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A comparison of secondary successional woody vegetation in two revegetated fields in South Texas and an assessment of habitat use by the olive sparrow, Arremonops rufivirgatus

Patrick Grant Wright

A COMPARISON OF SECONDARY SUCCESSIONAL WOODY VEGETATION IN TWO REVEGETATED FIELDS IN SOUTH TEXAS AND AN ASSESSMENT OF HABITAT USE BY THE OLIVE SPARROW, *ARREMONOPS RUFIVIRGATUS*.

APPROVED BY:

Robert Lonard
(MAJOR ADVISOR)

Timothy Brush
(MAJOR ADVISOR)

J Ortego
(COMMITTEE MEMBER)

John R. Villarreal
(DEAN OF THE GRADUATE SCHOOL)

DATE: June 17, 1996

This study is respectfully
dedicated to my wife

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by

Patrick Grant Wright, B.S.

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Patrick Grant Wright, M.S.
The University of Texas-Pan American
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1996

Major Advisors: Dr. Robert Lonard and Dr. Timothy Brush

Aspects of plant species composition and structure of two revegetated fields in western Cameron County, Texas, were studied between 1992 and 1995. Avian habitat suitability was assessed using the Olive Sparrow, *Arremonops rufivirgatus*, as an indicator species. Total vegetation volume at the Longoria Wildlife Management Area (WMA), an area revegetated in 1961, was 0.745 m^3V/m^2 and that of the Anacua WMA, revegetated in 1983-4, was 0.546 m^3V/m^2 in 1992. Secondary woody species at the Longoria and Anacua WMA's had a Shannon's index of diversity of 0.619 and 0.264, respectively. Secondary woody vegetation at the Longoria WMA had a Simpson's dominance value of 0.34 and the dominance of the secondary woody vegetation at the Anacua WMA was 0.66. Olive Sparrow densities at the Longoria and Anacua WMA's were 2.5/ha and 0.5/ha, respectively. The

greater secondary woody species diversity, smaller dominance, and higher density of Olive Sparrows found at the Longoria WMA were likely due to the greater age and density of the vegetation as well as the primary plant species introduced. A greater total vegetation volume and secondary woody species diversity appear to provide a more suitable habitat for the Olive Sparrow. It is likely that a greater diversity of avian species, including neotropical migrants, would be attracted to similar revegetated sites in this region, as such habitats mature.

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INTRODUCTION

The study of secondary growth and changes in floral and faunal diversity of revegetated fields of differing ages has attracted considerable interest in recent years. Many factors, including proximity of seed source, soil, degree of grazing and erosion, and different requirements and tolerance limits have been found to influence plant succession (Nixon, 1975). Other factors important in determining plant establishment and dominance in revegetated areas include herbivory, ability to compete for underground resources, and canopy position (Van Auken and Lohstroh, 1990).

While many studies have been conducted concerning secondary succession in abandoned fields, few have concentrated on secondary growth in revegetated fields. Secondary growth can be defined as the establishment and growth of plants after initial revegetation. Studies of succession in abandoned fields include the analyses of the conversion of grasslands to thorn woodlands (Whittaker et al., 1979; and Archer et al., 1988). The interactions between grasses such as *Cynodon dactylon* (bermuda grass), *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Bouteloua gracilis* (blue grama, darnel-regal), *Lolium perenne* (gulf annual ryegrass), and *Buchloe dactyloides* (buffalo grass), and seedlings of

Acacia smallii, (huisache), *Celtis laevigata* (Texas sugarberry), and *Prosopis glandulosa* (honey mesquite) have been studied (Van Auken and Bush, 1987; Cohn et al., 1988; Van Auken and Bush, 1988; Van Auken and Bush, 1990). The effect of light intensity on growth and development of *A. smallii* and *C. laevigata* has also been investigated (Bush and Van Auken, 1986; Lohstroh and Van Auken, 1987; Burmeister and Van Auken, 1989; Van Auken and Lohstroh, 1990), as well as nutrient requirements of *A. smallii* and *C. laevigata* seedlings (Van Auken et al., 1985). Spatial dynamics of primary succession have also been investigated (Yarranton and Morrison, 1974).

While many of the trees and shrubs of South Texas depend upon wind for seed dispersal, e.g., *Salix nigra* (Black Willow), many others which produce fleshy fruits, e.g., *Celtis pallida* (Granjeno) and *Morus alba* (White Mulberry), rely on avian frugivores for seed dispersal Lonard et al., 1991). McDonnell and Stiles (1983) suggest that the input of bird-disseminated seeds into fields appears directly related to the structural complexity of the field. Woody plants increase the structural complexity of old fields and serve as recruitment foci for bird-disseminated seeds. Therefore, existing vegetation influences seed dispersal by birds, which in turn influences future vegetational patterns (McDonnell and Stiles, 1983). The presence of recruitment foci in vegetation may influence dispersal patterns of bird-disseminated seeds which may enhance the abundance of plants whose seeds are dispersed by birds (McDonnell and Stiles, 1983).

The relationship between avian density and vegetation volume has also been investigated extensively (MacArthur and MacArthur, 1961; Karr and Roth, 1971; Meents et al., 1983; Erdelen, 1984; Mills et al., 1991). Initial comparisons by MacArthur and MacArthur (1961) between bird species diversity (BSD) and foliage height diversity (FHD) suggested a strong positive correlation between the two, linking avian community structure and critical resources. Since then, the relationship between BSD and FHD has been criticized due to the generality of the proposed relationship as well as the possibility that the method of calculating BSD and FHD (the information index) could hide important information by combining measures of species richness and relative abundance, resulting in the lack of a biologically meaningful relationship (Mills et al., 1991). Mills et al.(1991) found a strong positive correlation between breeding bird density and vegetation volume in Southwestern riparian habitats using total vegetation volume (TVV) and bird censuses to quantify the relationship between vegetation characteristics and avian community patterns. Mills et al. (1991) suggest the use of TVV as a means of providing a quick and accurate method of estimating this aspect of vegetation structure, as well as describing plant communities quantitatively.

Long-term observations suggest that populations of many species of birds, including permanent residents as well as migrants that nest in the Neotropics, are declining (Robbins et al., 1989). Biologists and resource managers agree that the factors responsible for recent population declines in some neotropical migratory birds are highly complex (National Fish and Wildlife Foundation, 1990). Two primary factors have been suggested to explain neotropical migratory bird declines including loss, deterioration and fragmentation of breeding ground habitat in the United States and Canada and loss or deterioration of wintering habitat in Mexico, the Caribbean, Central America, and South America (National Fish and Wildlife Foundation, 1990).

The Olive Sparrow, *Arremonops rufivirgatus*, was one potential seed disperser observed at both study sites. The Olive Sparrow's northern range in Texas includes Uvalde and Atascosa counties, Beeville and Rockport, south through both coastal slopes of Mexico to Chiapas and Belize, as well as the Pacific region of Costa Rica (Oberholser, 1974). The Olive Sparrow is a permanent resident throughout its range and inhabits scrubby chaparral, weedy thickets, and the undergrowth of forest edges from sea level to altitudes of 1,830 m (Andrle, 1967; Bent, 1968). The Olive Sparrow has also been documented as inhabiting the huipilla (*Bromelia pinguin*) thickets in the Gomez Farias District of southwestern Tamaulipas, Mexico (Sutton, 1948), as well as dense *Clematis* underbrush along Los Olmos creek in Brooks County, Texas (Smith, 1913). The northern range of the Olive Sparrow in the United States corresponds almost exactly with the northern boundary of the Tamaulipan Biotic Province (Oberholser, 1974). This species is apparently very sedentary (Laguna Atascosa National Wildlife Refuge, unpublished data) making it a good test species for the success of revegetation.

The Olive Sparrow is an olive-backed sparrow with a prominent brown eye streak and two dull brown crown stripes (Bent, 1968). Adult Olive Sparrows reach a length of 15.9 cm with a wingspan of 21.6 cm (Oberholser, 1974). Nesting occurs between mid-March and late August and four or five white, glossy eggs are commonly laid in a domed nest (Bent, 1968). The Olive Sparrow usually raises two broods per year (Bent, 1968). The Olive Sparrow feeds on insects, insect larvae and seeds (Bent, 1968). The Olive Sparrow was used as an indicator of the success of revegetation due to its known preference for dense, thorny brushland (Oberholser, 1974).

The objectives of this study are:

a) to measure and compare total vegetation volume (an index of the volume of woody perennial plants in each meter layer above the ground), and species composition of two revegetated fields in South Texas.

b) to assess the relationship between avian habitat use and total vegetation volume in two revegetated South Texas fields using the Olive Sparrow, *Arremonops rufivirgatus*, as an indicator species.

This study should aid resource managers in describing habitats created by revegetation and successional secondary growth of abandoned fields in South Texas. Descriptions of the stands created by revegetation will include floristics (plant species composition) and physiognomy (structure) of the vegetation present. Floristics and physiognomy should be useful in predicting habitat suitability as well as density for many species, including birds such as the Olive Sparrow.

MATERIALS AND METHODS

Study Areas

Both the Anacua and the Longoria units of the Las Palomas Wildlife Management Areas (WMA) are owned and managed by the Texas Parks and Wildlife Department (TPWD). The Anacua WMA is located 1.2 km. south of U.S. 281 near Santa Maria, in southwestern Cameron County, Texas. Vegetation samples were taken from tract 2 of the Anacua WMA which has an area of 10.6 ha, and was revegetated in April, 1983 and March, 1984 (Figure 1). The primary tree introduced in this tract was *Acacia smallii* (Huisache). *Acacia smallii* seedlings were planted in rows 85 degrees West of South with a mean row width of 4.65 m and mean tree spacing of 3.5 m. All vegetation sampling was done in February, 1992.

