

FUND FACTS

LIVING WITH DEER

More and more of the environment is being engulfed by urban sprawl. Some species, such as deer, adapt amazingly well to our human-created environments. The short-cropped lawns and tasty flowers in our suburban landscapes provide exactly the kind of succulent food that deer seek out in the “edge” habitat they prefer.

Once rarely seen, deer now abound, often achieving high densities. Some people relish the sight of a doe with fawns on their lawn, while others react with frustration at the thought of more browsed plants. All are concerned about increased levels of deer/vehicle collisions.

Controversy erupts when a cry for deer hunting goes up in communities around the country. Those who favor non-lethal alternatives argue against taking the lives of deer. Hunters claim that they can solve the problem with bullets or arrows. Politicians form deer advisory committees in an attempt to reach consensus. Newspaper headlines report spirited debates at town meetings. The scenario is all too familiar.

The following information discusses the *source* of a variety of deer problems as well as misconceptions that lead to exaggerated fears about the presence of deer. This is followed by a description of various non-lethal techniques that homeowners can use to resolve deer/human conflicts. Repellents and scare devices tend to work better for *low* to *moderate* browsing problems, yet fencing works better for more *severe* problems. Therefore, it is important to analyze your deer situation before choosing your deterrence plan.

SOLVING CONFLICTS

In most cases, the presence of a “nuisance animal” is just the “effect” half of a “cause and effect” scenario. The “cause” half is where our answers lie, and is almost invariably a food source or an attractive bit of habitat. The trick is to fix the *cause*. Merely removing animals doesn’t work — as long as attractants remain, more animals from the surrounding area will take the place of any removed. It can be a vicious

cycle and is the reason why animal removal rarely works to solve a nuisance problem. A better approach is to modify the habitat so it

provides less food and shelter, which in turn encourages the animals to go elsewhere.



Photo: Texas Parks & Wildlife Department

PLANTS: PLANTS THAT DEER WILL TEND TO AVOID OR PREFER

Deer taste buds vary geographically and seasonally, and are largely dependent on what alternative plants are available. Check your local garden store for information on what types of plants seem resistant in your area. You can also contact your local Cooperative Extension Service for this information. To find a Cooperative Extension specialist, see the directory for your state on the web site <www.reeusda.gov/statepartners/usa.htm> or call your local state university’s School of Agriculture. Many Cooperative Extension Services have web sites that give this kind of information.

The following charts contain a general description of plant species that tend to be deer resistant and those that you should NEVER plant in deer country!

TABLE 1:
DEER RESISTANT/ PREFERRED PLANTS

DEER-RESISTANT PLANTS Annuals and Biennials

Ageratum
Alyssum
Annual Periwinkle
Blanket flower
Blue salvia
California poppy
Cornflower
Dahlia*
Dusty miller
Flowering tobacco
Forget-me-not
Heliotrope

Lobelia
Marigold
Melampodium
Morning glory
Nasturtium
Parsley
Pansy*
Plectranthus (fuzzy leaves)
Polka-dot plant
Snapdragon
Spiderflower

Sweet basil
Sweet pea
Thorn apple
Tickseed (Coreopsis)
Verbena
Vinca
Wax begonia
Zinnia
Zonal geranium

Groundcovers/Vines

Bittersweet
Bugleweed
Carolina jessamine
Cherokee rose
Dead nettle

Honeysuckle
Myrtle
Pachysandra
Periwinkle
Sweet woodruff

Trumpet vine
Virginia creeper
Wild ginger
Wisteria

Perennials/Bulbs

Adam's needle	Colchicum	Goldenrod	Moss pinks	Silvermound
Alyssum	Columbine	Hay-scented fern	Mullein	Snakeroot
Amaryllis	Common dill	Heath	New York fern	Snowdrop
American bittersweet	Coneflower*	Heather	Oregano	Soapwort
Americana mountain mint	Cranesbill (Geranium)	Hellebore	Oriental poppy	Society garlic
Angelica	Crinum lily	Hen & chicks	Ornamental chives	Spiderwort
Anise	Daffodil garlic	Herb of grace	Ornamental grass	Spike gayfeather
Anise hyssop	Daffodil	Hungarian speedwell	Ornamental onion	Spurge
Astilbe	Dame's rocket	Hyacinth	Ornamental rhubarb	Squill
Avens	Daphne	Interrupted fern	Ostrich fern	St. John's wort
Baby's breath	Delphinium	Iris	Painted daisy	Star of Bethlehem
Balloon flower	Dropwort	Jack-in-the-pulpit	Partridgeberry	Star of Persia
Barrenwort	Euphorbia	Jacob's ladder	Pennyroyal	Statice
Basket-of-gold	Evening primrose	Joe-pye weed	Perennial blue flax	Stella de Oro daylily
Bearberry	False indigo	Lady's mantle	Perennial sunflower*	Summer snowflake
Bee balm	Ferns	Lamb's ear	Pinks	Sundrops
Bergenia	Feverfew	Lantana	Plumbago	Sweet Cicely
Bishop's weed*	Foam flower	Larkspur	Poppy	Sweet William
Bleeding heart	Four o'clock	Lavender	Primrose	Tansy
Blue star	Foxglove	Lavender cotton	Queen of the prairie	Thyme
Bluebeard	Fritillary	Lenten rose	Rhubarb	Tiger lily
Bolton's aster *	Gaillardia	Lily leek	Ribbon grass	Toadflax
Bugbane	Garden sage	Lily-of-the-valley	Rock-cress	Turtlehead
Buttercup*	Garlic chives	Lungwort	Rose champion	Tussock bellflower
Butterfly weed	Gas plant	Lupine	Rosemary	Wild indigo
Calamint	Gerbera daisy	Mayapple	Sage	Windflower (Anemone)
Cardinal flower*	Germander	Meadow sage	Scarlet sage	Winter savory
Catmint	Globe thistle	Mint	Scilla	Wintergreen
Christmas fern	Gloriosa lily	Monkshood	Sensitive fern	Wormwood
Cinnamon fern	Glory lily	Montauk daisy	Shasta daisy*	Yarrow
Cinquefoil	Goatsbeard	Montbretia	Siberian Iris	Yucca* (Adam's needle)
Clematis	Golden ragwort			

SHRUBS/TREES

Allegheny serviceberry	Cotoneaster	Gardenia	Leatherleaf mahonia	Rose of Sharon
American bittersweet	Cranberry	Ginkgo	Leucothoe	Rotunda
American Holly*	Crape myrtle	Goldenbells	Leyland cypress*	Russian olive
Astromeda	Creeping wintergreen	Gordonia	Lydia Morris hollies	San Jose holly
Austrian pine	Dawn redwood	Heather	Mountain laurel*	Scotch pine
Bald cypress	Deodar cedar	Heavenly bamboo	Mugo pine	Scots pine
Banana shrub	Deutzia	Heritage birch	Northern bayberry	Shadbush
Barberry	Douglas fir	Honey locust	Norway spruce	Shallon
Beautybush	Downy serviceberry	Honeysuckle	Oleander	Spirea
Blueberry elder	Dragon lady holly	Inkberry	Paper birch	Spruce
Bottlebrush buckeye	Dwarf sweet christmas box	Japanese andromeda	Panicled dogwood	Staghorn sumac
Boxwood	Dwarf Yaupon	Japanese cedar	Paw paw	Sweet mock orange
Butterfly bush	Eastern white pine	Japanese flowering cherry	Pitch pine	Sweetgum
Caryopteris	Eleagnus	Japanese holly	Plum yew	Sweetshrub
Cherry laurel	English hawthorn	Japanese Pieris	Red maple	Viburnum
Chinese holly*	European beech	Japanese rose	Red osier dogwood	Weigela
Chinese junipers	European privet	Japanese wisteria	Red pine	White spruce
Chinese paper birch	European white birch	John T. Morris holly	Redvein enkianthus	Winter daphne
Colorado blue spruce	False cypress	Kousa dogwood	River birch	
Common buckthorn	Fir			
Common lilac	Firethorn			
Common sassafras	Flowering quince			
Corkscrew willow	Forsythia (border)			

