ACKNOWLEDGMENTS

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FRONT COVER:
Mule deer buck, Auburn, California.
Photo by Peggy Mattison.

TABLE OF CONTENTS

INTRODUCTION

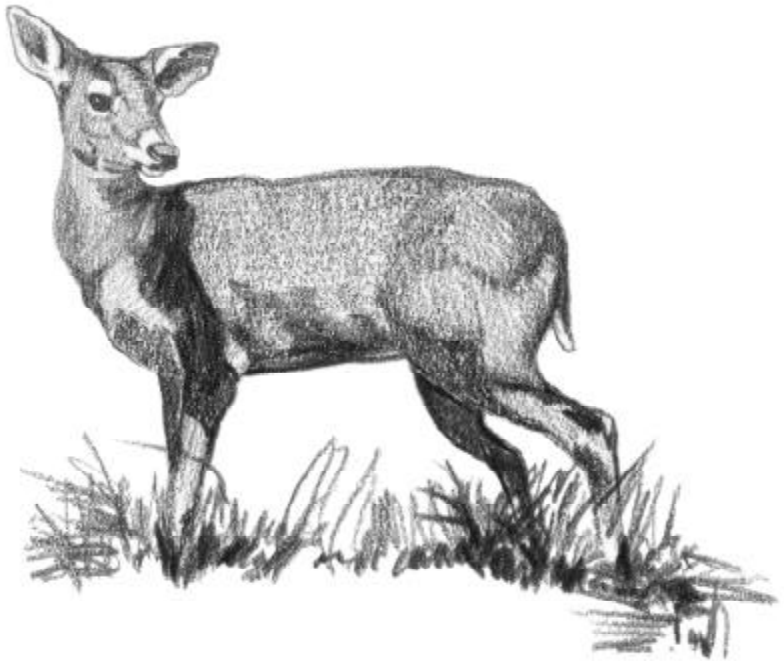
Part of the appeal of living in rural or semi-rural California is the ability to watch wildlife in your own back yard. Deer are especially fascinating to observe, but many homeowners are dismayed to discover that deer can be very destructive to gardens.

In some areas the damage can be seasonal, peaking in the winter when food sources for deer are at their lowest. Other areas, where deer habitat is heavily affected by residential development, may experience problems year-round. Drought, wildfires, livestock grazing and other habitat-altering events also play a role because they affect food sources for deer.

Rural dwellers frequently ask the California Department of Fish and Game how to minimize landscape damage caused by hungry deer. This booklet details three methods:

- the use of landscape plants that deer don't seem to like;
- application of commercial deer repellents;
- construction of deer-proof fencing.

All of the techniques are considered harmless to deer and other wild and domestic animals.



"DEER-RESISTANT" PLANTS

Deer are attracted to many popular garden and landscape plants but avoid others. The following list of deer-resistant plants should be considered a guide rather than the final word. Certain plants may not suffer deer damage in some gardens and landscapes, yet might be completely destroyed in others. This is due in part to the availability of natural food sources and the taste preferences of individual deer. If there is a severe shortage of natural deer browse, deer-resistant landscape plants may suffer damage.

Some of the plants listed are, in addition to being deer-resistant, considered noxious weeds. For example, bamboo is a pervasive grower and can become a significant problem because of its tendency to escape. Alternatively, native plants are better-adapted to the local climate than their exotic counterparts, and should be considered first in landscape planning.

Both native and introduced plants are listed in this booklet. The designation "some native" means some subspecies of the plant are native to California. Always consult a local nursery to select species which best fit your needs and your local climate. The Department of Fish and Game encourages use of native plant species where feasible. For example, most native perennial bunch-grasses would be suitable candidates for deer-resistant landscaping as well as being drought-resistant.