The Longoria WMA is located 6.6 km north of Texas highway 107 on Farm to Market road 506, North of Santa Rosa, in northwestern Cameron County, Texas. Vegetation was sampled in October, 1992. The Longoria WMA study site has an area of 1.21 ha and was revegetated in 1961 (Figure 2). The principal tree species introduced in this tract were *Celtis laevigata* (Hackberry), *Ehretia anacua* (Anacua), *Bumelia celastrina* (La Coma), and *Prosopis glandulosa* (Honey Mesquite). Seedlings were planted in rows 4 degrees West of South with a mean row width of 4.2 m and a mean tree spacing of 4.7 m.

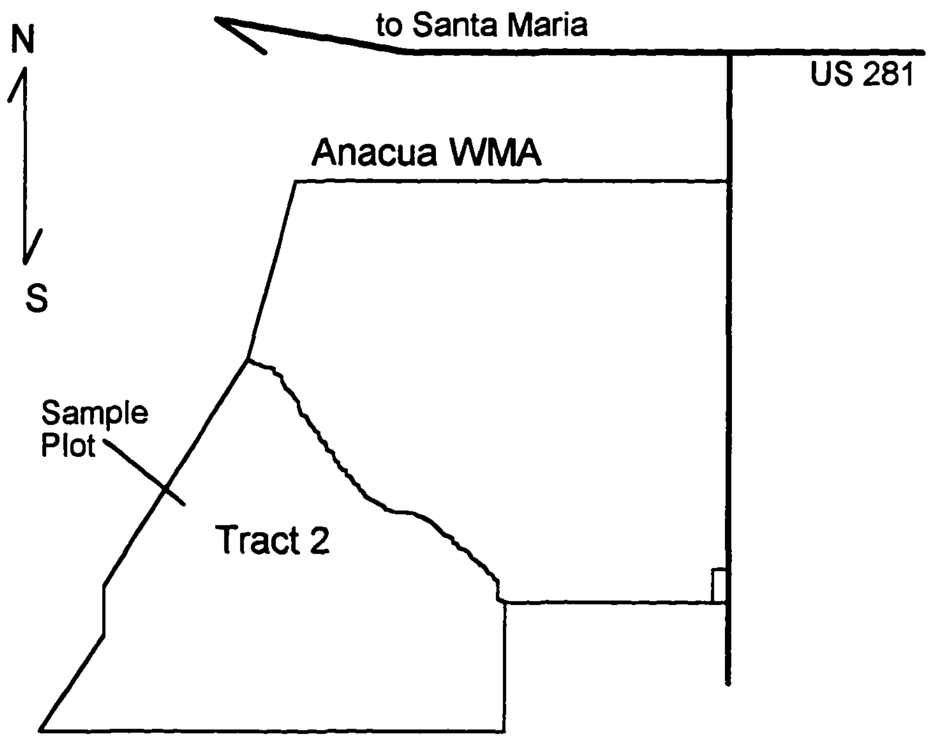

Figure 1. A map showing the location of vegetation and avian measurements at the Anacua Wildlife Management Area.

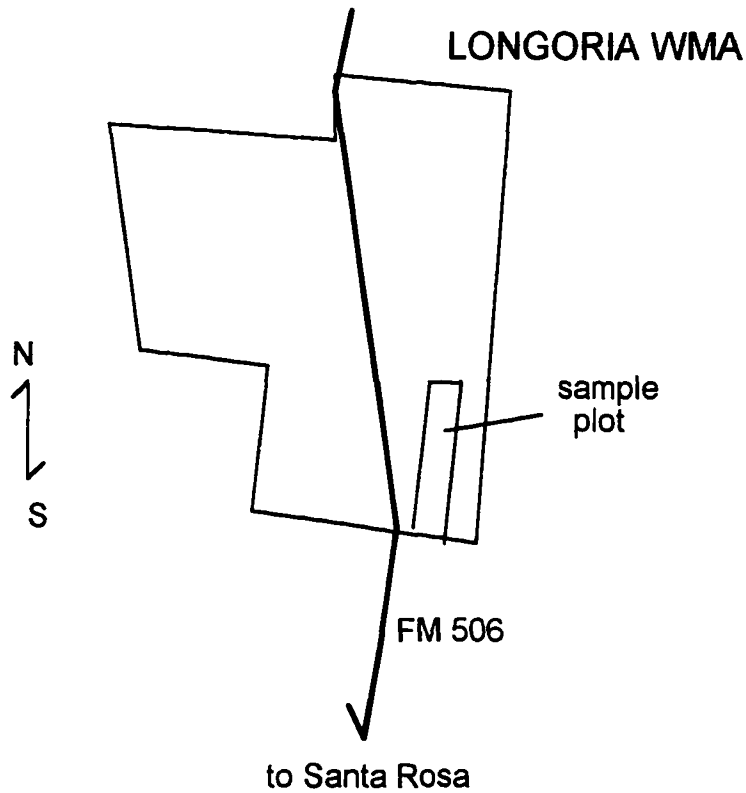

Figure 2. A map showing the location of vegetation and avian measurements at the Longoria Wildlife Management Area.

Vegetation Measurements

A series of plots 2 m in diameter were surveyed between the tree rows at 50 m intervals. At each plot, the height and stem diameter of each of the woody species present were measured. In addition, all of the herbaceous vegetation present in each plot was identified. Total vegetation volume was measured using a variation of the "pole method" described by Mills et al. (1991). A 6-m wooden pole was constructed from a 4 cm X 1.7 cm piece of wood and marked in decimeter and meter sections. The pole was used to measure an index of the volume of the woody perennial plants in each meter layer above the ground. Holding the pole in a vertical position at the center of each plot, the number of decimeter sections within each meter where vegetation touched the pole was counted. Each decimeter section containing vegetation was called a "hit", and the number of possible hits in each meter section ranged from 0-10. Species of woody plants responsible for each hit were also recorded. The number of hits in layers >6 m were estimated. Total vegetation volume (TVV) was estimated from these data as: TVV = h/10p; where h = the total number of hits summed over all meter layers at all points measured, and p = the number of points at which vegetation volumes were measured. TVV has the units of cubic meters of vegetation per square meter (m^3V/m^2).

At each plot, species of woody secondary successional vegetation were also measured. Height and stem diameter of each species within a 2 m radius of the center of each plot was assessed. Stem diameter was measured at a height of 10 cm unless the species was less than 50 cm tall, in which case stem diameter was measured at ground level. Species with multiple stems were measured as individuals and the largest of the stems were recorded. Hits by dead limbs and dead species were ignored. Plant nomenclature follows that of Lonard et al., 1991.

Avian Measurement

Olive Sparrow densities were estimated by censusing each study site three times during the spring and summer (March through August) of 1993, once in August of 1994, and three times (June through August) in 1995. All censuses were conducted between 05:00 and 09:00 AM CST during suitable weather. Singing males and other Olive Sparrows present within the habitats were counted. Densities of Olive Sparrows were compared with TVV at each site and between sites in order to determine whether or not a relationship exists between TVV and Olive Sparrow density.

Habitat diversity was quantified using Shannon's index of diversity (Brower, et al., 1990). Plant species dominance was assessed using Simpson's index of dominance (Brower, et al., 1990). Mean heights and stem diameters were determined for secondary woody species at each site.

Heights were divided into four classes, 0 to 0.5 m, 0.5 to 1 m, 1 to 2 m, and 2 m and taller. Total numbers of secondary woody species in each class common to both sites were compared.

Graphs illustrating relative foliage profiles for each study site were plotted, as were graphs comparing foliage profiles of woody species common to both sites. Tables summarizing secondary woody and herbaceous vegetation at each site were also constructed.

RESULTS

The total vegetation volume at the Longoria WMA was 0.745 m^3V/m^2 and that of the Anacua WMA was 0.546 m^3V/m^2. Olive Sparrow density at the Longoria study site was 2.5/ha while the Anacua study site had an Olive Sparrow density of 0.50/ha. Secondary woody species at Anacua WMA had a Shannon's index of diversity of 0.264 while that of the Longoria WMA was 0.619. The difference between the two indices of diversity was significant ($t = 8.54$, $DF = 404$). Secondary woody vegetation at the Longoria WMA had a Simpson's dominance value of 0.34 and the dominance of the secondary woody vegetation at the Anacua WMA was 0.66. A collection of species with high diversity will have low dominance.

Table 1 summarizes the total numbers of individual canopy species sampled at each study site. The individual canopy species were those species which touched the pole during sampling at each study site. *Acacia smallii* was the predominant canopy species at the Anacua WMA and *Pithecellobium ebano* was the principal canopy species at the Longoria WMA. Table 2 illustrates the total number of secondary woody plants found at each study site. Secondary woody plants are described as those species which became established after, and by different means than the introduction of the primary woody species by the TPWD. The most numerous secondary woody species at the Anacua WMA was *Baccharis neglecta*, a common primary succession species. *Celtis pallida* and *E. anacua*, two species characteristic of mature South Texas forests and Tamaulipan thornscrub, were the most numerous of the secondary woody species found at the Longoria WMA. Table 3 summarizes secondary woody vegetation density recorded as the number of plants per square meter at each study site. The total area sampled at the Anacua WMA was 163.4 m^2 (π52) and the total area sampled at the Longoria WMA was 62.8 m^2 (π20). *Baccharis neglecta* was the densest of the secondary woody species at the Anacua WMA while the densest secondary woody species of the Longoria WMA was *C. pallida*. Table 4 shows the height distribution of each of the secondary woody species common to both study sites when separated into four categories. The four categories are as follows: 1; 0 to 50 cm, 2; 51 to 100 cm, 3; 101 to 200 cm, and 4; 201 cm and up. *Baccharis neglecta* was the dominant secondary woody species in all four height categories at the Anacua WMA. At the Longoria WMA, *C. pallida* was the dominant secondary woody species in categories 1 and 2, while *B. celastrina* and *C. laevigata* dominated the third category. *Baccharis neglecta* was the dominant secondary woody species in the fourth category at the Longoria WMA. Table 5 summarizes the mean heights and stem diameters of the secondary woody species common to both study sites. The secondary woody species with the greatest mean height at the Anacua WMA was *Parkinsonia aculeata,* and that of the Longoria WMA was *Baccharis neglecta.*

Figures 3 through 7 illustrate the foliage profiles of the canopy species at the Anacua WMA. *Acacia smallii* is the dominant upper (4 to 6 m) canopy species whereas *B. neglecta, P. aculeata,* and *P. glandulosa* dominate the middle (2 to 4 m) canopy. *Celtis laevigata* is the primary lower (0 to 2 m) canopy species. Figures 8 through 15 show the foliage profiles of the canopy species at the Longoria WMA. Dominant upper (4 to 6 m) canopy species include *E. anacua, C. hookeri, P. glandulosa,* and *Z. fagara. Baccharis neglecta, P. ebano, C. pallida,* and *C. laevigata* were dominant middle (2 to 4 m) canopy species. *Condalia hookeri* and *Z. fagara* were the dominant lower (0 to 2 m) canopy species. *Celtis pallida* and *E. anacua* were the two dominant secondary species at the Longoria WMA, while *B. neglecta* dominated secondary growth at the Anacua WMA (Table 3).