**Deer damage on these plants show regional differences*

**Some plants listed may be both annual and perennial*

DEER-PREFERRED PLANTS

(Avoid planting these in deer country)

Annuals and Biennials

Dahlia
English daisy
Fibrous begonia
Geranium
Hollyhocks
Impatiens
Pansy
Sunflower (Mexican)
Violas

Perennials/Bulbs

Bishop's weed	Garden phlox	Lilies	Solomon's seal
Black-eyed Susan	Golden sunflower	Perennial sunflower	Spring-flowering crocus
Buttercup	Grape hyacinth	Periwinkle	Stock
Candytuft	Hibiscus	Rose	Trillium
Cardinal flower	Hosta (Plantain lily)	Rose mallow	Tulip
Crocus	Hollyhock	Sedum "Autumn Joy"	Wallflower
Daisy	Japanese painted fern	Shasta daisy	Yucca (Adam's needle)
Daylily	Jerusalem artichoke		
English ivy			

Shrubs/Trees

American arborvitae	Common winterberry	Evergreen azalea	Indian Hawthorn	Pinxterbloom azalea
American holly	Cornelian cherry	Evergreen holly	Japanese maple	Plum
Apple/crabapple	dogwood	Evergreen rhododendron	Japanese yew	Quince
Arborvitae	Cornelian dogwood	Florida azalea	Juniper	Redbud
Atlantic white cedar	Crabapple	Frazer Fir	Leyland cypress	Rhododendron
Atlas Cedar	Deciduous azalea	Fringe tree	Manchurian lilac	Rose
Aucuba	Eastern red cedar	Goldenrain tree	Merserve holly	Saucer magnolia
Balsam fir	Eastern redbud	Hemlock	Mountain laurel	Western yew
Blackberry & Raspberry	English yew	Highbush blueberry	Nellie Stevens holly	White pine
Catawba Rhododendron	English/Japanese hybrid	Hybrid rose	Norway maple	Winged euonymus
Cherries	yew	Hybrid tea rose	Pear	Wintercreeper
Chinese holly	Euonymus	Hydrangea	Pink shell azalea	Yew
Clematis (vine)	European mountain ash			

These tables of “deer-preferred” and “deer-resistant” plants are a compilation of information from the following sources: *Reducing Deer Damage to Home Gardens and Landscape Plantings* by Paul D. Curtis and Milo E. Richmond <www.dnr.cornell.edu/ext/chdp/reducingdeerdamage.htm>; *Limiting Deer Browse Damage to Landscape Plants* by Jeffrey Ward, Connecticut Agricultural Experiment Station, New Haven, Bulletin 968: Nov. 2000; *Resistance of Ornamentals to Deer Damage* by Jonathan Kays, 1999, Maryland Cooperative Extension Fact Sheet #655; *Deer Tolerant Ornamental Plants* by Jeff Jackson and Gary L. Wade, as listed under “Timely Horticulture Tips” Publication H-97-032 of the University of Georgia College of Agricultural and Environmental Sciences, Cooperative Extension Service <www.ces.uga.edu/agriculture/horticulture/deer.html>. We also used deer-resistant plant species lists given to us by Carolyn Singer of Foothills Cottage Gardens in California <www.fcgardens.com>, and the Deer Resistant Nursery in Michigan <www.deerxlandscape.com>.

REPELLENTS

Repellents are products that are meant to disrupt and reduce deer browsing. However, deer are very adaptable and may vary their taste preferences. Therefore, the effectiveness of repellents will vary and will depend on a number of factors:

- * Seasonal changes in plant palatability
- * Local deer taste preferences and nutritional needs
- * Availability of alternative foods
- * Time of year
- * Deer density
- * Type of repellent and concentration of active ingredients
- * Durability of the repellent and how often it is applied

Plants are most vulnerable in winter, when snow cover or extreme cold reduces food availability, and in early spring when young, succulent spring growth on ornamentals may occur before native plants. In addition, most repellents require reapplication at regular 3-4 week intervals and after heavy rains. This is why people may consider repellents to be labor-intensive and not always cost-effective, particularly over larger acreage. On the more positive side, repellents are easy to apply and invisible, thus having much aesthetic appeal.

What Makes Some Repellents More Effective than Others?

The most effective repellents tend to be those that produce sulfurous odors and are considered “fear-inducing.” These repellents depend completely on detection through odor. It is believed that deer associate a sulphur smell with the presence (or

carnage) of a predator. **(Some deer repellents and homemade recipes contain animal-based ingredients, and their discussion here for educational purposes does not imply endorsement by The Fund for Animals.)** Not all sulphurous odors are equally effective, however. For example, compounds containing garlic seem to be less effective than sulphur compounds in urine.

Aside from fear-inducing odors, repellents use other modes of action (some repellents combine several modes of action) which include:

- 1) **Taste:** these include bitter ingredients that presumably create a bad flavor. These must be continually applied to the growing parts of plants.
- 2) **Pain:** these include ingredients like hot pepper (capsaicin) or ammonia, which cause irritation on contact with the mucous membranes, eyes, mouth, nose or gut.
- 3) **Conditioned aversion:** these products cause animals to form an association between the treated item and a feeling of sickness, usually gastrointestinal.

There are two kinds of delivery systems for repellents: topical (repellent placed directly on the targeted plant) and area (such as scent packets, where the protection zone is meant to extend beyond the immediate area where the repellent is present). In general, topical repellents appear more effective than area-based ones and odor-based repellents tend to outperform taste-based repellents. Taste receptors in animals are different than those in humans.

Some chemical compounds which are extremely bitter to humans tend not to bother deer at all (Lutz and Swanson).



Photo: Laura Simon

A wide range of repellents are available at garden and hardware stores.

Tips for Successful Repellent Application:

- 1) All repellents work best if applied before the deer’s feeding pattern becomes established. This means applying repellents before bud-break and as new growth appears. You don’t want to break a browsing habit, but rather prevent one from forming!
- 2) Because rainfall washes off repellents, you’ll need to reapply repellents after heavy rains. We recommend routine re-

application at least every 3-4 weeks so that new, growing plant parts are protected as well.

- 3) Deer may become accustomed to the same repellent and ignore it over time. Alternating repellents may help to keep the deer confused and more wary.
- 4) At the height of growing season, you might consider choosing an odor repellent over a taste-based one. Taste-based repellents need to be constantly applied to any new growth to keep the whole plant tasting bad.
- 5) The longevity of some repellents can be enhanced by adding a “sticker,” which is an adhesive product that literally makes the repellent “stick” to the plant longer! Some commercial “stickers” are *Wilt Pruf*, *Vapor Gard* and *Weathershield* and can be purchased at garden stores. Some repellents already contain a sticker as part of their formulation.

How Do I Choose a Repellent?

Many repellents are stocked by your local garden, farm supply or hardware store, and it's a good idea to ask what seems to be working best in your area since the effectiveness of repellents varies locally and regionally. Ask your neighbors what works for them. Overall, the one repellent that seems to score highest most consistently is *Deer Away Big Game Repellent*. Table 2 gives sources for certain repellents that you may not be able to find locally.

Have There Been Comparative Studies of Repellents?

There have been some published studies that compare various repellent products on the market. A recent study (Wagner and Nolte) reported that the most effective repellents (out of 20 tested) were *Deer Away Big Game Repellent*, *Plantskydd*, *Bye Deer*, *Deer Away Deer and Rabbit Repellent* (now marketed as *Get-Away Animal Repellent*) and *Deerbuster sachets*. All of these products reduced deer browse damage for all 18 weeks of a winter study, with 2 (*Big Game Repellent* and *Plantskydd*) outperforming the others by repeatedly, and quite effectively, protecting plants for 6-8 weeks when directly applied. Interestingly, the sachets were effective only when they were placed so that any product dissolving in rain could drop onto the plant surfaces. Another earlier study (Lutz and Swanson) reported that *Deer Away Big Game Repellent*, *Hinder* (mixed 1/1 ratio with water), and *Miller Hot Sauce* (mixed at a ratio much higher than the labeled concentration, to achieve a 6.2% product /100 gallons water ratio) were the most effective repellents in several field trials.