AQUATIC PLANT

Bamboo (noxious)
Bamboo

CROP/ORCHARD PLANTS

Asparagus falcatus
Sickle-thorn asparagus

Clivia miniata
Kaffir lily

Diospyros virginiana
Persimmon

Ficus sp.
Fig

Gymnocladus dioica
Kentucky coffee tree

Helianthus spp. (some native)
Sunflower

Leptospermum sp.
Tea tree

Olea europaea
Olive

Punica granatum 'Nana'
Pomegranate

Rhubarb sp.
(poisonous to livestock and humans)
Rhubarb

GRASSES/FORBS

Acanthus mollis
Bear's breech

Achillea sp. (some native)
Yarrow

Aconitum sp. (native)
Monkshood

Agapanthus sp.
Lily-of-the-Nile

Ageratum houstonianum
Floss flower

Ajuga sp.
Bugle weed, Carpet bugle

Amaryllis belladonna
Belladonna lily, Naked lady

Aquilegia (some native)
Columbine

Arabis sp.
Rockcress

Arctosis sp.
African daisy

Arum sp.
Arum

Asarum caudatum (some native)
Wild-ginger

Aster alpinus
Aster

Begonia tuberhybrida
Tuberous begonia

Calendula officinalis
Pot marigold

Campanula medium
Bellflower

Catharanthus roseus (Vinca rosea)
Madagascar periwinkle

Cerastium tomentosum
Snow-in-summer

Chives sp.
Chives

Chrysanthemum frutescens
Marguerite, Paris Daisy

Chrysanthemum maximum
Shasta daisy

Clarkia
Godetia, Mountain garland,
Farewell to spring

Coreopsis grandiflora
Coreopsis

Coronilla varia
Crown vetch

Crinum sp.
Crinum

Crocosmia sp.
Crocosmia

Cyclamen
Cyclamen

Cymbalaria muralis
Kenilworth ivy

California poppy

Cyperus
Cyperus

Delphinium spp. (some native)
Larkspur

Dendromecon
Bush poppy

Dicentra (native)
Bleeding heart

GRASSES/FORBS CONTINUED

Dietes vegeta
Fortnight lily

Digitalis (native)
Foxglove

Duchesnea indica
Indian mock strawberry

Epimedium (native)
Epimedium

Eschscholzia californica (native)
California poppy

Festuca ovina (native)
Sheep fescue

Fragaria chiloensis (native)
Wild strawberry, Sand strawberry

Freesia
Freesia

Galium odoratum (Asperula odorata)
Sweet woodruff

Gamolepis chrysanthemoides
Gamolepis

Gerbera jamesonii
African or Transvaal daisy

Helichrysum spp.
Strawflower

Helleborus spp.
Hellebore

Hemerocallis
Daylily

Herbs, except *Basil*

Hippophae rhamnoides
Sea buckthorn

Hosta (Funkia)
Plantain lily

Hypericum
St. Johnswort

Iris spp. (some native)
Iris

Ixia maculata
African corn lily

Jasminum spp.
Jasmine

Kniphofia uvaria
Redhot poker, Torch-lily, Poker plant

Lamium maculatum (noxious)
Dead nettle

Laurentia fluviatilis
Blue star creeper

Leucojum spp.
Snowflake

Liriope
Lily turf

Lobelia (native)
Lobelia


Douglas iris

Lychnis coronaria
Crown-pink, Mullein-pink

Lysimachia nummularia
Moneywort, Creeping jennie

Mentha
Mint

Mirabilis jalapa
Four o'clock

Moluccella laevis
Bells-of-Ireland

Monarda
Bee balm, Oswego tea

GRASSES/FORBS CONTINUED

Myosotis spp.
Forget-me-not

Narcissus spp.
Narcissus, Daffodil, Jonquil

Nepeta
Catnip

Ophiopogon japonicus
Lily turf

Paeonia suffruticosa
Tree peony

Papaver rhoeas
Flanders field poppy, Shirley poppy

Papaver orientale
Oriental poppy

Papaver nudicaule
Iceland poppy

Penstemon spp. (some native)
Penstemon, Beard tongue

Phormiam tenax
New Zealand flax

Romneya coulteri (native and rare)
Matilija poppy

Rudbeckia hirta
Gloriosa daisy, Black-eyed Susan

Scabiosa spp.
Pincushion flower

Scilla peruviana
Peruvian scilla

Silene acaulis
Cushion pink, Moss campion

Sisyrinchium (native)
Blue-eyed grass

Soleirolia soleirolli
Baby's tears, Angel's tears

Sparaxis tricolor
Harlequin flower

Stachys byzantina
Lamb's ears

Strelitzia reginae
Bird of paradise

Teucrium fruticans
Bush germander

Tolmiea menziesii (native)
Piggy-back plant

Tradescantia spp.
Spiderwort, Wandering Jew

Trillium spp. (some native)
Trillium, Wake-robin

Tulipa spp.
Tulip

Valeriana officinalis
Valerian, Garden heliotrope

Vallota speciosa
Scarborough lily

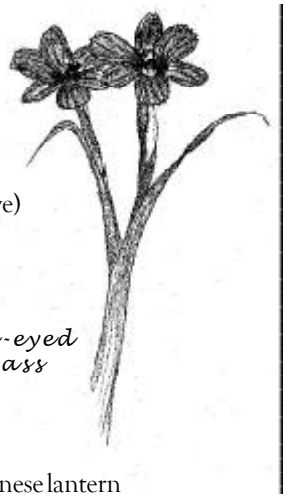
Verbena (native)
Verbena

Vinca spp. (some native)
Periwinkle

Zantedeschia spp.
Calla lily

Zinnia
Zinnia

Abutilon (native)
Flowering maple, Chinese lantern



SHRUBS

Acer circinatum (native)
Vine maple

Agave spp. (some native)
Century plant

Alcea rosea
Hollyhock

Aloe
Aloe

Aralia spinosa
Devil's walking stick, Hercules' club, Angelica tree

Arctostaphylos uva-ursi, and other species (some native)
Bearberry, Kinnikinnick

Baccharis pilularis (native, also noxious)
Coyote brush, Dwarf chaparral broom

Berberis (some native)
Barberry

Bragmansia (Datura)
Angel's trumpet

Brodiaea (native)
Brodiaea

Buddleia davidii
Butterfly bush, Summer lilac

Buxus spp.
Boxwood

Cactaceae (some native)
