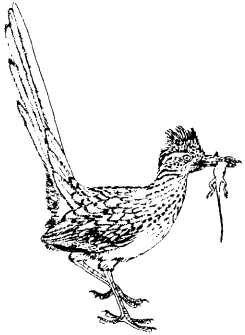


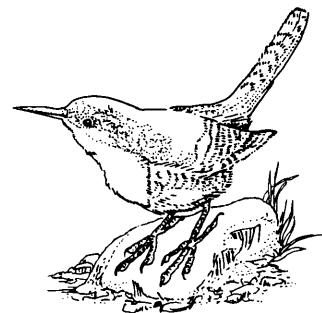
# **CREATING A <sup>TM</sup> SCHOOL HABITAT**

**A Planning Guide  
For Habitat Enhancement on  
School Grounds in Texas**



## **APPENDICES For West Texas**

**Trans-Pecos  
Ecological Region**



**Written by:**

**Diana M. Foss, Urban Program, Texas Parks and Wildlife  
Ronald K. Jones, U. S. Fish and Wildlife Service**

**Illustrations on pages A-15, A-17, A-21, and A-22 by:  
Michele G. Foss**

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**Additional copies of this manual may be obtained from the offices listed in the manual. Training workshops are offered periodically through the year in association with this manual.**



## Appendix A: Resource Professionals

These appendices include partial lists. Please write in additional resources as you discover them.

Center for Environmental Resource Management  
University of Texas at El Paso, P.O. Box 645  
El Paso, TX 79968  
Voice: (915) 747-5667 Fax: (915) 747-5145  
E-mail: edhamlyn@utep.edu  
<http://www.cerm.utep.edu/>

Chihuahuan Desert Wildlife Rescue  
4122 Emory Road  
El Paso, TX 79922  
Voice: (915) 584-7088 Fax: (915) 747-5731  
E-mail: cmiller@utep.edu  
<http://www.whc.net/cdwr>

El Paso Water Service Utilities Board  
Water Conservation Department  
1154 Hawkins Blvd.  
El Paso, TX 79961-0001  
Voice: (915) 594-5508 Fax (915) 594-5660  
E-mail: ajpadilla@epwu.org  
<http://www.epwu.org>

El Paso Zoo  
4001 E. Paisano  
El Paso, TX 79905-4223  
Voice: (915) 521-1850 Fax (915) 521-1857  
E-mail: epzooeduca@aol.com  
<http://www.epwu.org>

Environmental Defense Fund  
1100 N. Stanton, Suite 805  
El Paso, TX 79902  
Voice: (915) 543-9292 Fax: (915) 543-9115  
E-mail: carlos@edf.org  
<http://www.edf.org>

Insights El Paso Science Museum  
505 N. Santa Fe  
El Paso, TX 79901  
Voice: (915) 534-0000 Fax: (915) 532-7416  
E-mail: insights@elp.rr.com  
<http://nasa.utep.edu/insights>

Keystone Heritage Park Association  
4122 Emory Road  
El Paso, TX 79922  
Voice: (915) 747-6254 Fax: (915) 747-6214  
E-mail: cmiller@utep.edu  
<http://www.keystonepark.org>

Ladybird Johnson Wildflower Research Center  
4801 LaCrosse Ave., Austin, 78739-1702  
Voice: (512) 292-4100  
<http://www.wildflower.org/>

International Boundary and Water Commission  
4171 N. Mesa, Building C, Suite 310  
El Paso, TX 79902  
Voice: (915) 832-4100 Fax: (915) 832-4190  
E-mail: sallyspenser@ibwc.state.gov  
<http://www.ibwc.state.gov>

National Wildlife Federation  
Federation Homepage:  
<http://www.nwf.org/nwf/natlwild/index.html>  
Backyard Wildlife Habitat Homepage:  
<http://www.nwf.org/habitats/index.html>

Native Plant Society of Texas Statewide Office  
Bank One Building, 1111 N. IH 35, Suite 212  
Round Rock, TX 78664  
Voice: (512) 836-4751  
[http://lonestar.texas.net/~jleblanc/npsot\\_austin.html](http://lonestar.texas.net/~jleblanc/npsot_austin.html)

Natural Resource Conservation Service  
11930 Vista del Sol Drive  
El Paso, TX 79936  
Voice: (915) 855-0884 Fax: (915) 855-7278  
<http://www.nrcs.usda.gov/>

Rio Grande/Rio Bravo Basin Coalition  
Avenida de Charro 610 Norte Edificio  
E 110, UACJ, Cd. Juarez, Chih.  
Voice: (915) 747-5720, 52.16.17.5998  
Fax: (915) 747-5145  
E-mail: coalition@hotmail.com

River-Watch Network, Inc.  
7500 Viscount, Suite 147  
El Paso, TX 79925  
Voice: (915) 772-8650 Fax: (915) 772-8759

Texas Agricultural Experiment Station  
1380 A&M Circle  
El Paso, TX 79927-5020  
Voice: (915) 859-9111 Fax: (915) 859-1078

Texas Agricultural Extension Service  
Room 112, Jack K. Williams Administration Building,  
College Station, Texas 77843-7101  
Voice: (409) 845-7800 Fax: (409) 845-9542  
Texas Agricultural Extension Service  
Trans-Pecos County Offices:

Brewster County Extension Office  
P.O. Box 67  
Alpine, Texas 76831  
Voice: (915) 837-2265 Fax: (915) 837-7393  
E-mail: irion-tx@tamu.edu

Culberson County Extension Office  
P.O. Box 625  
Van Horn, Texas 79855  
Voice: (915) 283-2059 Fax: (915) 283-9234  
E-mail: culberso-tx@tamu.edu

El Paso County Extension Service  
1030 N. Zaragoza, Suite A  
El Paso, Texas 79907  
Voice: (915) 859-7725 Fax: (915) 860-0331  
E-mail: r-bader@tamu.edu

## Appendix A: Resource Professionals (cont.)

### Hudspeth County Extension Office

P.O. Box 278  
Sierra Blanca, Texas 79851  
Voice: (915) 369-2291 Fax: (915) 369-2361  
E-mail: [hudspeth-tx@tamu.edu](mailto:hudspeth-tx@tamu.edu)

### Pecos County, County Extension Agent-AG Box 1357

Fort Stockton, TX 79735  
Voice: 915-336-2541 or 915-336-3959  
FAX: 915-336-6107  
E-mail: [a-matthies@tamu.edu](mailto:a-matthies@tamu.edu)

### Presidio County Extension Office

P.O. Box 548  
Marfa, Texas 79843  
Voice: (915) 729-4746 Fax: (915) 729-4011  
E-mail: [presidio-tx@tamu.edu](mailto:presidio-tx@tamu.edu)

### Reeves-Loving Counties Extension Office

P.O. Box 2011  
Pecos, Texas 79772  
Voice: (915) 447-9041 Fax: (915) 447-6149  
E-mail: [reeves-loving-tx@tamu.edu](mailto:reeves-loving-tx@tamu.edu)

### Terrell County, County Extension Agent-AG

Box 650  
Sanderson, TX 79848  
Voice: 915-345-2291  
E-mail: [@tamu.edu](mailto:@tamu.edu)

### Val Verde County, County Extension Agent-AG

300 East 17th  
Del Rio, TX 78840  
Voice: 830-774-7591  
E-mail: [jw-allen@tamu.edu](mailto:jw-allen@tamu.edu)

### Texas Forest Service

401 E. Franklin, Suite 540  
El Paso, TX 79901  
Voice: (915) 834-5610  
E-mail: [tfselpas@swbell.net](mailto:tfselpas@swbell.net)

### Texas Natural Resource Conservation Committee

401 E. Franklin, Suite 560  
El Paso, TX 79901  
Voice: (915) 834-4949 Fax: (915) 834-4940  
<http://www.tnrcc.state.tx.us>  
Region 6, El Paso

### Texas Parks and Wildlife Wildlife Diversity Program

3000 IH-35 South, Suite 100  
Austin, TX 78704  
Voice: (512) 912-7011

### Texas Parks and Wildlife Dept.

Urban Wildlife Program  
401 E. Franklin, Suite 520  
El Paso, Texas, 79901  
Voice: (915) 834-7070 Fax: (915) 834-7060  
E-mail: [elpasowild@aol.com](mailto:elpasowild@aol.com)

### U.S. Fish and Wildlife Services

Austin Ecological Services Field Office  
10711 Burnett Rd., Suite 200  
Austin, TX 78758  
Voice: (512) 490-0057 Fax: (512) 490-0974  
E-mail: [r2we\\_tx@fws.gov](mailto:r2we_tx@fws.gov)

### University of Texas at El Paso

500 West University Education Building  
El Paso, TX 79968  
Voice: (915) 747-7679 Fax: (956) 747-7441  
E-mail: [ehampton@miners.utep.edu](mailto:ehampton@miners.utep.edu)

### The Centennial Museum

The University of Texas at El Paso  
University Ave. and Wiggins Avenue  
El Paso, TX 79968-0519  
Voice: (915) 747-5565, [www.utep.edu/museum](http://www.utep.edu/museum)

### ADDITIONAL RESOURCES:

## Appendix B: Teacher Training Resources

The Centennial Museum  
The University of Texas at El Paso  
University Ave. and Wiggins Avenue  
El Paso, TX 79968-0519  
Voice: (915) 747-5565, [www.utep.edu/museum](http://www.utep.edu/museum)

El Paso Zoo  
Education Specialist  
4001 E. Paisano  
El Paso, TX 79905-4223  
Voice: (915) 521-1850 Fax: (915) 521-1857  
E-mail: [EPZOOEDUCA@AOL.COM](mailto:EPZOOEDUCA@AOL.COM)

Master Composting Program,  
Texas Natural Resource Conservation Commission  
Voice: (512) 239-1000

Master Gardener Program  
Texas Agricultural Extension Service  
(El Paso County) 1030 N. Zaragosa, Suite A  
El Paso, Texas 79907  
Voice: (915) 859-7725 Fax: (915) 860-0331  
E-mail: [r-bader@tamu.edu](mailto:r-bader@tamu.edu)

Project Feeder Watch/CLO  
P.O. Box 11  
Ithaca, NY 14851-0011  
1-800-843-BIRD

Project WET, 1995, The Watercourse and the Council for  
Environmental Education, Montana State University,  
Bozeman, 59717-0570, (406) 994-5392

Project WILD and Aquatic WILD  
Texas Parks and Wildlife  
4200 Smith School Road, Austin, 78744  
Voice: (800) 792-1112  
<http://www.tpwd.state.tx.us>

School Habitat Design and Installation Workshop  
Texas Parks and Wildlife (512) 389-4974 or  
U.S. Fish and Wildlife Service (512) 490-0057

Texas Master Naturalist Program Coordinator  
Texas Parks and Wildlife  
111 Nagle Hall, Texas A&M University  
2258 TAMUS  
College Station, TX 77843-2258  
Voice: (979) 458-2034 Fax: (979) 845-7103  
[Mhaggerty@wfscgate.tamu.edu](mailto:Mhaggerty@wfscgate.tamu.edu) or [www.tpwd.state.tx.us](http://www.tpwd.state.tx.us)

### ADDITIONAL RESOURCES:

## Appendix C: Resources for Materials/ Supplies

**NOTE:** When trying to locate mulch, compost, rocks, and other such materials, be sure to contact possible free sources first. Quite often, cities, utility companies, and tree trimming services must trim trees. They frequently run the limbs through chipper/shredders and give away the mulch to school projects. In addition, many cities are beginning to operate composting programs and will offer the finished product to the public. Rocks and gravel may be a different story. These materials may have to be purchased from local sand and gravel companies.