Figures 16 through 18 show a greater canopy height at the Longoria WMA of three of the secondary woody species common to both study sites. All three species showed greater volume at higher levels at the Longoria WMA than at the Anacua WMA. These three species, *C. laevigata, P. glandulosa,* and *B. neglecta,* reflect the effect of maturity on canopy profile in the Longoria WMA study area. Figure 19 compares the overall foliage profiles of all canopy species at both study sites. Overall, there was greater vegetative volume in the high canopy at Longoria WMA and greater volume in the mid-canopy at Anacua WMA

TABLE 1. Total numbers of canopy species sampled at the Anacua and Longoria Wildlife Management Areas.

Anacua WMA	Number	Longoria WMA	Number
Acacia smallii	37	*Pithecellobium ebano*	7
Baccharis neglecta	13	*Ehretia anacua*	5
Parkinsonia aculeata	2	*Celtis laevigata*	3
Celtis laevigata	1	*Celtis pallida*	3
Prosopis glandulosa	1	*Condalia hookeri*	3
		Prosopis glandulosa	3
		Zanthoxylum fagara	3
		Baccharis neglecta	2

TABLE 2. Total numbers of individuals of secondary woody species found at the Anacua and Longoria Wildlife Management areas.

Anacua WMA	Number	Longoria WMA	Number
Baccharis neglecta	214	*Celtis pallida*	278
Celtis laevigata	12	*Ehretia anacua*	139
Acacia smallii	11	*Pithecellobium ebano*	43
Celtis pallida	5	*Zanthoxylum fagara*	31
Leucaena leucocephala	5	*Condalia hookeri*	24
Parkinsonia aculeata	5	*Forestiera angustifolia*	17
Prosopis glandulosa	5	*Celtis laevigata*	6
Pithecellobium ebano	3	*Baccharis neglecta*	4
Ziziphus obtusifolia	2	*Bumelia celastrina*	3
Aster spinosus	1	*Amyris texana*	1
Bumelia celastrina	1		

TABLE 3. Mean density (#/m^2) of secondary woody species found at the Anacua and Longoria Wildlife Management Areas.

Anacua WMA	Density	Longoria WMA	Density
Baccharis neglecta	1.31	*Celtis pallida*	4.42
Celtis laevigata	0.073	*Ehretia anacua*	2.21
Acacia smallii	0.067	*Pithecellobium ebano*	0.68
Celtis pallida	0.031	*Zanthoxylum fagara*	0.49
Leucaena leucocephala	0.031	*Condalia hookeri*	0.38
Parkinsonia aculeata	0.031	*Forestiera*	
Prosopis glandulosa	0.031	*angustifolia*	0.27
Pithecellobium ebano	0.018	*Celtis laevigata*	0.10
Ziziphus obtusifolia	0.012	*Baccharis neglecta*	0.06
Aster spinosus	0.006	*Bumelia celastrina*	0.05
Bumelia celastrina	0.006	*Amyris texana*	0.02

TABLE 4. A comparison of height classes of secondary woody species common to the Anacua and Longoria Wildlife Management Areas.

	height in cm			
	0 - 50	51 - 100	101 - 200	201 - up
Anacua WMA				
Baccharis neglecta	13	53	101	44
Bumelia celastrina	0	0	0	1
Celtis laevigata	1	2	7	2
Celtis pallida	2	2	0	0
Pithecellobium ebano	1	1	0	1
Longoria WMA				
Baccharis neglecta	0	0	0	4
Bumelia celastrina	2	0	1	0
Celtis laevigata	1	1	1	2
Celtis pallida	266	5	0	3
Pithecellobium ebano	39	3	0	1

TABLE 5. Mean heights and stem diameters of secondary woody species at the Anacua and Longoria Wildlife Management Areas.

Anacua WMA	Mean Height (cm)	Mean Stem Diameter (cm)
Parkinsonia aculeata	346	4.7
Prosopis glandulosa	310	4.2
Leucaena leucocephala	212	1.0
Bumelia celastrina	210	1.9
Baccharis neglecta	169	2.0
Celtis laevigata	139	0.8
Acacia smallii	131	1.4
Pithecellobium ebano	110	2.1
Ziziphus obtusifolia	105	0.3
Celtis pallida	46	0.3
Longoria WMA		
Baccharis neglecta	278	3.8
Celtis laevigata	265	2.8
Amyris texana	148	1.1
Forestiera angustifolia	118	0.6
Zanthoxylum fagara	100	1.0
Condalia hookeri	64	0.5
Ehretia anacua	64	0.9
Bumelia celastrina	58	0.5
Pithecellobium ebano	33	0.4
Celtis pallida	24	0.2

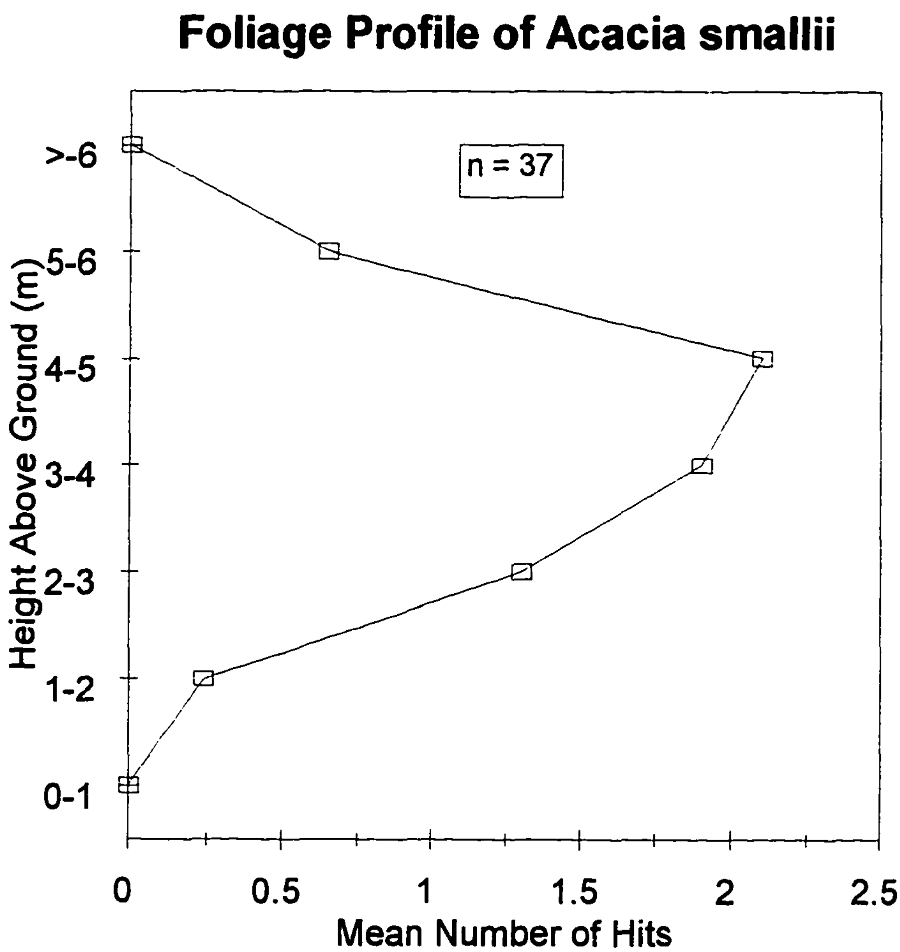

FIGURE 3. Foliage profile of *Acacia smallii* at the Anacua study site.

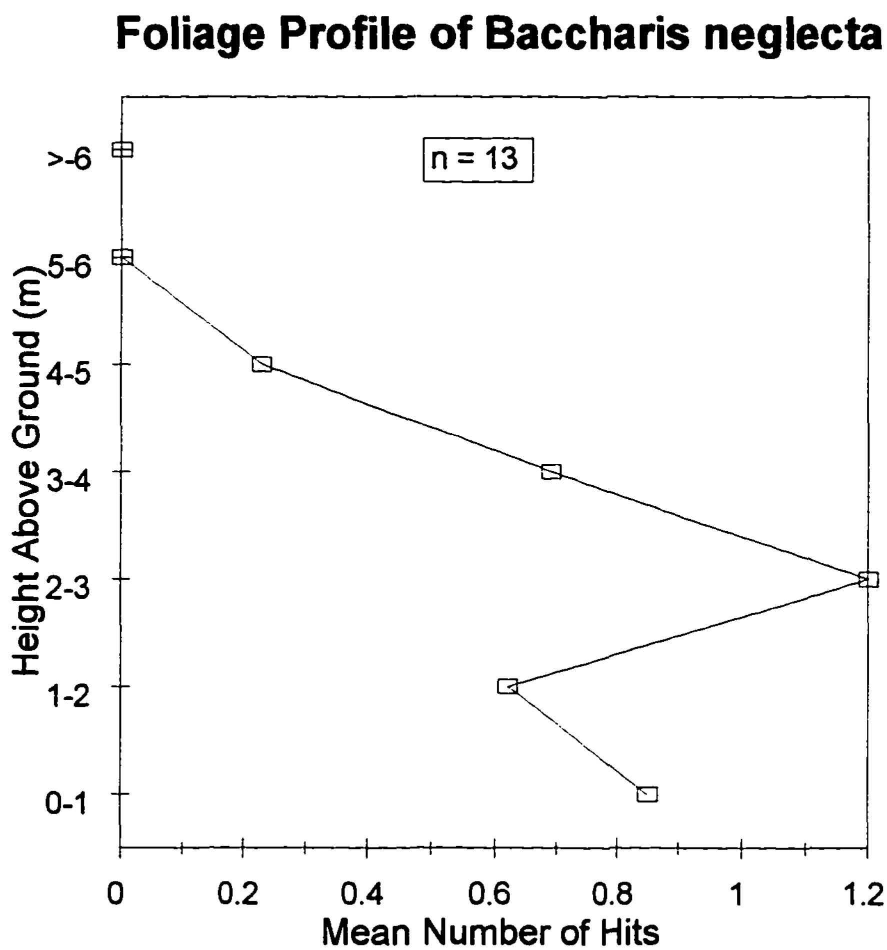

FIGURE 4. Foliage profile of *Baccharis neglecta* at the Anacua study site.