A note of caution: Studies vary widely in the types of repellents they tested, which plant or food was used as a carrier, repellent concentrations, test duration, experimental design, and criteria for success. Overall, many factors influence repellent effectiveness, including: a) relative palatability of the plant to be protected, b) availability of alternative forage, c) weather, d) amount and concentration of repellent used, e) size of the deer herd, and f) test duration (El Hani and Conover). There have also been less formal, consumer-based assessments, such as one published in *Consumer Reports* magazine which reported that 5 of the most effective repellents (out of 11 tested) were *Hinder*, *Bobbex*, *Irish Spring* soap, *Repel Bye Deer* sachets, and a homemade egg and hot pepper spray (see homemade solution #2).

NON-COMMERCIAL REPELLENTS:

Soap Bars: Hanging a bar of soap, particularly *Irish Spring*, from a bush or tree will help protect it. Be sure to leave the soap wrapper ON and drill a hole through the center of the soap and suspend it with a string. The brand of soap you choose must be high in tallow fatty acid. Glycerin and coconut-based fatty acid soaps do NOT seem to repel deer well. Disadvantage: the sphere of protection is limited to the immediate area around the tree/bush. Be sure to hang the soap bars no more than 3 feet apart, up to a height of 6 feet, all around the tree/bush.

Human Hair: Although hanging sachets of human hair costs very little, it does not consistently repel deer. Hair can be obtained from beauty salons and barbershops quite easily, however. Hair should be bagged in 1/8-inch mesh bags or nylon stockings, and contain at least 2 handfuls of hair apiece. Bags should be hung at least 3 feet apart from each other and up to a height of 6 feet if the tree/bush to be protected has a wide diameter. Refresh the bags monthly with fresh hair. Some users have found that periodically spraying the bags with cologne or aftershave enhances their effectiveness!

HOMEMADE SOLUTIONS:

- 1) Mix 3 eggs well in a blender. Mix with 1 gallon of water. Spray on plants. Reapply after heavy rains. Disadvantage: this solution may clog sprayer.
- 2) Mix 4 eggs, 2 oz. red pepper sauce, 2 oz. chopped garlic. Blend with enough water to make 1 quart. Strain and apply with spray can. This is the *Consumer Reports* recipe.

A SAMPLING OF COMMERCIAL REPELLENTS:

Note: See Table 2 for more options and a full ingredient list. **Some commercial deer repellent products contain animal-based ingredients, and their listing here for educational purposes does not imply endorsement by The Fund for Animals.**

Deer Away Big Game Repellent (BGR):

This product comes in both a powder and liquid form (the product's *powder form* seems more effective than the *liquid form*) and is considered by researchers to be the most consistently effective deer repellent. BGR is an odor-based repellent comprised mostly of putrescent egg solids. It is usually available in garden stores.

Miller's Hot Sauce and Deer Away Deer and Rabbit Repellent (now marketed as Get-Away Animal Repellent):

Both of these products rely on trigeminal nerve irritation in the mouth caused by the hot pepper sensation. For severe deer browsing, the *Miller's Hot Sauce* manufacturer may recommend that the product be applied at 10-100 times the labeled concentration and that a sticker, such as *Vapor Gard*, be added to ensure higher durability. The effectiveness of any capsaicin-based (hot pepper) product appears to depend largely on the concentration of capsaicin used and that the product be reapplied every 2-3 weeks (or less) so that any new plant growth is covered. Taste-based repellents seem to have a shorter duration of effectiveness than odor-based. This may be due to the lack of an associated odor cue, so deer continually sample growing plants and quickly notice if the hot pepper flavor is *absent* from any plant parts. See Table 2 for recommended applications and more information about these two products.

Hinder: This is an odor deterrent, based on ammonium soaps high in fatty acid. Advantage: This is one of the few products that can be used on garden vegetables. It is usually available in garden stores.

Milorganite: This human sewage-based fertilizer is primarily an odor deterrent, available at most garden stores. Recommendation: Spread in a wide band around the perimeter of a garden, reapply as directed and after heavy rains. It is usually available in garden stores. At this time, we can't say how effective this product is for deterring deer.

Plantskydd: This new product that originated in Scandinavia is made from dried blood and vegetable oils. Many animals react to the smell of blood, instinctively knowing that if blood is found outside the body, something is wrong. This product scored highly in deer repellency studies.

TABLE 2: COMMERCIAL REPELLENTS

NOTES:

- Many of these repellents are available at your local garden store.
- This list is not all-inclusive, but rather a representative sampling.
- RTU means “ready-to-use” form (i.e. pre-mixed).

Products marked with an asterisk include animal ingredients and their discussion here for educational purposes does not imply endorsement by The Fund for Animals.*

TRADE NAME	ACTIVE INGREDIENT(S)	COST OF ONE QUART OF READY-TO-USE	SOURCE	COMMENTS
*Deer Away Big Game Repellent (comes as a concentrate, powder, or a RTU form called “Deer and Rabbit Repellent”)	Putrescent eggs 4.63% in RTU, 37% in concentrate	Ready-to-use \$17.99 Concentrate \$9.95 Powder: 1 lb \$24.95	Intagra 8906 Wentworth Ave. S. Bloomington, MN 55420 (800) 468-2472 www.intagra.com	This putrescent egg-based repellent scores most highly in repellent studies. Powder form of product seems most effective. Odor based. Reapply every 4 weeks.
*Deer Off	.7813% egg solids; 0.0006% capsaicin and 0.0006% garlic in RTU	\$18.99	Deer Off 1492 High Ridge Rd. Suite 5 Stamford, CT 06903 (203) 968-8485 www.deeroff.com	This product combines taste (capsaicin) and odor (egg) for repellency effect. Reapply every 3-4 weeks.
*Liquid Fence	Contains egg solids (co. won't reveal %); 3% garlic powder	\$11.95	Liquid Fence Inc. PO Box 300 Broadheadsville, PA 18322 (888) 923-3623 www.liquidfence.com	Odor and taste-based repellent. Reapply after one week and then monthly.
*Plantskydd	87% edible animal protein (bloodmeal); 3% vegetable fat; 5% salt; 5% water	\$27.00	Tree World 4466 Stalashen Dr. Sechelt BC, Canada V0N 3A1 (800) 252-6051 www.plantskydd.com	A new product from Scandinavia, odor-blood-based ingredients. Scored highly in studies.
Miller's Hot Sauce	2.5% capsaicin	\$98.00 per half gallon (not sold by RTU quart)	Miller Chemical PO Box 333, 120 Radio Rd. Hanover, PA 17331 (800) 233-2040 www.millerchemical.com <i>* company will consult with you to make sure product fits your problem specifics</i>	Be sure to add a sticker (ex: <i>Vapor Gard</i>). This product must be handled very carefully due to capsaicin (hot pepper)! Manufacturer suggestion for heavy deer browsing: Apply at ratio of 1-2 quarts repellent, 1-2 quarts sticker (ex: <i>Vapor Gard</i>), to 100 gallons water.
*Deer Stopper	Mint oil, rosemary oil, sodium chloride Egg solids: 1.52% in RTU, 15.2% in concentrate	\$16.99	Landscape Plus PO Box 122 Chester, NJ 07930 (908) 832-0711 www.deerstopper.com	A new formulation containing herbal oils.
DeerBusters Deer and Insect Repellent	3.33% garlic	\$19.95 with hose-end sprayer attachment	DeerBusters 9735A Bethel Rd. Frederick, MD 21702 (888) 422-3337 www.deerbusters.com	This garlic-based repellent doesn't persist long so it must be re-applied every 7 days and after rain.
Get-Away Animal Repellent	.625% capsaicin, .21% allyl isothiocyanate (mustard)	\$17.99	Intagra 8500 Pillsbury Ave. Minneapolis, MN 55420 (800) 468-2472 www.intagra.com	This product scored fairly well in a recent study. Taste/pain based repellent. Reapply every 2 weeks.
*Hinder	RTU: consists of .66% ammonium salts of higher fatty acids Concentrate:13.8% ammonium salts of higher fatty acids	RTU 24 ounce \$12.99 \$25.00 for one gallon of concentrate	E. M. Matson Jr. Co. Inc. PO Box 1820 North Bend, WA 98045 (425) 888-6212	One of the few products registered for use on edible plants. Reapply every 2 weeks.
*Deerbusters Deer and Rabbit Repellent	Concentrate: 13.8% ammonium salts of higher fatty acids	\$33.95 for concentrate	DeerBusters 9735A Bethel Rd. Frederick, MD 21702 (888) 422-3337 www.deerbusters.com	This product can be used on edible plants. Reapply every 2 weeks.