### COMPOST:

White Mountain Composting  
P.O. Box 2537  
Ruidoso, NM 88355  
Voice: (505) 257-6708 Fax: (505) 257-2098

### Native Seed Sources:

Bamert Seed Company  
Route 3 – Box 1120  
Muleshoe, TX 79347  
Voice: (800) 262-9892 Fax: (806) 272-3114

### Native American Seed

Mail Order Station 127 N. 16th St.  
Junction, TX 76849  
Voice: (800) 728-4043, [www.seedsource.com](http://www.seedsource.com)

### Plants of the Southwest

Santa Fe, NM  
Voice: (800) 788-SEED

### Seeds of Change

Santa Fe, NM  
Voice: (505) 438-8080

### Wildseed Farms

1101 Campo Rosa Road-P.O. Box 308  
Eagle Lake, TX 77434  
Voice: (800) 848-0078 Fax: (409) 234-7407

### Turner Seed

211 CR 151  
Breckenridge, TX 76424  
(800) 722-8616 Fax: (254) 559-5024  
E-mail: [julie@texasisp.com](mailto:julie@texasisp.com) [www.turnerseed.com](http://www.turnerseed.com)

### WILDSCAPE PLANTS:

Caby's Landscape Garden Center  
4601 Hondo Pass Ave.  
El Paso, TX 79904  
Voice: (915) 755-5661

### Mountain State Wholesale Nursery

P.O. Box 2500  
Litchfield Park, AZ 85307  
Voice: (602) 247-8509 Fax: (602) 247-6354

### Nancy's Nursery

11355 Pellicano Drive  
El Paso, TX 79935  
Voice: (915) 598-3434

### Pearson's Trees

6900 Doniphan  
Canutillo, TX 79835  
Voice: (915) 877-3808

### Sierra Vista Growers (Wholesale and Retail)

2800 New Mexico Hwy. 28  
La Union, NM 88027  
Voice: (505) 874-2415 Fax: (505) 589-3024

### Sul Ross State University

Plant Resources Center  
Box C-64, Dept. of Biology  
Alpine, TX 79832  
Voice: (915) 837-8112

### ADDITIONAL RESOURCES:

## Appendix D: Reference Books

The following is a partial list of reference materials. Please write in additional books as you discover them. Also refer to books listed inside the Reference Boxes located at the end of various chapters.

### STUDENT REFERENCES

#### FIELD GUIDES:

Peterson Field Guide to:  
Butterflies and Moths  
Caterpillars  
Southwestern and Texas Wildflowers  
And others....

### TEACHER REFERENCES

- American Wildlife and Plants, by C. Martin, S. Zim, and A. Nelson, 1951, Dover Publications, New York.
- Backyard Naturalist, by C. Tufts, 1993, Washington D.C. National Wildlife Federation.
- Beyond the Classroom, Exploration of Schoolground & Backyard, Acorn Naturalists, (800) 422- 8886.
- Birds of the Trans-Pecos, by J. Peterson and B. Zimmer, 1998, University of Texas Press, Austin.
- Bottle Biology, Kendall/Hunt Publishing Company, 4050 Westmark Dr., Dubuque, IA 52002. Also available from Acorn Naturalists (800) 422-8886.
- Common Cacti Of The Southwest, by P.C. Fischer, 1989, Southwest Parks & Monuments Association, Tucson, Arizona.
- Education Goes Outdoors, Addison-Wesley Publishing Company, Acorn Naturalists, (800) 422-8886.
- Educator's Activity Book About Bats, Bat Conservation International, (800) 538-BATS.
- El Paso County Suggested Plant List, John White, Dr. Wayne Mackay, Wynn Anderson, Oscar Mestas, El Paso County Extension Service, El Paso, Texas.
- Grasses of the Trans-Pecos and Adjacent Areas, by M. Powell, 1994, University of Texas Press, Austin.
- Green Teacher magazine, \$27. Per year, P.O. Box 1432, Lewiston, NY 14092.
- Landscaping with Nature, by J. Cox, 1991, Rodale Press, Emmaus, Pennsylvania.
- Mammals of Texas, by W. Davis and D. Schmidly, 1994, Texas Parks and Wildlife Press.
- Native Texas Plants: Landscaping Region by Region, by Wasowski and Waskowski, 1989, Gulf Publishing Company, Houston, Texas.
- Plants for Texas, by H. Garrett, 1996, University of Texas Press, Austin.
- Spiders and Scorpions of Texas, by J. Jackman, 1999, Lone Star Books, Houston, Texas.
- Teaching kids about Birds (and other booklets), Bird Watcher's Digest, Pardson Corporation, (800) 879-2473.
- Texas Critters, by Rather and Rather, 1984, Taylor Publishing Co., Dallas, Texas.
- Texas Snakes, by A. Tennant, 1998, Gulf Publishing Company, Houston, Texas.
- Texas Prairies – Relationships, for Grades 4-7, The Botanical Research Institute of Texas, 509 Pecan St., Ft. Worth, TX 76102-4060, (817) 332-4441.
- Texas Native Ornamental Trees, by The Native Plant Society of Texas.
- Texas Wildflowers, by Loughmiller and Loughmiller, 1996, Austin, Texas: University of Texas Press.
- Texas Wildscapes, by N. Damude and K. Bender, 1999, Texas Parks and Wildlife Press.
- Trees and Shrubs of the Trans-Pecos and Adjacent Areas, by A.M. Powell, 1988, Austin: University of Texas Press.
- Wildflowers of the Davis Mountains and the Marathon Basin, Texas, by B.H. Warnock, 1977, Sul Ross University Press.
- Wildflowers of the Guadalupe Mountains and the Sand Dune Country, Texas, by B.H. Warnock, 1974, Sul Ross University Press.
- Wildflowers of the Western Plains, by Z. Kirkpatrick, 1992, Austin, Texas: University of Texas Press.
- Worms Eat My Garbage, by M. Appelhof, Kalamazoo, Michigan: Flower Press.

## Appendix E: Ecological Regions

by Noreen Damude, Texas Parks and Wildlife



Texas is divided into 10 ecological regions, according to the soil types, rainfall amounts, and vegetation. El Paso and the surrounding areas lie within the Trans-Pecos ecological region.

### TRANS-PECOS

The Trans-Pecos is perhaps the most remarkable ecoregion of Texas, offering at once breathtakingly spectacular vistas and incredible biological diversity. Located west of the Pecos River are 19 million acres featuring an impressive array of habitats from desert grasslands, desert scrub, salt basins, sand hills, and rugged plateaus to wooded mountain slopes with summits that support mixed hardwood and coniferous forests. The Trans-Pecos as a whole represents the largest United States portion of true Chihuahuan Desert. This combination of Chihuahuan desert flats with more humid mountain ranges of diverse geological origin creates a living museum of biological wonders. More rare and endemic species are found among its desert valleys, grassy plateaus, wooded mountains, and protected canyons than in any other part of Texas. Indeed, one out of five Texas endemic plants occurs here and nowhere else.

Parts of this region are the hottest and driest in Texas with the western-most reaches receiving a scant eight inches of annual rainfall, sometimes even less. The average annual temperature of 64 degrees Fahrenheit over the entire area does not reflect temperature extremes, heat being an important feature of the area. With elevations ranging from 2,500 feet to slightly over 8,500 feet, precipitation levels increase with increasing elevation, giving rise to more moisture-loving communities in the mountainous areas. Soils are exceedingly complex, ranging from very alkaline limestone-derived soils to highly acidic volcanically derived soils.

The Trans-Pecos cannot really be considered a single unit at all. For what occurs on the summit of the south rim of the Chisos Mountains – alligator juniper, Texas madrone, ponderosa pine, for example – bears no resemblance to the vegetation of the surrounding desert which includes creosote, tarbush, ocotillo, and lechuguilla. Generally, the

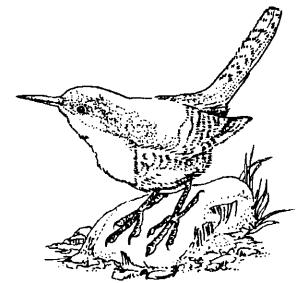
land is dominated by creosote-tarbush desert-scrub grasslands with scattered inclusions of montane ponderosa pine, pinyon pine, and oak forests along with yucca and juniper savannahs, grama grasslands, and saltbush and alkali sacaton-dominated salt basins.

Much of the landscape is dominated by desert grassland, but many of the desirable grasses have been replaced by lower quality plants due to continuous overgrazing. Stream



courses, or riparian areas, are the oases of the desert, yet few remain relatively undisturbed. These areas support stands of willows, cottonwoods, sycamores, ash, and little walnuts. In these spring canyons, plants that cannot tolerate the rigors of dry desert conditions find refuge in the cool, moist surroundings.

A total of fifty-four species of birds are primarily confined to this region, among them the crissal thrasher, the black-tailed gnatcatcher, Gambel's quail, and Lucy's warbler. In fact, the Chisos Mountains is the only place in Texas where one can reliably find the Lucifer hummingbird, Mexican jay, Hutton's vireo, and painted redstart. Reptiles abound, notably the eastern collared lizard, southwestern blackneck garter snake, and the Trans-Pecos rat snake. Mammals are equally diverse with the Mexican long-tongued bat, spotted bat, Texas





antelope squirrel, kit fox, and bighorn sheep occurring mainly in this region. Black bears and mountain lions still inhabit the region, although the native populations of wapiti and grizzly bear are long gone. Finally, unique species of desert-adapted and relict pupfish, mosquito fish, and shiners make their homes in the few remaining undisturbed desert watercourses and cienegas.

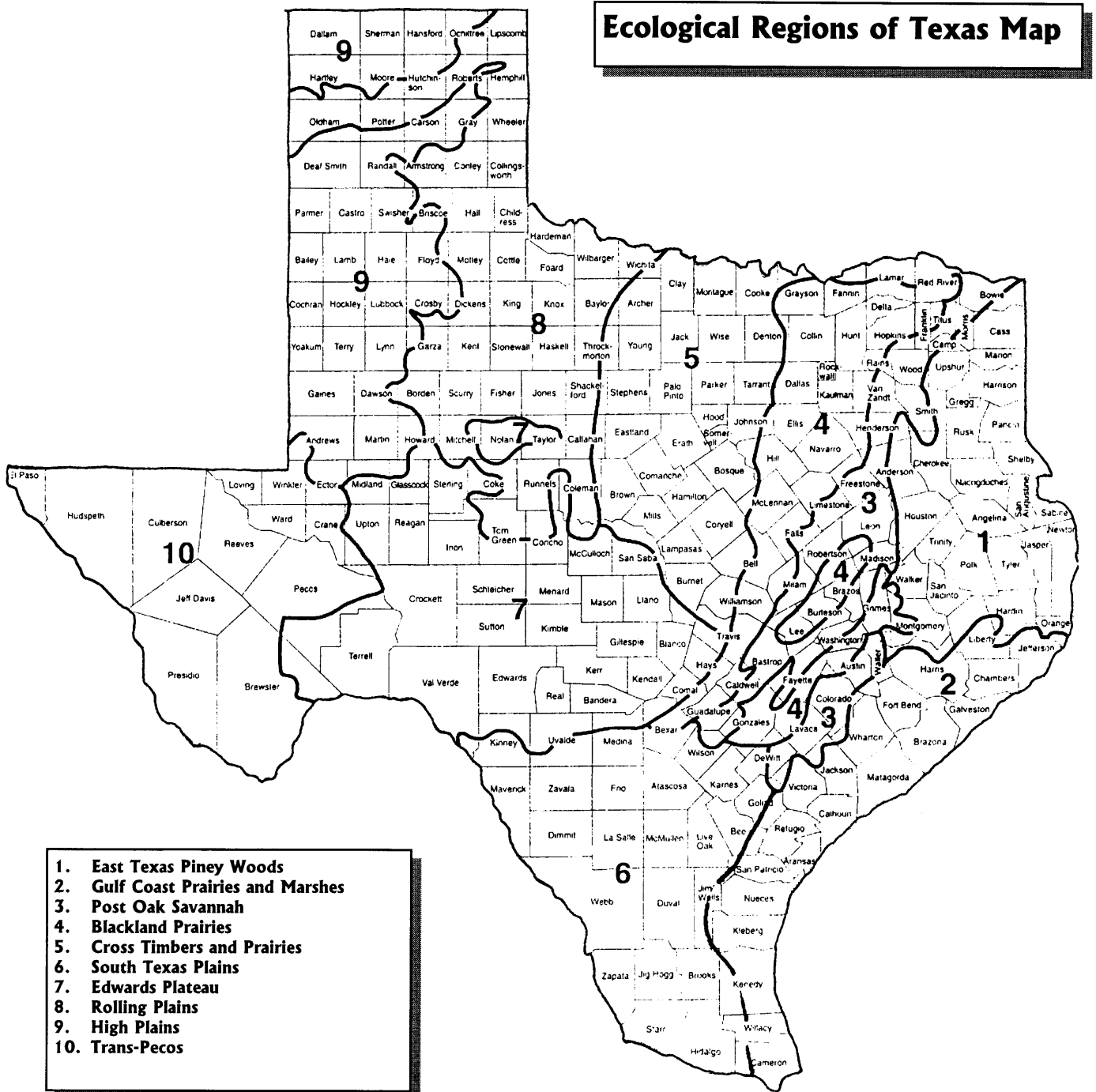


Figure ( 29 ). Map of the Ecoregions of Texas. Map adapted from F. W. Gould, G. O. Hoffman and C. A. Rechenhthn, *Vegetational Areas of Texas*, Texas A&M University leaflet 492.