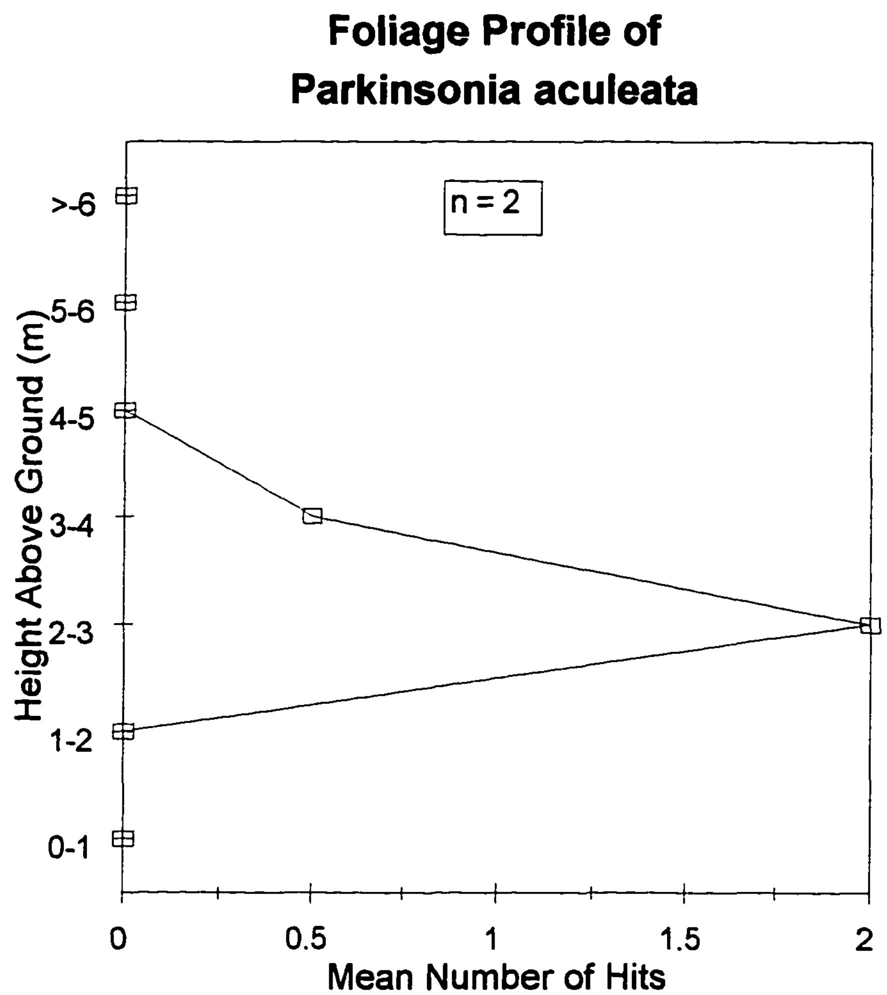

FIGURE 5. Foliage profile of *Parkinsonia aculeata* at the Anacua study site.

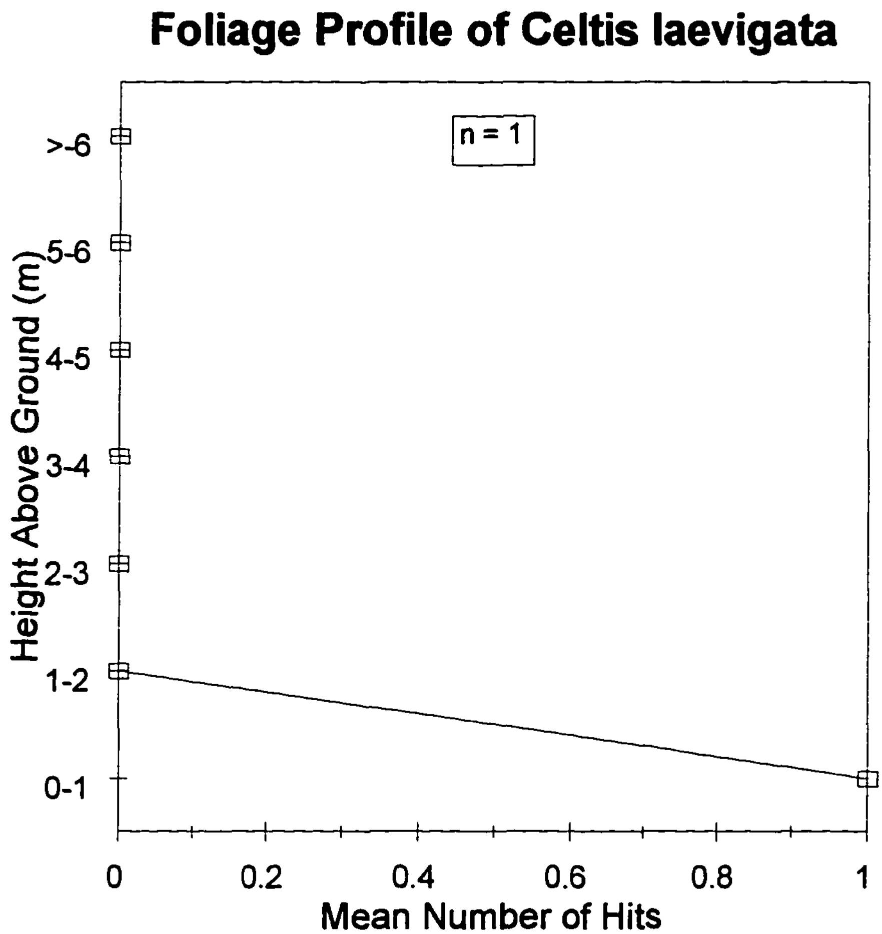

FIGURE 6. Foliage profile of *Celtis laevigata* at the Anacua study site.

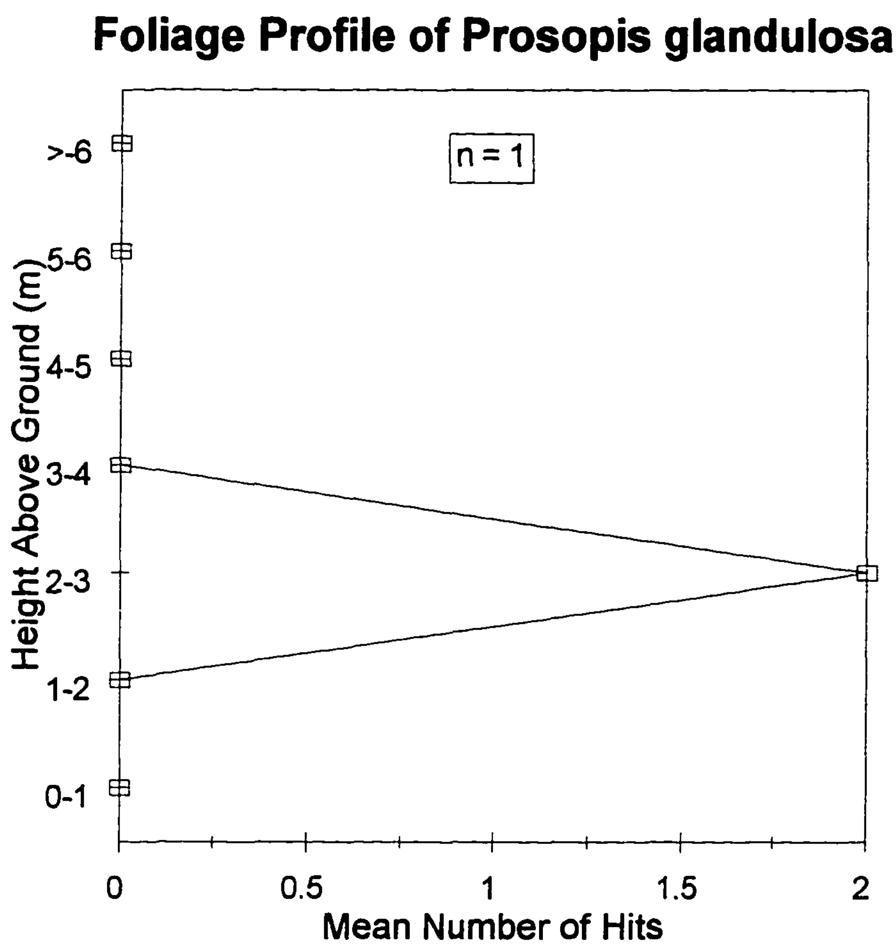

FIGURE 7. Foliage profile of *Prosopis glandulosa* at the Anacua study site.