SCARE DEVICES:

Another way to deter deer is to scare them. However, deer tend to habituate to most scare devices over time. Their initial fear of a device that looks, moves, or sounds strangely may even result in curiosity followed by rapid habituation as the deer learns that the device is not harmful.

Scarecrow Motion Activated Sprinkler: This is a motion sensor combined with a sprinkler that attaches to a spray hose. When a deer comes into its adjustable, motion detecting range, a sharp burst of water is sprayed at the animal. By combining a physical sensation with a startling stimulus, this device appears to be more effective than other devices that rely on sights or sounds alone. This device reportedly is effective for other mammals that may come into gardens and sells for approximately \$99. Purchasing information can be obtained from Weitech Company at (800) 343-2659 or <www.scatsmat.com.>

Havahart #5250 "Electronic Deer Repellent": This highly portable "repellent" consists of 3 stake-like devices, cotton and a scent lure and is aesthetically colored to blend into the environment. The deer are attracted to the lure and receive a mild electric shock when they reach it. The concept is to train them, through aversive conditioning, to stay away from gardens. This 3-post device covers 1200 square feet of garden, according to the company. The current produced by this device has very low amperage and duration of only a few milliseconds. It costs \$99. Look for this product in the "Electrical Repellents" section under "Deer" on the Havahart website, <www.havahart.com>, or by calling (800) 800-1819.

Ultrasonic Devices: There are several devices which supposedly repel wildlife by producing high-frequency, short-wave ultrasonic sounds that are inaudible to people but are heard by animals such as deer, dogs and cats. One commonly sold "deer alert whistle" is torpedo shaped and meant to be affixed to car bumpers. How well the devices work is not scientifically known. There is anecdotal information for and against them; therefore, we are not recommending the use of these products at this time.

FENCING OPTIONS:

When deer browsing is at moderate or high levels, or a landowner isn't willing to tolerate even a limited amount of browse damage, fencing to exclude deer is the only option. This will involve a more expen-

sive initial outlay of funds, yet a well-maintained fence should last 5-25 years. There is a wide variety of fencing options now available.

Certain fences, such as the 8-10 foot tall woven wire fence, provide an absolute barrier since they are high enough to prevent deer from going *over* them and solid enough to prevent deer from going *through* them. However, most other fences, such as electric fences, are considered more of a "mental barrier" since they are low enough to jump yet the use of electric shock (negative stimuli) or slanted-construction (i.e. illusion of a formidable fence) teaches the deer to stay away.

Full instructions for how to build or install many deer fencing options are available through the book *Prevention and Control of Wildlife Damage* (Craven and Hygnstrom, 1994 — see "Deer" Chapter) which is also available online via <www.wildlifedamage.unl.edu> (see "Resources" for how to access this text online). You can also consult with fencing suppliers (see Table 3) or your local farm supplies, garden, or hardware store.

ELECTRIC FENCES

Note: Be sure to check your local ordinances regarding electric wire fencing to find out what is permissible in your community.

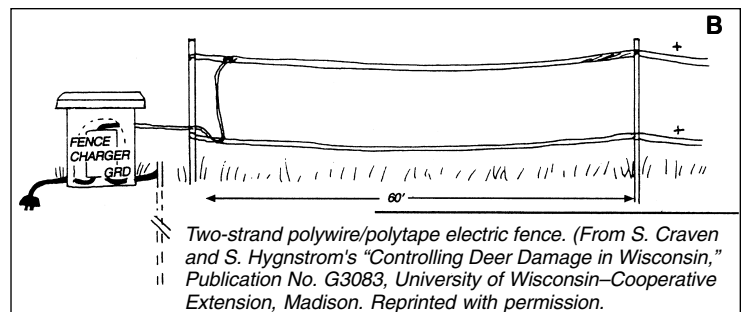
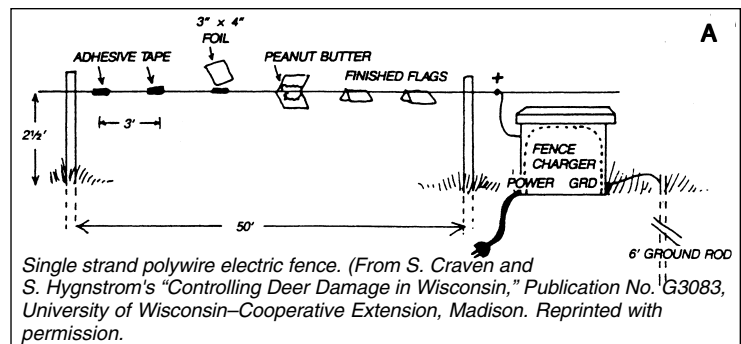
Electric fences are among the most effective deterrents. They can be constructed in a variety of configurations such as a baited, single strand or 5, 7, or 9 wires pitched either horizontally or vertically. They are powered by high-voltage, low amperage chargers that provide timed pulses of short duration. Deer quickly learn to avoid these fenced-in areas. Electric fences are more of a "behavioral barrier" than an absolute barrier, which means that if they're not properly maintained (see Tips), deer will learn how to get through them.

If you have a small garden or area to protect, check with your local garden store because many sell electric fence kits that may suit your needs. Know that deer are quite resistant to electric shock due to their hollow,

well-insulated hair, and the small, pointy design of their hooves which lessens the electrical impact. This is why they can often get through the horizontal wires of electric fences without feeling much of a shock.

TIPS FOR SUCCESSFUL ELECTRIC FENCES:

- 1) **INSPECTION AND MAINTENANCE:** Fences must be regularly inspected and maintained to remain effective. Every week, check for broken wire and do a voltage check. Deer constantly test fences and if they get through once, it is much more difficult to recondition them.
- 2) **MOWING:** Vegetation must be cleared away --- and kept away --- from the lower wires or the wire may short out. Be sure to clear a minimum 10-15 foot buffer on the outside of the fence so deer see it and don't run through it.
- 3) **BAITING:** Many professionals believe that baiting with peanut butter or other lure is vital to make electric fences fully functional. Some fencing suppliers incorporate bait holders into their fence kits (see *Premier 1 Supplies* and *DeerBusters* products, Table 3). Peanut butter baits can be applied to aluminum foil strips each week (see diagram A Below but be sure to scrunch the foil around the peanut butter so it doesn't flutter in the wind) or directly onto the electric wire/ polytape. You want the deer to first taste the peanut butter, not to be scared of it. When the deer make nose-to-fence contact, they get an unpleasant jolt that conditions them to avoid the fence in the



future. Clean off any old peanut butter so it doesn't get moldy. [A recent publication (Craven et al, 2001) suggests that baiting may not be necessary.]