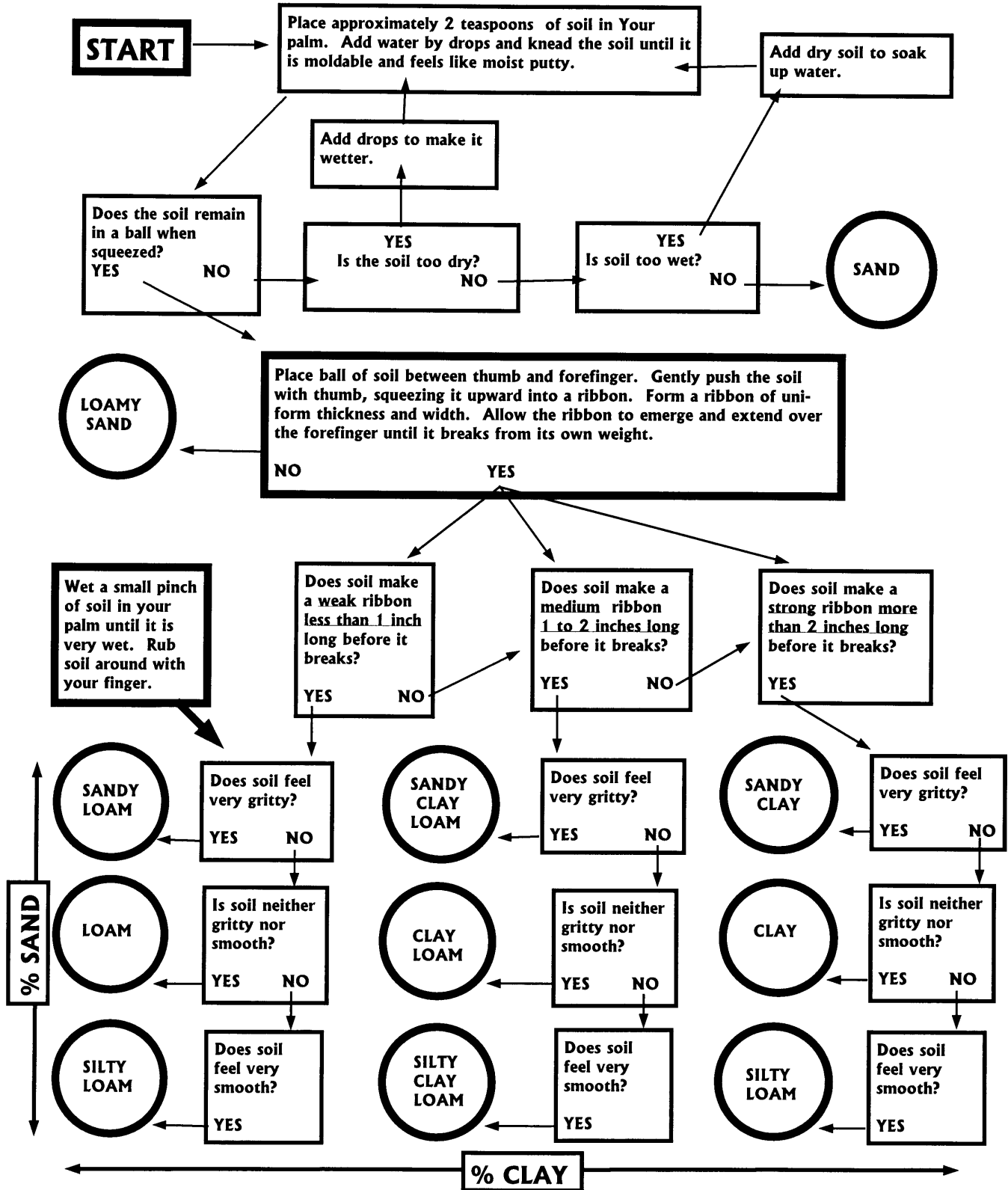


## Appendix G: Common Wildlife Foods

	Turkey	Deer	Squirrel	Rabbit	Quail	Bluebirds	Wood Duck	Hawks	Foxes	Beaver	Owls	Shrews	Snakes	Woodpeckers	Raccoons	Bats	River Otter	Turtles	Salamanders	Frogs
Spiders	X				X	X	X							X	X			X		X
Acorns	X	X	X				X							X	X					
Nuts	X		X				X								X					
Mushrooms		X																		
Seeds	X		X		X	X	X		X					X	X					
Fruit	X	X	X	X	X	X	X		X					X	X			X		
Tubers, Roots	X														X					
Greens	X	X		X	X					X					X			X		
Insects	X				X	X	X	X	X		X	X		X	X			X	X	X
Snails	X				X	X	X					X		X	X				X	X
Leaves, Twigs	X	X		X						X										
Lichens		X																		
Ferns		X																		
Buds		X																		
Grain	X	X	X	X	X		X							X						
Bark				X																
Fish							X	X			X			X	X		X	X		
Frogs & Salamanders							X	X						X	X				X	X
Snakes								X						X						
Crayfish	X						X	X												
Birds								X						X	X					
Small Mammals								X	X					X	X					
Aquatic Plants							X													
Carrion										X										
Earthworms								X						X	X					
Eggs														X	X					
Mussels							X								X		X			

# Appendix H: “Key to Soil Texture by Feel” Chart

Fig. (31). This key was adapted from a flow chart by Steve Thiem, 1979, source unknown.



## Appendix I: Cost Estimate Worksheet, Page 1

PROJECT DESCRIPTION – ITEM	AMOUNT NEEDED	COST PER ITEM	TOTAL COST
<b>POND AREA:</b>			
Backhoe rental with operator			
Pond Liner			
PVC Water Pipe to extend Water Line			
PVC Pipe Fittings			
15 gal. plants			
5 gal. plants			
1 gal. plants			
<b>DECK/ STUDY PLATFORM:</b>			
Boards -			
Boards -			
Boards -			
Nails -			
Concrete -			
<b>PATHWAYS:</b>			
Material -			
Edging -			
Lawn Roller Rental?			

## Cost Estimate Worksheet, Page 2

PROJECT DESCRIPTION – ITEM	AMOUNT NEEDED	COST PER ITEM	TOTAL COST
<b>WILDFLOWER / PRAIRIE AREA:</b>			
Tiller Rental			
Herbicide			
Wildflower/ Prairie Seed			
<b>OTHER:</b>			
15 gal. plants			
5 gal. plants			
1 gal. plants			
Plants – other			
Mulch			
Tools –			
Wheelbarrow			
6' X 8' Tool Storage Building			
Chain Link Fencing			
Chain Link Double Gate			
Chain Link Single Gate			





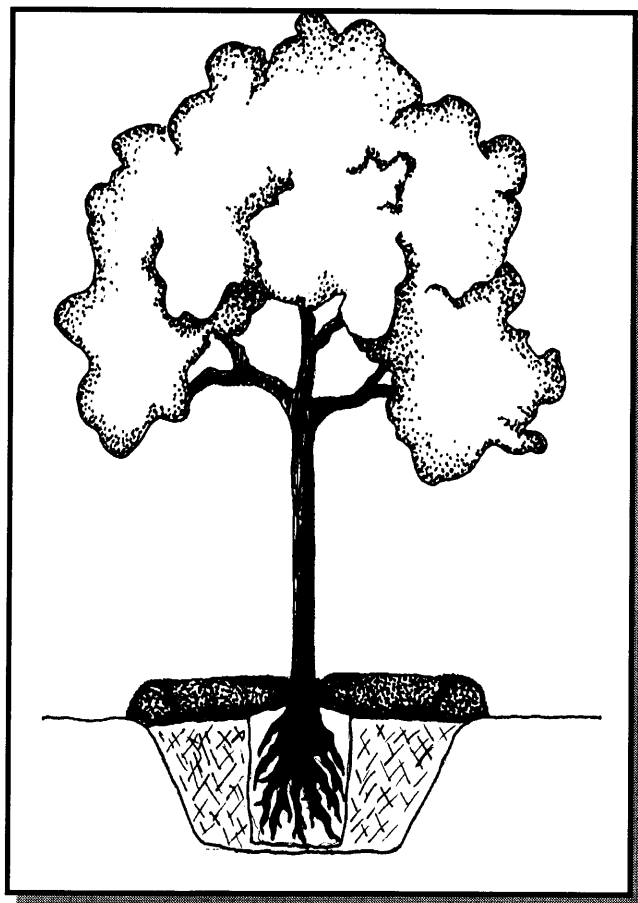


## Appendix K: Tips on Planting Trees and Shrubs

from The Houston Area Urban Forestry Council

Trees do wonderful things. They create shade around buildings which decreases summer electric bills. Their cool, green leaves create a peaceful setting, clean and cool the air, buffer wind and noise, protect water quality, prevent soil erosion, screen unsightly areas, and provide food and cover for wildlife. For all the benefits trees provide, it is worth the extra effort to give them a good start.

### PROPERLY PLANTED TREE



### PLANTING TIME:

Generally, mid-November to late February is the best time to plant trees. Planting in late fall or winter will allow roots to become established before moisture demanding summer sets in. Most shade and ornamental trees sold in the nursery trade are either balled and burlapped or container grown.

### 6 STEPS TO PLANTING A TREE:

#### 1. PLANTING A CONTAINER GROWN

**TREE** – Do not remove tree from container until you are ready to place into planting hole. Fine roots dry out rapidly when exposed to air.

**2. HOLE SIZE** - Loosen the soil in your planting site to a depth of 12 inches using a shovel or tiller. Dig a hole 2 to 3 times wider than the root ball and slightly shallower. The tree should be planted slightly above the original soil level. (This is especially important in heavy clay soils to aid in drainage.) When the hole is ready, gently remove the tree while lightly pressing against the sides of the container. If necessary, cut the container vertically to dislodge the root ball.

**3. PLACING THE TREE IN HOLE** - Set tree gently into hold, lifting by the root ball. When removing a tree from its container, take care to avoid breaking the root ball. Tree should be centered and level. Hold tree in place while backfilling around the root ball. Tamp soil lightly to eliminate air pockets. Large dirt clods should be broken apart before backfilling.

Figure (32). Properly Planted Tree. Dig the hole at least 2 to 3 times wider than the root ball. Slope sides of the planting hole. Gently place root ball into hole. Backfill with original soil. Build a ring of 3 to 4 inches of mulch around the tree with an indented saucer over root ball. Illustration by Michele G. Foss.

**4. MULCHING** - Remove any grass or weeds within a 3 foot minimum diameter circle around the tree. Create a slightly indented watering saucer. Cover with 3 – 4 inches of mulch composed of bark, woodchips, compost, or pine needles. Do not use fresh grass clippings. Do not place bark directly against tree bark.

**5. WATERING** - Adequate water is essential at planting time. Place water hose at base of tree and allow water to slowly trickle until the soil is saturated.

**6. CARE OF NEWLY PLANTED TREE -**

After watering, add mulch to compensate for any settling. If your tree needs additional support, use two or three six-foot stakes pounded into the ground outside the root ball. Attach the tree to the stakes with wide nylon webbing. The tree should have enough freedom to sway in the wind to develop strength. The stakes should be removed after the first growing season.