Cactus, many species and varieties

Calliandra tweedii
Trinidad female bush, Brazilian flame bush

Callistemon
Bottlebrush

Calycanthus occidentalis (native)
Spice bush

Caragana arborescens
Siberian peashrub

Bush anemone

Carpenteria californica (native)
Bush anemone

Cassia (some native)
Senna

Ceanothus gloriosus (native)
Wild lilac

Choisya ternate
Mexican orange

Cissus rhombifolia
Grape ivy

Cistus
Rockrose

Clematis (some native)
Clematis

SHRUBS CONTINUED

Clianthus puniceaus
Parrot-beak

Coleonema pulchrum
Pink breath of heaven

Coprosma repens
Mirror plant

Corokia cotoneaster
Corokia cotoneaster

Correa spp.
Australian fuchsia

Cotoneaster buxifolius
Cotoneaster

Cycas revoluta
Sago palm

Daphne spp.
Daphne

Datura
Jimson Weed

Diosma
Coleonema

Dodonaea viscosa
Hop bush, Hopseed bush

Echium fastuosum
Pride of Madeira

Elaeagnus pungens
Silverberry

Erica
Heath

Eriogonum (some native)
Wild buckwheat

Escallonia spp.
Escallonia

Euonymus japonica
Evergreen euonymus

Euphorbia
Spurge

Euryops pectinatus
Euryops

Fatshedera lizei
Fatchedera

Fern, except Pellaea (some native)
Fern

Forsythia
Forsythia

Gaultheria shallon (native)
Salal, Lemon leaf

Gelsemium sempervirens
Carolina jessamine

Genista monosperma
Bridal veil broom

Grevillea
Grevillea

Griselinia lucida
Griselinia

Gunnera
Gunnera

Halimium (native)
Halimium

Hedera helix (noxious)
English ivy

Heteromeles arbutifolia (native)
Toyon, Christmas berry,
California holly

Hibbertia scandens
Guinea gold vine

SHRUBS CONTINUED

Impatiens wallerana
Busy Lizzie

Iochroma cyaneum
Iochroma

Kerria japonica
Japanese rose

Lantana montevidensis
Trailing lantana

Lavandula
Lavender

Leonotis leonurus
Lion's tail

Loropetalum chinense
Loropetalum

Lupinus (some native)
Lupine

Mahonia spp. (some native)
Mahonia, Oregon grape

Melianthus major
Honey bush

Mimulus
Monkey flower

Muehlenbeckia complexa
Mattress vine, Wire vine

Myoporum laetum
Myoporum

Myrtus californica
Wax myrtle

Nandina domestica
Heavenly bamboo

Nerium oleander
Oleander

Nolina parryi (native)
Nolina

Osteospermum fruticosum
Trailing african daisy, Freeway daisy

Oxalis oregana
Oregon Oxalis, Redwood sorrel

Pandorea pandorana
Wonga-wonga vine

Phaedranthus buccinatorius
Blood red trumpet vine

Phlomis fruticosa
Jerusalem sage

Plumbago auriculata
Cape plumbago

Potentilla fruticosa (native)
Shrubby cinquefoil

Raoulia australis
Raoulia

Rhododendron—except azaleas (native)
R. macrophyllum, R. occidentalis

Rhus ovata (native)
Sugar bush

Ribes (native)
Currant, Gooseberry

Rosmarinus officinalis
Rosemary

Ruscus aculeatus
Butcher's broom

Sambucus (native)
Elderberry

Santolina
Santolina

SHRUBS CONTINUED

Senecio cineraria
Dusty miller

Symphoricarpos albus (native)
Common snowberry

Syringa vulgaris
Common lilac

Syzygium paniculatum
Bush cherry, Australian brush cherry

Tecomaria capensis
Cape honeysuckle

Trachelospermum jasminoides
Star jasmine

Yucca spp. (some native)
Yucca, Spanish bayonet

Zauschneria spp. (some native)
California fuchsia,
Hummingbird flower

Common snowberry

TREES

Abies (some native)
Fir

Acer macrophyllum (native)
Bigleaf maple

Acer palmatum
Japanese maple

Acer negundo (native)
Box elder

Agonis flexuosa
Peppermint tree

Albizia
Silk tree, Plume acacia

Angophora costata (A. lanceolata)
Gum myrtle

Araucaria spp.
Araucaria

Arbutus unedo
Strawberry tree

Arbutus menziesii (native)
Madrone, Madrono

Beaucarnea recurvata
Ponytail, Bottle palm

Brachychiton populneus
Bottle tree

Calocedrus decurrens (native)
Incense cedar

Casuarina stricta
Mountain or Drooping she-oak,
Coast beefwood

TREES CONTINUED

Catalpa bignonioides
Common catalpa, Indian bean

Cedrus
Cedar

Celtis australis
European hackberry

Ceratonia siliqua
Carob, St. John's bread

Cercis occidentalis (native)
Western redbud

Chamaecyparis sp. (native)
False cypress

Chamaerops humilis
Mediterranean fan palm

Cordyline australis
Dracaena palm

Cornus capitata
Evergreen or Himalayan dogwood

Corylus cornuta californica (native)
Western hazelnut

Cotinus coggygria
Smoke tree

Crataegus spp. (some native)
Hawthorn

Cupressus spp. (some native)
Cypress

Erythea edulis
Guadalupe palm

Erythea armata
Mexican blue palm

Eucalyptus spp.
Eucalyptus, Gum

Fraxinus velutina (native)
Arizona ash

Gagetes spp.
Marigold

Ginko biloba
Maidenhair tree

Hakea suaveolens
Sweet hakea

Ilex (except thornless)
Holly

Jubaea chilensis (J. spectabilis)
Chilean wine palm

Juniperus (some native)
Juniper