4) **LEAVE FENCE ON:** Leave the electric fence ON at all times to prevent deer from testing the fence when it's off.

5) **CHARGERS AND WARNINGS:** It is important to use a high quality energizer (or charger) that puts out 5000 volts. Chargers (also called energizers) are AC, battery or solar-powered. How well a charger performs is dependent on its power output measured in "joules under load." To effectively repel deer, a good rule of thumb is that one joule of output from a charger will adequately power 3000 feet of fence wire. Check with your fence supplier to make sure that the charger is matched to the fence design and is appropriate for your needs (Kays 2001). And don't forget to put up warning signs.

6) **REPELLENTS:** For added deterrence, after deer have made initial contact with the fence, you can take strips of cotton and soak them in an odor repellent (Table 2). Hang the strips at regular intervals and reapply the repellent every month. The odor will help reinforce the negative impact of the electric shock.

SOME ELECTRIC WIRE FENCE TYPES:

Single-Strand "Peanut Butter Fence": This single-strand fence design relies on a peanut butter (*see "A" at left*) or other "bait" being attached to the wire (usually through strips of aluminum foil hung from the wire with cloth adhesive tape) to reinforce a negative message. This fence is only 2 ½ feet high and most effective for small gardens and nurseries under 3 acres. Use 17-gauge smooth wire and attach to wooden posts (as illustrated, except be sure to scrunch aluminum foil around the peanut butter so it doesn't flutter in the wind). The cost is under 15 cents per linear foot. *DeerBusters* sells a single strand, baited fence kit for properties under 4 acres. This kit has aluminum caps built into the fence design to hold lure, which makes bait application easier and "less messy."

Polytape and Polywire Fences: These temporary fences (*see "B" at left*) are highly portable and best suited to home gardens, small nurseries, and orchards under 40 acres that don't have severe browsing pressure. Polywire is composed of 3, 6, or 9 strands of metal filament braided with stands of colored polyethylene. Polytape is wider and more expensive, yet flutters in the wind more so it may not last as long

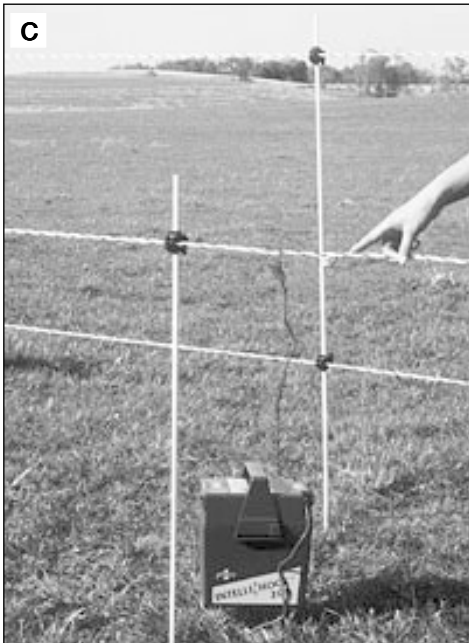
TABLE 3: SUPPLIERS OF DEER FENCING

Please note that this is a partial list of some mail order fencing suppliers.

FENCING SUPPLIER	COMMENTS
Premier Fence Co. 2031 300 th St. Washington, IA 52353 (800) 282-6631 www.premier1supplies.com	The catalog contains excellent electric fence tips and a broad variety of fencing options. <i>Call to request a catalog and for free consulting and guidance. The 3-D Scented Anti-Deer Fence</i> (a kit that includes scent lures built into the electric wire system), <i>Intellirop</i> , and <i>electrified netting</i> are some of the fencing products available from this source.
Kiwi Fence Systems, Inc. 121 Kiwi Rd. Waynesburg, PA 15370 (724) 627-8158 www.kiwifence.com	The catalog contains a variety of fencing options including the relatively new five-wire electrified "spider" fence for farm use.
Forestry Suppliers, Inc. PO Box 8397 Jackson, MS 39284 (800) 647-5368 www.forestry-suppliers.com	This company sells solid tube seedling protectors (i.e. individual 4-foot high cylindrical tubes) that protect seedlings and saplings during the early growth stages.
Gallagher Power Fence, Inc. PO Box 708900 San Antonio, TX 78270 (800) 531-5908 www.gallagherusa.com	This company sells permanent and portable (temporary) electric wire fence systems. They also carry the high-quality electric Turbo-tape.
Benner's Garden, Inc. 6974 Upper York Rd. New Hope, PA 18938 (800) 753-4660 www.bennersgardens.com	This black, polypropylene fencing is very lightweight and blends into the environment but may entangle wildlife due to its low visibility. If used, be sure to attach light, bright streamers to the fence every 3 feet so animals see it. This fencing is for short-term use only.
Kencove Farm Fence, Inc. 344 Kendall Rd. Blairsville, PA 15717 (800) 245-6902 or (800) 536-2683 www.kencove.com	The website offers an electric fence manual on-line including installation strategies for 7-wire deer fence.
DeerBusters 9735 A Bethel Rd. Frederick, MD 21702 (888) 422-3337 www.deerbusters.com	This company offers a single strand, electric fence kit that includes warning signs, posts, corner supports, polywire, a tester, and a "deer pop" bait system (aluminum caps filled with a refillable scent lure), that attaches to the wire for easy use. Also carried is invisible, lightweight black polypropylene fencing.
West Virginia Fence Co. US Route 219 Lindside, WV 24951 (800) 356-5458 www.maxflex.com	This company offers electric fence and high tensile woven-wire fences to exclude deer.
Margo Supplies PO Box 5400 High River Alberta, Canada T1V 1M5 (403) 652-1932 www.margosupplies.com	This company offers electric fencing: portable, high tensile and a galvanized cable electric fencing.
Live Wire Product, Inc. 1127 E St. Marysville, CA 95901 (800) 272-9045	This company offers woven-wire high tensile fencing systems as well as electric fences.
Deer-Resistant Landscape Nursery 3200 Sunstone Court Clare, MI 48617 (800) 595-3650 www.deerlandscape.com	This company offers a nearly invisible 8 foot polypropylene fence. Be sure to attach light, bright streamers to avoid entangling wildlife.

as polywire. It is best to purchase materials with the least electrical resistance (ohms/1000 feet) to prevent loss of voltage due to long distances. Polytape or polywire

fences are usually suspended 30 inches off the ground by fiberglass rods at 2-4 foot intervals. It is recommended that a second wire be added to increase effectiveness, so



C
3-D Scented Anti-Deer Fence

that one is at 18 inches and the other at 36 inches. These fences can last 15+ years and be installed for less than 25 cents per linear foot. Many kits, which include all materials, are available so check fencing suppliers (see Table 3) and your local garden store.

3-D Scented Anti-Deer Fence:

This new electrified rope system (see "C") (sold by Premier 1 Supplies) takes advantage of the fact that deer have limited depth perception. Two electric fences are spaced 3 feet apart from each other to create somewhat of a 3-D effect. The outer fence has one rope with scent caps attached (which contain cotton to hold an apple scent lure) to attract the deer. The inner fence has 2 strands of electrified rope. Both fences are electrified by the same energizer. The whole system costs under 35 cents per linear foot to install and will last 7-10 years. The apple scent is sold separately for \$5 an ounce, and a few drops are used per application. It is recommended that the scent be refreshed ev-

ery 10-14 days.

