Longitude	Northing	Easting
14	40	34.56892356	-112.4373272	368152	3826178
15	0	34.56971841	-112.4346938	368395	3826263
15	20	34.56986191	-112.4345680	368407	3826279
15	40	34.56974543	-112.4343984	368422	3826266
16	0	34.56790136	-112.4366485	368213	3826064
16	20	34.56776750	-112.4367955	368199	3826050
16	40	34.56789553	-112.4369666	368184	3826064
17	0	34.56938980	-112.4360795	368268	3826229
17	20	34.56956457	-112.4360522	368270	3826248
17	40	34.56957377	-112.4358256	368291	3826249
18	0	34.57118759	-112.4367322	368211	3826429
18	40	34.57093962	-112.4366237	368229	3826419
18	40	34.57110407	-112.4365342	368220	3826401
19	0	34.57039068	-112.4376977	368121	3826342
19	20	34.57020802	-112.4377267	368118	3826321
19	40	34.57024371	-112.4379386	368098	3826326
20	0	34.56975017	-112.437283	368158	3826270
20	20	34.56956221	-112.437287	368157	3826249
20	40	34.56955767	-112.437504	368137	3826249
21	0	34.57633918	-112.4302839	368810	3826992
21	20	34.57649360	-112.4301724	368821	3827009
21	40	34.57641123	-112.4299778	368838	3826999
22	0	34.57597263	-112.4297434	368859	3826950
22	20	34.57606839	-112.4295591	368876	3826961
22	40	34.57592697	-112.4294278	368888	3826945
23	0	34.57412191	-112.4310528	368736	3826747
23	20	34.57394518	-112.4310552	368736	3826727
23	40	34.57393062	-112.4312753	368715	3826726
24	0	34.56807397	-112.4375955	368126	3826085
24	20	34.56805659	-112.4373919	368145	3826082
24	40	34.56788285	-112.4373787	368146	3826063
25	0	34.56978319	-112.4381511	368078	3826275
25	20	34.56995180	-112.4380612	368087	3826293
25	40	34.56987189	-112.4378682	368104	3826284
26	0	34.56863122	-112.4392229	367978	3826149
26	20	34.56877261	-112.4393517	367966	3826164
26	40	34.56884340	-112.4391597	367984	3826172