Larix decidua
European larch

Liquidambar styraciflua
American sweet gum

Lithocarpus densiflorus (native)
Tanbark oak

Lyonothamnus floribundus (native)
Catalina ironwood

Maclura pomifera
Osage orange

Magnolia spp.
Magnolia

Maytenus boaria
Mayten tree

Melaleuca leucadendra
Cajeput tree

Melia azedarach
China-berry

TREES CONTINUED

Metrosideros excelsus
New Zealand Christmas tree

Michelia figo
Banana shrub

Myrtus communis
True myrtle

Parkinsonia aculeata
Jerusaleum thorn, Mexican palo verde

Paulownia tomentosa
Empress tree

Phoenix spp.
Date palm

Picea spp. (some native)
Spruce

Pinus spp. (some native)
Pine

Pittosporum spp.
Pittosporum

Platanus racemosa (native)
California sycamore

Podocarpus
Fern pine

Prunus caroliniana and other spp.
(some native)
Carolina laurel cherry

Quillaga saponaria
Soapbark tree

Robinia pseudoacacia
Black locust

Sabal
Palmetto

Schinus molle
California pepper tree

Thuja spp. (some native)
Arborvitae

Trachycarpus fortunei
Windmill palm

Umbellularia california (native)
California laurel, California bay,
Oregon myrtle, Pepperwood

Washingtonia spp.
Washington palm

California bay laurel

DEER REPELLENTS

Various types of devices and chemicals have been used to repel deer including scare devices, over-the-counter repellent sprays and powder, and home remedies. Scare devices such as exploders, radios, lights, and even a dog on a leash have short-term limited effectiveness at best. Home remedies such as hanging bags of hair, soap, rotten eggs or animal urine are not trustworthy, long-term repellents. Over-the-counter repellents have been the most successful deterrent for non-commercial users experiencing light to moderate damage. However, repellents must be applied frequently and vigilantly prior to and during the period of anticipated damage in order to be effective. For example, repellents should be applied to plants prior to planting and reapplied during the growing season.* 'Hinder,' which is a mixture of ammonium soaps, and 'Deer Away,' made from putrescent whole egg solids have been the most widely used and effective repellent sprays. Other repellents available are:

REPEL ANIMAL REPELLENT
Farnam Co. Inc.
301 W. Osborn Rd.
Phoenix, AZ 85013
(800) 825-2555

HOT SAUCE ANIMAL REPELLENT
Miller Chemical & Fertilizer Corp.
P.O. Box 333
Hanover, PA 17331

HINDER
Crompton Chemical
UAP Great Lakes
La Crescent, MN
(507) 895-2103

**DEER AWAY
Intagra, Inc.
8500 Pillsbury Ave. South
Minneapolis, MN 55420
(612) 881-5535

NATIONAL DEER REPELLANT
National Scent
P.O. Box 667
San Jacinto, CA 92581
(909) 654-2442

* Consult individual manufacturers for proper spray concentration and application.

** *Deer Away* is not approved for application on edible crops.

FENCING APPLICATIONS

For nurseries, orchards, pastures, and large gardens, fencing is often the only way to prevent damage from animals. Many of the fencing options discussed on the following pages also work well for small gardens because they are easy to build and very cost-effective. The following fencing designs are the primary methods being used by professional game managers and many state and federal agencies to control damage from both livestock and wild animals.

HIGH-TENSILE WIRE FENCE

By far, the most effective and most maintainable new fencing used are the New Zealand-designed high-tensile wire fences (See FIGURE A, page 19). Although the initial cost is high, this type of fence requires the least maintenance, and thus the cost per ft/yr is the lowest of all discussed. The fence uses smooth wire instead of barbed wire which is tensioned using a 'strainer' device. The strength of this type of fencing is in the tension applied. Animals cannot "squeeze" through the fence.

Although construction is somewhat technical, the fence actually takes less labor to install because line posts are only needed every 25-50 ft. Proper construction of the "H-brace" corners is critical since the twelve wires used exert tremendous pressure on the corners (See FIGURE B, page 20). The horizontal wires can be spaced varying distances apart (usually from 4-6 inches) and separated by fiberglass or wooden 'droppers' (similar to stays) every five feet. The bottom wire is placed 6 in. off the ground. Tension is applied using a rachet tool and must be periodically adjusted for the fence to function effectively. Because construction is highly specialized, the manufacturer should supply instructions when purchasing materials.