**PLANTS TO AVOID IN A SCHOOL HABITAT**

<b>Non-Natives:</b>	<b>Natives:</b>
Chinese tallow	Trumpet creeper
Purple loosestrife	Mexican hat
Kudzu	Datura
Exotic Privet	Ruellia (katie's ok)
Ligustrum	
Bermuda grass	
Paperbark tree (Melaleuca)	
Torpedograss	
Johnson grass	
Salt cedar	

The plants listed above should be avoided due to their invasive growth habits or poisonous properties.

For a list of **FEDERALLY PROHIBITED PLANTS** - [Http://www.aphis.usda.gov](http://www.aphis.usda.gov)

**TREE PLANTING TIPS**

- Loosen the soil far beyond the drip line of the tree.
- Brace the tree only if it will not remain upright in a moderate wind.
- Brace with broad, belt-like material that will not injure the bark. Remove after one growing season.
- Cover root ball with mulch, but keep trunk exposed.
- Keep soil moist, but not water-logged.
- Remove dead, diseased and damaged branches.
- If planting a balled and burlapped tree, check with your local resource professionals for advice on proper methods for your area.

**MISTAKES TO AVOID**

- Do not plant too deep.
- Do not wrap trees.
- Do not amend the soil, unless the soil is very unhealthy.
- Do not brace the tree so tightly that the tree cannot sway.
- Do not leave the bracing material on for more than one growing season.
- Remind students to remove the container before placing the plant in the ground.



# Appendix L: Sample Butterfly & Hummingbird Garden

- GARDEN CHECKLIST:**
- For Hummingbirds**
- \_\_\_\_\_ Open space for flying
  - \_\_\_\_\_ Tubular, nectar-rich flowers
  - \_\_\_\_\_ Twig perches nearby
  - \_\_\_\_\_ Source of small insects, such as gnats
- For Butterflies:**
- \_\_\_\_\_ Open spaces in full sun for fluttering
  - \_\_\_\_\_ Away from strong winds or provide windbreak
  - \_\_\_\_\_ Masses of color (pink, purple, yellow, orange)
  - \_\_\_\_\_ Fragrant, nectar-rich flowers
  - \_\_\_\_\_ Larval food plants
  - \_\_\_\_\_ Puddling area

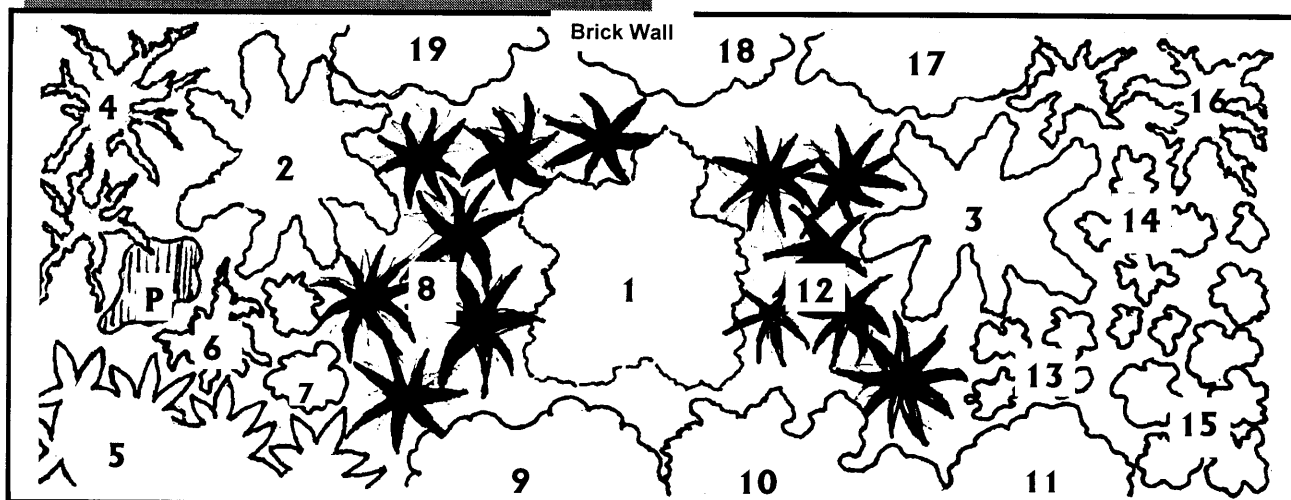


Figure ( 33 ). Sample design for a simple 10 foot by 28 foot butterfly and hummingbird garden. The garden is located in full sun against a brick wall. The design includes nectar sources for hummingbirds and butterflies, as well as a few larval host plants for caterpillars. Larger shrubs and vines could be planted nearby. The map scale is 1 inch equals 4 feet. Illustration by Michele G. Foss.

**MAP LEGEND:**

- 1 Autumn Sage (*Salvia greggii*)
- 2,3 Butterfly Bush (*Buddleja marrubifolia*)
- 4 Flame Acanthus (*Anisacanthus quadrifidus*)
- 5 Handleleaf Coneflower (*Echinacea angustifolia*)
- 6 Mealy Blue Sage (*Salvia farinacea*)
- 7 Dill (*Anethum graveolens*)
- 8,12 Milkweed (*Asclepias spp.*)
- 9 Chocolate Daisy (*Berlandiera lyrata*)
- 9 Blue Flax (*Linum lewisii*)
- 10 Lantana (*Lantana spp.*)
- 11 Prairie Verbena (*Verbenna bipinnatifida*)
- Parsley or Cilantro
- 14 Plain's Penstemon (*Penstemon ambiguus*)
- 15 Mountain Peppergrass (*Lepidium montanum*)
- 16 Havard Penstemon (*Penstemon havardii*)
- 17,18,19 Maximillian Sunflower (*Helianthus maximiliani*)
- P Puddling area

**REFERENCE MATERIALS**

The Hummingbird Book by Donald and Lillian Stokes, Little, Brown and Company publishers.

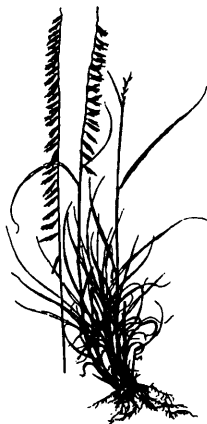
The Butterfly Book by Donald and Lillian Stokes, Little, Brown and Company publishers.

How to Attract Hummingbirds & Butterflies, Ortho Books, Chevron Chemical Company, Consumer Products Division, Box 5047, San Ramon, CA 94583.

Butterfly Gardening for the South by Geyata Ajilvsgi, Taylor Publishing Company.

## Appendix M: Establishing a Prairie and Wildflower Area

Your school habitat will likely attract more birds and insects than any other wildlife. Both of these wildlife groups can provide many opportunities for observation. Insects not only attract birds to your habitat, but also offer life cycle observations that can be conducted outdoors or moved into the classroom. Herbaceous vegetation in the form of forbs (i.e., wildflowers) and grasses is more likely to attract insect species, including butterflies, than any other type of vegetation.



Schools often want to plant wildflowers for their aesthetics, and it is often seen as an inexpensive and easy project to do with children. Wildflowers alone do not constitute a habitat type. Mixed with native grasses, these areas will resemble a native prairie. Native grasses like Buffalograss (*Buchloe dactyloides*), Blue Grama (*Bouteloua gracilis*), Indian Ricegrass (*Oryzopsis hymenoides*), Little Bluestem (*Schizachyrium scoparium*), Plain's Bristlegrass (*Setaria macrostachya*), and Sideoats Grama (*Bouteloua curtipendula*) can be mixed with wildflowers like Desert Marigold (*Baileya multiradiata*), Indian Blanket (*Gaillardia pulchella*), Sand Bells (*Nama hispida*), Mexican Hat (*Ratibida columnaris*), Indian Paintbrush (*Castilleja integra*), and Spotted Gayfeather (*Iiatris punctata*) to create a mixed meadow. To maximize your ability to attract insects, it is necessary to provide a mix of forbs and grasses that will provide both food and cover for a wide variety of species.



This bit of habitat may also provide food and cover for some bird species.

The establishment, maintenance and sustainability of these areas can be one of the most difficult phases of your school habitat projects. The area may also draw the most comments, both positive and negative.

**The establishment of a prairie/wildflower area is divided into 3 phases:**

1. Site preparation
2. Planting
3. Maintenance

### 1. SITE PREPARATION

Site preparation may be the most important aspect of this project. The successful establishment of desired species is directly related to how well you remove and control undesirable competitors, many of which are exotic plant species. Complete elimination of this vegetation should be your goal. There are several techniques available to achieve this goal. Choose a technique or combination of techniques suitable for your site and appropriate for your skill level and available resources.

#### Methods for Removing Vegetation:

##### Cultivation

This method includes such techniques as plowing, tilling, rototilling, and scarifying. Cultivation serves to kill undesirable plants and their germinating seeds. This process can be effective but labor intensive and requires the use of machinery. Repetition will probably be required to kill plants that germinate from dormant seeds brought to the surface. Many perennial weeds may not be destroyed by this process, and may, in fact, be spread and increased. This is not an appropriate technique for erosion prone sites. Repeated cultivation may be detrimental to the soil structure.

##### Herbicide Treatment

If this method is chosen, use a low toxicity, non-persistent herbicide, such as Round-up or Kleenup and follow the manufacturer's instructions carefully. Apply the chemical to green, actively growing

preparation may bring dormant seed to the surface, resulting in the need for an additional treatment with herbicide or additional tilling for control. This treatment is an effective technique for weed removal and works well on erosion prone sites. Remember that school districts may restrict the use of herbicides or require the spraying be conducted by a licensed applicator.

**Solarization Method**

Solarization is the process of trapping heat generated by sunlight to kill plants and sterilize the soil. This method involves wetting the soil surface and covering it with clear or black plastic sheeting. Some studies indicate that clear plastic is more effective than the black. The material will have to be anchored down to keep it in place. In our climate, ultraviolet light tends to break the plastic down within one season. To be totally effective, the plastic should remain in place for an entire year to allow for the control of both cool and warm season plant species. While this is a safe process, it can be expensive and impractical for a large area. Some of the tougher plant species may still persist after this treatment.

Your site may require a combination of these methods to achieve the best results. You will find that your efforts will be rewarded by higher survival of your desired species.

**Seedbed Preparation**

For the most part, seedbed preparation should only consist of lightly tilling or disking of the soil. The goal is to prepare the soil to enable good seed contact with the soil. Tilling or disking should be restricted to the top one or two inches of the soil. By tilling deeper, you encourage undesirable dormant seeds to germinate.

**2. PLANTING**

The planting process provides another good opportunity to involve students. Students can do everything from selecting the proper plant species for your site to doing the actual installation.

**Plant Selection**

Select species native to this area. Choose species that match your site conditions. Remember that most of the plants in a prairie wildflower area prefer

full sunlight. Select a mixture with approximately 60% grass species and 40% forbs. You may find that emphasizing perennial species will result in a more successful project. Prepared seed mixes available on the market tend to have a high percentage of annual species. Purchase seeds from a reputable source. [Avoid purchasing seed mixes or “seed mats” that don’t list the flower species on their packaging. These mixes are usually designed for cooler climates and cannot handle our summer heat.] If you collect seeds from the wild, make sure you obtain the permission of the landowner. Never collect more than 50% of the seed available in that wild spot. By leaving half the available seed, this will leave seeds to germinate in the wild next year. Rescuing plants from an area that will be developed, with the landowner’s permission, would be the exception to the collection rule.

**Seeding Rates**

The seeding rate is the amount of seed applied to a given area, usually shown as lbs./acre or ozs./ 1000 sq. ft.. Seeding rate is based on the PLS (pure live seed) content of your mixture. Seed purchased from a reputable dealer will have the PLS content indicated on the packaging, as well as the recommended seeding rate. You will not know the PLS content for seeds you hand collect from the wild and planting rates may be difficult to calculate. For calculating seeding rates for collected seed, use the rates recommended by seed dealers and then err to the excessive.