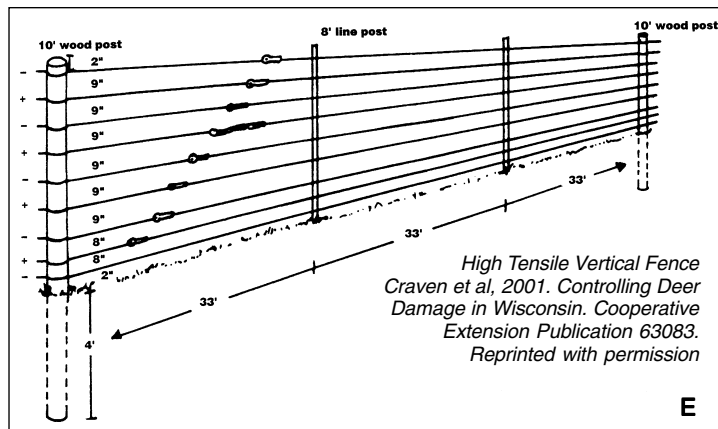
Electric-Bait Kit: *Deerbusters* sells a single-strand electric fence kit that comes with "deer pops" (aluminum caps that hold scented lure), posts, corner supports, polywire, a tester, and warning signs. The kits come in either solar or plug-in designs. The plug-in is recommended because it's more powerful. This kit is for small (under 4 acre) gardens. Cost of kit ranges from \$225-315 depending on size of area to be covered.

Electric Spider Fence: This relatively new fence is mainly used to protect domestic animals or crops. It contains a 5-wire system that is only 4 feet tall and uses a light 16-gauge wire (see "D"). It relies on fiberglass posts that maintain wire tension and spacing. It does not require bracing but requires wood posts on the corners. It comes with an electrified gate. Note: this is a semi-permanent fence (lasts 10-12 years), and not as durable or long lasting as woven wire. Baiting with peanut butter (as outlined above) is important to make

5000 volts at a maximum pulse. This fence can last as long as 25 years. Installation and materials range from 50 cents to \$1.50 a linear foot. Some people run an additional, baited strand of hot wire (such as Premier Fence's *Intellitape* or *Intellirope*) outside the fence to ensure that deer encounter electrified wire and get a shock before attempting to go through the vertical fence. The main problem with vertical fences is that deer tend to get *through* them, which is why this new design (9 high tensile wires, strung no more than 9 inches apart) replaces the older recommendation of a 7-wire vertical fence, with wires 10-12 inches apart (Craven et al, 2001).

Slanted 7-Wire Fence: This 12 gauge fence is a variation of the vertical fence and generally more effective because it confuses deer. It must be slanted at a 30-degree angle to the ground. Because of the slanting effect, the deer see a much more formidable barrier than really exists. It measures only 5 feet high but 8 feet wide, and contains an electrical "incentive" which

increases its deterrent value. This kind of fence costs about \$1.50-2.00 per linear foot. The disadvantages are that it's more difficult to maneuver around this slanting fence to do maintenance (mowing, etc.) due to its wide berth. More importantly, far fewer people use this fence because it "requires strict adherence to construction guidelines concerning rigid fence corner assemblies and fence configurations (Craven et al, 2001)."



High Tensile Vertical Fence
Craven et al, 2001. *Controlling Deer Damage in Wisconsin. Cooperative Extension Publication 63083.*
Reprinted with permission

this fence fully effective. The cost is under 50 cents per linear foot.

High-Tensile Vertical Fence: These fences deter deer effectively as long as a height of 8 feet is achieved and the wires are correctly spaced so deer don't go through them (see "E"). We recommend the design using 9 high-tensile wires (Craven et al, 2001 — see diagram). Deer will try to go under or through these kinds of

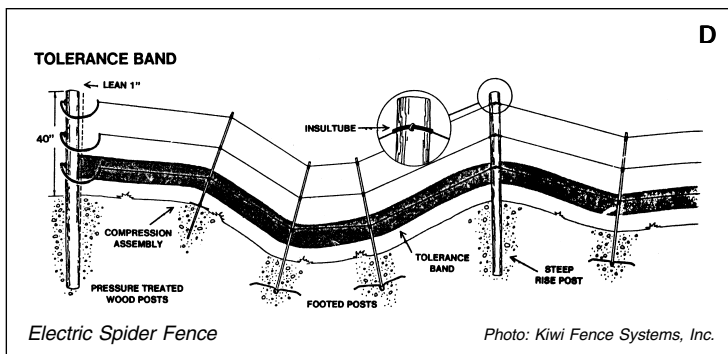
fences, so the bottom wire should be no more than 2 inches off the ground (strung very tightly) with additional wires spaced at 8-9 inch intervals. The materials include high-tensile, smooth wire, (12 1/2 gauge) and an energizer that puts out

NON ELECTRIC FENCE TYPES:

Woven Wire Fencing: The woven wire fence (see "F" top of next page) is considered the most effective deer barrier. It is very durable and excludes deer quite effectively as long as it is at least 8 feet high. Woven wire fencing will last 20+ years. It can be a bit expensive initially (about \$5 per linear foot) and labor intensive to install, but is well worth the effort!

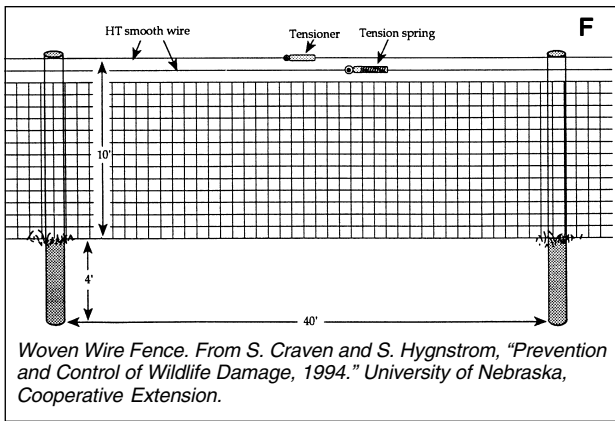
Plastic Mesh: Netting provides protection for individual ornamental shrubs and fruit plants. The netting can be draped over each individual plant or an enclosure made of netting to "box off" an entire blueberry bush area. Netting can be inexpensively bought at most garden or hardware stores.

"Invisible Fence": (see "G" top of next page) Rolls of 8-foot high plastic netting can be purchased to create an "invisible fence." However, the advantages of this product

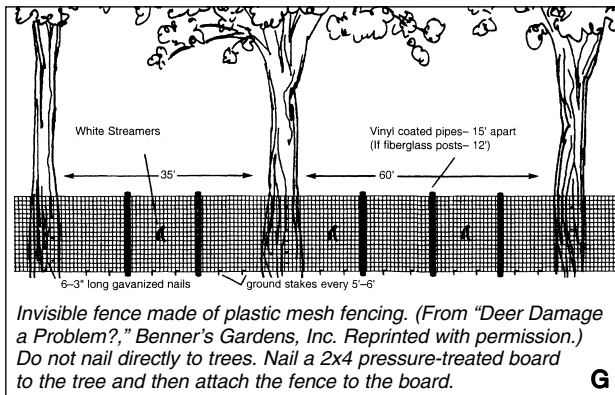


Electric Spider Fence

Photo: Kiwi Fence Systems, Inc.



Woven Wire Fence. From S. Craven and S. Hygnstrom, "Prevention and Control of Wildlife Damage, 1994." University of Nebraska, Cooperative Extension.



Invisible fence made of plastic mesh fencing. (From "Deer Damage a Problem?," Benner's Gardens, Inc. Reprinted with permission.) Do not nail directly to trees. Nail a 2x4 pressure-treated board to the tree and then attach the fence to the board.

(blends into environment) is what make it potentially dangerous for wild animals who may get entangled in it. This type of fencing costs less than \$1 per linear foot. A recent study (Rosenberry et al) reported that this material can be used to create portable, inexpensive deer-proof fencing using PVC pipes for corner posts. The netting used was 2.4 m, 8 foot tall plastic fencing material with 2 x 2.75-inch mesh. A gas-powered auger was used to place PVC pipes underground into which corner posts were inserted.

A note of caution: if an invisible fence is used, please be sure to hang long (12-18 inches) white streamers, at least 4 feet off the ground, at every 3 foot interval so that deer, birds and other wild animals see it and don't plunge through and become entangled.