ELECTRIFIED HIGH-TENSILE WIRE FENCE

In areas experiencing persistent and severe deer damage, the same fence discussed above can be electrified using AC current (See FIGURE C, page 21). DC battery or solar/battery chargers are used where electricity is unavailable. The modern-type fence chargers currently available have a strong shocking power (up to 8000 volts) but low impedance. Thus, they are extremely effective but safer than older-type chargers because they don't cause a burning effect. Construction is similar although insulators are used in lieu of staples, fewer wires are needed, and wires are alternating negative and positively charged (with a positive wire on the bottom and top). This is important in that the animal will always be in contact with the ground-wire even when standing in deep snow or in a mid-air jump. The fence functions as more of a psychological barrier than a physical one after animals have experienced the shock, thus even a low fence (+ or - 24") can be effective in keeping the majority of animals out. The fence can be baited by tying aluminum foil flags covered with peanut butter on to the charged wire to aid in training animals to the fence.

MODIFIED ELECTRIC HIGH-TENSILE WIRE FENCE

A nice feature of the above design is that it can be used with an existing fence in a variety of applications, and can be utilized even on a small scale for the average garden grower. The electric high-tensile fence discussed above can actually be constructed on top of an existing fence (such as a square or v-mesh wire or wood fence) using extensions, such as stand-off insulators for a single wire, or a 2" x 4" board attached to the existing post with lag screws for multiple wires. High-tensile fencing manufacturers do not recommend combining electric fencing with barbed wire however as severe injury and fatalities to animals have resulted. With the multiple wire design, positive wires should be alternated with grounded wires.

An advantage to this type of fencing over the completely electrified high-tensile fence is that this one will not often ground out due to vegetation growth and thus will require less maintenance. Much of this equipment can also easily be erected on a temporary basis during the height of the growing season if the problem is only a seasonal one. A disadvantage is that it will probably not be 100% effective in keeping out all animals. 'Polywire,' which is basically an electrified plastic tape can also be used for higher visibility (a bright orange color) and doesn't require tensioning.

SQUARE-MESH WOVEN-WIRE GAME FENCE

Square-mesh fence has been used primarily to control damage to orchards and nurseries (See FIGURE D, page 22). The fence is constructed similar to the high-tensile design, is considerably lighter than the V-mesh wire fence and is easier to construct. The fence is constructed using 10 ft. posts set 4 ft. in the ground and spaced 20 ft. apart. Wire fencing is available in 6-ft. and 8-ft. heights. This fence design has been proven to repel deer and elk. The fence is also effective against coyotes, pigs and rabbits when the wire is buried one foot in the ground.

V-MESH

The V-mesh wire fences have been used primarily to control damage to haystacks. The V-mesh wire fence is constructed using 10 ft. wood posts set 4 ft. in the ground at 12 ft intervals. The V-mesh wire comes in heights of 42 in. to 96 in. with the 72 in. being the most commonly used to control deer. This fence is difficult to build because of the heavy wire.

CONSTRUCTION

All fence designs utilize double braced corner posts set in concrete or 'tamped' in gravel, with line-posts in between corners and fence-stays in between line-posts to maintain wire position. A construction manual or the fence manufacturer should be consulted on how to build particular fence types. Several are listed on page 25. Cost per foot and fence lengths may vary depending on the manufacturer (See "PLANNING," page 23). Manufacturers and other pertinent regulatory agencies should be contacted when using any treated wood products, particulary around groundwater. Except where noted, longer posts and taller wire can be used with each design with minor modifications to control elk effectively as well.

