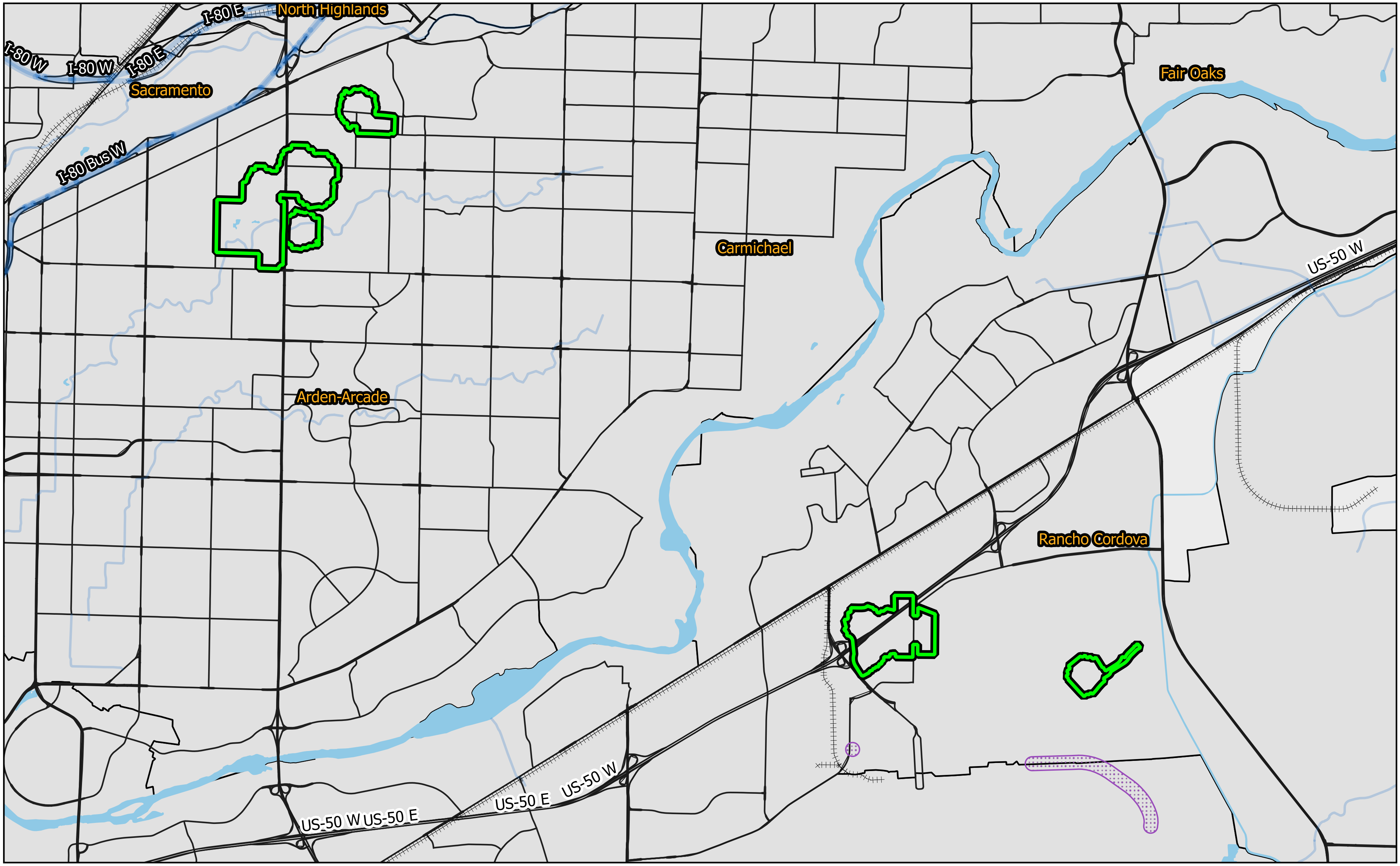
Japanese Beetle Eradication Project
Arden-Arcade and Rancho Cordova, Sacramento County
2020



200 Meter Treatment Area

Sensitive Environmental Area/Treatment Mitigations In Place

ERADICATION PROJECT WORK PLAN FOR JAPANESE BEETLE

SURVEY

1. **Detection Trapping**

The California Department of Food and Agriculture (CDFA) maintains a cooperative State/County trapping program for various invasive pests, including Japanese beetle, to provide early detection of any infestation in the State. Traps are serviced by either County or State personnel and funded by the Department. The Japanese beetle program uses a green plastic or metal trap baited with a commercially produced combination of food lure (phenylethyl propionate, eugenol, and geraniol), and male sex attractant (Japonilure). Traps are placed near grass areas and other favored host material in residential and densely populated rural areas, at a density of two per square mile. In addition, traps are placed around high hazard adult introduction points such as airports and freight forwarding facilities. County or State employees inspect the general detection traps every six weeks and the high hazard traps every two weeks from June through August.