**Planting Technique**

Many of the seeds you will be working with are very small. Several thousand seeds per one ounce is not uncommon. To evenly distribute such tiny seed on your site, it is necessary to dilute them by mixing them with a suitable material, such as dampened sand or sawdust. Use a volume of sand or sawdust equal to or greater than the volume of your seeds.

The more you dilute your seed mixture, the more students you can involve in the planting activity. Divide the mixture in half. Distribute one half of the mixture between the students and have them broadcast it gradually while walking across the site. Distribute the second half of the seed and broadcast it while walking perpendicular to your first path. This process will allow for a more even distribution

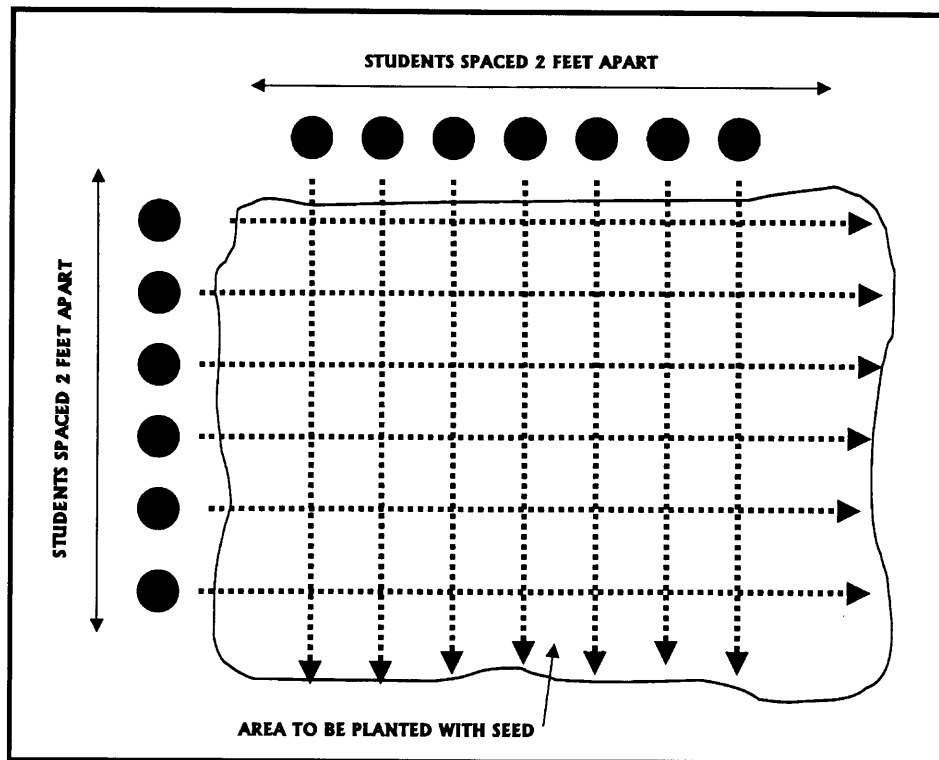


Figure ( 34 ). Student Seed Planting Activity. Students line up on two sides of the site to be planted with seed. Students on one side walk in straight lines from their side to the opposite side, gently releasing seed all along their path. Then students from the other side walk in lines perpendicular to the original students' paths. This process results in a fairly even distribution of the seeds.

of the seed mixture. Lightly rake the soil surface. Have the students walk back and forth across the site or rent a lawn roller to gently push the seed mixture into the soil surface. Good soil contact is important for germination success. **Burying the seed is not your goal.** Many of these seeds require light to germinate. Watering after planting may not be necessary and may actually favor the germination of weed seeds. Late summer through fall is the best time to plant warm season grasses and spring or summer blooming wildflowers. Late winter into early spring is the best time to plant fall-blooming wildflowers.

Establishing your habitat with containerized plants rather than from seed will give you quicker results. However, you may find the cost prohibitive and that not as many species are available in containers. An alternative would be to have students raise the plants from seed and transplant them to the habitat. You may choose to use this alternative method for those plant species that are difficult to germinate in the field and then have your students intersperse the seedlings with those that were seeded directly into the ground.

### 3. Maintenance

Most seeds will germinate the first year. If optimum conditions do not exist the first year, some seeds may lie dormant and then germinate the second year. Many of the grasses concentrate on establishing root systems the first year and as a result, do not produce much top growth. The second year these grasses will produce more top growth and may bloom.

This several year process aids in prairie management. Many unwanted weeds are annuals that will grow taller than your desired prairie species. Therefore, to maintain the prairie, you can cut down the taller annual weeds without damaging your new grass or wildflower seedlings. The goal is to cut the undesirable annuals before they produce and distribute their seed. During the second or third years, you may want to reseed any bare spots or add transplants to increase your plant diversity.

**Controlling Invasive Species**

You will probably discover that spot applications of herbicide and hand weeding are necessary. If used, a herbicide should be applied to a specific problem plant only, called spot treatment, rather than sprayed widely over the area. Be persistent in controlling invaders, such as bermuda grass and johnson grass. If these tough, invasive grasses persist while your project becomes established, it will be extremely difficult to control them. After these invaders wind their way among your desired plants, spot treatment with herbicide can be almost impossible. Without control, they will eventually outcompete the natives and become the dominate plants in your site.

Prairies benefit from occasionally being burned. In most cases, this is not practical on a school site. An annual mowing in late winter will be your best substitute. However, do not mow your entire site at one time. Instead, mow in small sections at a time, or in a mosaic of strips with unmowed sections in between. As the prairie wildflower area matures, it will provide wintering areas for various insects. Leaving some of it untouched each year assures that some winter cover remains available for wildlife.

**ROOT SYSTEMS IN A PRAIRIE**

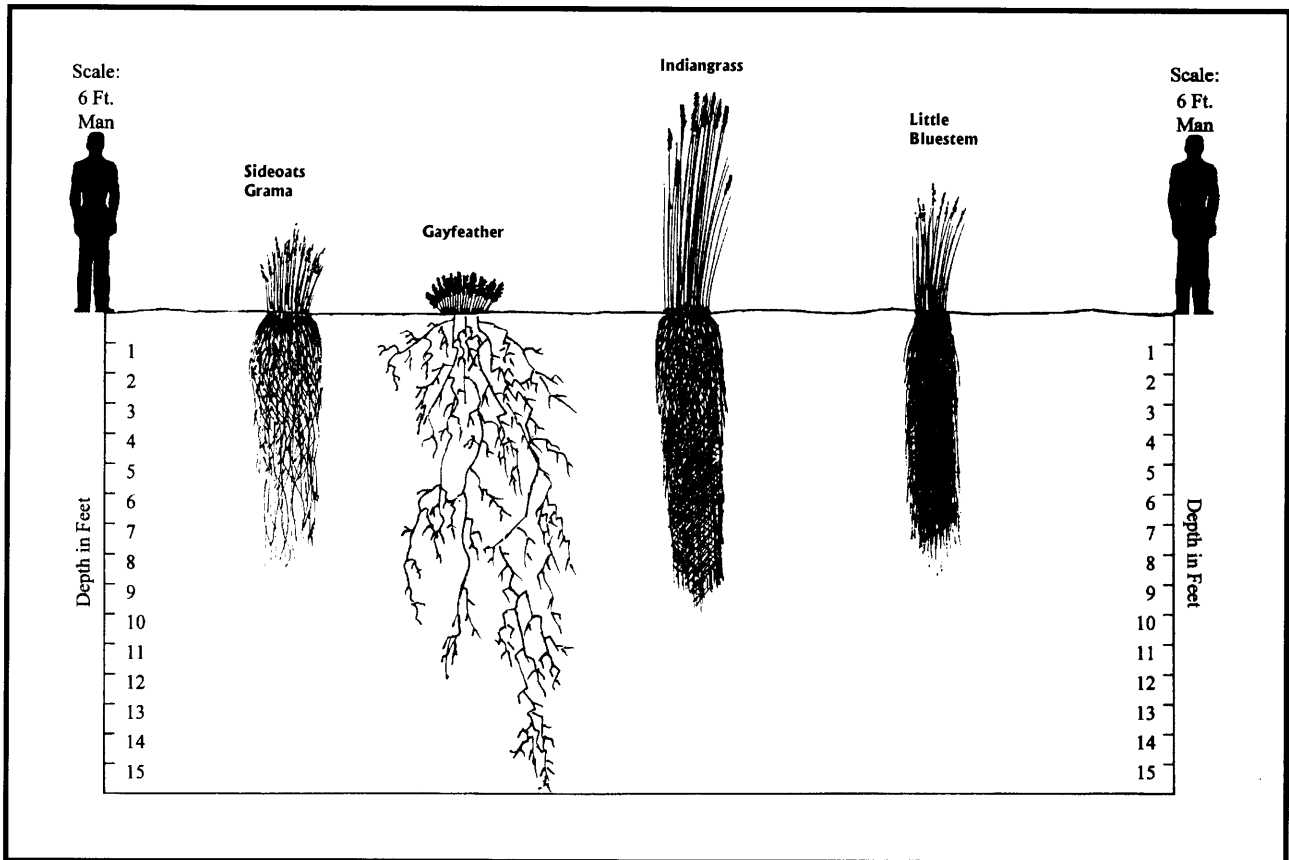
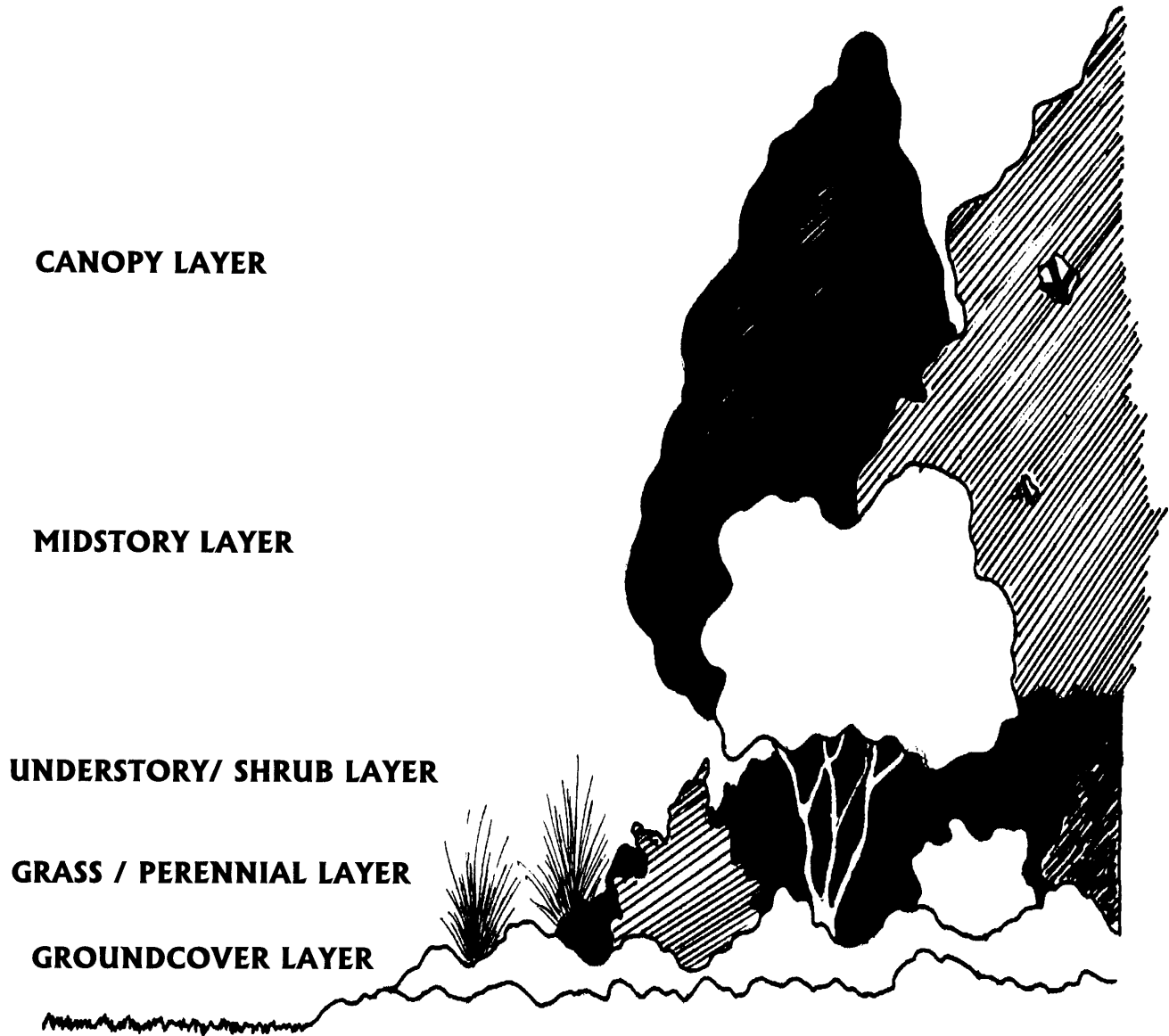


Figure ( 35 ). Prairie Root Systems. Extensive root systems are essential for vigorous growth, even during unfavorable weather conditions. The roots hold the plant in place and absorb soil water and nutrients. Perennial plant roots function as surplus food storage centers. Most of the plant root material is concentrated within the top 12 inches of soil; however, as illustrated, many desirable species have deep, vigorous feeding root systems. Illustration by Michele G. Foss.