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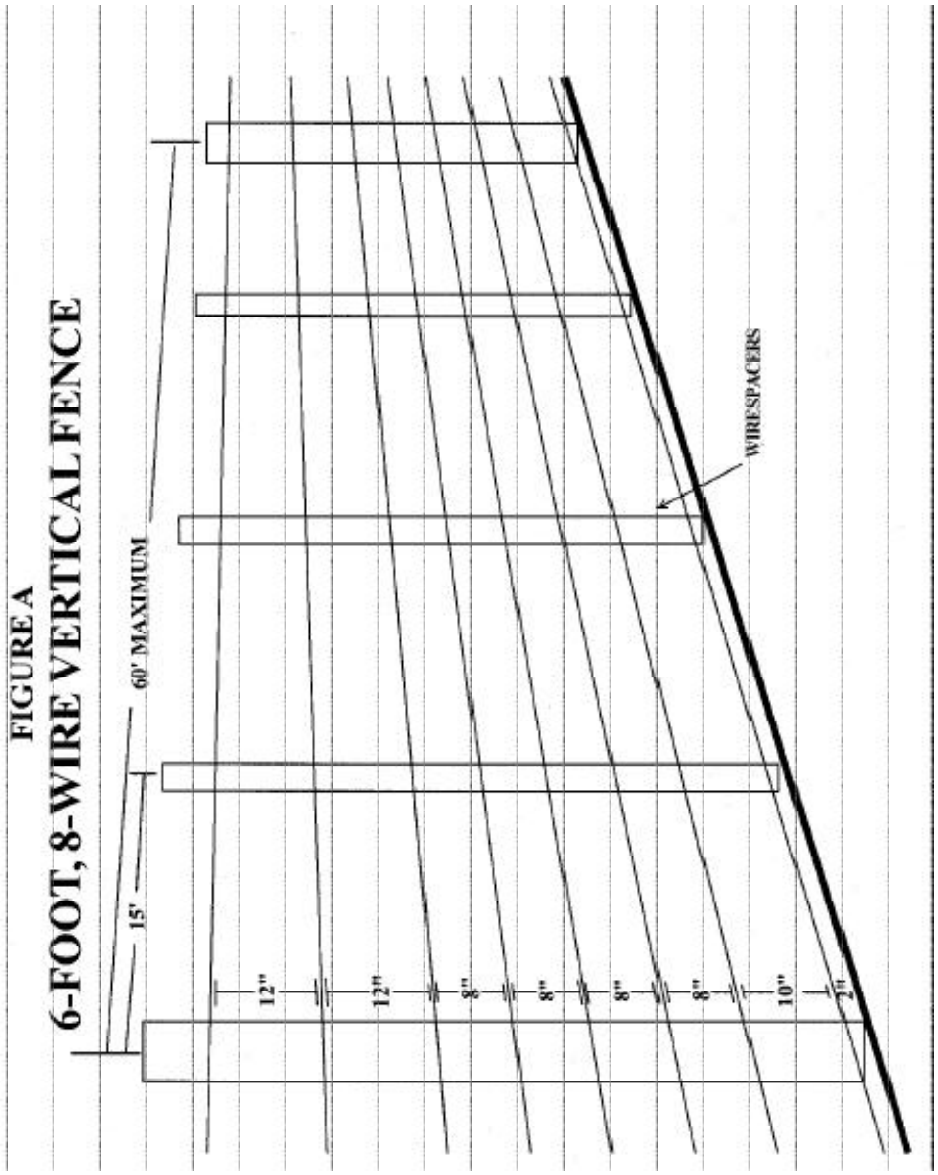
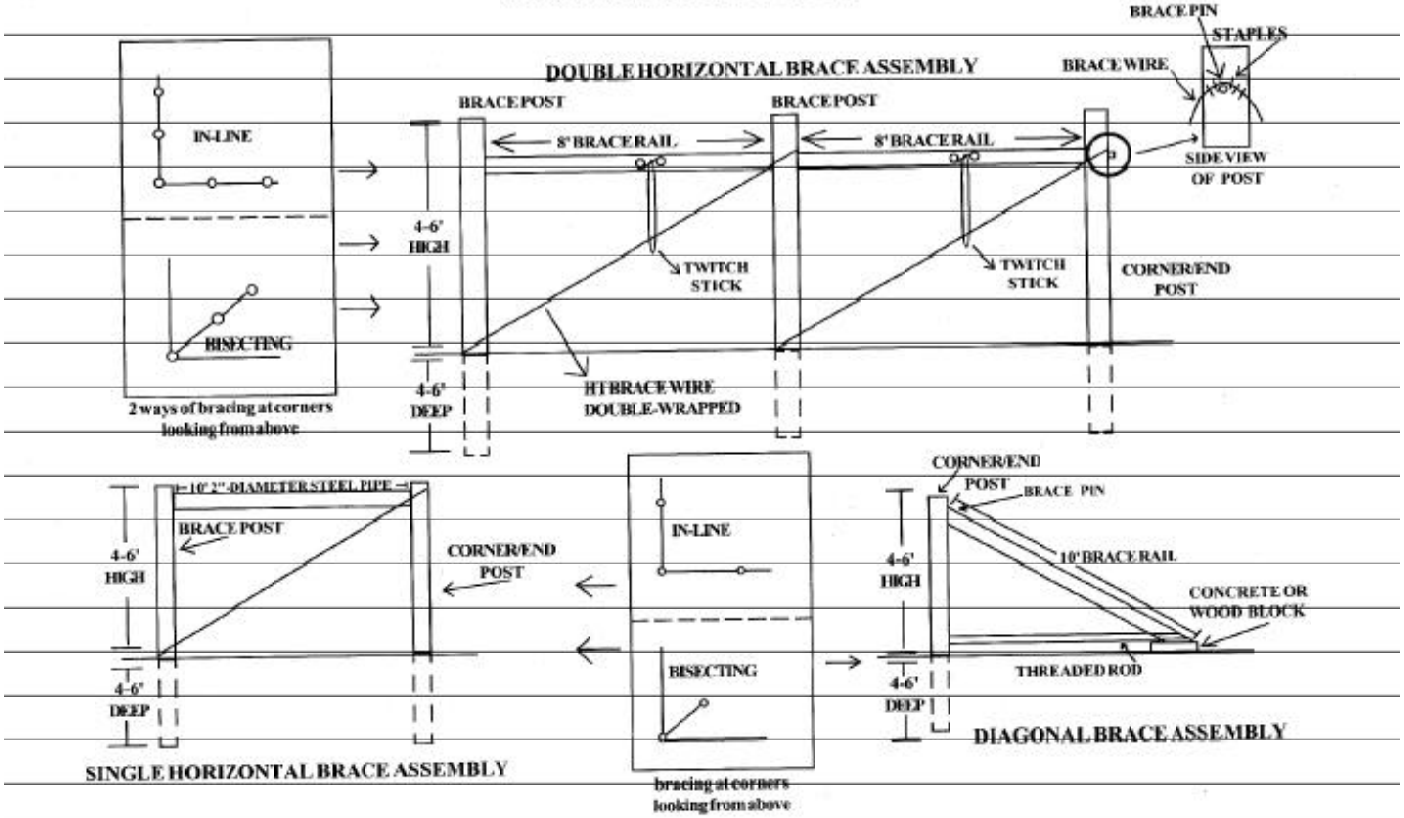