2. **Intensive Trapping**

Intensive trapping is triggered after a single beetle is detected. Following confirmation of the specimen, trap densities are increased over a 49 square-mile area (127 km^2). Trap density in the core square mile is increased to 100 traps. Trap densities in the remainder of the delimitation area are increased from the core outward within 48 hours of the find to complete a 100-25-5-5 array. Higher core trap densities, such as 160 or 640 traps per square mile, have been used in the past for heavy infestations and may be adopted if needed. Trap densities in the core square mile are increased to protocol levels within 24 hours, while trap placement in the remainder of the delimitation area will be completed from the core outward within 48 hours of the find. Traps in the core mile are serviced daily for the first week, and all others serviced at least once within the first week. After one week of negative finds, trap inspection frequency changes to weekly. Delimitation trapping then continues for the remainder of the season. If eradication is not triggered, trap densities revert to detection levels after two seasons of negative finds. If eradication is triggered, trap densities revert to detection levels after three seasons of negative finds.

3. **Visual Survey**

Host plants within 400 meters of a detection may be visually inspected for adult beetles at the discretion of project management. Other visual survey methods which may be used include sweep-netting host plants and soil inspection on find properties. Finds in high-hazard traps will not trigger visual survey unless repeated finds indicate a potential infestation. Highly attractive hosts are roses, stone fruits, grapes, and corn. Beetles are more likely to be seen when temperatures are between 70º and 90º F.

4. **Post-Treatment Monitoring**

The success of the eradication program is monitored by intensive trapping levels for two years after the last treatment season. If no beetles are caught during that time, trap densities return to detection levels.

TREATMENT

Treatment is triggered or expanded by the detection of a total of two or more Japanese beetle adults within three miles of each other and during the timeframe of one life cycle, which includes the next flight season; or by a mated female; or by one or more immature beetles. Treatments will occur in a 200-meter radius of each detection location. If a portion of a property lies outside the treatment boundary, the entire property shall be treated. Treatments are applied for one life cycle past the last beetle detected, but may be extended to two life cycles at the discretion of project management. Affected properties will be notified in writing at least 48 hours prior to treatment. Following treatment, completion notices are left with the homeowners detailing precautions to take and post-harvest intervals applicable to any fruit on the property. There are two types of treatments, each of which targets a specific life stage.

1. The soil surface of grass turf areas and other ground cover plantings are treated in order to target the young grubs. Acelepryn®, containing chlorantraniliprole, is applied via hoses or granular dispersal to the soil surface once during April to May. In the event that Acelepryn® cannot be used during this time period due to weather or other factors, then Merit 2F, containing imidacloprid, will be used in mid- to late-June. Merit 2F will also be used if one or more adults or other life stages are detected at one or more locations which necessitate expanding the treatment area, and after the treatment window for Acelepryn® ends but before the treatment window ends for Merit 2F, specifically, from May through June. Beetles found from July onward at such locations will trigger treatment the following year.

2. In the event that one or more live adult beetles are found in the environment (i.e., not in a trap), then Tempo® SC Ultra, containing cyfluthrin, or Acelepryn®, containing chlorantraniliprole may be used to target the adults. Project management will use several factors to decide whether to treat, including but not limited to number of beetles, locations in relation to previous detections, suitability of surrounding environment for establishment, etc. Should the decision to treat be made, then all plants which are allowed to be treated as per the product label will be treated with this product using hydraulic spray or hand spray equipment.

SENSITIVE AREAS

The treatment area has been reviewed through consultation with the California Department of Fish and Wildlife's California Natural Diversity Database for threatened or endangered species. The CDFA also consults with the California Department of Fish and Wildlife, the U.S. Fish and Wildlife Service and the National Marine Fisheries Services when rare and endangered species are located within the treatment area. Mitigation measures will be implemented as needed. The CDFA will not apply pesticides to bodies of water or undeveloped areas of native vegetation. All treatment will be applied to residential properties, common areas within residential development, non-agricultural commercial properties, and right-of-ways.