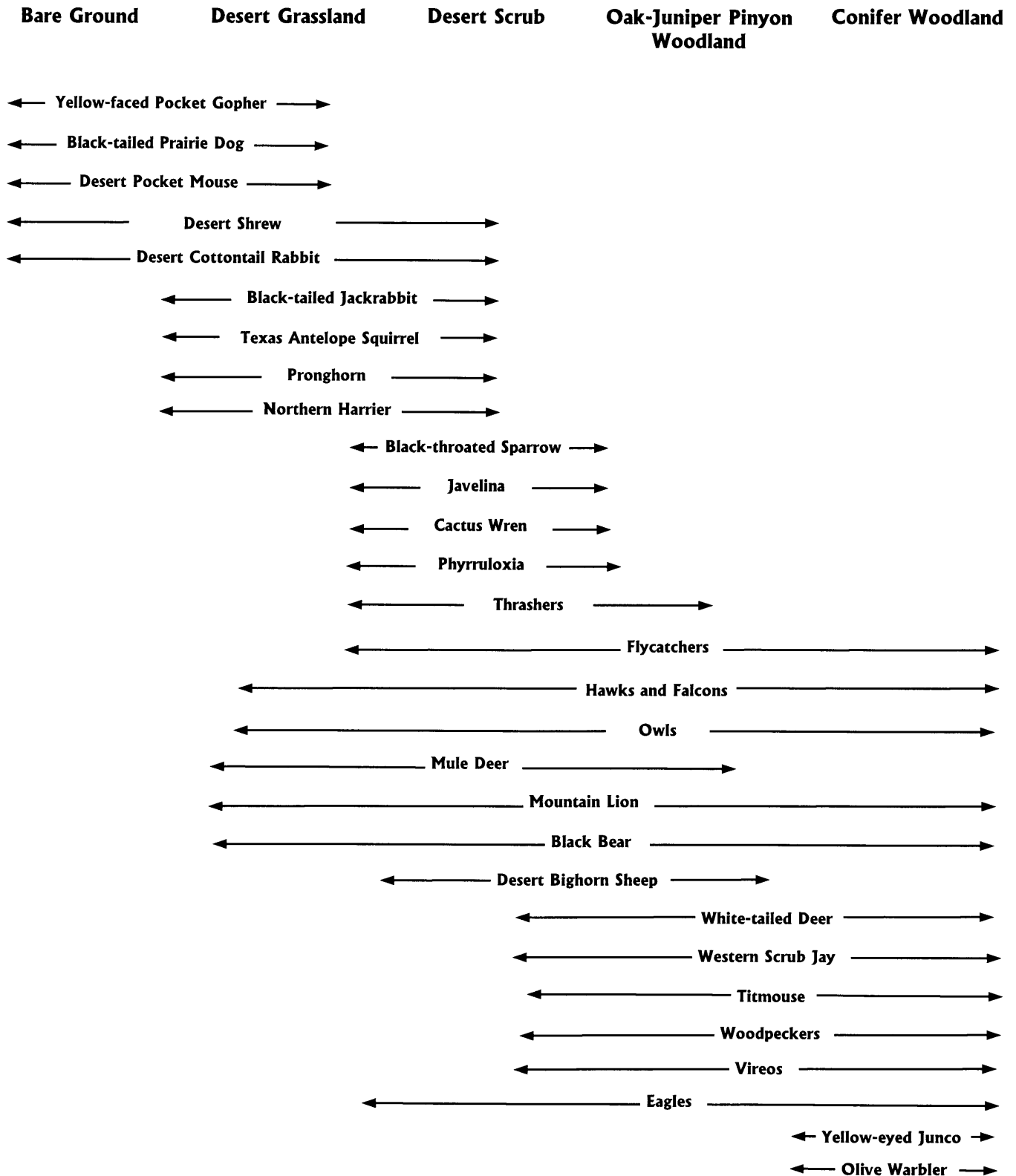
## Appendix N: Vertical Layering in a Habitat



Layers in a habitat. Try to reproduce the many vegetation diversity and layers in a natural habitat in your school habitat. The majority of wildlife species utilize the lower two thirds of a habitat. Illustration by Michele G. Foss.



## Appendix O: Stages of Plant Succession and Associated Wildlife Species



Stages of Plant Succession and Associated Wildlife Species. Modified from Homes for Wildlife, published by the New Hampshire Fish and Game Department.

## Appendix P: Constructing Raised Beds

If you are constructing raised beds for planting annuals or perennials, delineation and preparation of your beds should be done prior to planting.

1. Kill or remove the grass from the bed area. There are several methods you may choose.

- One method involves using herbicides, such as Roundup, to kill the grass. Remember that most general herbicides kill all plant material they touch, so spray on windless days.
- Another method, called smothering, involves placing black plastic, 3 to 7 layers of newspaper, or cardboard over the grass to deprive it of light. A variation is to place plastic down with a layer of mulch on top. The cover must remain in place for approximately 3 months. When ready to plant, you may remove the cover completely, or simply cut holes through the plastic to plant. The dead grass layer may be left in place to decompose, thus forming a weed barrier and providing nutrients for the soil.
- Another alternative is to dig out the grass layer by hand. Simply tilling the grass, especially Bermuda grass, into the ground without killing it first is a mistake. The grass usually re-seeds or re-sprouts and grows up through your newly planted bed, requiring you to dig it out by hand.

### SOIL ESTIMATION FORMULA

$$\text{Volume of Soil (cubic yards)} = \frac{\text{Length of Area (feet)} \times \text{Width of Area (feet)} \times \text{Depth of Area (inches)}}{324}$$

Figure ( 36 ). This formula determines the amount of soil, compost, or mulch, in cubic yards, that you will need to order. Pay close attention to the units of measurement when using the formula. Do NOT convert so that all the units are the same.

2. Estimate the amount of soil, mulch, sand, or compost you need. To do this, determine the number of square feet of garden bed you need to fill. Then decide how deep (in inches) you want your soil. Remember that fluffy soil will eventually settle, so plan to add a little extra. Use the Soil Estimation Formula (Figure ) to determine the number of cubic yards of soil you need. (Example: Your planting area measures 10 feet long by 12 feet wide. You want the soil in a raised bed 4 inches deep. Multiply 10 feet by 12 feet by 4 inches. Divide by 324. You will need to order 1.5 cubic yards of soil for your area.)

3. Add any soil amendments at this time to correct deficiencies in the soil. (See Soil Health) Till or mix the soil by shovel. Water the soil and allow the area to settle for a week.

4. Use garden hose, rope, string, stakes, lines of flour, or spray paint to temporarily delineate bed edges. Add edging, if desired.

### SOIL HEALTH

**Good soil health insures plant health. Soil should be loose, fluffy, and fairly well-drained. If your soil resembles hard packed cement, then you need to add some ingredients to amend the soil, such as compost, mulch, leaves, or sand. By mixing in the appropriate ingredients, you return needed nutrients to the soil and improve its ability to drain water.**

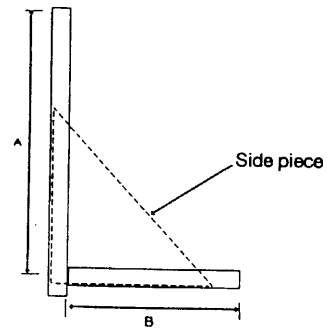
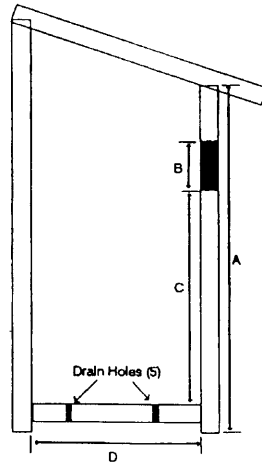
- **Simply add small amounts of compost and dead leaves to the soil and till them in. Over a long period, these additions will gradually improve the soil.**
- **For a quicker solution, order a larger amount of compost or topsoil and add this regularly to your topsoil.**

## Appendix Q: Nest Box Specifications

<sup>1</sup> Requires habitat to include open areas, such as fields or meadows.

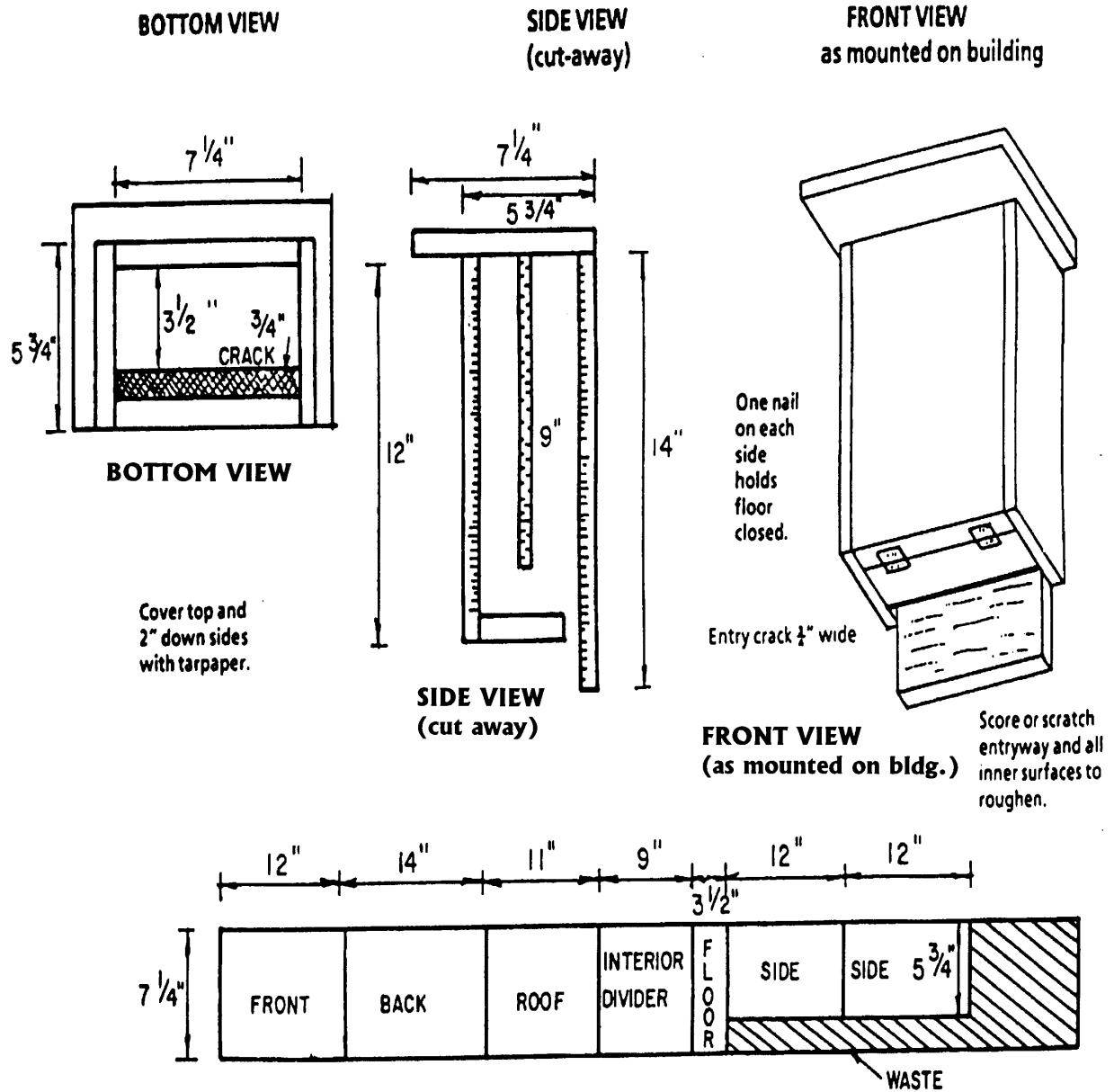
<sup>2</sup> Two or more sides need to be open (nesting shelf).