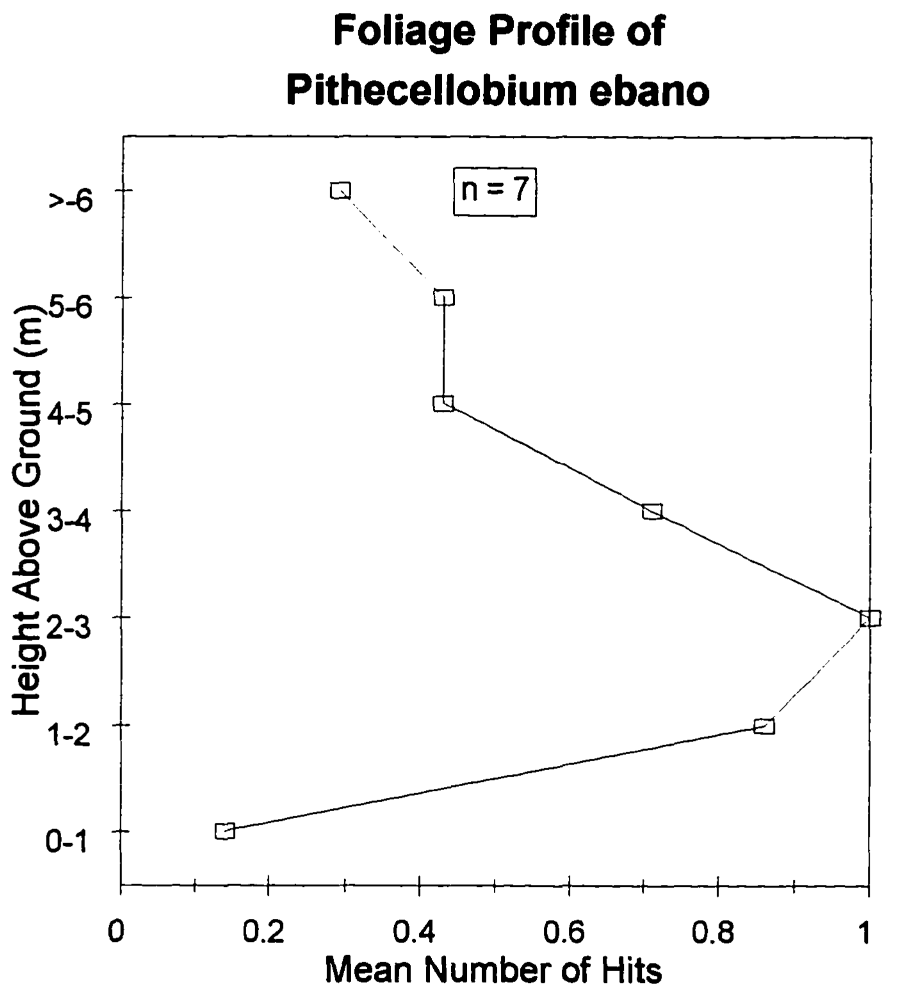

FIGURE 8. Foliage profile of *Pithecellobium ebano* at the Longoria study site.

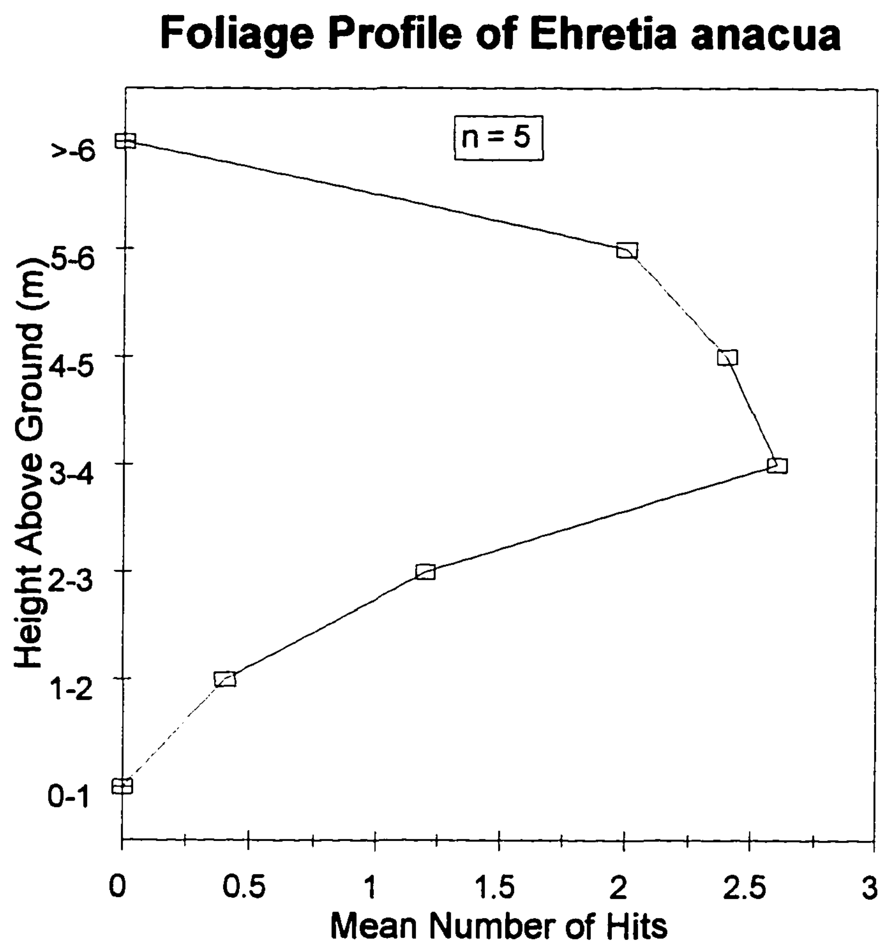

FIGURE 9. Foliage profile of *Ehretia anacua* at the Longoria study site.

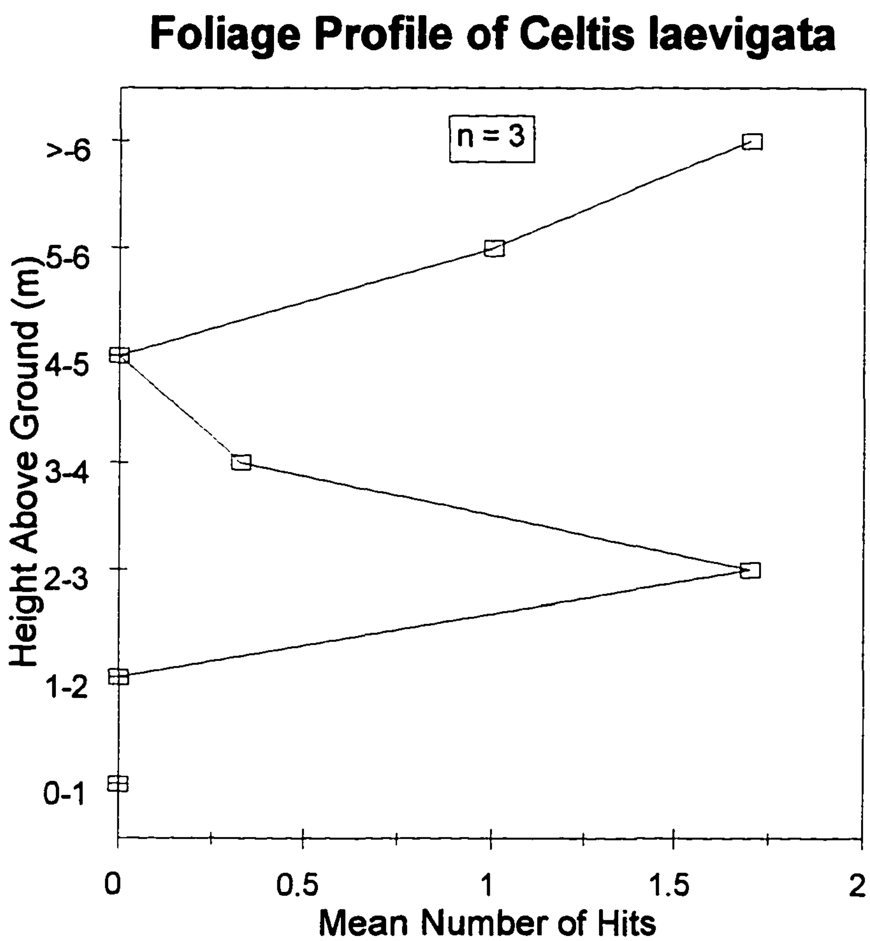

FIGURE 10. Foliage profile of *Celtis laevigata* at the Longoria study site.

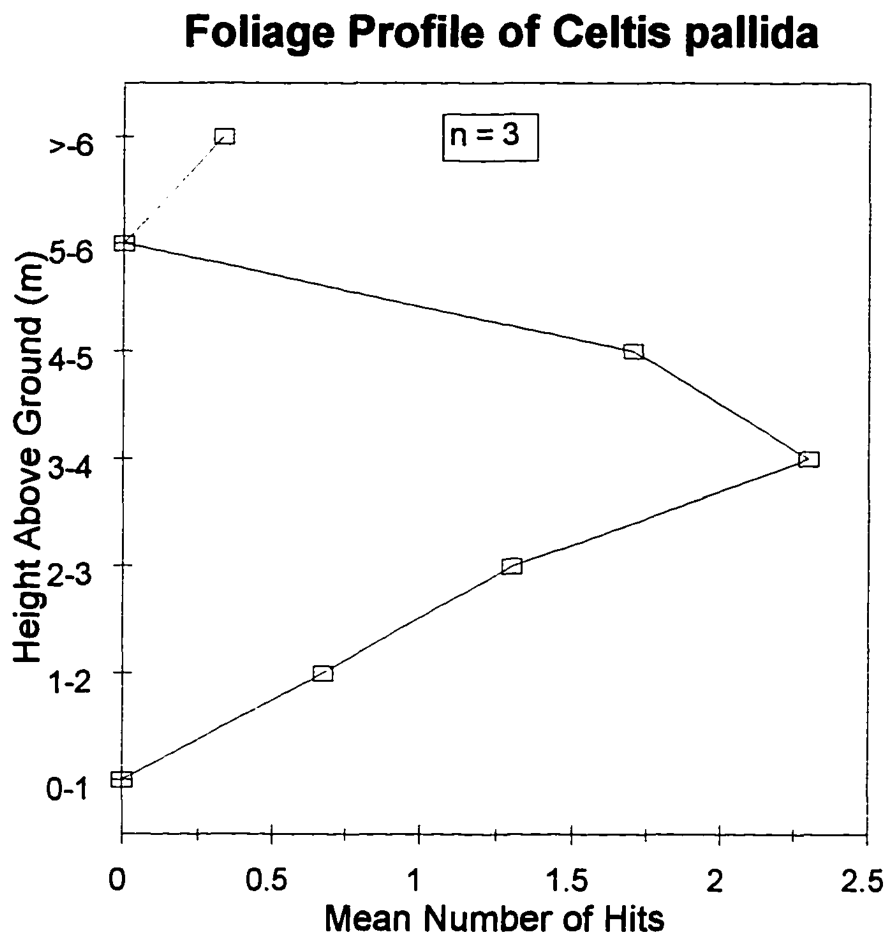

FIGURE 11. Foliage profile of *Celtis pallida* at the Longoria study site.