FIGURE A
6-FOOT, 8-WIRE VERTICAL FENCE
60' MAXIMUM
15'
12"
12"
8"
8"
8"
8"
10"
2"
WIRESPACERS

FIGURE B

BRACE SYSTEMS



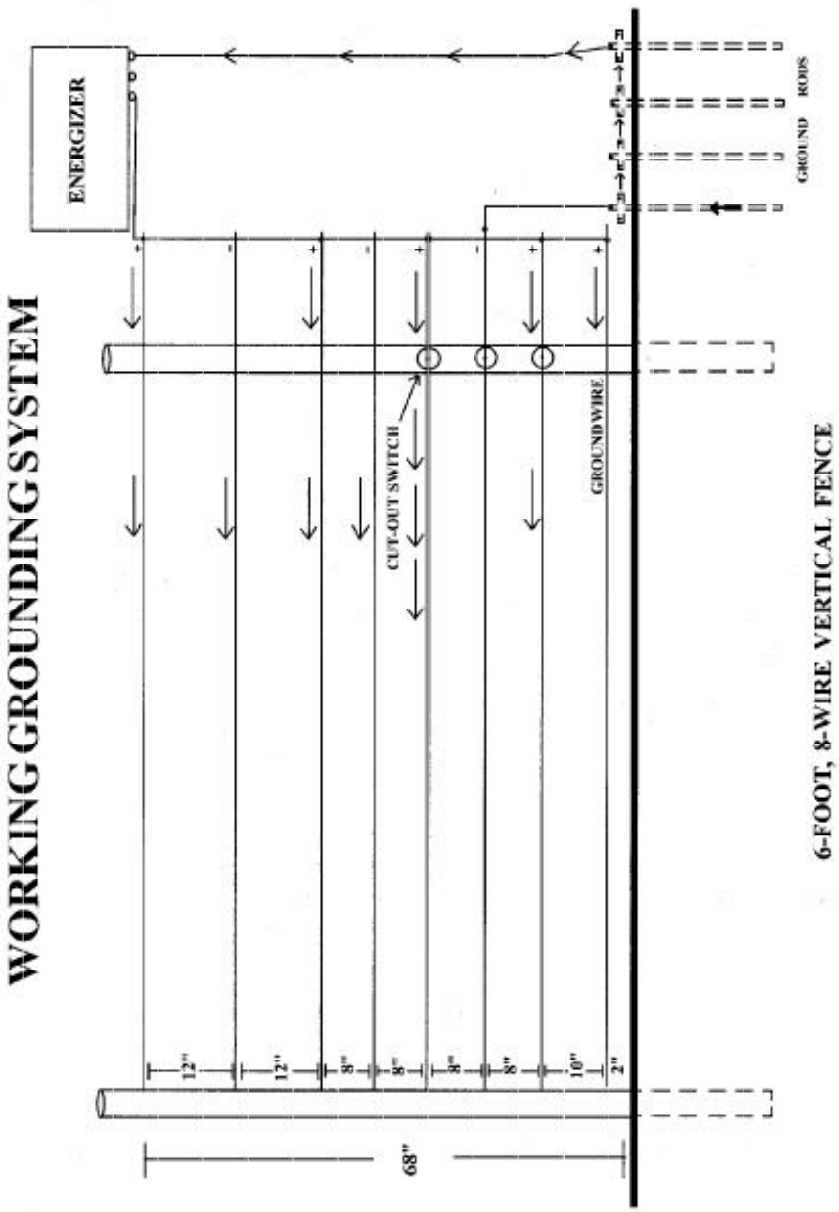


FIGURE C
WORKING GROUNDING SYSTEM
ENERGIZER
GROUND RODS
CUT-OUT SWITCH
GROUND WIRE
12"
12"
8"
8"
8"
8"
10"
2"
68"
6-FOOT, 8-WIRE VERTICAL FENCE