<sup>3</sup> Requires habitat to include wetland type areas, such as ponds, lakes, or streams.



BIRD SPECIES (Inches)	FLOOR SIZE (Inches)	DEPTH OF CAVITY (Inches)	ENTRANCE HEIGHT ABOVE FLOOR (Inches)	DIAMETER OF ENTRANCE (Inches)	HEIGHT ABOVE GROUND (Feet)
American Kestrel	7 <sup>3/4</sup> x 7 <sup>3/4</sup>	16	11 ½	3	10 - 30
Ash-throated Flycatcher	6 x 6	8 - 10	6 - 8	1 ½	8 - 20
Barn Owl	10 x 18	15 - 18	4	6	12 - 18
Barn Swallow	6 x 6	6	2	2	8-12
House Wren	4 x 4	8 - 10	1 - 6	1 ¼	6 - 10
Juniper and Black-crested Titmice	4 x 4	8 - 10	6 - 8	1 ¼	6 - 15
Ladder-backed Woodpecker	6 x 6	12 - 15	9 - 12	1 ½	12 - 20
Mountain Chickadee	4 x 4	8 - 10	6 - 8	1 ⅛	4 - 15
Northern Flicker	7 x 7	16 - 18	14 - 16	2 ½	6 - 20
Violet-Green Swallow	5 x 5	8	6	1.5	3 - 4
Western Bluebird	5 x 5	8	6	1 ½	5
Western Screech Owl	8 x 8	12 - 15	9 - 12	3	10 - 30
White-breasted Nuthatch	4 x 4	8 - 10	6 - 8	1.25	12 - 20
Wood Duck	10 x 18	10 - 24	12 - 16	4	10 - 20

## Appendix R: Bat House Plan (Small)

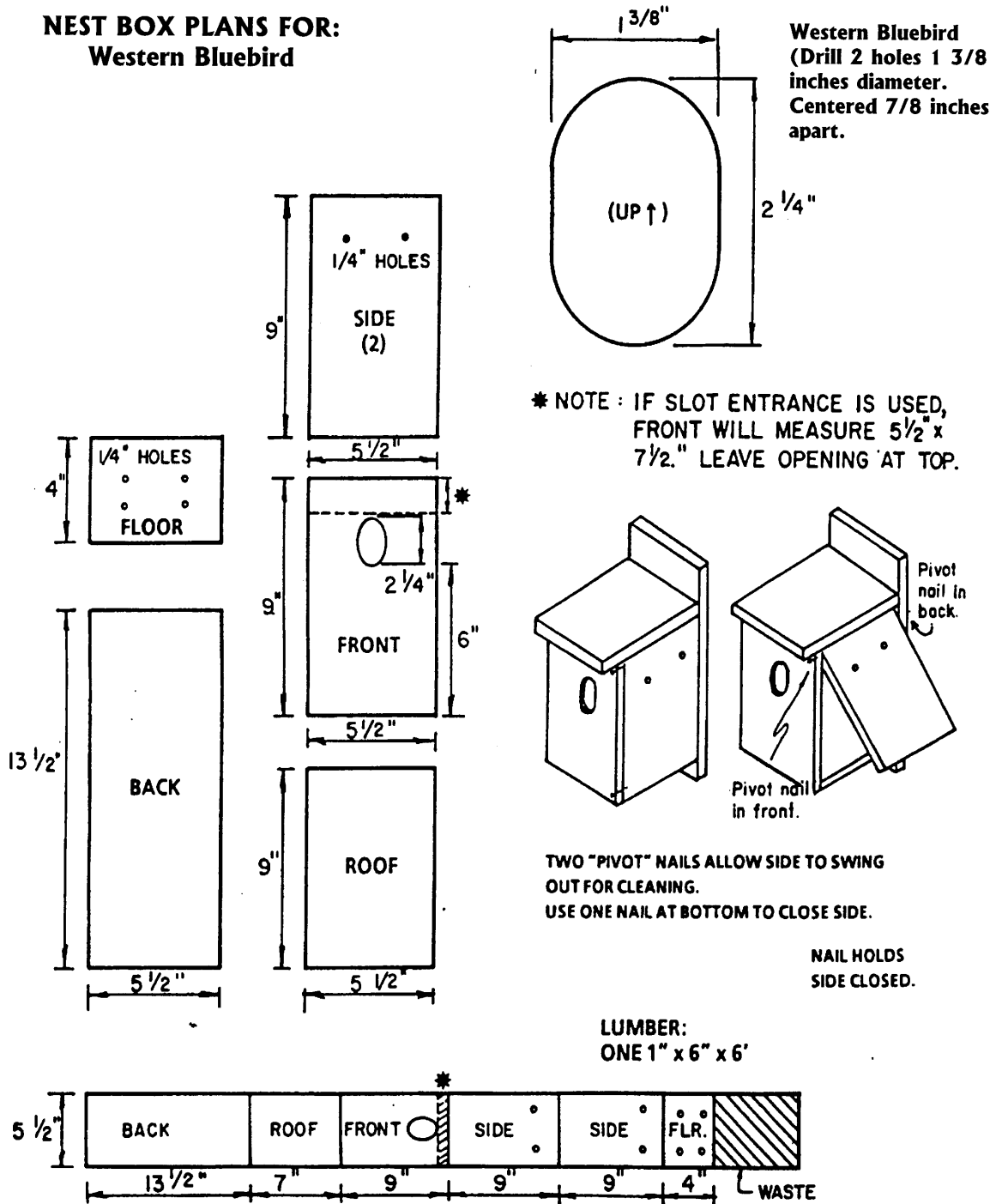


**LUMBER: 1 inch X 8 inch X 8 feet**

Plans for a small bat house. Reprinted from Woodworking for Wildlife, Minnesota Department of Natural Resources.

# Appendix S: Small Nest Box Plan

## NEST BOX PLANS FOR: Western Bluebird



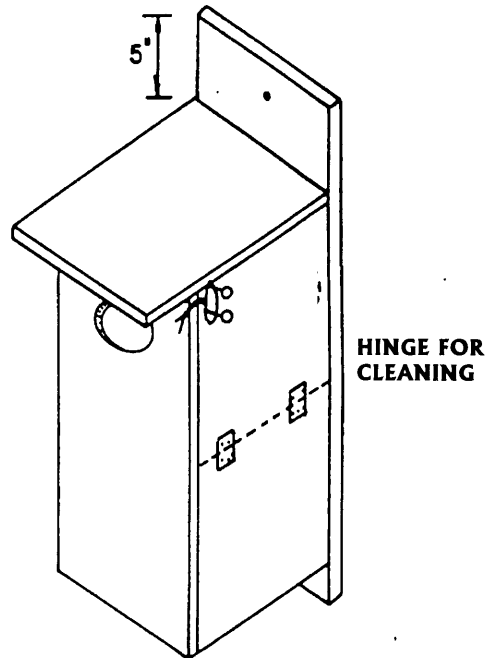
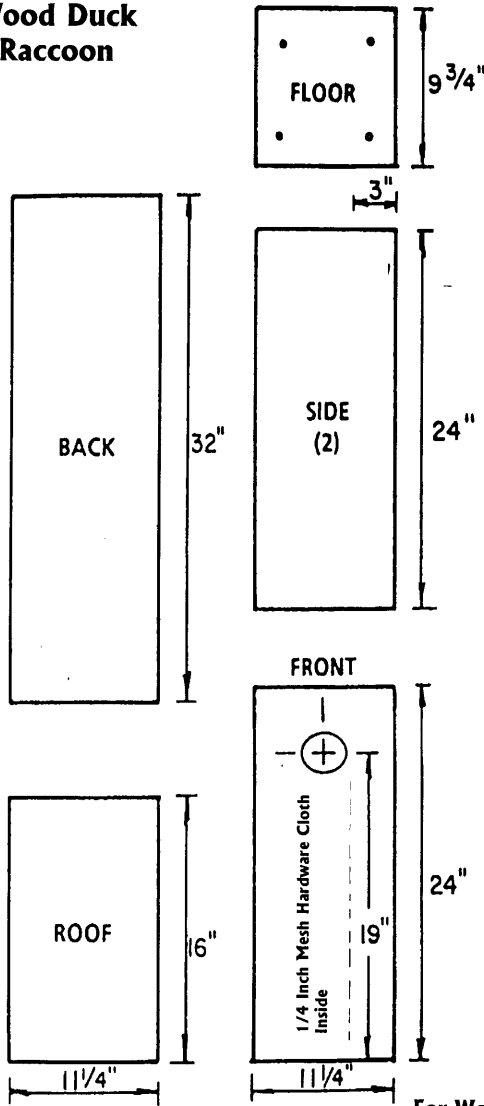
Plans for bluebird nest box. Reprinted from Woodworking for Wildlife, Minnesota Department of Natural Resources.

# Appendix T: Large Nest Box Plan

**NEST BOX PLANS FOR:**

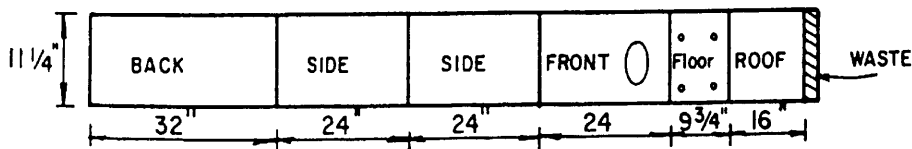
**Wood Duck  
Raccoon**

**Hole Dimensions**  
Wood Duck 3" high & 4" wide oval  
Raccoon 5" high & 9" wide oval



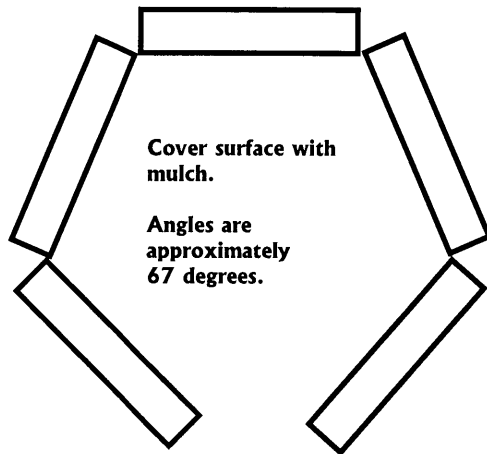
**Lumber**  
One 1 inch X 12 inch X 12 foot