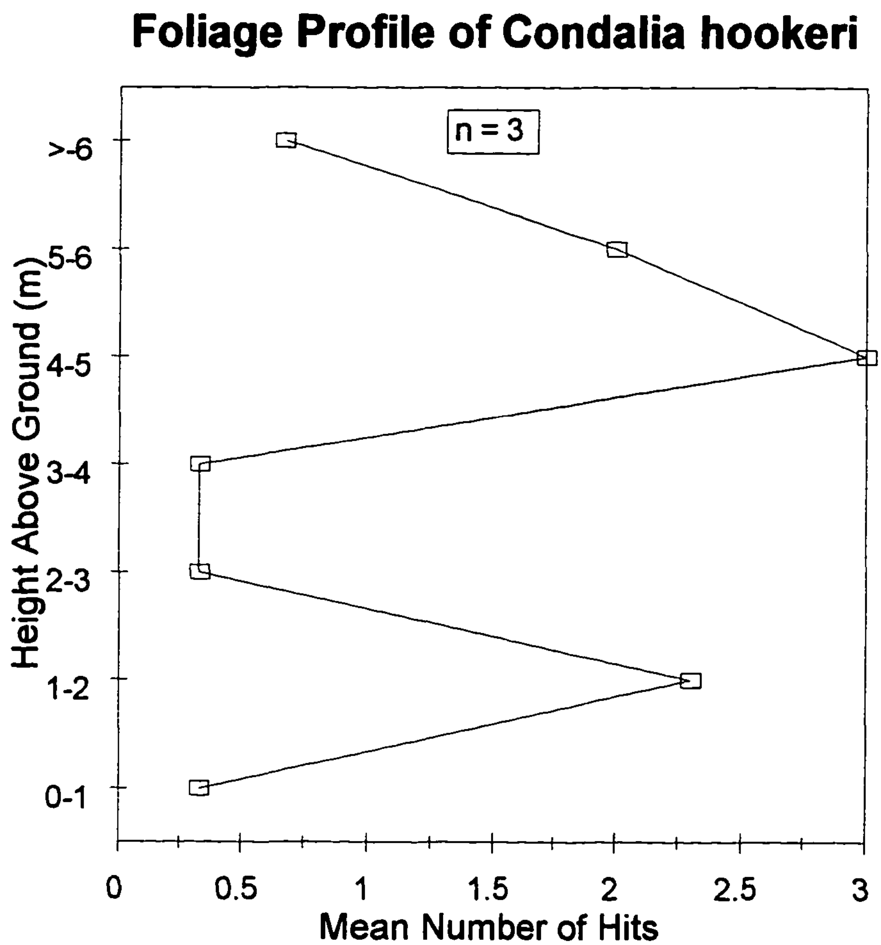

FIGURE 12. Foliage profile of *Condalia hookeri* at the Longoria study site.

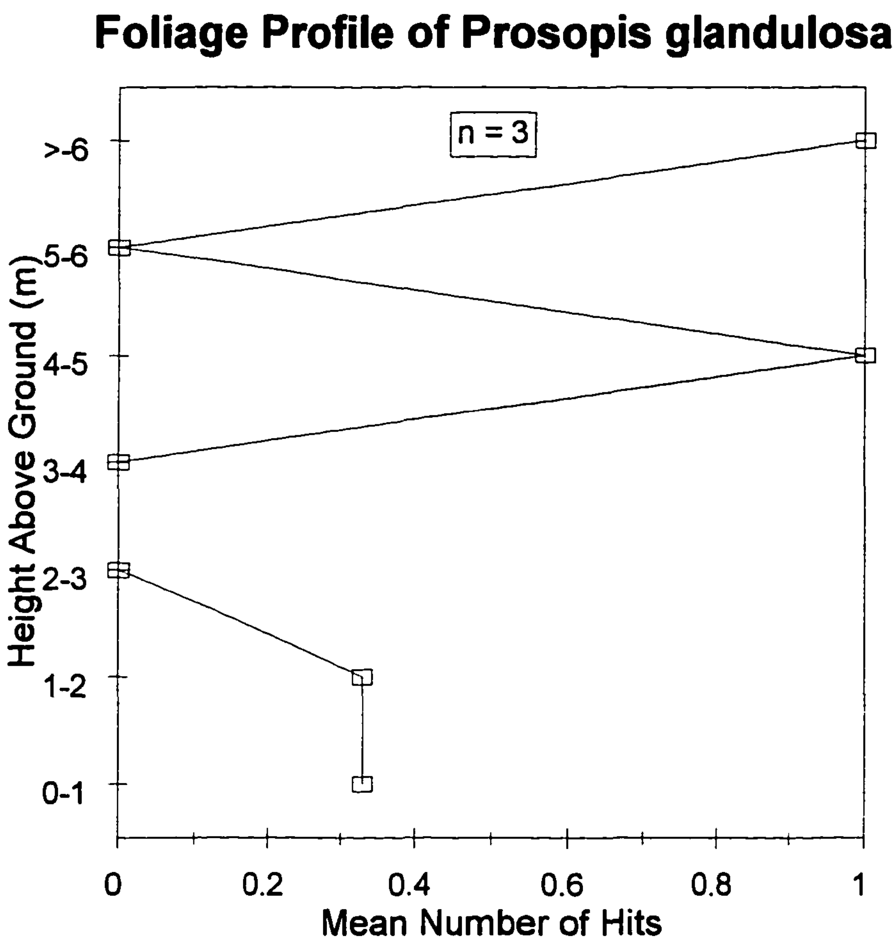

FIGURE 13. Foliage profile of *Prosopis glandulosa* at the Longoria study site.

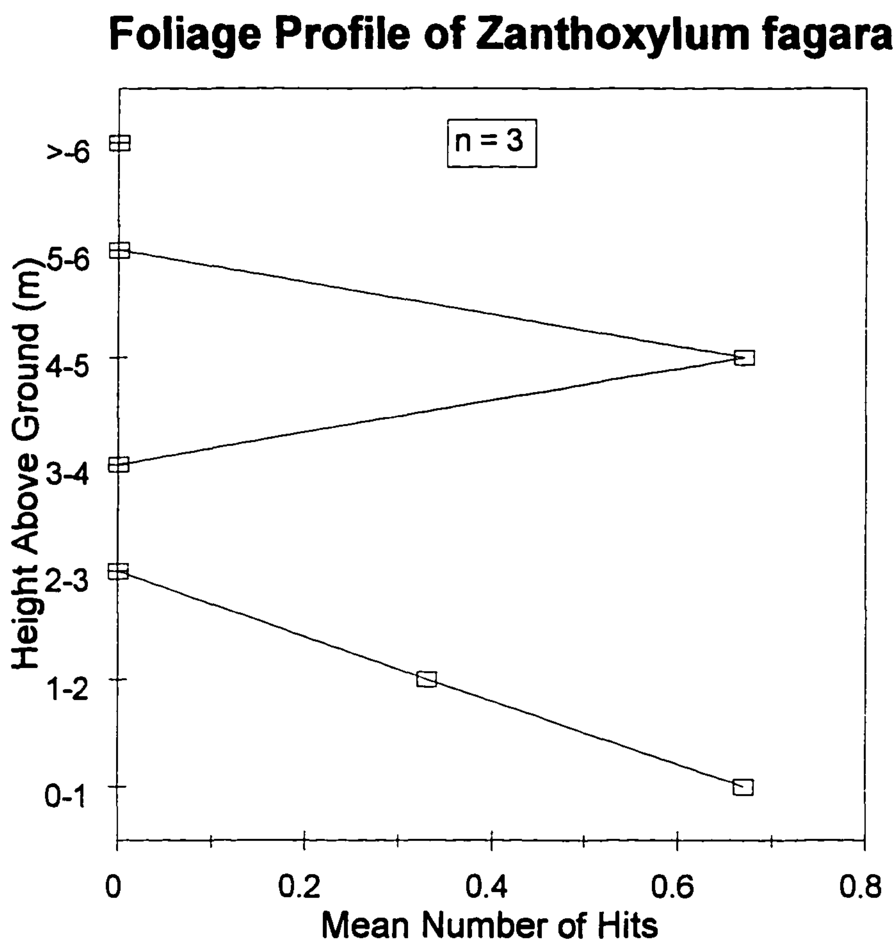

FIGURE 14. Foliage profile of *Zanthoxylum fagara* at the Longoria study site.