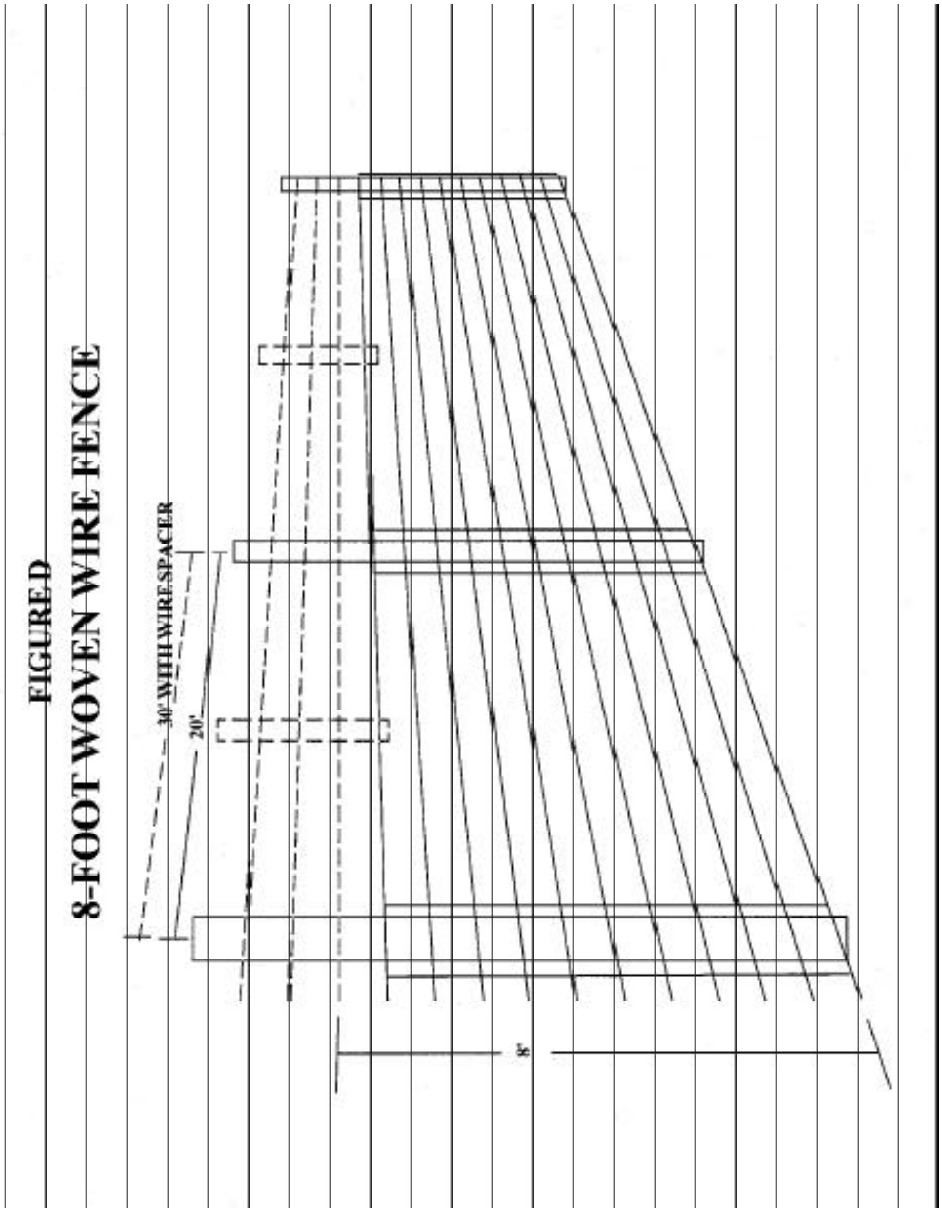


FIGURE D

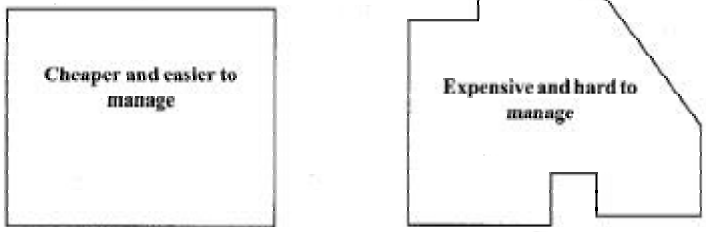
8-FOOT WOVEN WIRE FENCE

PLANNING

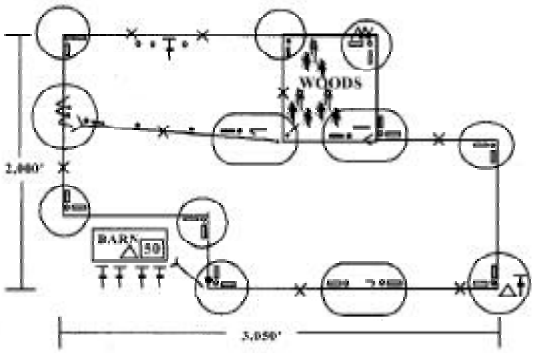
* CHECK LOCAL LAWS AND ZONING REGULATIONS REGARDING FENCES AND ELECTRICITY, ESPECIALLY IN URBAN AREAS

* LOCATE HAZARDS AND OBSTACLES SUCH AS POWER LINES, HILLS, DIPS AND WATER

* USE AS FEW CORNERS AS POSSIBLE



* PREPARE A SKETCH OF THE FENCE



KEY	BASIC FENCE COMPONENTS
50	CONTROLLER
	GROUND ROD
•	STANDARD DUTY POSTS-END CORNER RISE OR DIP
—	STANDARD DUTY BRACE
◦	HEAVY DUTY POSTS-END CORNER RISE OR DIP
▬	HEAVY DUTY BRACE
X	WIRE TENSIONERS
	CURL ON CONNECTORS
	GATE HANDLES
△	LIGHTNING DIVERTERS

* PREPARE A LIST OF MATERIALS

* A WELL-PREPARED FENCE LINE SAVES TIME AND MATERIALS

* INCLUDE SPACE FOR EASY FENCE CONSTRUCTION AND VEHICLE ACCESS

* BUILD THE FENCE AT LEAST FIVE FEET FROM OLD FENCE ROWS, BRUSH LINES OR WOODS

* A CHARGER MUST BE READY BEFORE CONSTRUCTION BEGINS