Tree Shelters (also called seedling protectors): Tree shelters are individual corrugated polypropylene tubes, 4 feet high, placed around individual seedlings so they can grow quickly in a protected environment until they are fairly well out



The town of Waterton, Canada sets a model in living compatibility with deer, elk, and pronghorn sheep. Wrapping protective devices around trees is so common that it has become part of the town aesthetic.

of the reach of the deer. The tubes are supported by wooden stakes. The tubes function as a "mini-greenhouse" due to the warmer and moister micro-climate contained within. Tree shelters are fairly costly, averaging about \$2.50 per tube. Tree shelters are most widely used in commercial forestry practices.

DISEASE: LYME DISEASE MISCONCEPTIONS

Lyme Disease is spread by *Ixodes scapularis*, the black-legged tick. The actual disease-carrying agent is a bacterium (*Borrelia burgdorferi*). It is carried in the bloodstream of hosts who get infected when bitten by a bacterium-carrying tick. Although the disease is transmitted entirely through tick bites, the disease can be transported to new areas by birds who carry the ticks (Anderson et al, 1984).

The *Ixodes* tick has a 3-stage life cycle in which the tick transforms from a larvae into a nymph and finally, into an adult. This life cycle takes 2 years to complete. At each stage, the tick attaches to a host and slowly takes a blood meal over the course of several days. A blood-engorged tick then drops off the host and molts into the next stage. For some unknown reason, the tick seems to prefer a progressively larger host moving through the larval, nymph and then adult life stages. Although deer are a preferred host for the adult stage of the tick, they are not the only host (the term "deer tick" is a misnomer!). The black-legged tick is carried by 49 bird species and all mammals except bats (Anderson, 1984). Therefore, the removal of one host, the white-tailed deer, does not stop the spread of the disease. In some cases, when deer numbers have been experimentally eradicated from an area, the ticks have been noted to switch to other hosts (Duffy et al, Mannelli et al) or occur at higher densities on the remaining deer (Deblinger et al).

of the reach of the deer. The tubes are supported by wooden stakes. The tubes function as a "mini-greenhouse" due to the warmer and moister micro-climate contained within. Tree shelters are fairly costly, averaging about \$2.50 per tube. Tree shelters are most widely used in commercial forestry practices.

DEER AND LYME DISEASE

The reason that hunting doesn't control Lyme disease is because hunting does not significantly reduce the tick population. In one study where as many as 70 percent of the deer were removed from an island, there was "no marked reduction in the abundance of the tick" (Wilson et al, 1988). In later years, the sub-adult tick numbers declined but the adult tick abundance actually increased.

Another study found that a gradual reduction of deer density (from 350 to 60 deer) did not produce a rapid, precipitous decline in immature tick abundance but rather, immature ticks declined 5-7 years after the depopulation effort while adult tick numbers actually increased. The threshold of deer abundance below which tick reproduction declines remains unknown (Deblinger et al). However, it appears that well over 70 percent of a deer population would need to be removed to have an impact on the tick population (pers comm, Kirby Stafford). Yet a recreational deer hunt only removes 25-30 percent of a deer population at best, therefore hunting does not come anywhere near reaching this critical threshold.

There is another reason why hunting won't reduce Lyme disease. When looking at the life cycle of the black-legged tick, one sees that the ticks tend to utilize deer in the adult stage, when they mate and take a final blood meal prior to the adult females dropping off and laying eggs. This occurs in September through November. However, hunting season in the northeastern United States takes place in late November through January, after most of the ticks have mated and dropped off the deer already. Thus, hunting season occurs too late to disrupt the tick's reproductive cycle. Ironically, hunting may actually increase the public safety risk by increasing the number of "questing" ticks who are looking for a host after deer numbers have been reduced.

The bottom line is that Lyme disease is a serious, complex disease. An integrated approach is needed to curtail its spread. Current research focuses on using deer feeders that have vertical rollers coated with an acaricide (tick-killing product) called *Amitraz*. The concept is that the chemical will rub off on the deer's neck when the deer comes to feed, and thereby kill the ticks before they reproduce. Researchers are also looking at various ways to apply acaricide treatments to the first host of the tick, the white-footed mouse (*Peromyscus leucopus*), so that the dis-

Photo by Laura Simon.

ease spread is curtailed in the early stages.

STEPS TO REDUCE THE RISK OF LYME DISEASE:

Dress Preventatively: When outdoors, wear light colored clothing and tuck pant legs into socks. Most ticks are picked up on the lower legs and then crawl up the body seeking a place to feed. Also apply a good tick repellent (containing *deet* or *pyrethrim*) to clothing, particularly around legs and pant cuffs. Check for ticks frequently. Studies indicate that it takes a tick several hours to attach to a host, and, on average, it takes 24-48 hours for Lyme disease transmission to occur through a biting tick. Therefore continual tick checks and a nightly thorough check after removing clothing should reduce the risk. If a tick is found, pull straight out carefully with a tweezers, being sure to get the mouthparts out intact. Contact your local health department if you want the tick tested for the presence of the Lyme disease bacterium. Save the tick (alive) in a small vial or jar.

Watch for Rash: After being bitten by a black-legged tick, watch for reddish, sometimes bulls-eye shaped rash, which is a classic sign of Lyme disease onset. However, this characteristic rash does not occur in all cases, so consult your doctor if recurring flu, fatigue, or other symptoms develop after an *Ixodes scapularis* tick may have bitten you.

Alter the Habitat: Closely cropped lawns with substantial solar exposure appear to contain fewer ticks. Simply mowing the lawn and removing debris piles and any other vegetative cover will discourage mice, which will reduce the tick population.

DEER POPULATIONS AND "MANAGEMENT" METHODS

Hunting deer will not significantly reduce the incidence of Lyme disease nor is it an effective population reduction method. In fact, deer hunting actually *increases* deer population size. When a deer population is hunted, about 20-30 percent of the population may be removed. This results in more food being available for the remaining deer. Deer exhibit a physiological response to their nutritional condition. Scientific studies show that better-nourished deer have more fawns, lower neonatal mortality, increased conception rates, and a higher prevalence of pregnancy in yearlings (Verme, 1969; Verme, 1982; Severinghaus and Cheatum; Mansell). For example, in hunted populations, does are more likely

to have twins rather than a single fawn. One study revealed that the incidence of twinning was 38% on a hunted site as compared to 14% on a non-hunted site (Richter and Labisky).

In other words, after hunting season, deer have more young and breed at an earlier age. The result is a quick rebound in population size. So as illogical as it sounds, hunting, in essence, increases deer population size. This is why hunting is more of a "temporary fix" rather than a real solution to deer problems.

But state fish and game agencies have several powerful motivations for not allowing deer populations to fall too low. First, agencies are largely funded by the sale of hunting licenses. The federal Pittman-Robertson Act apportions monies to states based on their land area and number of hunting licenses sold. Thus, the more licenses sold, the more revenue generated for the state. Second, most fish and game agencies have a dual mandate, written into law, which presents contradictory demands: 1) to manage deer for recreation, i.e. to keep the deer population high enough so there are enough deer for hunters to shoot and 2) to keep deer numbers compatible with other land uses, i.e. to keep deer numbers low enough so they don't have a negative impact on landowners. This mandate presents an impossible challenge for agencies since they are being pressured to both increase and decrease the deer herd at the same time. However, because the agency's funding base is so dependent on hunting license revenue, there is irresistible incentive to prioritize managing for a large deer herd.

DEER/VEHICLE COLLISIONS

There are reports around the country of increasing numbers of deer/vehicle collisions. It is estimated that there are 1.5 million deer/vehicle collisions in the U.S. every year resulting in 200 human fatalities and approximately 1.4 million deer deaths (Conover et al). Public officials frequently attribute these collisions to an increasingly large deer population, but fail to see the greater impact of more roadways being built, more people driving, and more roadways bisecting wildlife habitat and migration routes. In addition, human activities such as frequent mowing of roadsides, along with road salt use in winter, regularly attract deer to roads. Collisions are influenced by the weather, the time of year (spring and fall are peak collision times), amount of roadside shrubbery which can reduce visibility, and the palatability of

roadside vegetation, among other factors.