PUBLIC NOTIFICATION

Any resident whose property will be treated will be notified in writing at least 48 hours in advance of any treatment, in accordance with Food and Agricultural Code Sections 5779 and 5401-5404. Following the treatment, completion notices are left with homeowners detailing precautions to take and post-harvest intervals applicable to any fruit on the property. Treatment information is posted on the CDFA website at http://www.cdfa.ca.gov/plant/JB/index.html. Information concerning the project will be conveyed directly to concerned local and State political representatives and authorities via letters, emails, and/or faxes. Press releases, if issued, are prepared by the CDFA information officer and the county agricultural commissioner, in close coordination with the project leader responsible for treatment. Either the county agricultural commissioner or the public information officer serves as the primary contact to the media.

INTEGRATED PEST MANAGEMENT ANALYSIS OF ALTERNATIVE TREATMENT METHODS TO ERADICATE JAPANESE BEETLE
March 2016

The treatment program used by the California Department of Food and Agriculture (CDFA) for control of the Japanese beetle, *Popillia japonica* (Coleoptera: Scarabaeidae), primarily targets the larval stage. The program follows recommendations formulated by a Science Advisory Panel which met in December 2015 (please visit https://www.cdfa.ca.gov/plant/JB/index.html for more information). A systemic insecticide containing either chlorantraniliprole or imidacloprid is used to control developing larvae, and a contact insecticide containing cyfluthrin may be used if adult beetles are collected from the environment but not in a trap. These products have been shown to be effective against Japanese beetle during eradication projects in other uninfested states.

Below is an evaluation of alternative treatment methods for Japanese beetle which have been considered for eradication programs in California, including the methods chosen for the current program.

A. PHYSICAL CONTROL

Mass Trapping. This method involves placing a high density of traps in an area in an attempt to physically remove the adults before they can reproduce. It is not recommended as a general eradication measure against established populations because trap capture rates can be low, and studies indicate that there is only a 40 to 50% drop in population numbers at high trap densities (1 per acre, or 640 per square mile). It has been shown to reduce numbers significantly in isolated populations, but several years are required. Also, trapping as a small scale eradication technique within a larger infested area is not recommended because it has been shown to encourage mating by drawing in males and females to nearby foliage, where they can more readily find each other and mate, and can actually increase the damage on plants around the traps.

Active Removal of Beetle Life Stages. Adult Japanese beetles are mobile day time fliers, and adults could theoretically be netted or collected off of foliage. However, due to their ability to fly when disturbed, and the laborious and time prohibitive task of collecting small insects from many properties by hand, it would be highly improbable that all of the adults could be captured and removed. Eggs, larvae, and pupae all occur in the soil in and around plant roots, so all potentially infested plant roots and associated soil in the entirety of the eradication area would have to be removed and disposed of in order to remove the these life stages from the environment.

Host Plant Removal. Removal of host plants involves the large scale destruction of plants by either physical removal or phytotoxic herbicides. Host plant removal is not considered an economically efficient option for area-wide treatment because it is so labor intensive. It is also intrusive to residents, who may oppose losing their plants. Additionally, this method may possibly promote the dispersal of beetles in search of food and egg laying sites, thus spreading the infestation if other treatments are not used outside the host plant removal area.

B. CULTURAL CONTROL

Cultural Control. Cultural controls involve the manipulation of cultivation practices to reduce the prevalence of pest populations. These include crop rotation, using pest-resistant varieties, and intercropping with pest-repellent plants. None of these options are applicable for Japanese beetle eradication in an urban environment with multiple hosts, and may only serve to drive the beetles outside the treatment area, thus spreading the infestation. For these reasons, cultural control is not considered to be an effective alternative.

C. BIOLOGICAL CONTROL

Microorganisms. Milky spore is a soil bacterium, *Paenibacillus popilliae* (formerly *Bacillus*), which attacks the grubs. It can be effective in limiting the density of populations, but takes two to three years to build up sufficient numbers for control. The 1983-84 California Environmental Assessment of the Sacramento County Japanese beetle project noted that USDA had an extensive program that resulted in inoculation of the milky spore pathogen into large areas of the northeast U.S. However, results were variable and complete elimination of Japanese beetle had never been achieved. In addition, pest resurgences were noted in a number of areas. Also, at very low Japanese beetle densities there are insufficient grubs to allow buildup of spores in the soil. The assessment concluded that milky spore was not an option for eradication. No milky spore products have been registered in California since 1987. Two other bacteria, namely *Bacillus thuringiensis japonensis* and *Ovavesicula popilliae*, have shown some effectiveness against Japanese beetle grubs. However, no products containing these microorganisms are registered for use in California.