**For Wood Duck House:**  
Place 3 to 4 inches of  
Wood chips in bottom of  
box.

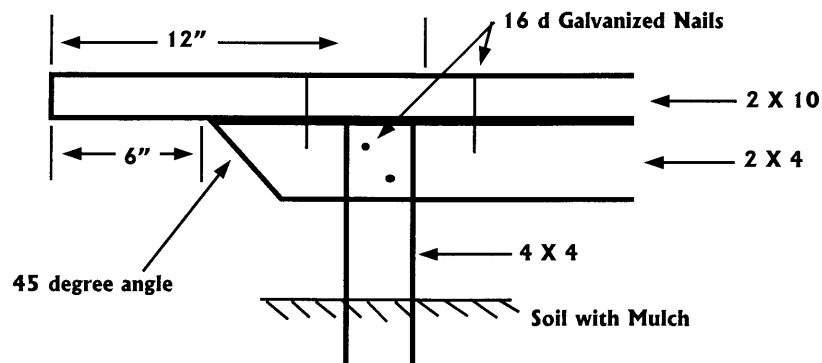
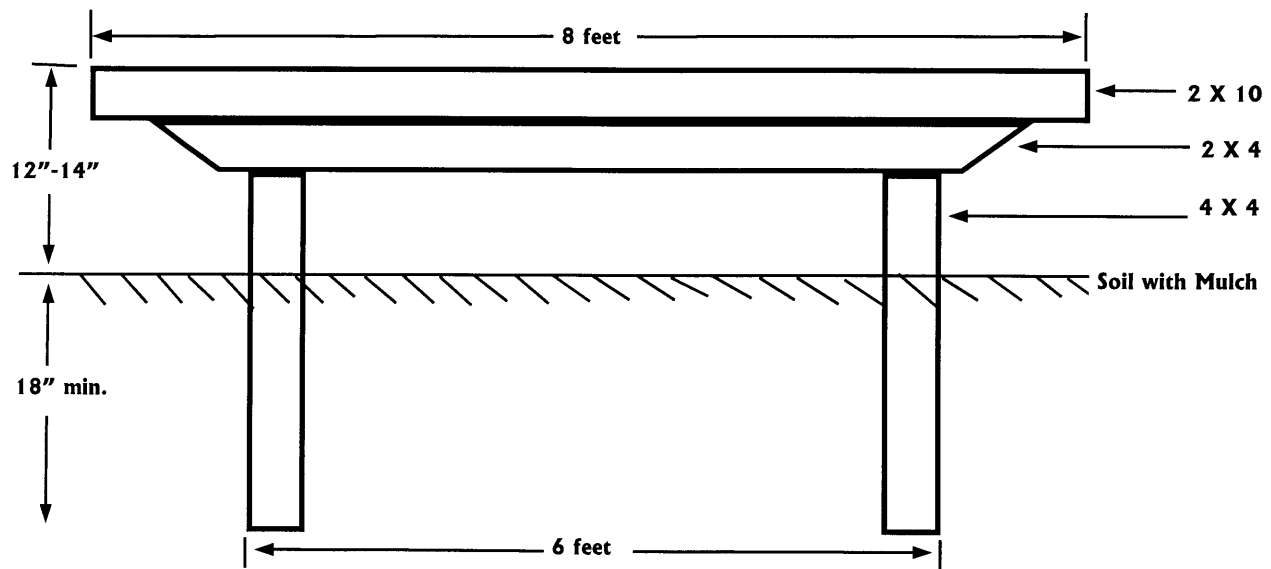
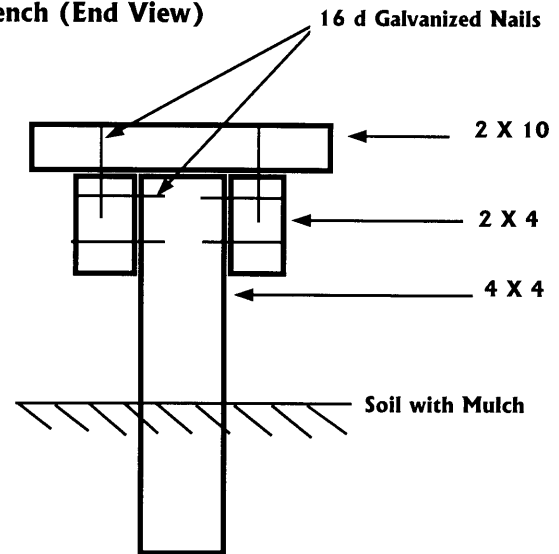


## Appendix U: Sample Bench Design

**Bench Configuration**



**Bench (End View)**



Typical outdoor bench design. Note that all lumber is pressure treated yellow pine. Nails are 16 penny galvanized screw or ring shank. Landscape timbers may be substituted for the 4 X 4 material. Nails are spaced 12 inches apart off center. Design by Ronald K. Jones, U. S. Fish and Wildlife Service.





# **Appendix W: Plant Tables**











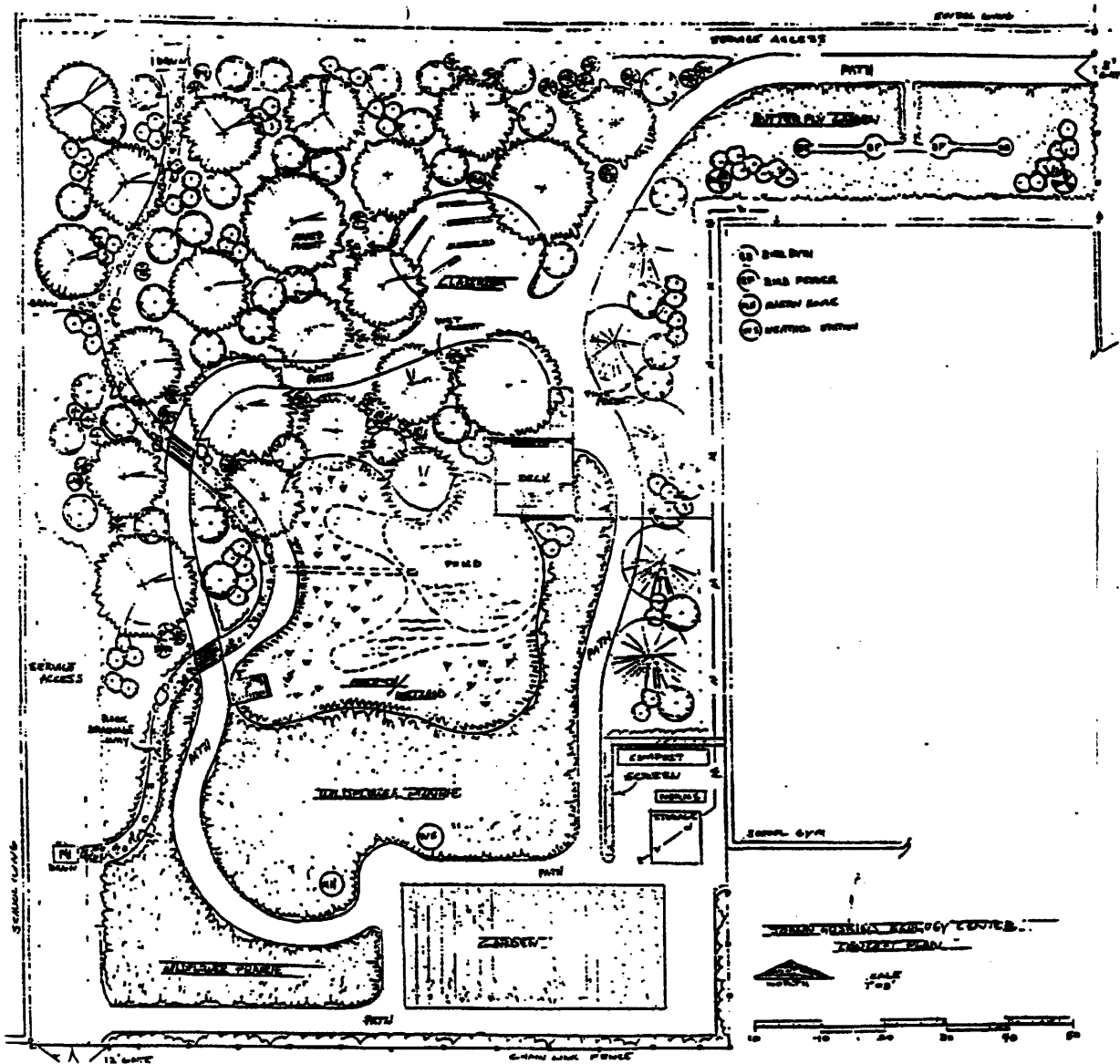






# Appendix Y: Concept Drawing

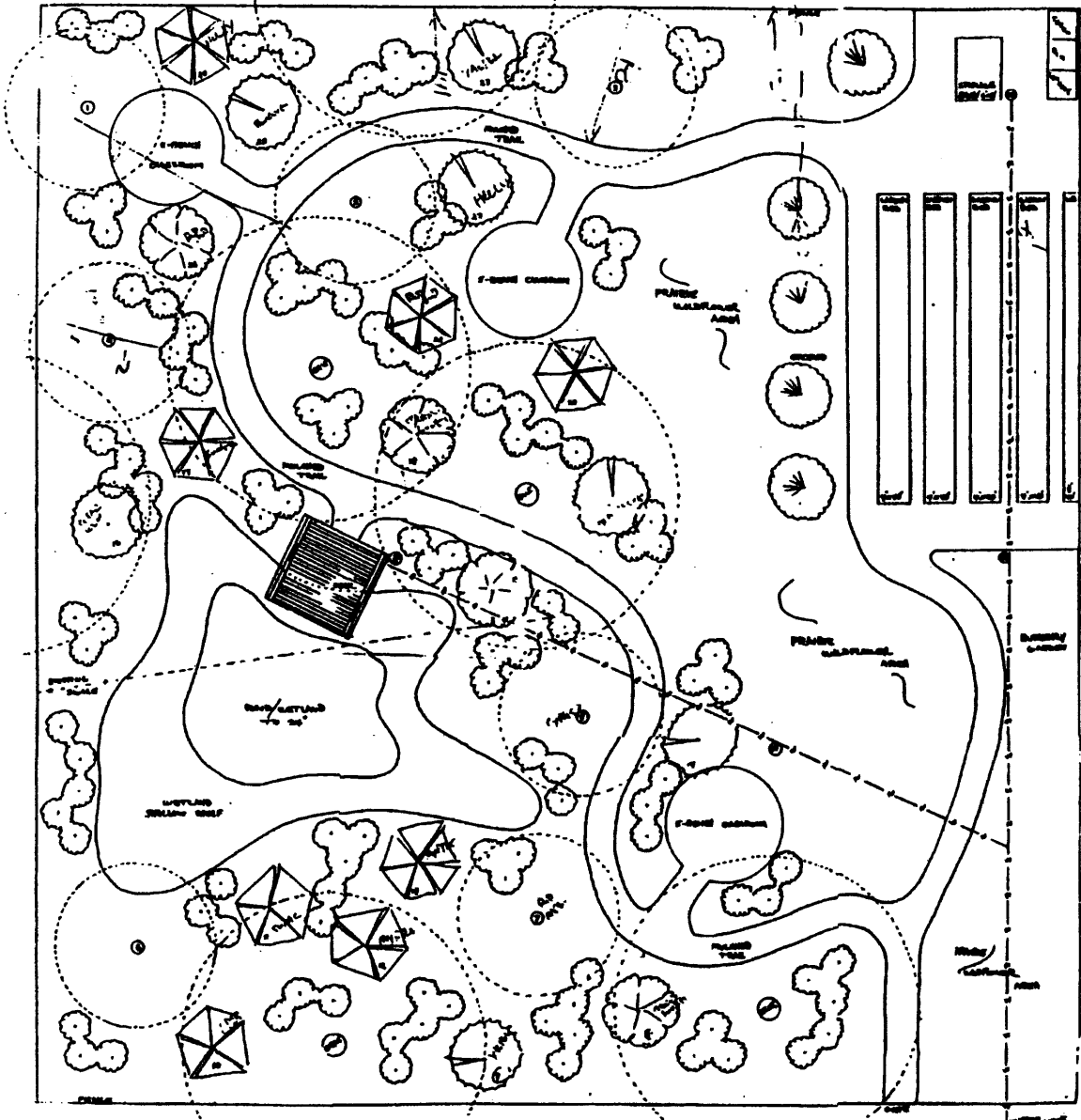
Pearl Hall Elementary, Houston, Texas



Concept design for Pearl Hall Elementary, Pasadena Independent School District. Design by Ronald K. Jones, U. S. Fish and Wildlife Service.

# Appendix Z: Concept Drawing

Brannon Elementary School, Lake Jackson, Texas



Concept design for Brannon Elementary School, Brazosport Independent School District. Design by Ronald K. Jones, U. S. Fish and Wildlife Service.