PREVENTION TECHNIQUES:

The Wildlife Society conference* in 1996 devoted a full day workshop to seeking solutions to the dilemma of wildlife-highway collisions (West and Messmer). Several studies revealed that road design, road condition, and speed traveled were the factors that most strongly influenced the number of deer/vehicle collisions. Bumpier, narrower roads with twists and turns, and slower travel speeds (under 45 mph), resulted in fewer collisions with wildlife. Interestingly, the bumps and twists and turns in the road seemed to slow down drivers more than posted speed limits, which people tend to ignore.

*For more information on this conference's findings, please write to:

Wildlife and Highways
c/o Terry Messmer
Jack Berryman Institute
UMC 5210, Utah State University
Logan, UT 84322-5210

Crossing Signs: Attempts to alert motorists to the presence of deer through the standard "deer crossing" signs have proven ineffectual because people grow accustomed to the pretty yet static silhouette of a running deer and no longer react to it. However, when signs are combined with flashing red lights, drivers tend to slow down.

Fencing: One of the most successful but expensive techniques for alleviating deer/vehicle collisions is to use fencing to prevent deer from crossing roads. At times, deer get over one fence and then are trapped on the road, creating a serious safety hazard. To counter this, some states use crossing structures, such as one-way steel return gates and earthen ramps, to allow deer to leave the roadway and not re-enter. Most effective are earthen ramps which are constructed to be easy to climb on one side (i.e. the road side) but have a steep 5 foot drop-off on the other, thereby discouraging the deer from coming back onto the road.

Over/Underpasses: Deer overpasses and underpasses, which provide safe tunnels and passages over or under roadways, also help avert deer/vehicle collisions. This technique is being used by an increasing number of western states and parts of Canada and is particularly popular in Europe for species ranging from amphibians to deer. However, this method is quite ex-

pensive and requires proper placement where deer are likely to cross (i.e. along migration routes/common crossing areas) and also requires fencing to funnel deer to the crossings.

Strieter-Lite Wildlife Warning Reflectors: According to Strieter-Lite, more than 50 communities in North America have reported a reduction in deer/vehicle collisions by 60-100 percent by using this innovative reflector system. The concept is simple: the device reflects the headlights of oncoming vehicles in a way that creates a perpetual “fence” which deer along roadways will see at night. The dim light is not seen by drivers, but it appears to be moving and unnatural to the deer, thus preventing them from entering the road until the vehicle has passed and the light is no longer present. Nationally, some departments of transportation are experiencing the effectiveness of these reflectors firsthand. For example, on a test site in Kansas, a 68-100 percent reduction in collisions has been cited over a 10-year period. In a one-year period (the project will be evaluated over a 2-year period), the New Jersey Turnpike reported a similar decline in its test area (Strieter-Lite). Although some scientific studies on Strieter-Lite reflectors are inconclusive and require further research, anecdotal information points to their effectiveness when they are installed to the manufacturer’s specifications and maintained properly. The reflectors cost approximately \$3,000 per mile (the price depends on the type of terrain) but the long-term benefits are promising (further studies are needed), as the reflectors can reduce property damage, can save insurance costs, and can possibly last more than 20 years when maintained properly. More information is available at <www.strieter-lite.com> or by calling (309) 794-9800.

Motion-Sensing Flashing Warning System: A new system currently being tested combines a motion sensor with powerful flashing lights that would be triggered only when large animals come into the danger zone along a highway. At test sites in Indiana and Yellowstone National Park in Montana, warning signs are being installed in areas with large animal migrations. On the back of each sign is a microwave radar unit that emits a beam for detecting the movement of large animals. When an animal breaks the beam, flashing lights on the signs are activated. This technology is similar to security systems used at military installations and prisons. The beauty of this system is that it provides a novel, scary

stimulus only when the deer are in a potentially dangerous area. Because the device is not continually operating, it is less likely that deer — and drivers — will habituate to it.

SOME CURRENT RESEARCH

Researchers at the Berryman Institute in Utah are testing the use of temporary signs in mule deer migration corridors. The signs are only used during migration so motorists will not habituate to them. Pilot studies revealed that there was a 70 percent reduction in deer/vehicle collisions using this technique. Studies are also being done to assess whether planting less palatable plants along roadways — or planting grasses that contain a fungus that grows inside the leaves and produces alkaloids — would prevent deer from being attracted to roadsides in the first place.

TIPS FOR AVOIDING DEER/VEHICLE COLLISIONS:

There are steps motorists can take to reduce the likelihood of collisions:

- 1) **BE VIGILANT:** When you drive, make a habit of watching from side to side, especially in areas of low visibility or where roadside shrubs or grasses are close to the road.
- 2) **WATCH FOR GROUP BEHAVIOR:** Deer tend to travel in groups. If one deer crosses the road, watch for more to follow. Female deer tend to stay together as “doe groups” in winter and have young fawns following them in the spring.
- 3) **BE AWARE OF SEASONS:** In the fall, bucks are on the move due to rutting and hunting seasons. In spring (May-June), yearlings are seeking new territories. Be extra careful driving at these times of year.
- 4) **BE AWARE OF TIME OF DAY:** Deer are most active at dusk and dawn. Be watchful, especially during early morning and evening, when wildlife may be moving across roads.
- 5) **USE HIGH BEAMS:** At night, use your high beams to see farther ahead. Slow down and watch for the eye-shine of deer near the road edges.
- 6) **DRIVE STRAIGHT!** If at all possible, do not swerve to avoid wildlife but brake firmly and blow your horn. Animals are easily confused. If you swerve, deer may run into the vehicle rather than away from it. And swerving could mean driving into another vehicle or off the road into poles or fences.

RESOURCES:

Haddidian, John, Guy Hodge, and John Grandy, eds. *Wild Neighbors: The Humane Approach to Living with Wildlife*. The Humane Society of the United States. Golden, CO: Fulcrum Publishing, 1997.

Deer Resistant Nursery is a mail order company that sells a diversity of flowering plants that are generally resistant to deer browsing: <www.deerxlandscape.com> or call (800) 595-3650.

Foothills Cottage Gardens is a California-based company that sells deer resistant plants to California state residents (many other mail order companies cannot ship plants to CA due to strict requirements). They can be reached at <www.fcgardens.com> or (530) 272-4362.

Scarecrow motion-sensing device to hook-up to water hose, for gardens, is available at <www.scamat.com>.

My Deer Garden is a site devoted to living with deer: <www.MyDeergarden.com>.

Deerbusters is a mail order company that has a comprehensive inventory of deer repellent products. Please note that we endorse many but not all of the products in this catalogue and believe some to be ineffective. Web site: <www.deerbusters.com>.

For conference proceedings on the topic of wildlife/vehicle collisions and alleviation techniques, go to <www.deercrash.com> or The Berryman Institute at <www.berrymaninstitute.org/internetpubs.htm>.

“Reducing Deer Damage to Home Gardens and Landscape Plantings” can be accessed online via <www.dnr.cornell/ext/chdp/reducingdeerdamage.htm>. This document provides a good list of deer resistant plants as well as information on fencing and repellents.

Continued next page.

Resources *continued*

Full instructions for how to build or install many deer fencing options are available through the book *Prevention and Control of Wildlife Damage* (Craven, S. and S.E. Hygnstrom, 1994 - see "Deer" chapter) which is also available online via <www.wildlifedamage.unl.edu>. Click on the book icon (with that title) and go to "Mammals" and then "Deer-D-25." Electric deer fencing installation instruction and tips are given here. You can also consult with fencing suppliers (see Table 3) or your local farm supplies, garden or hardware store.

More information about Strieter-Lite Wildlife Warning Reflectors is available at <www.strieter-lite.com> or by calling (309) 794-9800.

SPECIAL THANKS:

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