Nematodes. *Heterorhabditis bacteriophora* and *Stenernema glaseri* appear to be the most widely used soil nematodes used against Japanese beetle grubs. The California Department of Pesticide Regulation does not regulate nematodes because they do not require pesticide registration for multicellular biocontrol organisms, so they can be used in California. However, success of nematodes is problematic because soil type, moisture, and temperature can greatly influence their effectiveness. Nematodes require a fairly loose textured soil (sand, loamy sand, or sandy loam) because they need to be able to move through the spaces between the soil particles. Nematodes work best in a moist soil (watered, but not to excess) and generally have a narrow soil temperature range in which they work best.

Parasites and Predators. There have been 24 parasites released in the U.S. against Japanese beetle, but only five have become established and only three of these are considered somewhat successful. However, they are not available commercially. Parasites and predators in general are not considered an effective stand-alone eradication method because their success is density dependent, in that they are more effective against dense prey populations than against light populations, so their effectiveness decreases as the prey population declines.

Sterile Insect Technique (SIT). The sterile insect technique (SIT) involves the production and release of reproductively sterile insects, with the goal of preventing reproduction in a pest population via the mating of the sterile insects with the existing field population. Some research on the production and release of sterile Japanese beetle adults was done in the 1960's and 1970's, but it has never been developed as a control tactic.

D. CHEMICAL CONTROL

Soil Treatment. A number of systemic and contact insecticides have been researched for use against Japanese beetle grubs. The following products have been chosen for use by the CDFA, based on a combination of effectiveness against Japanese beetle, worker and environmental safety, and California registration status. One or the other will be used, depending on time of year.

- Acelepryn® is a formulation of chlorantraniliprole which is applied via hoses to the soil surface. Chlorantraniliprole is most effective against young larvae and takes up to six weeks to be effective, so application of this compound is made during mid- to late-April. In the event that Acelepryn® cannot be used during this time period due to weather or other factors, then Merit® 2F, containing imidacloprid, will be used in mid- to late-June (see below). Chlorantraniliprole is a synthetic anthranilic diamide insecticide which controls a number of other root feeding pests, but is generally considered safe for beneficial biocontrol insects.

- Merit® 2F is a formulation of imidacloprid which is applied via hoses to the soil surface. Imidacloprid is most effective against young larvae, so application of this compound is made during the early summer in areas where Acelepryn® has not been used. Imidacloprid is a synthetic neonicotinoid insecticide which controls a number of other root feeding pests, but is generally considered safe for beneficial biocontrol insects.

Foliar Treatment. A number of contact insecticides have been researched for use against Japanese beetle adults elsewhere. The following product has been chosen for use by the CDFA, based on a combination of effectiveness against Japanese beetle, worker and environmental safety, and California registration status. Foliar treatment is warranted only if one or more live adult beetles are found in the environment (i.e., not in a trap).

- Acelepryn® is a formulation of chlorantraniliprole which may be applied to the foliage of host plants. Chlorantraniliprole is a synthetic anthranilic diamide insecticide that is generally considered safe for beneficial insects. The foliar spray application may be made using mechanically pressurized sprayers, hand sprayers, or backpack sprayers. Applications could be made to ornamental plants and trees (up to 30 ft. into the canopy), as well as landscaped areas including flowers and containerized plants. Up to four applications may be made per year at a 21-day re-treatment interval.

- Tempo® SC Ultra is a formulation of cyfluthrin which may be applied to the foliage of host plants. Tempo® SC Ultra is a wide-spectrum synthetic pyrethroid insecticide which controls hundreds of insect species. Tempo® SC Ultra is preferentially used over other contact insecticides by the CDFA because it has low mammalian toxicity and a relatively shorter half-life. However, it is not registered for use on a number of backyard fruit and vegetable crops which are attacked by Japanese beetle, so its usage is restricted primarily to ornamental plants.

E. RESOURCES

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PEST PROFILE

Common Name: Japanese beetle

Scientific Name: *Popillia japonica* Newman

Order and Family: Coleoptera: Scarabaeidae

Description: The adult beetle is a broadly oval insect about 13 millimeters long (0.5 inch) and about six millimeters wide (0.25 inch). The body is a bright metallic green, the legs are a darker green, and the wing covers are a coppery brown and do not quite extend to the end of the abdomen. There are two small tufts of white hairs just behind the wing covers and five patches along each side. The small white oval eggs are laid in the soil. The larva is C-shaped with three pairs of legs, white, and grows to 25 millimeters in length (one inch). Pupae are light reddish-brown and 13 millimeters long (0.5 inch).