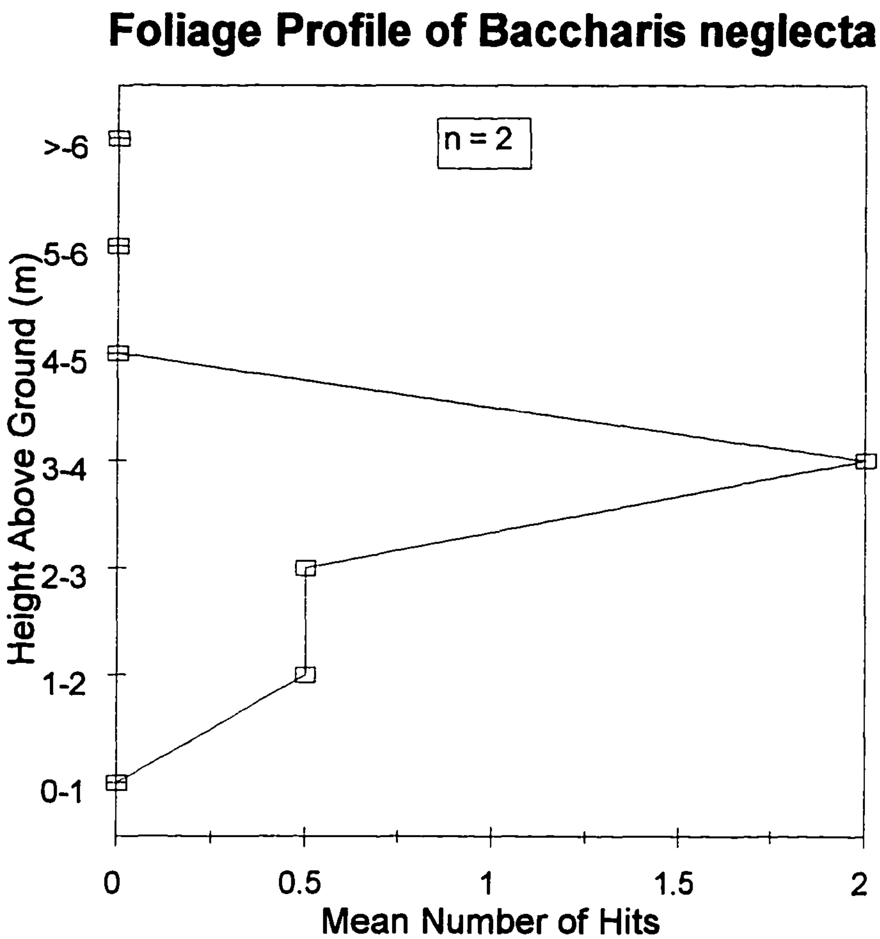

FIGURE 15. Foliage profile of *Baccharis neglecta* at the Longoria study site.

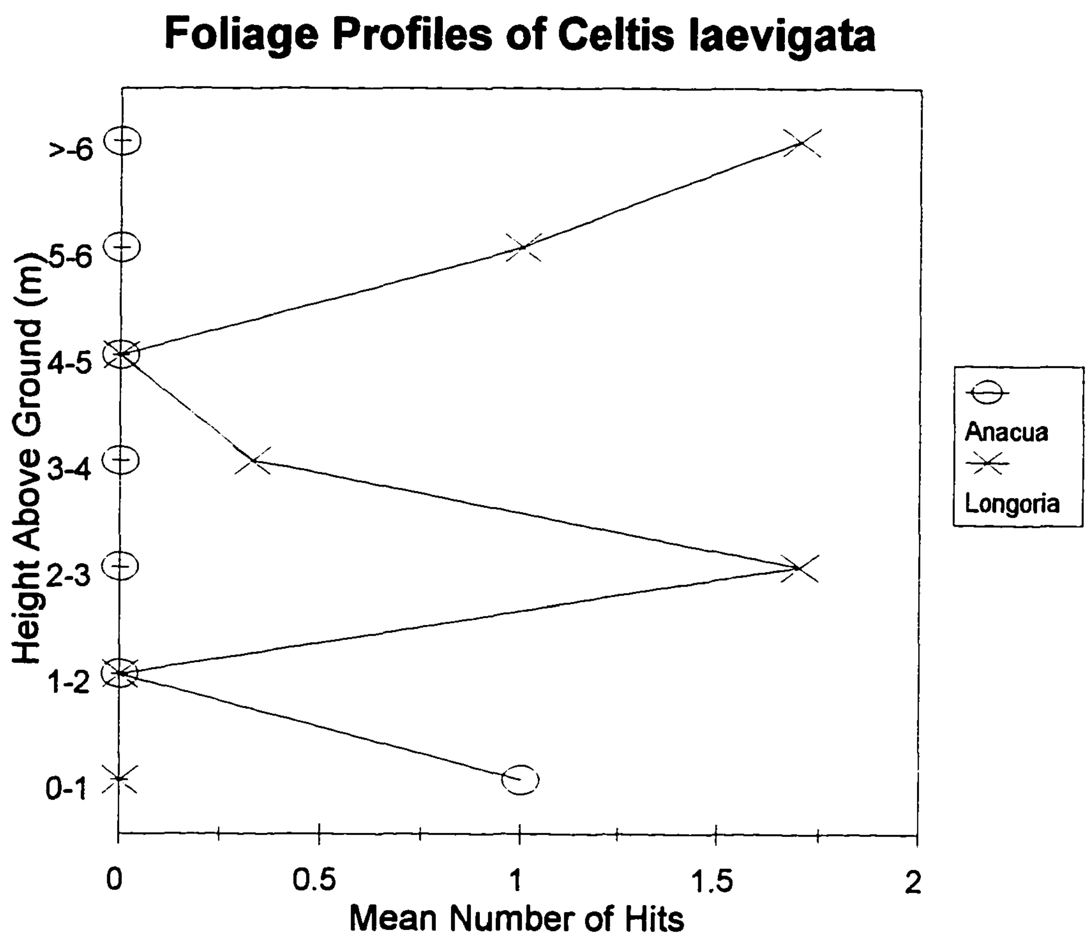

FIGURE 16. Foliage profiles of *Celtis laevigata* at both study sites.

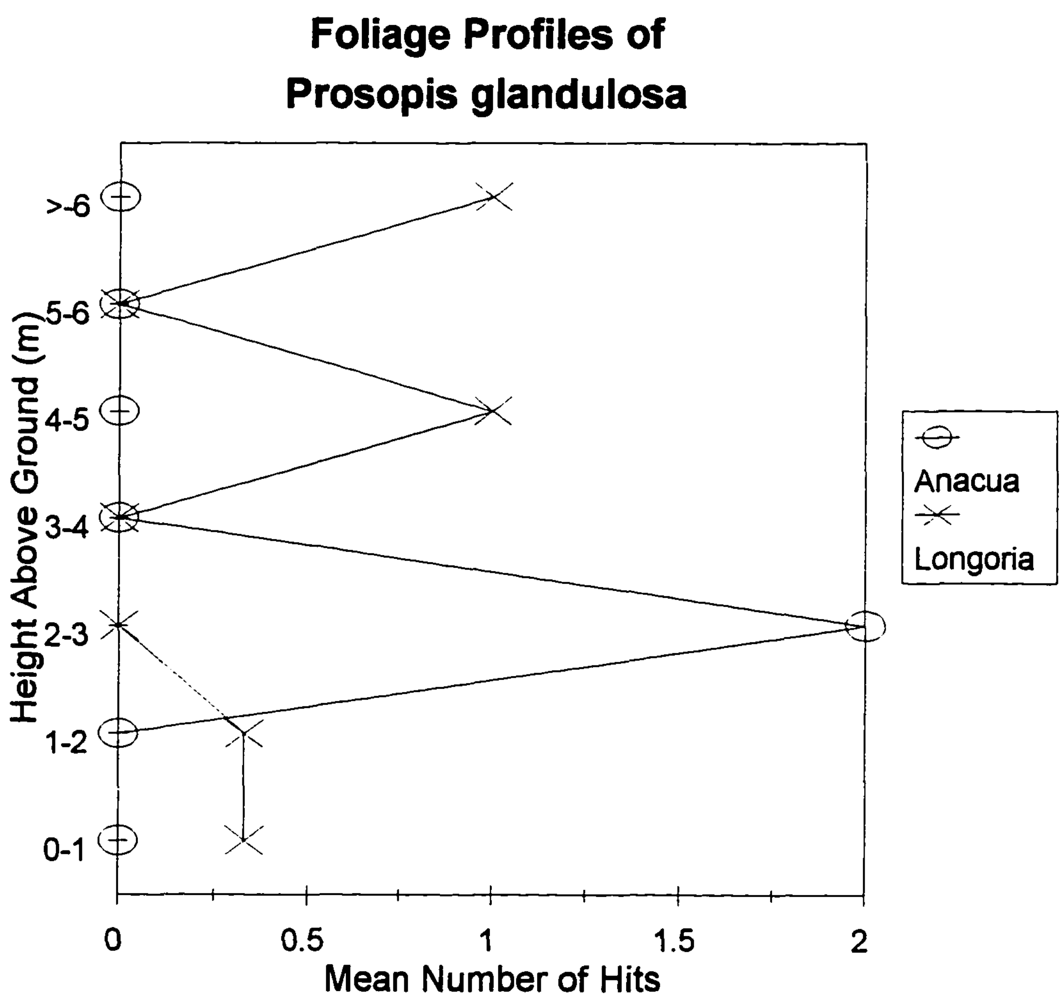

FIGURE 17. Foliage profiles of *Prosopis glandulosa* at both study sites.

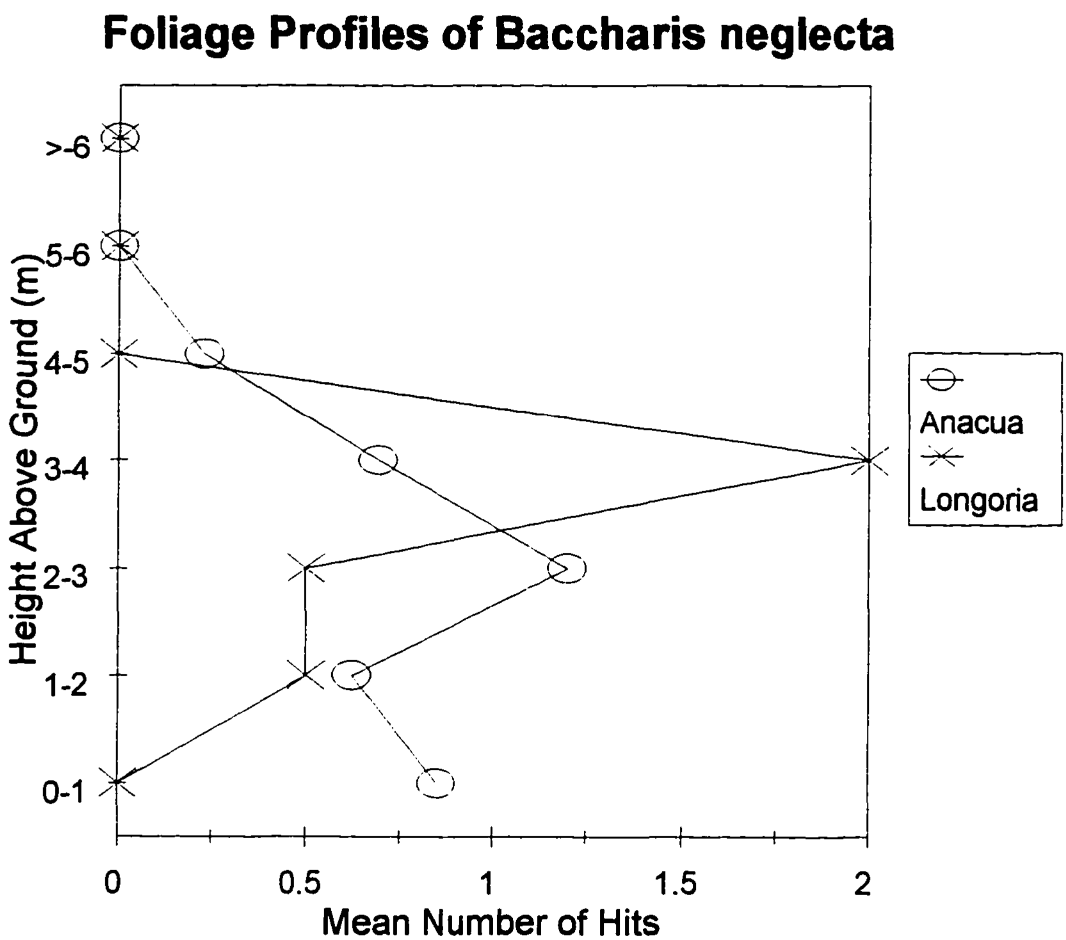

FIGURE 18. Foliage profiles of *Baccharis neglecta* at both study sites.

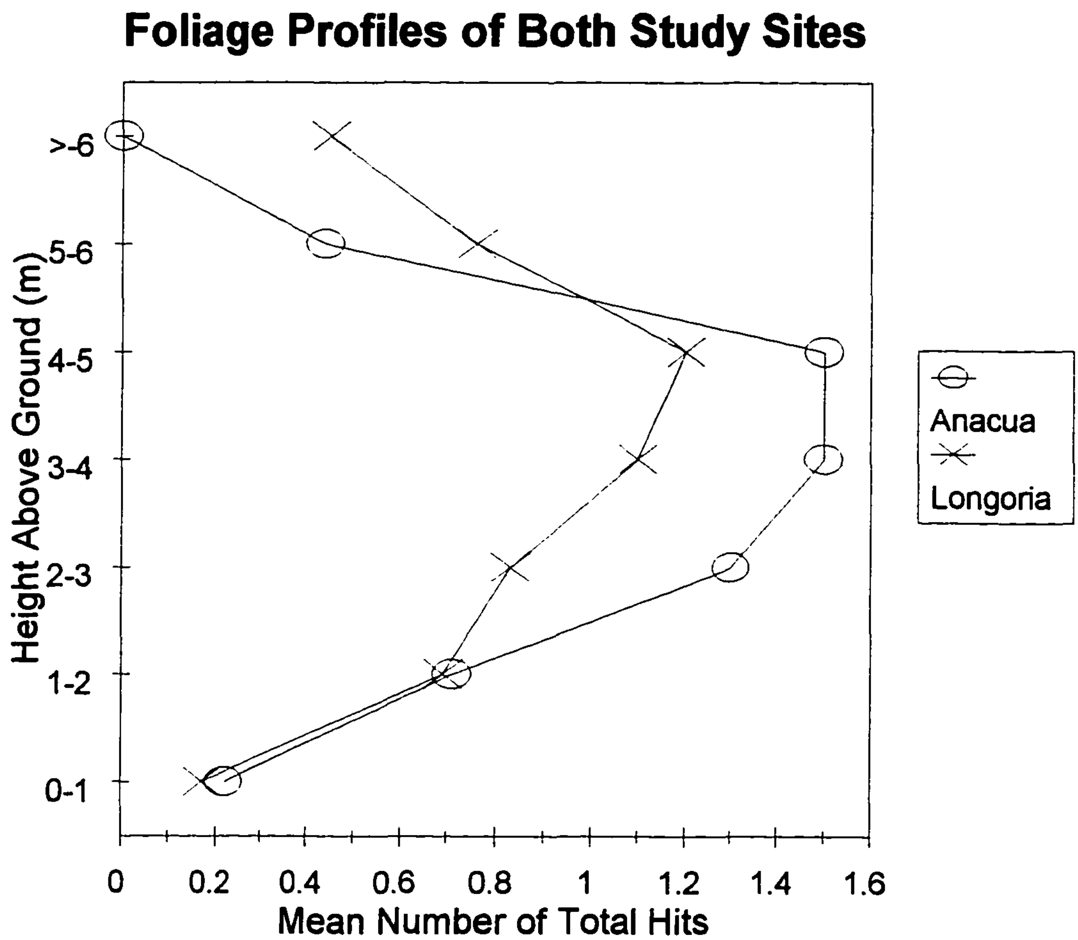

FIGURE 19. Mean foliage profiles of all canopy species at both study sites.

DISCUSSION

The greater TVV, greater woody species diversity, and lower dominance value observed at the Longoria WMA than those of the Anacua WMA is likely due to two main factors. The first is the disparity of age between the two WMA's. Because the Longoria WMA was revegetated 23 years prior to the Anacua WMA, more time has elapsed for the development of a thicker canopy and a greater secondary woody species diversity at the Longoria WMA. Secondly, the Longoria WMA was revegetated primarily with relatively long-lived species such as *Ehretia anacua*, *Bumelia celastrina*, *Prosopis glandulosa*, and *Celtis laevigata*, whereas the Anacua WMA was revegetated principally with *Acacia smallii*. The reason *A. smallii* was introduced into the Anacua WMA by the Texas Parks and Wildlife Department (TPWD) was to provide a breeding habitat for game birds such as White-winged and Mourning Doves (G. Waggerman, personal communication). *Acacia smallii* is a tree species which declines after about 35 years (Van Auken, et al., 1985; Cohn, et al., 1988). *Celtis laevigata* is usually present in early successional communities in South Texas, but remains a minor species until the stands are around 25 years old (Van Auken, 1985). At this time, *C. laevigata* becomes a dominant and remains as such in many mature communities (Van Auken, et al., 1985).

Although the structural, spatial, and chronological relationships of many South Texas plant communities remain poorly understood (Van Auken and Bush, 1985), several long-term effects of revegetation of abandoned fields with *A. smallii* seem clear. As the *A. smallii-B. neglecta* community develops, it is used by several avian species which may disperse small numbers of seeds, such as doves and Great-tailed Grackles, and smaller numbers of good seed dispersers such as Northern Mockingbirds and Cedar Waxwings. As the *A. smallii-B. neglecta* stands yield to more permanent community species such as *C. laevigata*, *C. pallida*, *P. glandulosa*, *P. ebano*, and *Ulmus crassifolia*, a more complex and a wider variety of habitats develop. These more complex communities in turn support a greater diversity of avifauna, including sparrows, thrashers, Plain Chachalacas and neotropical migrants. Many of these species consume fruits readily and are probably good-excellent seed dispersers (Carter, 1986; Brush, unpublished data). Because the plant community type which supports the greater density of Olive Sparrows is an older, more diverse one, it seems reasonable to conclude that the Olive Sparrow can be used as an indicator species in predicting habitat suitability for other avian species requiring similar habitat complexity, at least in Tamaulipan thornscrub habitat. The density of Olive Sparrows shown in the Longoria WMA (2.5/ha) compares favorably to that observed in mature Tamaulipan thornscrub habitat at the Santa Ana National Wildlife Refuge (Carter, 1986), indicating that revegetation can be successful for Olive Sparrows. It is possible that Olive Sparrow densities may continue to increase as the habitat continues to mature (Carter, 1986).

According to Oberholser (1974), since 1933, the twenty million or so Texas acres that make up the Olive Sparrow's sole U.S. range, have been subjected to widespread brush removal. Indeed, over six million acres, 98%, of the Olive Sparrow's optimum habitat in the Rio Grande delta had been cleared by 1968 (Oberholser, 1974). Oberholser (1974) concluded that in spite of the destruction of much of the Olive Sparrow's habitat, the bird is able to maintain a fairly healthy breeding population in and near the Rio Grande delta. Oberholser (1974) cites the Olive Sparrow's nest sites, which are so well hidden that even cowbirds have trouble finding them, as well as the isolation of their remaining thicket habitat from farming activities, as the two principal reasons for their ability to maintain their breeding population. However, revegetation on state, federal, and private land, should provide more habitat for both residents such as the Olive Sparrow, as well as migrants, and increase their populations in the Lower Rio Grande Valley of Texas.

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VITA

Patrick Grant Wright was born in Kirkwood, Missouri, May 21, 1963, the son of Margaret Soderquist Wright and Billy Grant Wright. Nine years later, he moved to Weslaco, Texas, where he completed High School in 1981. He entered the University of Texas-Pan American in Edinburg in 1983 where he received the degree of Bachelor of Science with a major in Biology in May of 1990. In September, 1991, he entered the Graduate School of the University of Texas-Pan American. In 1993, he began teaching High School Chemistry in Lyford, Texas, where he lives with his wife Yvonne Johnson Wright and his son Dalton.

Permanent Address: Route 2 Box 7
Lyford, Texas 78569