History and Economic Importance: The Japanese beetle is originally from Japan, and was first found in the U.S. in 1916 in New Jersey. It is not a serious pest in Japan where there are relatively few large grassy areas favorable for its reproduction, and the action of predators, parasites, and pathogens keep the beetle numbers low. In the U.S. however, a favorable climate, large areas of permanent turf for reproduction, and ineffectual natural enemies favor increased population densities. It is considered a serious pest of turf, and adults damage a wide variety of both ornamental and agricultural plants.

Distribution: The Japanese beetle is native to the main island of Japan. The beetle is currently found in coastal and adjacent states from Maine to Alabama with small infestations westward to beyond the Mississippi River.

Life Cycle: Females lay eggs in small clusters of one to four eggs within cells two to four inches below the soil surface. Each female may lay 40 to 60 eggs in her lifetime. Eggs hatch in 10 to 14 days. Larvae feed on many types of plant roots, but are fond of grasses. They move deeper into the soil at the onset of winter, and return to the root zone in the spring to feed. Larvae develop through three instars. Pupation takes place in earthen cells later in the spring, and adults emerge after eight to 20 days. There is usually one generation per year, although larvae can take up to two years to develop in unfavorable conditions such as wet, damp soils. The adults emerge from May to September and feed on foliage, flowers and fruit. The exact timing of emergence depends upon geographical location and weather.

Hosts and Damage: A wide range of plants are attacked in the U. S. by the adult beetles, which skeletonize leaves by eating around the larger veins and chew on flowers. Hosts include small fruits, tree fruits, truck and garden crops, ornamental shrubs, vines, and trees. Feeding studies show a host range in excess of 300 plants in 79 plant families. Among the preferred plants are grape, apple, cherry, peach, plum, rose, and corn. Corn is injured by eating the silk which interferes with formation of kernels. Soft fruits such as grapes, berries, and stone fruits may be completely consumed. Medium to high densities of larvae will cause patches of dead grass.

Partial Favored Host List of Adults

Common Name	**Scientific Name**
American chestnut	*Castanea dentata*
American elm	*Ulmus americana*
American linden	*Tilia americana*
American mountain ash	*Sorbus americana*
Apple	*Malus sylvestris*
Apricot	*Prunus armeniaca*
Asparagus	*Asparagus officinalis*
Black walnut	*Juglans nigra*
Cherry, black	*Prunus serotina*
Cherry, sour	*Prunus cerasus*
Cherry, sweet	*Prunus avium*
Common mallow	*Malva rotundifolia*
Common rose mallow	*Hibiscus moscheutos*
Corn	*Zea mays*
Crepe myrtle	*Lagerstroemia indica*
Evening primrose	*Oenothera biennis*
Grape	*Vitis vinifera*
Grape, fox	*Vitis labrusca*
Grape, summer	*Vitis aestivalis*
Gray birch	*Betula populifolia*
Highbush blueberry	*Vaccinium corymbosum*
Hollyhock	*Alcea rosea*
Horsechestnut	*Aesculus hippocastanum*
Japanese flowering crabapple	*Malus floribunda*
Japanese maple	*Acer palmatum*
Kerria	*Kerria japonica*
Kiss me over the garden gate	*Polygonum orientale*
Lombardy poplar	*Populus nigra' Italica'*
London planetree	*Platanus x hispanica*
Marsh mallow	*Althaea officinalis*
Nectarine	*Prunus persica* var. *nucipersica*
Norway maple	*Acer platanoides*
Peach	*Prunus persica*
Pennsylvania smartweed	*Polygonum pennsylvanicum*
Plum	*Prunus domestica*
Plum, Japanese	*Prunus salicina*
Poison ivy	*Toxicodendron radicans*
Pussy willow	*Salix discolor*
Rhubarb	*Rheum rhabarbarum*
Rose	*Rosa* spp. and hybrids
Sassafras	*Sassafras albidum*
Shrub Althea	*Hibiscus syriacus*
Siberian crabapple	*Malus baccata*
Soybean	*Glycine max*
Sweet pepper bush	*Clethra alnifolia*
Virginia creeper	*Parthenocissus quinquefolia*